

Minimum infrastructure integration for fixed-mobile converged offerings

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ABSTRACT

In the face of increased competition from mobile operators and their continued dominance traditional fixed-line incumbents were forced to acquire or build mobile capability and become integrated operators. However, the advantages these mobile operators derived from early entrance in the mobile market makes it difficult for incumbents to compete against them, even with mobile capability. Integrated operators therefore see Fixed-Mobile Convergence (FMC) as the next evolutionary step to increase their competitiveness through differentiation.

FMC requires significant investment in infrastructure and technology integration which comes at significant cost. This is further compounded by un-assured return on investment for the capital employed to integrate infrastructure. This study explores the customer experience benefits envisaged by the implementation of FMC as well as the minimum level of infrastructure integration required to support FMC sustainably.

Data was collected through semi-structured interviews with open ended questions and was exploratory in nature. The key findings were that FMC provides clear differentiated customer experience benefits around convenience & simplicity, cost, quality and innovation in relation to traditional telecommunication services. These benefits had to be achieved in totality to obtain real differentiation while achieving them required integration across the system, network, organisation and strategic levels of the organisation. It was also found that complete integration is required to deliver FMC sustainably, however, this can and should be done in a phased manner in order to capture available opportunities immediately and to manage risk.

Integrated operators should therefore pursue FMC in a measured and cautious way while considering all the elements required to differentiate their offering from existing substitute products. The infrastructure integration roadmap should also be context specific and executed in a phased manner.

DECLARATION

I, Farhaad Gany, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

Farhaad Gany

Signed at

On the day of 2013

DEDICATION

To my family, without their tireless support, encouragement and patience this research would not have been possible.

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CHAPTER 1: INTRODUCTION

1.1 Purpose of the study

The purpose of this research is to identify the minimum level of infrastructure integration required for integrated telecommunications operators to provide fixed-mobile converged solutions that meet customer experience requirements in the consumer market.

1.2 Context of the study

Telecommunications operators were traditionally categorised as either fixed-line or mobile operators. The South African market is not unique in this respect and is constituted by two dominant mobile operators, a dominant fixed-line operator and two smaller operators; one in fixed-line and one in mobile. Fixed-line operators are the traditional incumbents that offer fixed wireline telecommunications services while mobile operators offer wireless telecommunication services and were initially seen to be market attackers. Until recently the fixed-line and mobile domains were separate ecosystems and were generally separated by regulatory mechanisms such as licencing for specific types of telecommunications technologies within the fixed-line and mobile domains. This has however changed, and there is a trend from regulators towards providing technology agnostic licenses to operators in an effort to liberalise the market by removing barriers to competition (Nielson, Falconer, & Mashinini, 2012). This trend is also evidenced in the South African context where the industry regulator, ICASA, instituted a new licensing regime in 2008 that made no distinction between operators from a technology perspective, but instead classified operators as electronic communication service providers (ECS) or electronic communication network service providers (ECNS) (Nielson et al., 2012). ECNS licensees are able to own and operate telecommunication networks of any technology type i.e. fixed-line or wireless, and ECS licensees are only able to offer telecommunication services to consumers while leasing network infrastructure from ECNS licensees. An operator, though, is able to

acquire both ECNS and ECS licences with the traditional large telcos from both the fixed-line and mobile persuasions usually recipients of both.

This new regulatory environment caused fixed-line incumbents to develop mobile capability and become integrated operators so that they could mitigate declining fixed-line revenue as a result of fixed-mobile substitution; a trend where consumers increasingly substitute their fixed-line telephony and data products with mobile products (Nielson et al., 2012). It is within this context that integrated operators are now increasingly looking towards FMC to improve their profitability and increase their market shares (Kim, Nam, Jung, & Ryu, 2010).

1.2.1 *Fixed Mobile Convergence (FMC)*

FMC is the convergence of wireless and wireline voice, video and broadband services through seamless integration of fixed and wireless networks (Raj, Narayan, Datta, Das, & Pathak, 2010). It allows consumers to seamlessly move between an operator's fixed and mobile networks via a single device without having to disconnect and reconnect their calls or interrupt their data sessions.

1.2.2 *Infrastructure integration and Equipment*

Substantial investment in network infrastructure is required for FMC since the fixed-line networks and mobile networks of operators together with their supporting operational support (OSS) and business support (BSS) systems are separate and un-integrated. This is due to mobile and fixed-line networks historically using different technological platforms such as circuit-based switching for fixed-line networks and GSM or WCDMA for mobile networks. With the investment in next generation networks, both fixed-line and mobile networks are moving towards a common Internet Protocol (IP) based platform that will allow seamless switching of calls between the fixed-line and mobile networks (Amer, 2009). This network integration will require substantial investment in infrastructure and equipment before an operator is able to deploy FMC offerings (Kim et al., 2010). Compounding this are the uncertainties operators face with customer demand, choice of technology and choice of

strategy (Wong, Low, & Hiew, 2006). The business challenge being faced by operators pursuing FMC strategies is identifying the optimal point in the infrastructure integration process at which they are able to offer FMC solutions that meet customer experience requirements, thus enabling them to timeously differentiate their offerings from those of competitors. Furthermore, given the significant capital investment required for infrastructure, it would be beneficial to operators if they are able to recoup some of the investment earlier in the process.

1.2.3 *Customer Experience*

The question therefore arises; what are FMC customer experience requirements? The literature states that customer experience arises from the interaction between a customer and a company, or its product, or any part of its organisation, where it elicits a reaction from the customer on either an emotional, physical, rational, sensorial or spiritual level (Gentile, Spiller, & Noci, 2007). From a telecommunications industry perspective, given that operators are usually fixed-line or mobile operators, customers face specific inconveniences in relation to their fixed and mobile telecommunications service usage. Some of these are the use of two handsets or terminals for fixed-line and mobile services, subscription to two operators and receiving two separate bills (Wong et al., 2006). It is plausible to assume that addressing these inconveniences, among others, through FMC would elicit a positive, valuable and meaningful customer experience.

