6 Competing Technologies.

6.1 Competition between technologies

In this chapter the author talks of competing technologies. These competing technologies are a result of markets that have not being tapped. For example the rural areas in South Africa are under-serviced where telecommunications is concerned. Because the rural areas are sparsely populated and in most cases very far from metropolitan areas, it has been very expensive to layout the infrastructure needed for telecommunications. The introduction of the cellular technologies may be one of the solutions to putting up telecommunications infrastructure in the rural areas.

Burgelman *et al* [19] says, that technologies can compete passively and unconsciously. When this happens, one technology may displace adoption of its rivals. Competition can be strategic, such as when products are priced and manipulated. They further point out that, as a result of technology competition, technologies become attractive and customers adopt them readily. This is caused by the following:

- Learning by using;
- Network externalities;
- Scale of economies in production;
- Informational increasing returns; and
- Technological inter-relatedness.

The above mentioned factors determine the character of the competition.

Fry [45] says that the changes in driving forces in the wireless infrastructure are numerous. Any one of these forces is sufficient to cause wireless equipment vendors to adapt their product offerings. In combination, they have a multiple effect resulting in an imperative for new developments in the field. The following section explores the various forces driving the development of the next generation of wireless infrastructure products.

6.1.1 Deregulation and the competitive climate

The emergence of standards and persistent market growth will continue to diminish the barriers to entry into the market and to raise the level of competition among equipment providers. We have already witnessed the emergence of new entrants who have made great progress in establishing themselves in the market. Some have done so by providing solutions consistent with emerging standards, (e.g. stand-alone home location register databases, authentication centres, intelligent antennas and cellular digital packet data [CDPD] systems).

Successive generations of products and the competition facilitated by open systems, which are defined by the American National Standards Institute (ANSI) and the European Telecommunications Standards Institute (ETSI), have resulted in the introduction of wireless solutions at extremely competitive price points.

The result is that today's advanced base stations and switching equipment (hardware) will become tomorrow's commodity products and manufacturers must therefore innovate new products to maintain or enhance their market positions. Success in the marketplace depends on the delivery of complete solutions, especially software that enhances carriers. On international level governments are quickening the pace of deregulation as they recognise the obvious benefits of competitive forces driving service costs down and enhancing local telecommunications infrastructures. Increased competition leads carriers to seek new ways to differentiate or focus their service offerings and to reduce costs.

Fry [45] says that with competition increasing for basic voice services and minute-of-use prices falling, carriers are seeking to differentiate themselves in two notable ways. First, they are attempting to develop branded identities through the use of logos and signature sounds/tones (e.g. pre-call announcements and voice mail notification tones) and focused marketing campaigns. These attempts aim to develop markets. In this situation, interoperability and feature transparency are crucial to a campaign's success. Network-based features and services must be flexible in the ways in which they are administered and presented to an end customer.

Secondly, carriers are trying to segment their subscriber base and offer more targeted features and services. Initially these features and services took the form of simple multi-

rate and use-sensitive billing plans. More recent approaches are more complex, bundling wireless and wireline services, adding geographic or time-of-day/day-of-week restrictions and supporting custom-calling plans or private networks. The trend is toward more sophisticated horizontal (messaging, paging and data) and vertical (cellular dispatch, power company meter reading) applications. Ideally carriers would like to see a continuous stream of new applications and features becoming available to their subscribers. Such a strategy is the key to their differentiated and share growth in the marketplace.

According to Fry [45] in order to increase competition among equipment vendors, carriers demand solutions that are based on industry standards, with the ultimate goal of achieving interoperability among network nodes. Not only will standards allow carriers to secure solutions to lower price points; standard-based solutions will also enable carriers to obtain a complete solution by purchasing partial solutions from a multitude of equipment providers. Such an environment will put equipment vendors under pressure to become competitive in areas that have been bundled with the total network offering.

Ochtel [46] endorses this by saying that "The World Trade Organisation's new agreement on basic telecommunications, endorsed by 69 countries, has opened new markets and increased competition as we move to the 21st century. Service providers need to shift their rural telephony strategies to take advantage of newly opened markets".

6.1.2 The Rural Phone Market

Geographically dispersed and sparsely populated areas pose a significant challenge. It is often unfeasible to fulfil the service required using traditional terrestrial technologies such as wireline, cellular or wireless local loop, because of high installation costs. As a result many service providers look to very small aperture terminal (VSAT) satellite technology to provide telephony to the rural market. Most providers understand the advantages of VSAT's, including distance independence, quick installation and greater reliability than the local terrestrial systems.

These remote VSAT sites, or "village phones", include stand alone, privately owned phones, public pay phones and public calling centres. The breadth of services required for remote villages is also quite limited. Typically only voice service is required, though some sites may need limited fax and data services.

As Ochtel [46] points out, since rural areas generally have a smaller economic base than urban areas and the geographic dispersion of lines makes maintenance, marketing and revenue collection expensive, telecom operators have until recently not been viewing rural service as a profitable business. Rural service is generally seen as an obligation, which is met by the development of the absolute minimum quality and quantity of service necessary to satisfy that obligation. For this "village phone" market, typical VSAT remote terminals focus on low cost and offer limited non-toll quality services.

Ochtel [46] also states that as communication services spread so does economic development and prosperity. The sizeable rural business market in developing nations is of utmost macroeconomic importance, even when it is not immediately self-sustaining.

A single customer may require from one to several hundred remote lines at farms, mining camps, petroleum exploration and other remote business entities. The demand for remote business calling is anticipated to be greater than for village phones and higher value services are also expected to be in demand. Toll-quality voice, fax and data services are also required for remote businesses. There are also opportunities for value-added services such as voice mail or call forwarding. In addition, Internet Protocol data services (for Internet access or corporate file transfers) may be required on the same platform.

The typical rural business user requires a single platform that supports advanced features to meet business needs. To match the toll-quality services offered in urban areas, VSAT products for rural business need to focus on quality and breadth of services and on satellite bandwidth efficiency.

For heavy rural mining camps, that sort of efficiency in satellite bandwidth will significantly reduce the service provider's total cost of ownership.

Deregulation in the worldwide telecommunications market provides incredible opportunities and new dimensions in rural telephony. The emerging rural business market promises to be a fast growing new addition to satellite services. "Village Phone" solutions are not appropriate for the business market, where much higher levels of daily communication are the norm and quality voice and fax services are required as well as advanced data services.

This wider range of services influences systems economics. A VSAT solution that minimises satellite bandwidth usage will offer rural business service providers a long-term solution. Ochtel [46] says that the ideal approach is to provide a single platform that can support the wide range of voice and data services required by the business market while minimising the total cost of ownership.

6.1.3 Rural Business Phone Market Characteristics:

- Remote businesses: Single business entity (farms, mines, other)
- Terminal sites: Single platform for private applications
- Low call activity: One to multiple hours per day per telephony line.
- Broad services: Toll-quality voice, fax, data, Internet access and video conferencing

Talmor [47] says VSAT allows for reliable data, voice and video communication using small satellite antennas. As a result of the search for new markets, VSAT vendors have succeeded in steadily lowering the price of the terminals while increasing their features and functionality.

When VSAT technology was first introduced into rural areas as a means of providing "last mile" telephony services, most takers were large corporations or international organisations that needed to ensure reliable telecommunications at any price. Tenders for government-initiated rural telephony projects usually specified microwave radio, since that was the familiar technology. Copper wire was not even considered since the cost would have been much too high. But microwave radio also had its limits. It does not adapt easily to mountainous terrain or terrain that requires widespread coverage, for example islands. Microwave towers transmit signals from control centres using a line of sight from one centre to the next. If a mountain is in the way the signal disappears.

Talmor [47] furthermore says that satellite solutions have a distinct advantage. The idea is to give rural subscribers what they need and to avoid making them pay for what they don't need. Smaller rural populations may be happy to have one or two telephone lines in their village. People use the telephone more as they become accustomed to it and increased use means increased value for the service provider. In some rural areas users are requesting not only private telephone lines, but also Internet access.

Talmor [47] adds that a new network in these locations can improve communications not only in terms of the number of lines, but also in terms of their quality and in the overall reliability of the network. Private users, government offices, military outposts, post offices and hospitals want to be able to connect within minutes and they want to be sure that they will be able to hear the person on the other end of the line.

The VSAT system can support private mailboxes at the public call office. Incoming calls can be addressed to a particular individual, even from a payphone. VSAT can be integrated with a virtual phone service and supply a message notification to users. Subscribers can access their mailboxes to verify whether they have a message. Data services, including fax, electronic mail and Internet access, are also supportable on the same VSAT system.

On a national level, governments are often anxious to provide improved access to education in areas outside the main city. Distance learning over a VSAT network enables an instructor, located in a fully equipped studio, to interact with students over a distance of hundreds of kilometres. The instructor's voice and image are transmitted from the studio by satellite to all the remote classrooms. Students watch the lecture on a television or computer screen and actively participate in the lessons using a standard touch-tone telephone. The teacher may call on a specific student and activate his/her telephone set so that all the students can hear.

According to Talmor [47] Global Mobile Personal Communications by Satellite (GMPCS) systems involve voice or data transmission to and from hand-held, portable and vehicle-mounted terminals. Two markets will be profoundly affected by these services: rural telephony and business travellers. The most important aspect is that the cost of completing a phone call over a satellite is independent of distance.

In conclusion cellular technology may be a solution for the rural area telecommunications dilemma. The cellular technology as a solution to telecommunications, has an advantage in the sense that, the solution can be tailor made to respond to the telecommunications needs of the individuals in a particular area.

7 Clusters.

7.1 Technology Clusters

In this chapter the author gives an example on how the cellular technology is being exploited in the vehicle tracking industry. This is a solution that is responding to crime prevention needs of the country. It illustrates how different industries come together and put their capabilities together and come up with a solution across a cluster.

Rogers [7] states that, "a technology cluster consists of one or more distinguishable elements of technology that are perceived as being interrelated. The boundaries around any given innovation are often not clear-cut or distinct. In the minds of potential adopters, one innovation may be perceived as closely related to another new idea. If this is the case, a change agency may find it useful to promote a cluster or package of innovations to clients, rather than treat each new idea separately". As an example of a technology cluster is the vehicle tracking industry.

BMI [48] says that the vehicle tracking, communication and recovery industry has been in existence for more than 15 years, yet the South African transport industry continues to be plagued by numerous factors, which, have slowed down the growth of the industry.

The main reasons for the current volatility is that, insufficient capital has been invested to maintain the infrastructure necessary for a good after-sales service and that resources have been poorly managed.

The industry structure consists of the service provider, installation company reaction unit and network provider. The service provider provides the customer with tracking and fleet management services. The customer deals only with the service provider and has no direct contact with other key players. Examples of service providers companies are Altrac, Tracker, Ressco, G-Track, Tamlock-V, Trans RSA, Paytrack, Matrix and Trakbak.

The service provider enters into a contract or agreement with an installation company, who installs the tracking system in the customer's vehicle. The service provider may also sub-contract a reaction unit to recover the vehicle if it is stolen. Once the distress signal is activated, the network through the service provider's base station picks it up. The location

and status of the vehicle is identified and a report is forwarded to the reaction unit who then recovers the stolen vehicle.

A Network Provider supplies the service provider with a communications infrastructure through its communications network. The communications network technologies used in the tracking device are GSM cellular networks; Global Positioning System (GPS) satellite networks; radio networks (VHF) and radio trunking. The network providers are Vodacom, MTN, Netstar, Fleetcall, Inmarsat, and Telkom's SPACETREAM VSAT service.

According to BMI [48], market segmentation is made up of large fleets consisting of commercial vehicles and car hire fleets, which are regarded as the upper end of the market.

A small fleet consists of sedans, LVD's and luxury cars weighing less than three tons. Normally there is no cargo at risk. Insurance companies are playing an active role in improving the existing operations in this fast growing segment of the market.

Parastatals such as Eskom need vehicle tracking and fleet management to monitor their fleet and also fleet management services such as performance analysis and trip planning.

7.1.1 Communications Networks and Coverage Areas

Communications networks are:

- Voice;
- Fixed wire;
- Cellular;
- Radio trucking;
- Paging.
- Data;
- Satellite;
- Mobile packet data network;
- Wireless; and
- Paging.

7.1.2 Mobility versus. Coverage Areas

According to BMI [48], most of the tracking systems mobile, stationary or fixed, cover the regional and national areas, but the main focus is on large conurbations such as Gauteng and Durban, and on the N1, N2 and N3.

7.1.3 Short and Long Range Tracking Systems

Short range tracking systems make use of radio repeater networks between the vehicle and the service provider base station. The base station sends out cyclic polling commands to each vehicle using one of the short-range networks. The polling command reaches the vehicle and triggers the on-board computer to transmit a status report to the base station. The on-board computer collects sensor outputs such as vehicle position derived from Global Positioning System (GPS) receiver. Long range tracking systems are similar to short range tracking systems, but instead of terrestrial radio they use geostationary Inmarsat satellite transmission.

7.2 Future technologies

BMI [48] identifies vehicle identification as a future development. This system consists of a device that is installed in the vehicle, which can transmit a secret signal with certain information about the vehicle, such as the make and registration number. The responders at the service provider's base station can pick up these signals. The vehicle can be identified even if its exterior has been tampered with.

7.2.1 Vehicle Immobiliser and Anti-Hijack Systems

Anti-hijack systems that use fibre optics as their main component are being installed in companies. Only trained personnel using sophisticated equipment can install these systems.

7.2.2 Satellite versus Radio and Cellular Networks

Vehicle tracking systems are increasingly becoming GPS and GSM based. The satellite network can enhance the operations of existing radio networks so efficiently that operators would rather collaborate than have their systems working independently.

In conclusion it can be appreciated how companies can come together as a cluster to respond to a market need.

8 Subscriber Trends

8.1 Overview

In South Africa the cellular industry has grown by more than a hundred percent in the first two years, with a gradual decrease in the subsequent years. This is illustrated in the figures and tables in this chapter. In this chapter S-curves are used to illustrate the growth trends of the market, with the subscribers/consumers as main focus. An explanation for the growth trends is also given.

8.2 Consumers

S-curve for Vodacom subscribers using cellular phones and S-curve of data communications services subscribers.

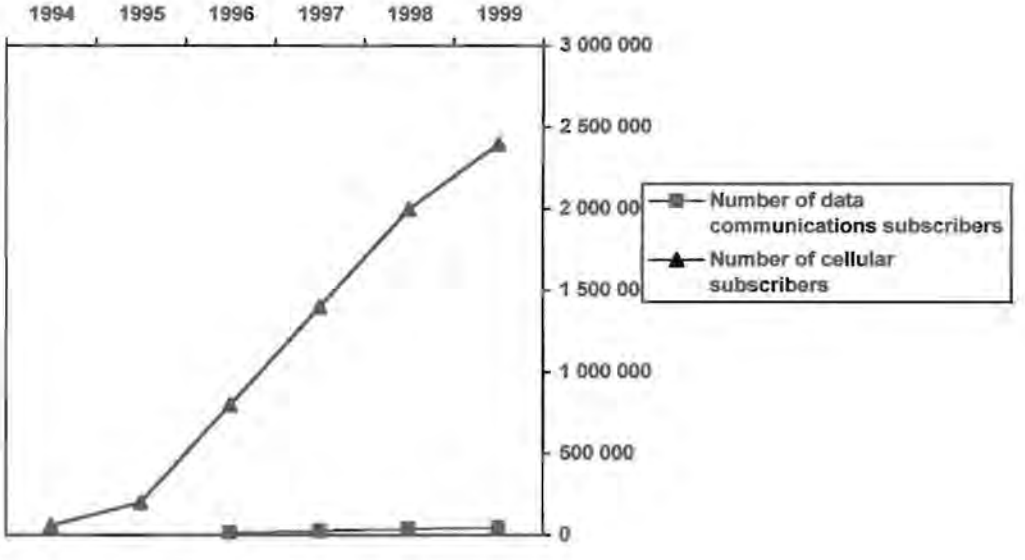


Figure 8. 1 Vodacom Subscribers [49]

According to a Vodacom representative [49] Vodacom has only 20000 data communications subscribers. Vodacom had 2.4 million subscribers in 1999. 60% of these subscribers were prepaid subscribers.

Table 8. 1 Number of Vodacom Subscriber [49]

Year	Number of subscriber	Annual Growth Rate
1994	60,000	
1995	200,000	107 %
1996	800,000	120 %
1997	1,400,000	55 %
1998	2,000,000	35 %
1999	2,400,000	18 %

The number of data communications subscribers at Vodacom is very low. The reason why the number of data communications subscribers is so low is that the community has not been fully educated on data communications and cellular phone users have up to now been more interested in making telephone calls as opposed to using data communications. Subscribers have to be taught to be data users.

The perception of the subscriber is important. Once subscribers have become used to using the Internet and e-commerce, they will want to transfer these transactions to mobiles. Service providers are not used to using Internet Protocol and the Internet. Once service providers get exposure on the Internet Protocol and become familiar with the Internet, they will be energised and the sales channels will become interested in selling data packages. The distribution channels will have to be integrated into this solution because they are still geared to selling voice only. The solution is simple bundle packages, with software integrated with the telephone and the PC card integrated with the terminal.

MTN, on the other hand had 1,200,000 subscribers up to 1999, of which 40% are prepaid according to Chard [50]. By the year 2002 projections by Vodacom are that the total cellular market consist of 10 million subscribers being serviced by MTN, Vodacom and the third service provider, and that satellite telephone technology will have 2000 subscribers. The target market for satellite telephone technology is corporate management and travellers. Bearing in mind that it is a very expensive service. Vodacom predicted that mobile satellite services would commence on the second half of 1999.

The figures in table 8.1 are used to analyse trends in the cellular telephones industry in South Africa.

Please note that for doing calculations for data communications that 60% prepaid do not use data communications. Therefore 60% of the total number of subscribers was subtracted to get the number of subscribers who can actually opt for the service. The author of this report calculated 5% of the subscribers to actually get the number of subscribers who are using data communications.

Figure 8. 2 MTN Cumulatives Figure For Cellular Phone Subscribers And Satellite Telephone Subscribers [51]

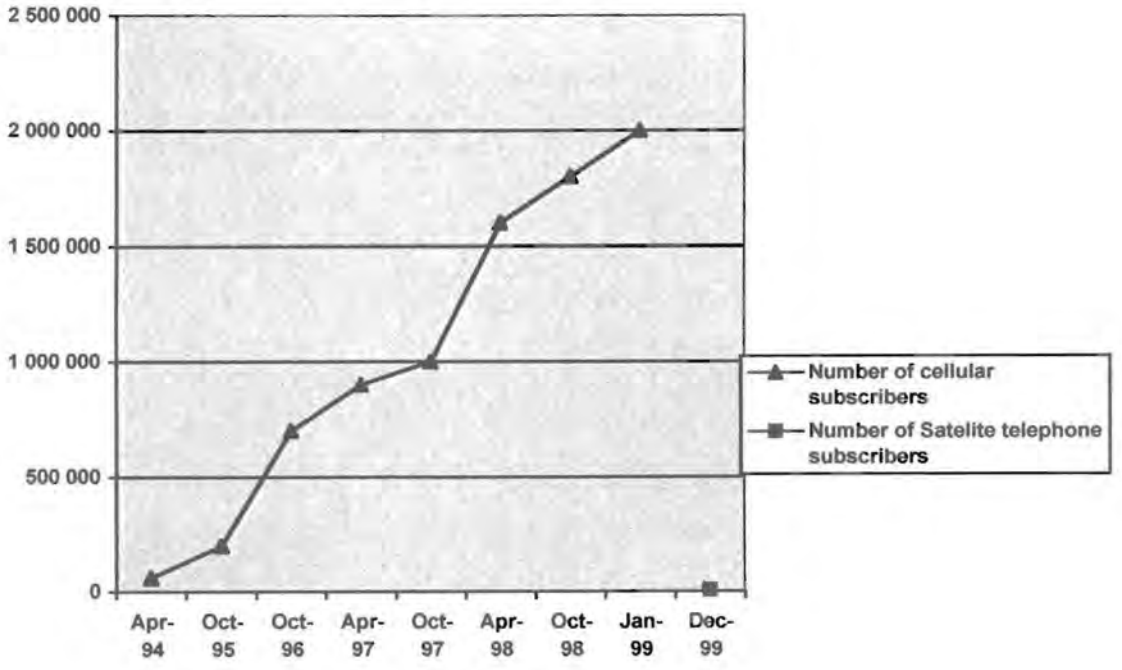


Table 8. 2 MTN Subscriber Levels [51]

YEAR	Subscriber Levels	Annual Growth Rate
1994	60,000	
1995	200,000	107%
1996	700,000	111%
1997	1,000,000	35%
1998	1,800,000	57%
1999	2,000,000	10%

These figures were provided by an MTN marketing representative [51]. The figures illustrate how MTN was competing in the cellular phone market. The author decided to start MTN and Vodacom off at the same level of subscribers because MTN was not forthcoming with its figures for the years 1994 and 1995.

An MTN representative [52] gave an estimation of the MTN's satellite telephone subscriber level. He estimated that there would be 5000 subscribers by the end of 1999. The reason is that satellite telephones were considered to be too expensive and out of reach in terms of price. He added that in the future there would be an increase in subscriber level when prices come down and volumes go up.

Another source from MTN [53] said that between 5000-8000 cell phones per month are stolen in South Africa. He estimated that there are 100 000 stolen cell phones on the South African market. He gave the subscriber numbers in South Africa up to 1999 as 1,1 million MTN subscribers and 1,4 million Vodacom subscribers. He thus claimed that there were 2,5 million cell phones on the market.

These figures furnished to the author of this report do not tally with marketing figures from the marketing offices of both Vodacom and MTN.

Figure 8.2 indicates an initial growth in MTN's number of subscribers during the years 1994 to 1997. After these years the growth had become is less rapid. This could mean that the market was becoming saturated with contract subscribers. In figure 8.2 a second rapid growth period is indicated during 1997-98 after the introduction of the prepaid service. Here a second phenomenon is observed of substitution of prepaid for contracts. Another observation is that market expansion took place as a result of the introduction of the prepaid service, which is more affordable than the contract service. The rapid market growth in 1996, is the result of the introduction of prepaid service at MTN, and also illustrates that substitution of one service for another had started to take place.

In the next section reasons are given to explain the growth rate of the MTN subscriber level illustrated in figure 8.3 below

Chard [50] says that prepaid customer, now account for more than half of the subscribers of many of the region's cellular network operators. In countries like Uganda and Zimbabwe this figure has risen to 90% or more. Statistics such as these provide a clear indication of how the cellular market is evolving and diversifying.

In South Africa MTN is phasing out the Pay-as-you-go option as it presently stands. The new, all encompassing Pay-As-You-Go 'One Card', brings MTN prepaid offering in line with prepaid systems widely used by most European operators. With around 80-90% of its subscribers using prepaid option, this operator has tailored its package to cater for two types of users, by introducing the, receive a lot card and call-a-lot card.

Both cards give access and airtime, but the user's choice depends on card value and the type of subscriber one is. On the corporate side, MTN has a card costing R720, that provides a year's access to the network and allows the user outgoing calls up to the value of the card. MTN to MTN calls are R2.50 per minute and MTN calls to other services is R2-75 a minute. Subscribers can load up to 24 months access time.

Chard [50] says that prepaid service is a regional solution where many of the people are unable to produce financial credentials necessary for a conventional airtime contract agreement. Prepaid service has opened a whole new market to access. There was a quote from the Reserve Bank stating that 30% of South Africans have bank accounts, which

means that 70% of the population operate with cash, and many of them want to be on the cellular network. This is why the prepaid market has grown so rapidly (Vodacom launched its Vodago service in 1995, and now has 1,2 million users).

A further reason why the prepaid is attractive to the South African users is that it is an off-the-shelf product, which is readily available through a wide variety of retail outlets. It is, in most cases, virtually ready for use the moment it is taken out of the box and a simple card to the operator is all that it takes to activate the service. Another reason for the popularity of the prepaid option is the freedom it gives the user. Airtime access can be purchased as and when it is required. For users who are on a tight budget, this provides them with the ability to control expenditure, which is an important advantage of prepaid services.

A cellular network operator can exploit other opportunities, for example by increasing the number of distribution channels to widen market opportunity (and hopefully sales volume). Greater market segmentation and therefore an opportunity to target a specific user sector. The market for used handsets can also be expanded (thus encouraging greater sales of prepaid SIM's). Another result is greater product differentiation from the competition.

Since most cellular contracts in the Southern African region result in the user owning a handset when the contract expires, transferring to prepaid becomes a viable option, as is selling the handset and starting a new contract (in order to upgrade the handset). The market for used handsets is flourishing, an individual can purchase a handset between R200-R400 in South Africa. Redeployment of the handset can be directly linked to an increase in the number of subscribers for the network operator.

Another advantage of prepaid services is that the number of distribution channels can be increased. The network operator can distribute its prepaid packages through virtually any channel, such as traditional service provider routes, supermarkets or petrol stations, etc.

Chard [50] points out that the same applies to airtime vouchers. One of the biggest challenges facing network operators is getting vouchers distributed as widely as possible and this has created a whole new industry. The voucher seems to appeal to the market since it is a "cash-and-carry" transaction. One party hands over cash and the voucher is

given in exchange. Vouchers are now sold virtually everywhere. Dealers are encouraged to stock vouchers through discount incentives and there are now even roadside vendors selling vouchers to motorists who stop at traffic lights.

Service providers and independent dealers can also create their own prepaid packages. MTN supplies its standard prepaid SIM packs to dealers, who can in turn buy their own handsets and bundle these together with the SIM and badge the product as their own. While the risk of internal fraud is very limited, given the high security measures implemented throughout manufacture and distribution, prepaid vouchers/scratch cards still pose a problem. Once they are printed, active and ready to use they could be stolen. MTN has a stringent system and its prepaid platform can blacklist all stolen cards and make them unavailable for loading.

Another threat to the network operator's prepaid system is the fact that SIM-only packages encourage the black market for stolen handsets.

The consensus from network operators is that the future for prepaid is bright. Its challenge is tailoring packages that meet the demand for different market segments. The prepaid option itself will diversify further. The whole intelligent network concept has great growth potential. There will be more flexibility in services with the possibility of two different accounts for the same customer. In corporate applications, for instance, certain numbers could be specified and when dialled could be charged to a corporate account, while personal calls could be charged to a private account.

Industry insiders are certain that the corporate business can turn the prepaid option to their advantage by changing from contract to prepaid, since it enables them to work according to a set budget. This ensures that employees of corporate do not exceed their cell phone allowances. The barriers to such a conversion are the initial monetary outlay, the cost-benefits off-peak calls with conventional airtime agreements and the cost and inconvenience of changing cell phone numbers.

Some cellular providers do not see migrating from contract to prepaid as a problem, since contracts are still more attractive to customers than the prepaid option when tariffs are compared, and have advantages like eventual ownership of the cell phone, more value-

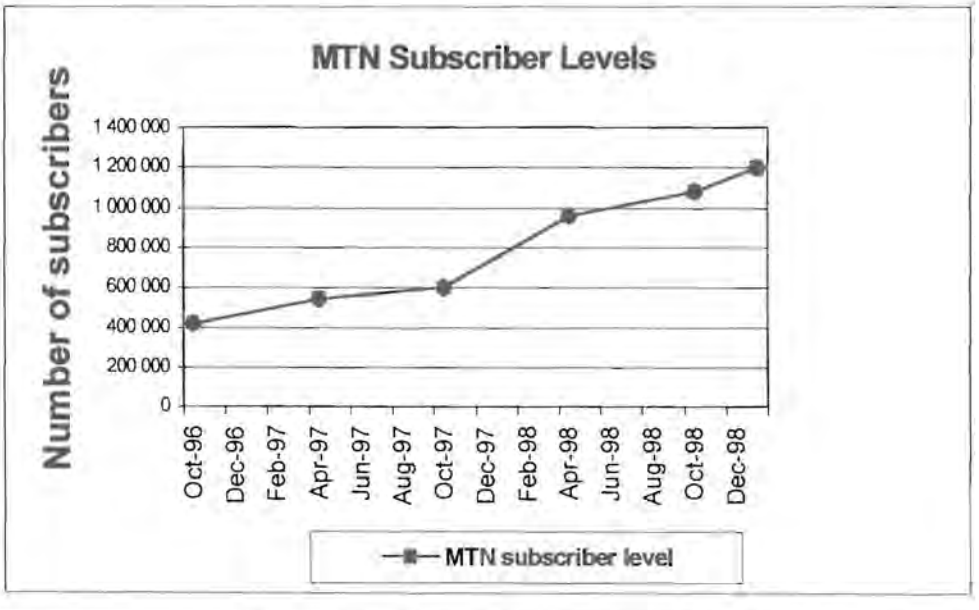
added services and international roaming. Prepaid actually reduces the risk of client bad debt as those who cannot afford to purchase an airtime agreement can simply buy-as-they-go.

When the third operator comes into business a drop in tariffs is anticipated. Price wars and prepaid packages will be a big contributing factor to the positioning of the networks in terms of subscriber base. Chard [50] says that the importance of prepaid for the network operator is beyond question. The main challenge will be to prevent customer churn through quality of service and to limit the amount of migration from contract to prepaid.

BMI [48] says the growth of the SA cellular market has been spectacular, up to ten times the expected take-off. Both Vodacom and MTN regularly claimed world records for the installation of base stations and subscriber growth. Churn, or the rate at which people swop networks, is relatively low at less than 20%. This suggests that people are reasonably happy with the service they get from their operators, but no one tracks down people who use the services then quit completely or who perhaps prefer the prepaid route.

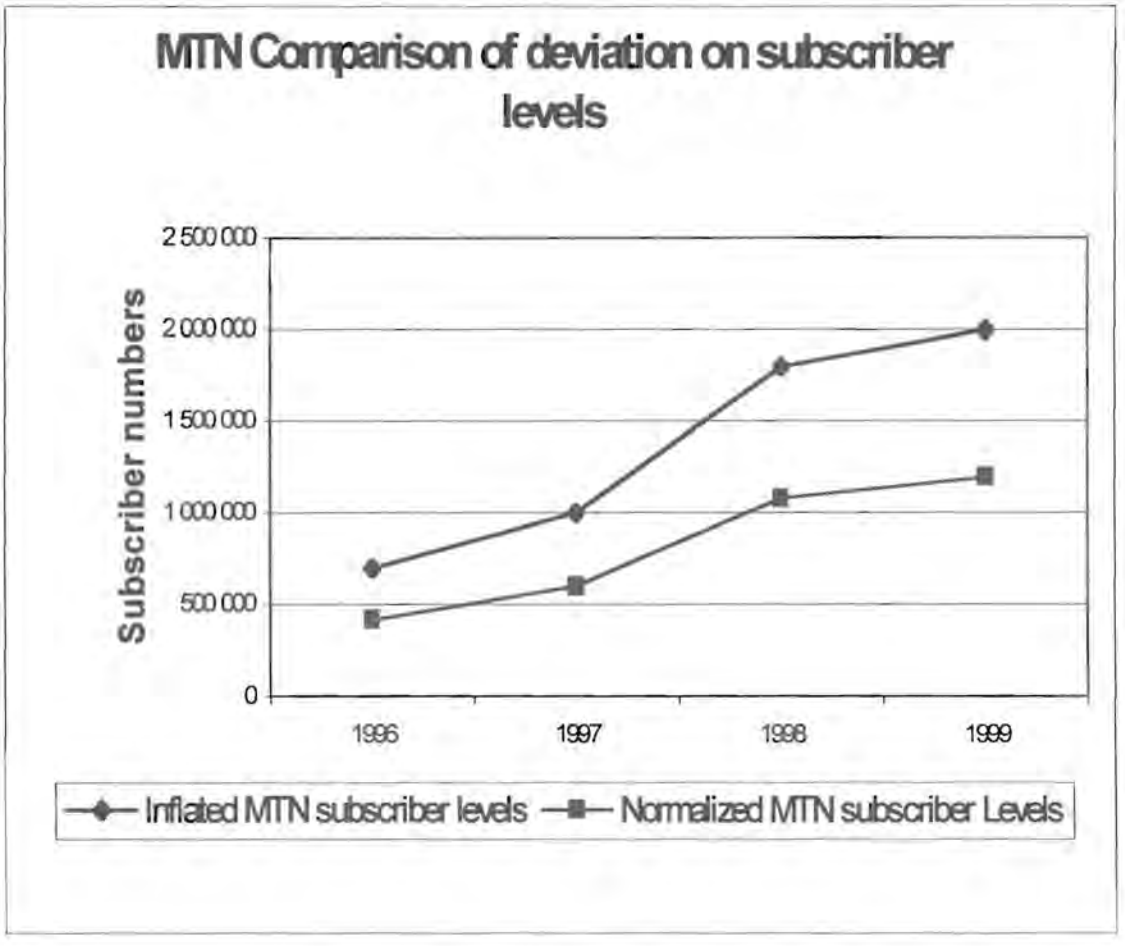
Both network operators have introduced value-added and premium rate services such as short message sending, fax mail, phone-in enquires, paging, vehicle tracking, sports results and stock market prices.

Figure 8. 3 MTN Subscriber Levels [53]



According to an MTN representative [53] the correct figures for MTN's subscriber base are the above in figure 8.3 as opposed to the ones received from MTN's marketing department in figure 8.2. In 1996 MTN introduced the prepaid packages for its subscribers, which, fuelled the growth of the subscriber levels. This package needs no contracts, no credit checks and the client gets instant access. While examining figure 8.3 one can observe that the S-curve is still in the growth phase. Here growth is driven by investment in terms of the fact that MTN had increased its distribution capacity and perhaps had solved some of its problems, for example by expanding its coverage in South Africa. At the same time MTN substituted its existing services (the ordinary prepaid package) with new and improved services that has benefits, such as free voicemail and unlimited incoming calls for a prepaid amount of money.

Figure 8. 4 MTN Comparison Of Deviation On Subscriber Levels



The subscriber base shown in figure 8.2 is much larger than that shown in figure 8.3. As a result it shows the MTN subscriber base to be much larger that it really is. When looking at the above figure 8.4 it shows the inflation of MTN's subscriber levels. These figures make up almost the total figure of the then given subscriber levels in South Africa in 1999 which was, 2,5 million subscribers.

MTN [54] says it conducts constant market research to determine the rapidly evolving changes in customer demand to enable them to tailor packages accordingly. In 1999 their marketing department introduced some customer friendly packages. These packages were for example *Carryover minutes*: which permits subscribers to transfer unused free airtime from one month to the next, and *share-time* an new package for couples, partners and children or any other twosome). Further developments include the elimination of a two card system and the introduction of a much more convenient one-card system for the prepaid options.

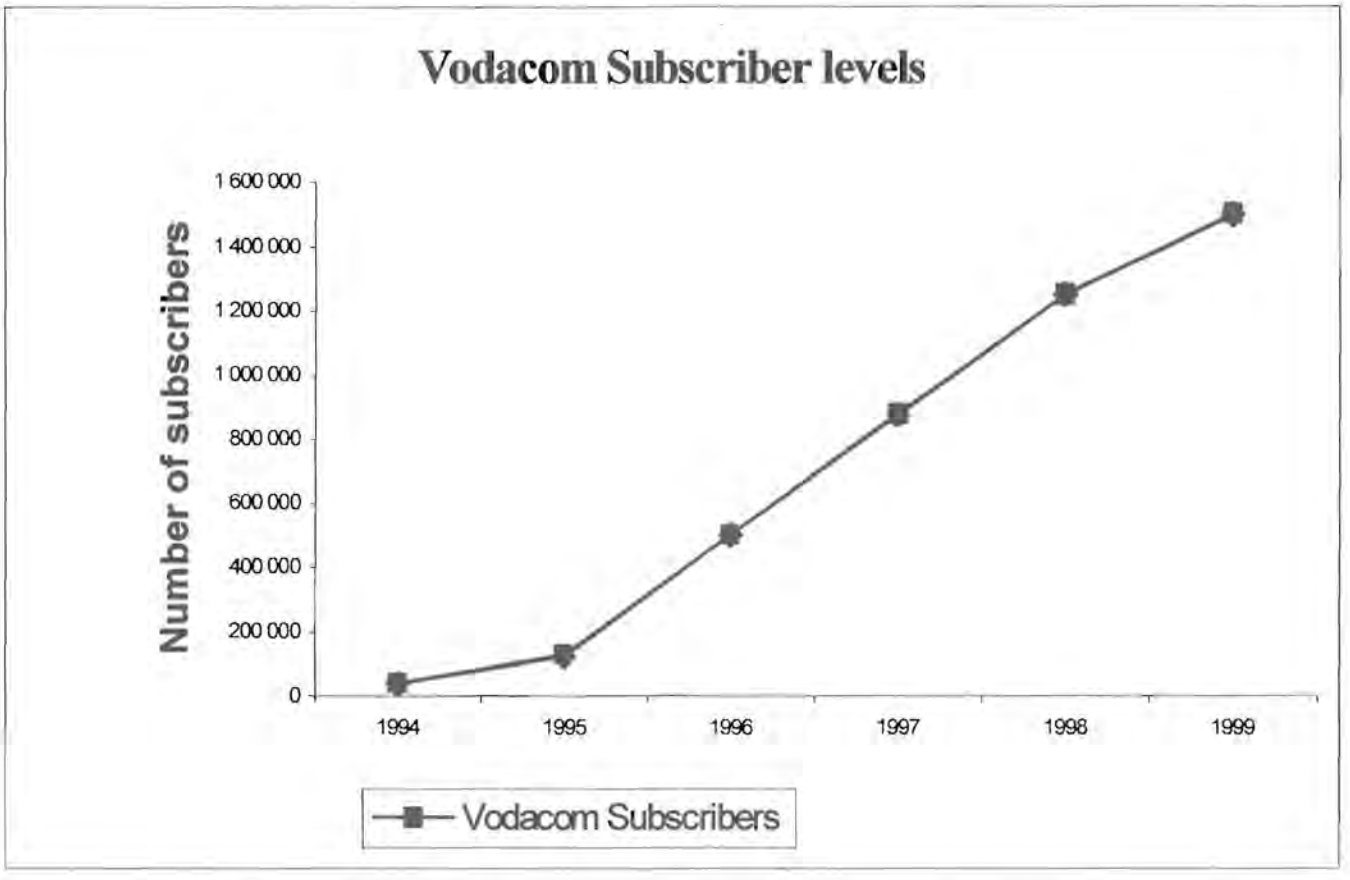
MTN [54] says among the unique services are "CallQuest" and "CallAudit". These software packages, which utilise the Internet are comprehensive on-line bill analysis tools, suited to both individuals and corporations, which provide access to valuable information about individual and group cellular usage.

In keeping MTN's young-at-heart spirit and dynamism of attractive promotions throughout the year, which are geared for subscribers of all ages and at every level of society, MTN's strategy is focused on developing regional hubs around which clusters of business will be developed. MTN has become an integral part of the challenging new developments taking place in technology. Convergence is one of the latest phenomena palms at the merging of technologies including cellular, Internet and even satellite.

MTN [54] says the future promises technology, which will enable mobile phones to roam seamlessly on desktop extensions, while synchronising transparently with desktop PCs and corporate local area networks (LAN's). The clear definition between PCs, mobile handsets, PDA's and television sets is already starting to disappear. Voice over the Internet will make PCs and mobile handsets almost indistinguishable. In other words, technology is converging around consumer and the consumer is mobile.

In the next section, Vodacom (the other service provider) is discussed.

Figure 8. 5 Vodacom Subscriber Levels [53]



From figure 8.5 it is clear that the introduction of the prepaid service in 1995 increased the growth of the subscriber base. This increase continues steadily along the growth phase of the S-curve as Vodacom introduced new bundled packages that replaced the ordinary prepaid packages. And the no credit no contract service is really gaining market share. The difference between figure 8.1 and figure 8.5 is that the subscriber bases are different in number. The subscriber base used in figure 8.1 were from figures given by the marketing department which seemed to be of the mark.

Figure 8. 6 Vodacom Subscriber Level deviation Comparison

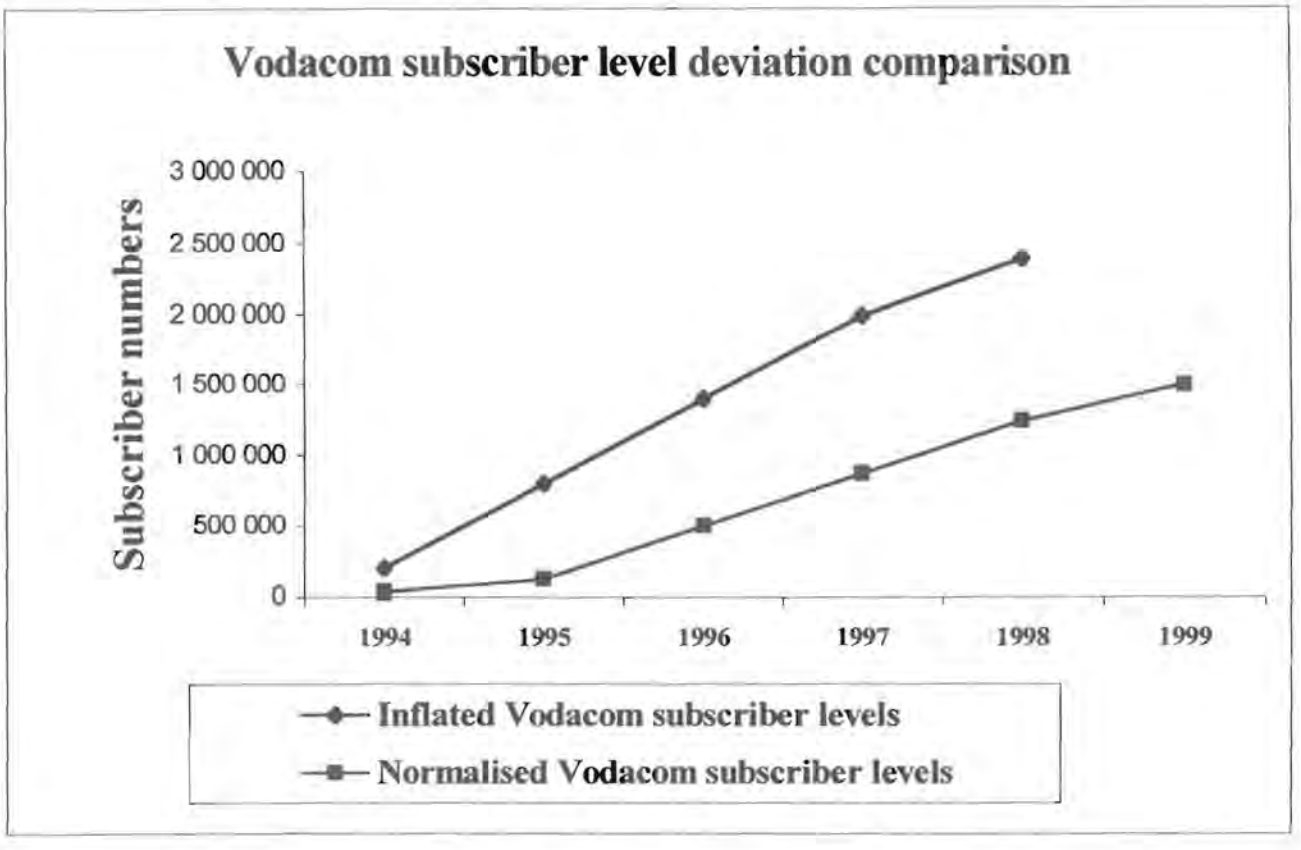


Figure 8.6 shows the difference between the two given logically, the inflated levels are inaccurate because they represent the total subscriber base of South Africa in 1999. Some other factors that are influencing the growth phase of Vodacom's subscriber base are mentioned below.

On 1 March 1994 the first 2,000 phones were connected, just before the elections, as a test phase. The following month another 10 000 were installed. As soon as this happened done election officers and journalists wanted cell phones. When the floodgates opened on 1 June 1994, in the first month Vodacom had 50, 000 subscribers. In order for Vodacom to gain and maintain its lead it had to ensure that an effective retail structure was in place. That helped attract subscribers through fierce competition at retail level. At the same time Vodacom was rolling out its network along 3000 kilometers of national highway.

In 1995, Vodacom used personal safety as their advertising ploy to increase subscriber levels. Value added services were also introduced such as voice-mail platform to increase the number of subscribers. In 1996, Vodacom introduced a fresh growth strategy, by building its Intelligent Network (IN) platform. The IN paved the way to a number of new products, which attracted new groups of consumers to cell phones. Vodacom introduced four new bundled tariff packages. The "Weekender" (free calls over the weekends) was aimed at the growing informal and casual market. Significantly, service providers qualified for a full connection bonus on Weekender connections, thereby discounting the price of cell phones and making it more accessible to this market.

The "Talk100", "Talk200" and "Talk500" tariffs indicated the number of free minutes included in a fixed monthly fee and were aimed at existing users who had a good idea of their cell phone usage. Vodacom did not charge for migration between its various tariff plans, thereby boosting usage of the new packages.

The most spectacular new growth came from the introduction of "Vodago", a prepaid, no contract, no-credit product. In fact the introduction of the prepaid propelled the cellular industry into a fast-moving consumer goods market. In 1997, a new service called "Shareline" was launched jointly with Business Report and Dow Jones, giving investors instant access to JSE share price information. In 1998 Vodacom entered the Internet market with the launch of Vodacom's Internet company, its new Internet Service Provider, a Yebo! Net which prepaid access to the Internet at local Telkom rates.

In 1999 Vodacom also signed a roaming agreement with another satellite system, Iridium. The agreement with Iridium means that Vodacom subscribers in possession of Iridium satellite handsets are able to use their Vodacom SIM cards in the handsets.

A Communications Consultant [55] says that, in the past four and a half years, cellular telephony has put some two million cell phones in the hands of South Africans across the spectrum and it has given millions more meaningful access to telephony for the first time. Effective marketing driven by people with an understanding of the importance of timing has been the key force in the explosive growth of the R10 billion South African cellular industry. The key to success in a competitive marketplace is to associate one's brand with a product category so that when customers think "cell phones", for example, the brand

name "Vodacom" springs to mind first. An example of a brand name, which has successfully achieved this, is Hoover. Not only do millions of consumers think "Hoover" when they think, "vacuum machine", but they actually refer to "Hoovering" when they mean "vacuuming". A marketer has really cracked it when it can claim this kind of association in the minds of consumers.

A communications Consultant [55] claims that Vodacom has achieved this in some respects. Vodacom's hugely popular television advertising largely revolves around two central characters, the antics of which are followed with great interest. One catchy phrase in the script - "Yebo gogo", is meant as a greeting and is difficult to translate. However, many people now refer to cell phones as "Yebo gogo's" and the "Yebo" part of the phrase (which means "Yes" or "hello"), is often found in newspaper headlines referring to Vodacom and cellular in general.

A communications consultant [55] points out that being proactive, as Vodacom was when it began advertising its brand seven months ahead of commercial operations, has the advantage of enabling a company to establish its brand as the generic term for its product category, as described above. However, there is the disadvantage of having to carry substantial marketing costs as one takes on the responsibility of guiding the consumer through the process of learning about a totally new product. Once a marketer has spent millions on this education process there is nothing to stop a competitor from entering the market and embarking on straight brand advertising once all the groundwork has been laid.

According to Communications Consultant [55] it is relatively easy to create an awareness of a need, but more difficult to take a product to those places where customers can be found. Vodacom had a vision of turning airtime into a fast moving consumer good and therefore cellular needed to be available where consumers bought their groceries. Vodacom took cellular out of the exclusive realm of the specialist retailer. Today there are more or less 6 000 distribution outlets where one can buy cellular-related goods, including hundreds of corner cafes, garage shops and takeaways.

A communications consultant [55] add that marketers often talk of the importance that retailers attach to the parking lots next to their supermarkets. It is not that parking lots attract customers, but they have become a "given" and the customer views them as an

essential element of the shopping experience. They do not per se generate revenue and seem to make extremely unproductive use of space; but without a parking lot the supermarket is doomed. South Africa's network of national roads is the "parking lot" of the cellular industry. Vodacom will certainly not generate much revenue from a base station erected alongside a highway in the middle of nowhere; however, the cellular customer expects to be able to use a cell phone all the way from Cape Town to Johannesburg.

The South African cellular industry is organised in such a way that customers have little contact cellular network operators. There is a number of service providers who are responsible for the retailing of airtime contracts and who have more day-to-day contact with customers than service providers do. As a result, the customer could feel more loyal towards the service provider than towards the network operator.

Many service providers are dual service providers and confused loyalties do not go a long way towards reducing churn, an important objective of any cellular network operator. Therefore, Vodacom developed the first cellular retail centre in the world, "Vodaworld", to generate loyalty towards Vodacom by satisfying every customer who visits the centre while keeping the service provider structure in place.

Marketing is best done within a competitive environment and therefore Vodacom welcomes South African Telecommunications Regulatory Authority's (SATRA) decision to award an additional two cellular network licences. The introduction of new networks is an excellent development in an industry with the capacity of growing to 10 million users in the medium term. However, Vodacom is concerned about the conditions that SATRA would apply to the new licences, particularly that they might be more favourable than those under which Vodacom began operations.

A communications consultant [55] says that if Vodacom has to absorb the costs of these conditions and new entrants do not, then that will be against the spirit of free competition, which, Vodacom is trying to foster. New entrants are already fortunate enough not to have had to build awareness of cell phones and their applications. As mentioned above, Vodacom has carried substantial marketing costs in its quest to educate consumers about cell phones.

Burgelman *et al* [19] say the following, "corporate management of technology requires careful planning of the relationships among a company's technologies, its markets and its development activities and it requires systematic linkages between a company's product and process technologies, the products developed must also be produced efficiently". They say that in marketing many critical questions remain unanswered. Some of them are:

- What problems are involved in selling a technology?
- Is a company that sells a technology giving away its "seed" and thus prejudicing its future?
- How, to whom and when should a technology be sold?
- What is the relationship between the sale of a technology and the sale of a product based on that technology?

They say that a complete marketing of a technology requires the development of a coherent strategy for a full portfolio of technologies.

8.3 Development of a Coherent Strategy for a Full Portfolio of Technologies

The decisions on acquisition or divestment of individual technologies are the result of an awareness of the value of developing technology primarily for direct sale without incorporation into products. The clear understanding of the relationship between the sale of a technology through license and the sale of products based on that technology is a recognition that a technology buyer often has a better idea of its needs and opportunities than a technology seller; reliance on technology marketers.

Vodacom addresses some of these issues in its marketing strategy. Vodacom's marketing profile has the following characteristics.

Vodacom's positioning:

A communications consultant [55] talks, of Vodacom's advertising he says that Vodacom's Yebo Gogo advertising campaign has given the brand a 100% awareness level and that it has won numerous awards for effective and popular advertising. A series of commercials with the Yebo Gogo theme and characters have been developed which has become an

integral part of the South African culture. The characters are in demand and consumers anticipate the next chapter in the ongoing story.

The tone of the advertising is warm, likeable, friendly, humorous, and relays the message that Vodacom is South Africa's favourite and most reliable network. Vodacom continues to concentrate its advertising on the medium of television, especially as cellular services and products have developed into a mass-market product.

Vodacom's advertising strategy communicates Vodacom's leadership strategy and shows subscribers the benefits of leadership.

According to Communications Consultant [55] relationship marketing at Vodacom focuses to retain preferred clients and build loyalty. This is achieved through database evaluation, data enhancement, analysis, research, marketing and sales. One of the most effective vehicles used is Vodacom's subscriber magazine, *Vodaworld,* with a print order of 160,000.

Vodacom's regional marketing department is acutely aware of the different requirements in the regions of operation. Local tactical communication opportunities are used advantageously by regional marketing teams who understand that market.

Sports marketing at Vodacom has achieved massive brand awareness through its sport sponsorships, especially as official network of the Rugby World Cup, sponsorship of Vodacom Cup rugby and, more recently, its multi-million sponsorship of the PGA Golf Tournament.

In addition Communications Consultant [55] says retail market research at Vodacom's thousands of outlets retailing airtime and cell phones, point-of-sale material has to be innovative, eye-catching and has to communicate the brand-character of Vodacom. Literature has been developed that is flexible, interchangeable and durable. The characters from Vodacom's 'Yebo Gogo' campaign have been used extensively in point-of-sale material to communicate the brand qualities and distinguish Vodacom from its competitor.

Figure 8. 7 Total Cellular Subscriber Base In South Africa [56]

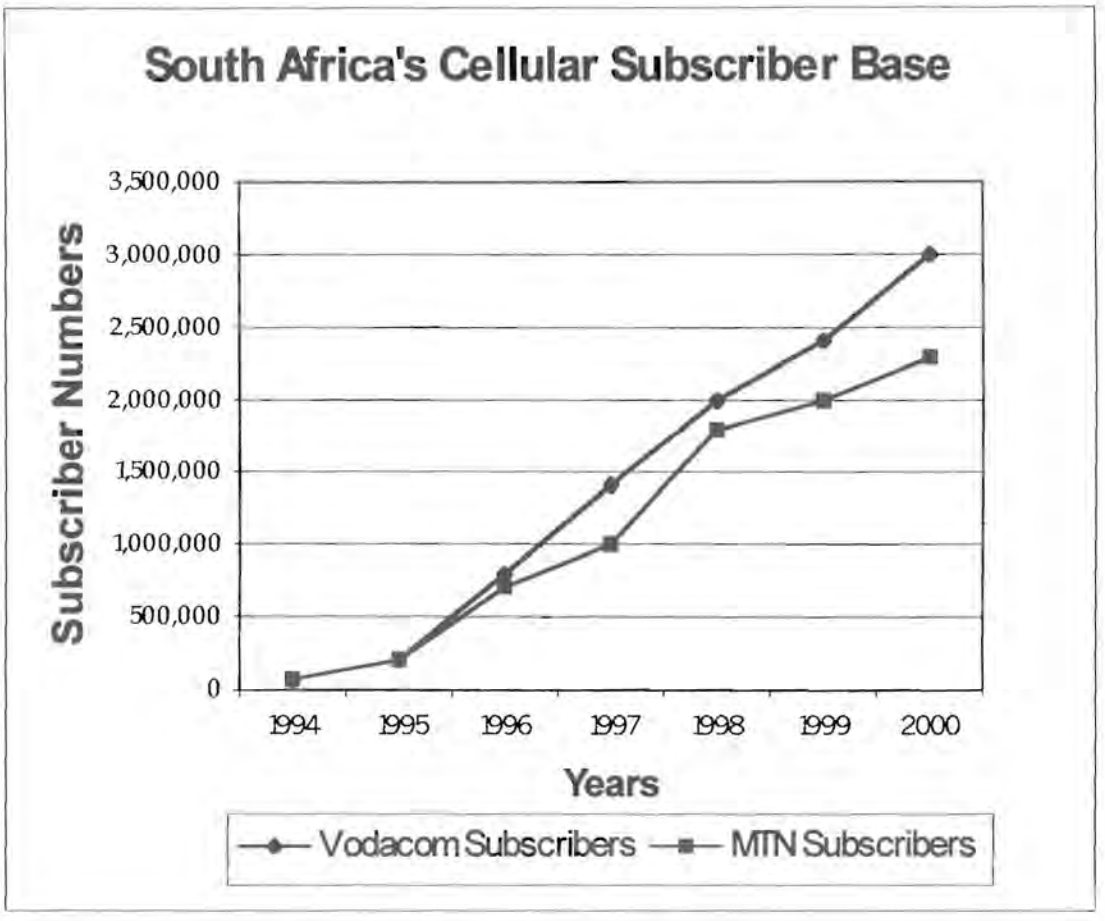


Figure 8.7 illustrates a few things about the cellular industry in South Africa. First of all it gives us a clear indication that Vodacom is leading in terms of subscriber base. Secondly it shows us that the growth rate that Vodacom is experiencing is much higher than that of MTN. This could be attributed to the fact that Vodacom is always ahead in introducing services. MTN seems to have taken the "follower approach" in this market. The reason could be that MTN does not want to invest too much into breaking ground in services; all it does is to come up with a product/service that will substitute a product/service that Vodacom has already introduced.

9 Industry Interviews.

9.1 Overview

In 1994 South Africa's leading service provider, Vodacom, published its projections for growth in the cellular market. Vodacom had projected 250,000 subscribers in ten years starting from 1994. Within a month of operation, starting from the 1st of June 1994, Vodacom had 50,000 subscribers. By the year 1996 Vodacom had passed its 300,000-subscriber milestone. In 1995 Vodacom introduced the "Vodago" package and its introduction caused rapid growth in the cellular industry. This is clearly illustrated on the S-curve of cellular subscribers with Vodacom, (see figure 8.7). In 1996 MTN introduced the prepaid package for its customers. By the same token examining MTN's S-curve (see figure 8.7) this was the beginning of growth of MTN's subscriber base.

It is important to establish what facilitated the growth of the cellular industry in South Africa. A questionnaire was put together to establish what propelled the diffusion of cellular phones and the ever-increasing customer base of the service providers. The questions asked were inline with diffusion mechanisms used in the industry. The author wanted to establish how mechanisms actually influenced the growth of the industry. The questions were important, because they enabled the author to establish what type of industry of South African cell phone industry is and which mechanisms are used to diffuse product and service.

A questionnaire/Interview was administered to help address the below mentioned questions:

- How did the industry manage to attract a subscriber base that far exceeds the projections?
- What type of industry is the cellular industry in South Africa?
- What types of mechanisms were used to promote the technology and the service?
- What sort of social factors are involved in the desire to have access to airtime plus owning a cell phone?
- Is a cellular phone a status symbol, convenience or necessity?

- Is it necessary to be able to communicate while one is on the move?

To address the issues mentioned above a questionnaire was put together in order to provide insight into the cellular phone industry. The method of administering the questionnaires was to interview top level officials in the respective companies, namely Ericsson and Nokia, (the leading suppliers of cell phones in South Africa). Vodacom and MTN (the service providers) and Iridium as the new satellite service in South Africa.

Representatives from the following companies were interviewed:

- Nokia;
- Ericsson;
- Iridium;
- MTN; and
- FCB, on behalf of Vodacom.

The questionnaire used in the interviews is included in the appendix, as well as definitions of the various diffusion methods.

9.2 Interviews about Diffusion Mechanisms

9.2.1 Nokia Interview

The Nokia representative indicated that Nokia diffuses cell phones by working through the service providers. The service providers buy cell phones from the suppliers in bulk, e.g. 50,000 units. Then the service provider in turn distributes these cell phones through retail outlets. The retail outlets vary: MTN uses Saleshouse, MTN cellshops, Incredible Connections outlets, grocery stores (such as Checkers) and garages (such as Engen).

Vodacom, on the other hand, uses Jet, Vodac, Radiospoor, Nashua, Plessey cellular, Nedtel Cellular, Dion, Jet, GSM, Vodac, Smartcall, Teljoy Cellular services, Edgars, Global Telematics, grocery stores (such as Pick n' Pay) and garages such as Engen).

In terms of brand names Nokia is number one in South Africa; this is because of their aggressive advertising strategy. They fund the retail outlets to advertise for them in conjunction with service providers. Nokia owns 51 % of the market share in South Africa

because of their brand name awareness. It is the eleventh strongest brand name in the world, worth 11 billion Rand.

Nokia is always pushing for functionality improvement to ensure that their customers remain loyal. A new direction that Nokia is taking is providing business solutions for corporations; this is done by selling their equipment, in such a way that, the technology can be used for problem solving. Nokia recently provided a business solution for Askafrica, which is a research company that does market research across the country. In order for Askafrica to get its results quickly and to enable them to timeously update their database in Pretoria. They use a network technology business solution, which allows researchers in the field to dial directly from their cell phones into the network to update their database. It is an efficient way of using sophisticated equipment to do research at low cost and a different mindset. This in turn is translated to competitive advantage in the marketplace for this company, since the results they get from the field are reported on time and analysed quickly to be first to market.

The Nokia representative added that he saw a new market penetration at the lower end of the market, which includes school children up to the age of five. This is because of the new packages "call a lot" and "receive a lot" which both service providers have introduced. Running costs of these packages is about R10-00 a month.

The prepaid option has made it possible for a new market of second hand cell phones and stolen cell phones. Stolen cell phones are becoming a problem because countries like Zimbabwe, Mozambique and Malawi are not part of the International Trust Corporation (ITC), which is the body that keeps a blacklist of stolen cell phones. Since these countries do not belong to the ITC, they provide a market for stolen cell phones from South Africa.

In response to the questionnaire the Nokia representative rated the effectiveness of diffusion mechanisms in this order:

Rate 1: Excellent / Very Good

- Collaboration
- Corporate Research
- Joint Ventures
- Corporate Culture

- Newspaper Advertising

Rate 2: Medium

- Outsourcing Agreements
- Long-term-contracts
- Partnership
- Technology Transfer
- Billboard Advertising
- Radio Advertising
- Convenience versus price ratio

Rate 3: Low

- Board Participation

Rate 4: Poor

- Technology Conferences
- Technical Expertise
- Expeditions(Expo's)
- Regulation and Legislation

Rate 5: I do not know

- Gatekeepers
- Competing Technologies

In other words, according to the Nokia representative collaboration, corporate research, joint ventures, corporate culture and newspaper advertising are the best ways of diffusing cellular phones.

9.2.2 Ericsson Interview

The Ericsson representative said that South Africa has a potential market of 17 million subscribers of which the market has only just captured 2.5-million subscriber base. He says that Ericsson, as a supplier, does not have direct contact with the end-users, since they use the service providers to distribute their handsets. The two service providers MTN and Vodacom buy handsets in bulk from Ericsson, then in-turn distribute these handsets to

wholesalers. These wholesalers are their direct link to the end-user. He added that Nokia has a 30% market share as opposed to Ericsson that has a 17% market share. Nokia sales are said to be ahead of those of Ericsson because of the aggressive marketing strategy that Nokia uses.

Like Nokia, Ericsson is also on a campaign of brand building. They are concentrating on cell phones with more functionality, in order to improve their end-user base. The Ericsson representative rates prices as the most important factor in the diffusion of cell phones.

In response to the questionnaire the representative rated the effectiveness of diffusion mechanisms in this order:

Rate 1: Excellent/Very Good

- Board Participation
- Technology Transfer
- Technical Expertise
- Newspaper Advertising
- Price
- Industry Structure
- Clusters

Rate 2: Medium

- Collaboration
- Outsourcing Agreements
- Gatekeepers
- Corporate Culture

Rate 3: Low

- Competing Technologies

Rate 4: Poor

- Corporate Research
- Long-term contracts

- Radio Advertising
- Convenience versus price ratio

Rate 5: I do not know

- Billboard Advertising
- Expeditions (Expo's)

According to the Ericcsson representative board participation, technology transfer, technical expertise, newspaper advertising, price, industry structure and clusters are the best diffusion mechanisms.

9.2.3 Iridiumafrica Interview

The Iridiumafrica representative pointed out Iridium does not have a licence to operate in South Africa. As a result they provide services to companies which operate outside of South Africa, e.g. Anglo-American and Murray & Roberts. These companies are doing development work where landlines are unavailable, so satellite communication is a solution for them. The representative felt that Iridium would be a solution for South Africa's communication difficulties especially in the rural areas.

Iridium's licence to operate in South Africa has not yet been granted. As a result they are unable to do business with big companies like Eskom and Standard Bank. These companies had indicated they were prepared to use Iridium services to provide Y2K solutions and Iridium already has the infrastructure to do business in South Africa. In addition, MTN has contracted to work with them and already uses them as a roaming service outside South Africa. Like other cell phone suppliers they will use MTN and Vodacom as their distributors, who will, distribute to the wholesalers, who are in direct contact with the end user.

In response to the questionnaire the representative rated the effectiveness of diffusion mechanisms in this order:

Rate 1: Excellent / Very Good

- Gatekeepers

- Technical Expertise
- Radio Advertising
- Expeditions (Expo's)
- Regulations and Legislation
- Clusters

Rate 2: Medium

- Collaboration
- Corporate Research
- Outsourcing Agreements
- Long-term contracts
- Partnership
- Corporate Culture
- Billboard Advertising
- Convenience versus price ratio
- Industry Structure

Rate 3: Low

- Price Influence

Rate 4: Poor

- Joint Ventures
- Competing Technologies

Rate 5: I do not Know

- Board Participation
- Technology Transfer

According to the Iridiumafrica representative, gatekeepers, technical expertise, radio advertising, expeditions (Expo's), regulation and legislation and clusters are the best diffusion mechanisms.

9.2.4 MTN interview

The MTN representative was part of their strategic planning department. She highlighted how MTN adds value to cell phones by providing them airtime. Without airtime cell phones are of no use. She confirmed that MTN has agreed to use Iridiumafrica provide satellite services. According to the MTN representative, they are constantly improving their services by bringing out new packages like the Incomer / Outgoer. This are aimed at subscribers who operate strictly on cash basis and have no credit record and also provides a market for second hand cell phones.

In response to the questionnaire the representative rated the effectiveness of diffusion mechanisms in this order:

Rate 1: Excellent/ Very Good

- Collaboration
- Corporate Culture
- Technology Transfer
- Technology Conferences
- Newspaper Advertising
- Competing Technologies
- Price
- Clusters

Rate 2: Medium

- Corporate Research
- Joint Ventures
- Partnership
- Board Participation
- Technical Expertise
- Radio advertising

- Industry structure
- Regulations and Legislation

Rate 3: Low

- Gatekeepers
- Billboard advertising
- Expeditions(Expo's)

Rate 4: Poor

- Long-term Contracts

Rate 5 : I do not know

- Outsourcing Agreements

According to the MTN representative the best diffusion mechanisms are collaboration, corporate culture, technology transfer, technology conferences, newspaper advertising, competing technologies, price influence and clusters.

9.2.5 FCB Interview on behalf of Vodacom

At Vodacom a Communications Consultant [55] pointed the author of this report in the direction of Lindsay Smithers, who look after their marketing.

The representative from FCB pointed out that in this industry the suppliers, service providers and wholesalers work together. They all need each other to be in business. The suppliers need the service providers to promote and sell their handsets because they do not have direct access to the end user. The service providers need supplier's handsets to add value to their airtime, so they actually need the suppliers to make the equipment, for them to be able to give the airtime service. They also do not have direct contact with the end user so they need the wholesalers to distribute their services to the end user. As either a package meaning that one could get a free cell phone on contract or one would purchase a cell phone and just buy airtime. He emphasised that they use billboard advertising just for brand building, while radio and newspaper advertising is used to promote the service provider.

Vodacom also sponsors events like music shows (e.g. Roberta Flack shows) and sports events in conjunction with companies like Siemmens and Telkom. It is very cost effective because of the exposure that Vodacom gets through these concerts, which increase the number of subscribers. He pointed out how effective it is to use stores like Jet, Edga's and Game, at one point they seemed to be selling more cell phones than clothes.

In response to questionnaire the FCB representative rated the effectiveness of diffusion mechanisms in this order:

Rate 1: Excellent / Very Good

- Collaboration
- Joint Ventures
- Partnership
- Gatekeepers
- Board Participation
- Billboard Advertising
- Radio Advertising
- Newspaper Advertising
- Price
- Convenience
- Clusters

Rate 2: Medium

- Corporate Research
- Long-term contracts
- Corporate Culture
- Competing Technologies
- Industry Structure
- Regulations and Legislation

Rate 3: Low

- Outsourcing Agreements

- Technology Transfer
- Technology Conferences
- Technical Expertise

Rate 4: Poor

- Expeditions (Expo's)

The representative from FCB says that the best diffusion mechanisms are collaboration, joint ventures, partnership, gatekeepers, board participation, radio and newspaper advertising, price, convenience and clusters.

10 Discussion of Diffusion.

10.1 Discussion of Diffusion

In the cellular industry in South Africa, collaboration plays an important part, an aspect already mentioned in previous chapters. The suppliers need the service providers to diffuse their hardware (cellular phones). In return the service providers need the suppliers to add value to their airtime by providing them with cell phones.

For the purpose of this research the author looked at two suppliers: Ericsson and Nokia. Ericsson and Nokia have no access to the end users. For their hardware to get to the end users, the suppliers need the retailers or wholesalers (Jet, Saleshouse, etc.) to sell their cell phones. In order to get the cell phones to the retailers, the suppliers have to go through the service providers (distributors), who have set-up shop for the retailers.

Figure 10. 1 A Summary of the Structure of South Africa's Cellular Industry.

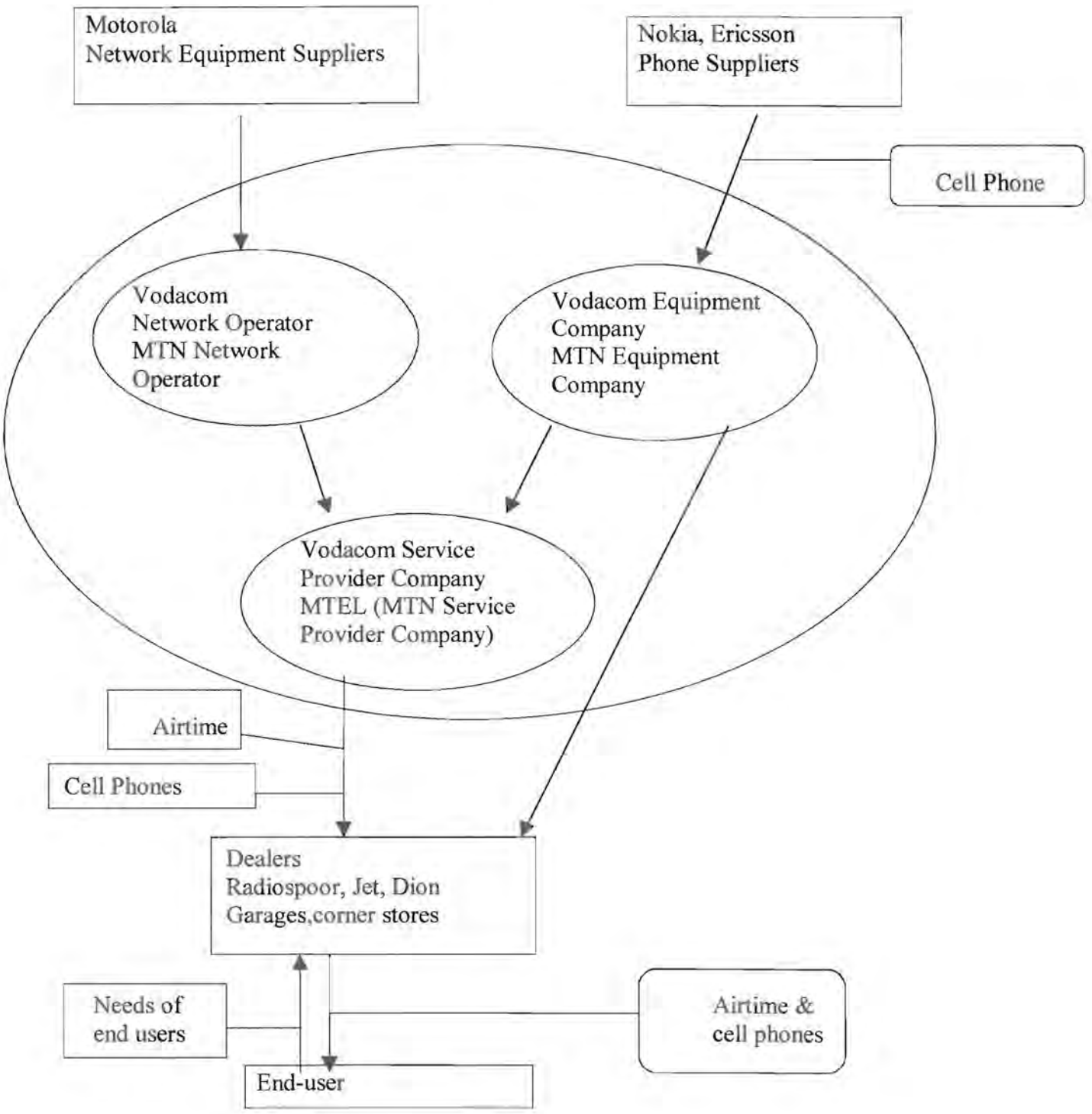


Figure 10.1 illustrates the links between different players in the cellular industry in South Africa. There are links from the Network equipment supplier to the network operator, from the network operator to the service provider, from the service provider to the dealers then eventually to the end-user. There are links from the phone suppliers such as Nokia and Ericsson to the service providers, from the service provider to the dealers and then from the dealers to the end-user. There are links from the phone suppliers to the Vodacom equipment company to the dealers and then to the end-user. The service providers are responsible for setting up the dealership infrastructure, which is the interface between the end-user and the network operator. What happens in this industry is that in order for the cell phone from the supplier to reach the end-user, two routes can be taken. The first is that the cell phone goes from the supplier to the service provider who adds value to the cell phone by supplying airtime. Then, the cell phone and the airtime are supplied to the dealers by the service providers to be sold to the end-users. The second route is that the cell phone comes from the supplier directly, then to the equipment company, then directly to the dealers, then from the dealers to the end-user. In order for the cell phone and airtime to reach the end-user, the use of innovation and diffusion theory takes place. With regards to innovation service providers, network operators, equipment companies and suppliers scanned the environment for processes and products that would satisfy the end user. In addition these players worked together as a team to ensure that product/service innovation took place. The interplay between the dealers, suppliers, service providers and end users contributed positively in the marketing arena by enabling the service providers to position their products and enter target markets successfully. To sustain the industry, the service providers need the support of the other players in the industry. The support system relies on interaction, integration and links of the different components of the industry.

Once this has been achieved a second level of innovation is needed, namely process innovation. Process innovation aims to improve processes within a company, industry or collaboration. It is focused on the current position and direction of a business. In the cellular industry, process innovation is focused on making the industry more efficient by improving certain functions and activities. In figure 10.1 links between the different players are shown, which indicate that there is a lot of communication between the players and that means there is a communications network that has to be managed effectively to

ensure that all players are synchronized. The type of management used here is innovation management; in other words, management by learning. Because new knowledge and technology is being introduced and then diffused and disseminated.

The objective of this research is to analyse the diffusion process (as discussed in the previous paragraphs) of personal telecommunications. The service provider in the personal telecommunications industry has to make sure there are end users who need their services (airtime); by the same token, suppliers need end users to whom to diffuse their hardware (cell phones). For this to take place diffusion theory has to be implemented. Figure 10.1 shows an "end user" category that can be referred to as a social system. This is a requirement for diffusion service provider/supplier has to have an adopter system to adopt the innovation or service in the market. Secondly communication is necessary in order for diffusion to take place. This is illustrated, in figure 10.1, where arrows indicate the communication channels between the role players in the industry. Communication also fulfils other requirements for diffusion, such as advertising for marketing and the exchange of ideas and know-how, which improves, the efficiency of the process and product innovation. Included would be the management of the Collaboration within the cellular industry.

Another interesting facet within the cellular industry is that one of the role players, namely the network operator, is in control. This network operator has been able to manipulate the total system to its advantage. The network operator influences all other role players, from the supplier to the end user. The network operator can even influence regulations in the industry. In the next paragraph, detailed description of some of the processes is given.

In order for these cell phones to be sold, some awareness campaign or information about the cell phones has to get to the end users. This is done through advertising. The suppliers cross subsidise the retailers for advertising purposes. This is done such that, for example a Nokia cell phone can be bought from the retailer Radiospoor. Before this stage is reached, Nokia's brand awareness has to take place, which means Nokia on its own has had to do some ground work for its merchandise. This is to ensure that end-users are aware of what it is selling and that it is meeting the demands of the target market. For Nokia to get this right it has to understand its customer profile. The customer profile has to be defined from the up market end, to the other extreme, which is low-end market extreme. Once this has

been achieved then a supplier can now market along side a retailer to actually sell the actual merchandise.

The network operator influences the actual sales of the cell phone. The reason for this is that the network operator offers airtime through its service providers, at rates that the end user will afford. Included in this should be their value adding services that the service provider offers to the end user. In the days when contracts were the only way to get mobile the subscriber levels were increasing, but not at the rate that, subscribers are increasing since the introduction of the prepaid packages. Once we saw an introduction of the prepaid we observed a defined increase in the subscriber levels. This is because it has become quite easy to get mobile. Subscribers no longer have to be credit worthy to become mobile. This has definitely influenced the growth of the market size and a new penetration in the market. Service providers influence the market penetration through the price of their airtime in the market. The lower the cost of being mobile, the higher the subscriber levels.

The author of this report can deduce that the network operators control the cellular industry. Another factor is that the network operators through their service provider companies are the main distributors for the dealers and as a result the author could say the network operators control the cost of the handset. The service providers advertise their value-adding services and packages. At service provider level advertising is done at tariff level and what services they actually provide. There are also special deals that the service providers advertise, in conjunction with their dealers who do business with the end user. For example, the service provider offer the in-comer and out-goer packages, targeted at the lower end of the market. These have proven to be affordable for people who are not heavy users of cell phones. The rates are fixed during the day at peak hours and there are discounts after peak hours. Airtime for incoming calls is unlimited in this market segment. Contracts are advantageous for people who use cell phones frequently, because they have peak and off peak tariffs.

Collaboration in the cellular industry is done for strategic purposes. The network operators ~~service providers~~ and suppliers have teamed up because they both specialise in different facets of the personal telecommunications. The other reason could be that individual players do not have the capital or skill to put on a one-man show in the industry. The supplier uses the service provider's capabilities whilst the service provider on the other

hand uses the capabilities of the supplier. This is done strategically to enter certain markets and sell certain products on the market. For example: Vodacom works together with Nokia with the goal of selling Nokia's cell phones and Vodacom's airtime. Nokia has no access to the end user and therefore uses its strategic partner to access the end user. Vodacom has access to the end user through its dealers. Through the dealers needs from the end user are channelled through the service provider to the equipment company then to the supplier. These needs are used to develop technology or improve existing technology. Working closely with users facilitates for technology development and enhancements. As an illustration Nokia has responded to the need of mobile subscribers who want to access their data files on their cellular phones. It has responded by developing cellular phones with big screens such that end users may view their files on their screens. In addition service providers have already taken the liberty of training end users to use data communications by offering its subscribers fifteen text messages per month. This is done to wet the appetite of WAP users. Another facet illustrated by figure 10.1 is the entrepreneurial aspect of it. This industry is set up in such a way that new businesses must be developed to facilitate the diffusion of personal telecommunications. For example distribution channels were set up to be able to bring the innovation to the end user. To achieve the goal of taking the innovation to the end user new business centre had to be set up.

For the cellular industry to operate there must be some form of regulation in it. There must be some regulatory body to run this industry. In the case of South Africa it is SATRA, which focuses on telecommunications regulation, which is becoming an outdated way of running this industry. Telecommunications and Broadcasting are converging technologies. In the past telecommunications and broadcasting were separated by the fact that they had separate markets with no common characteristics in both infrastructure and service aspect. Another factor is that both telecommunications and broadcasting belonged to monopoly market structures that were traditionally state owned. Even when these markets were privatised it was imperative to focus mainly on the core business. This era has now come to an end where these industries were separate. Because of developments such as liberalisation in the telecommunications sector and digitalisation in broadcasting, these markets have converged and a single regulatory body for both broadcasting and telecommunications has become necessary.

The purpose of regulations is to safeguard against anti-competitive practices from Public Switch Telephone Network (PSTN) monopoly operations and to ensure fair competition and an increased operating efficiency in the mobile communications market, which strengthens market competitiveness.

In this context liberalisation means the political desire to open up the emerging market to different operators. This is so consumers can be given a chance to choose from alternative solutions. It is a difficult task because main contenders like service providers find it difficult to retain their market share. In addition rapid technological evolutions lead to the globalisation of markets, with the result that operators compete beyond their traditional national markets. This is where strategic alliances come into play, because once companies start to compete beyond their borders they need to join forces for a number of different reasons.

Joint ventures are formed to create alliances between two or more competitors. In the telecommunications industry competitors join forces so that they can enter markets in advanced telecommunications services. The parent companies of these joint ventures remain independent competitors on neighbouring markets, which means that the joint venture is a vehicle for co-operation with the goal of ensuring that parent companies co-ordinate their activities in the markets where they remain competitors. This results in reduction of competition in markets. In addition joint venture between companies operating in different economic sectors often creates or strengthens the dominant position of either joint venture or the parent company.

The regulator has to look after asymmetrical (mis-proportioned) regulation, which normally seems to favour former monopoly service providers. This is because they have the advantages of market knowledge, which sometimes ensures that they already have a reputation amongst consumers. Economies of scale are taken advantage of by broadening of services offered. Included is the availability of developed, distributed infrastructure and financial resources. On the other hand it allows for new entrants to leapfrog, by using the latest technology without worrying about its returns.

As far as symmetrical (proportioned) regulation is concerned, it is supposed to favour newcomers. This is because the former monopolies find themselves burdened with the

costs of supplying the basic services to non-profitable areas plus social categories. The basic assumption is that the telecommunications markets are competitive and that regulation should be as limited as possible.

For the purpose of this research two supplier companies (Nokia & Ericsson) were asked to participate in a questionnaire. In addition the two service providers (MTN & Vodacom) as well as Iridium, also participated.

The goal of the questionnaire was to establish, the most effective diffusion mechanisms, as prescribed by the companies. These were their responses.

Scale of 1 to 5

1. Excellent/Very Good;
2. Medium;
3. Low;
4. Poor;
5. I do not know.

Table 10. 1 Results from Questionnaire Administered in Industry.

Diffusion Mechanisms	Supplier	Supplier	Service Provider	Service Provider	Satellite	Average Score
	Nokia	Ericsson	Vodacom	MTN	Iridiumafrica	
Cluster		1	1	1	1	1.0
Newspaper Advertising	1	1	1	1		1.0

Diffusion Mechanisms	Supplier	Supplier	Service Provider	Service Provider	Satellite	Average Score
	Nokia	Ericsson	Vodacom	MTN	Iridiumafrica	
Collaboration	1	2	1	1	2	1.4
Price		1	1	1	3	1.5
Corporate Culture	1	2	2	1	2	1.6
Technology Conference	2	1	3	1	5	2.2
Industry Structure		1	2	2	2	1.8
Partnership	2			2	2	2.0
Joint Ventures	1		1	2	4	2.0
Radio Advertising	2	4	1	2	1	2.0
Corporate Research	1	4	2	2	2	2.2
Technical Expertise	4	1	3	2	1	2.2
Outsourcing Agreements	2	2	3		2	2.3
Convenience Versus Price	2	4	1		2	2.3

Diffusion Mechanisms	Supplier	Supplier	Service Provider	Service Provider	Satellite	Average Score
	Nokia	Ericsson	Vodacom	MTN	Iridiumafrica	
Ratio						
Regulations & Legislation	4		2	2	1	2.3
Gatekeeper	5	2	1	3	1	2.4
Board Participation	3	1	1	2	5	2.4
Technology Transfer	2	1	3	1	5	2.4
Billboard Advertising	2	5	1	3	2	2.6
Long-term Contracts	2	4	2	4	2	2.8
Competing Technologies	5	3	2	1	4	3.0
Expeditions (Expo's)	4		4	3	1	3.0

In table 10.1 above, an average score was calculated on every diffusion mechanism and the list was arranged according to the score. The lowest average is given the highest rating according to the rating scale. The most highly rated mechanisms are **clusters** and **newspapers** with the average rate 1.0. The second highest is **collaboration** with an average rating of 1.4. Third rated mechanism is **price** with an average rating of 1.5.

Fourth is **corporate culture** with an average of 1.6. Fifth position is **industry structure** with a score of 1.8. **Partnership, joint venture** and **radio advertising** are sixth with an average of 2. **Corporate research, technology conference** and **technical expertise** are seventh with an average of 2.2. Eighth is **convenience versus price ratio, regulation legislation** and **outsourcing agreements** with an average of 2.3. In the ninth position are **gatekeepers, board participation** and **technology transfer** with an average of 2.4. Tenth is **billboard advertising** with an average of 2.6. **Long-term contracts** with an average rating of 2.8 are eleventh and **competing technologies** and **expo's** are rated lowest with an average rating of 3.

Judging from the above mentioned it is clear that according to the leaders in this industry, the most effective diffusion mechanisms are clusters, newspaper advertising, collaboration, price, corporate culture, industry structure, joint venture, partnership and radio advertising. Diffusion in this industry is done by joining forces: from the supplier through the equipment company, the service provider to the dealer, then from the dealer to the end-user. This diffusion process has to be managed. Management of this industry is both vertical and horizontal. The industry requires management that is knowledgeable at all levels and with strong links and interrelationships that are very strong. The risk involved in managing an industry like this should be spread across the players, so that everybody understands their stake and is willing to share responsibility.

11 Conclusion and Recommendations.

11.1 Conclusion

In this research the diffusion of personal telecommunications is examined. The literature review included theories like, diffusion theory, competition theory, forecast theory, cluster theory and managing innovation theory. These theories all encompass diffusion of an innovation. According to these theories firms almost never innovate in isolation and purely from their own resources. The direction of an innovation and its form are influenced by the way firms interact with one another within their industry.

For innovation to place and be diffused it must be done within a regulatory framework. This regulatory system does not only formalise rules and regulations but helps shape public policy within the environment. In addition one has gathered that an innovation/technology does not translate into profit on its own. It needs the diffusion process to achieve that. By description diffusion is a social process that relies on channels of communication, through which knowledge, skill and competence can be spread.

This flow of information should come from customers and should be fed back into the innovation process. It should also flow between companies, strategic alliances and clusters. For the diffusion process to take place it also needs flexibility in operation to meet diverse and emerging company needs. The flexibility mentioned here is such that one can also deduce that there are different rates of diffusion across firms, which result sometimes in output growth, which translates into new employment opportunities. This is seen especially in communications and information sectors. What it means then is that diffusion should not only be aimed at disseminating technology and knowledge to firms. It should also enhance the ability of firms to identify, absorb and build on technologies in the future. To be able to achieve this firm needs to be able to learn.

Diffusion policies should be used to foster the learning process within companies. Learning is imperative since diffusion is complex: it involves interactions with different actors, companies with different roles, for example suppliers, producers, adopters, information networks and non-adopters. This can only be achieved through space, time

and between different industries and companies, bearing in mind that it depends on a particular product or service.

In conclusion: for diffusion to be successful, companies must be encouraged to work together to accumulate information, learning and strengthen ongoing business technology development. This type of networking may be horizontal, vertical and in firms of different industries but with shared interest in technology.

This whole process of innovation and diffusion has to be managed somehow. In this process of management clear business objectives and strategies have to be formulated. What is even more important is the handling of the product including the target market. Analytical tools must be used to analyse activities and information flows. Furthermore external analysis of competitors, customers, suppliers, legislation and value must be identified in order to gear the strengths of firms and weaknesses and opportunities.

From the literature review and discussions with leading players in personal telecommunications companies in South Africa, namely Nokia, Ericsson, Iridiumafrica, Vodacom and MTN, the following conclusions about the South African cellular industry can be reached.

It is an industry, which has shown rapid growth. The main driving force behind this rapid growth is the cost of airtime and the price of the handsets. In addition subscribers do not have to be creditworthy to be mobile. In a nutshell one does not have to enter into a contract with the service providers and earn a monthly salary in a certain bracket to be able to be connected.

Another contributing factor is the ease with which subscribers can get cellular phones and airtime vouchers. The accessibility of these facilities has definitely contributed to the increase of the subscriber base, and the cash-and-carry phenomenon with no strings attached, has worked magic for the South African industry.

The awareness campaign, which Vodacom engaged in seven months before the industry went operational, was worth the investment in every sense. It did not only benefit Vodacom but also benefited MTN. By the time Vodacom went operational, the subscribers who could afford the service, flooded Vodacom with requests for connection.

One can also concluded that the network operators are controlling the industry. The reason is that the network operators operate as a hub or central point in the industry. They control the link between the suppliers and the end users. The service providers have set up dealers to sell airtime and the hardware to the end users. The dealers have to work through the service providers to purchase the hardware (cell phones) from the suppliers. With this in mind it can be seen that competition in this industry is thus both horizontal and vertical and has boundaries so to speak. It is also competition that has helped in the rapid diffusion of the cellular phone. This is illustrated by the fact that the network operators set up distribution channels through their service provider companies as wide as possible and as quickly as possible in order to beat their competitor in capturing the desired market. The suppliers have a dedicated market of supplying equipment in which they compete at supplier level and at retail level. The service providers compete at the level of service providers with services they offer and also at the level of retailers. In order for this industry to survive and keep growing players continually have to develop competencies such as teamwork, networking, systems thinking, creativity, resourcefulness, rapid learning ability and adaptability because they will be skills that employers will value and reward for they need them according to Buys [57].

This whole diffusion process has to be managed from the development of the product to the use of the product and service. The different levels of the industry all have to be managed: the supplier, service provider, dealer and end user. At each level an integrative type of management has to be administered, ensuring that all the interrelationships of the industry are maintained and strengthened from time to time, both vertically and horizontally. SATRA is the regulatory body who regulates competition and administers regulation and legislation within the industry. The regulator should be pro-active in making sure that it introduces policies that are in line with other countries of the world. So as to encourage a more dynamic environment for the telecommunications industry. The regulator should also have incentives for encouraging competition amongst players in the industry.

Since the industry is flourishing, one can conclude that; experts in technology management are managing the telecommunications industry, in South Africa.

11.2 Recommendation

The regulatory body, should, foster successful competition in the market. This could be achieved by doing the following:

- Defining the most appropriate market form and formalities that govern the entry of new operators;
- Managing the conditions under which the various operators can carry out business;
- Managing the possible market exit of some of the operators;

In addition, if the dominant provider is already vertically integrated, favourable interconnection terms must be set for the newcomer, or the newcomer must be allowed selective entry into the profitable markets. The responsibility for providing universal service is the obligation of the incumbent.

Another important task is to encourage unbundling with regards to potential newcomers, by preventing them from acquiring whole packets that are prepared by dominant providers.

Innovation is a process that needs diffusion in order to make an impact or be profitable. It has now been established that for diffusion of an innovation to take place, the ideas can stem from many sources, including the recognition of markets. This means that a great amount of communication takes place. Knowledge and information are shared between firms, consumers, laboratories etc, and feedback from product development and marketing is also part of the sharing of information.

The distribution of knowledge is becoming, increasingly important and it is necessary to develop knowledge distribution networks. For the knowledge distribution networks to be effective and effective linkages between them have to be established and the diffusion of technology has to be effectively managed.

It is recommended that technology management be used exploit knowledge management.

11.3 Further research:

A topic for further research could be:

How can technology management as a tool be used to advance knowledge management?