Waiting for full integration of network infrastructure, however, would delay implementation of FMC offerings and result in lost opportunity, especially if FMC customer requirements can be satisfied much sooner in the infrastructure integration journey or by substitute products.

1.3 Problem statement

1.3.1 *Main problem*

Identify the minimum level of infrastructure integration required for integrated telecommunication operators to offer FMC services that meets customer experience requirements.

1.3.2 *Sub-problems*

The first sub-problem is to identify the required customer experience for FMC services delivered by integrated operators.

The second sub-problem is to identify the minimum infrastructure integration requirements that will meet the required customer experience in a sustainable manner.

1.4 Significance of the study

This study fills a gap in that there is currently a dearth of academic research addressing FMC in general, and the minimum level of infrastructure integration required specifically (Amer, 2009). Many operators with fixed-line and mobile capability are currently pursuing FMC strategies to create value in their businesses (Vrdoljak, Vrdoljak, & Skugor, 2000). This strategy requires significant capital expenditure in network and information system infrastructure, with technocrats espousing the virtue of a fully integrated network. A fully integrated network, however, represents the ultimate capital investment. The question thus arises as to whether fully integrated network infrastructure is absolutely necessary for delivering FMC offerings that satisfy customer needs. This question receives further importance due to the fact that operators are already offering products that from a customer perspective seem to provide what FMC promises (Wong et al., 2006). A South African case example is the Unipresence offering from MTN in the business market that allows customers to access calls from one number on multiple devices (MTN Unipresence, 2013).

By elucidating upon areas where network infrastructure integration can support the deployment of FMC offerings and identifying the minimum infrastructure integration required to make this a reality, this study provides industry executives with insight on the possibilities for capitalising on the market opportunity for FMC offerings at various points in the infrastructure integration journey. The application of this understanding may result in more competitive and functionally robust telecommunications products and services in the market sooner.

This study also provides guidance to other scholars and researchers by identifying further areas of research thereby creating a platform for further research into the subject. The current dearth of research into this area may also be overcome as this research highlights further areas of exploration.

1.5 Delimitations of the study

- The focus of this paper is on the consumer market and thus omits the enterprise market from the study. The enterprise market customer experience requirements tend to be driven by different factors from the consumer market and as such, would best be analysed in a separate study.
- The study does not result in a quantification of the minimum financial investment required for introducing FMC voice offerings in the market.
- The study does not take the perspective of mobile operators looking to offer FMC type voice services or Mobile Virtual Network Operators (MVNO) looking to do the same. It takes the perspective of a fixed-line incumbent that has developed/acquired mobile capability and is now looking to pursue an FMC strategy. These operators are known as integrated operators.
- This study is not a case study of a specific operator. Although the research was carried out in South Africa, the findings are viewed as having relevance to most companies facing similar challenges across the globe.

- This study does not take a longitudinal approach to the data. The factors observed as part of the study are seen to have relevance for the foreseeable future.

1.6 Definition of terms

- Fixed Mobile Convergence (FMC) - the convergence of wireless and wireline voice, video and broadband services through seamless integration of fixed and wireless networks (Raj et al., 2010).
- Operational Support System (OSS) - Software (occasionally hardware) applications that support back-office activities which operate a telco's network, provision and maintain customer services ("OSSline," 2012).
- Business Support Systems (BSS) - Software applications that support customer-facing activities. Billing, order management, customer relationship management, call centre automation, are all BSS applications ("OSSline," 2012).
- Fixed-line Operator - a larger wireline carrier that often owns its equipment and offers fixed-line phone service.
- Mobile Network Operator – a larger cell phone carrier that often owns its equipment and offers mobile phone service (International Telecommunications Union, 2013).
- Integrated Operator - a larger carrier that often owns its equipment and offers fixed-line and mobile phone services.
- Infrastructure – Includes the network, technology, software, hardware and organisational components of an operator
- MVNO – Mobile Virtual Network Operator: An organisation that buys minutes and services wholesale from an existing cell-phone carrier and resells them under its own brand. (Newton, 2009)
- VoIP – Voice over Internet Protocol: When a phone call is transmitted over a data network such as the internet. (Newton, 2009)
- ARPU – Average Revenue per User: The average revenue generated per customer unit per month. (Newton, 2009)
- IMS – IP Multimedia Subsystem: An open, standardised, “operator friendly”, Next Generation Networking (NGN) multi-media architecture for mobile and fixed IP services. (Newton, 2009)

- NGN – Next Generation Network: when a phone company, instead of using circuit switching to move phone calls, uses packet and VoIP technology. (Newton, 2009)
- Telecommunications Services – Services offered by telecommunications operators that are generally categorised into voice (telephony), data (broadband/internet) and multimedia (video/content)
- PSTN – Public Switched Telephone Network: Any common telephone carrier network that provides circuit switching between public users. (Newton, 2009)
- OTT – Over The Top: Videos provisioned by 3rd parties, such as Google and TV studios, and delivered directly to customers over cable companies' and telephone companies' networks. (Newton, 2009)
- SIP – Session Initiation Protocol: The most important standard for setting up telephone calls, multi-media conferencing, instant messaging and other types of real time communication over the internet. (Newton, 2009)
- OPEX – Operational expenditure
- CAPEX – Capital expenditure

1.7 Assumptions

The following assumptions are held regarding the study:

- a) The sample size is sufficient to obtain data for analysis.
- b) Respondents are well positioned and have sufficient knowledge to provide information regarding infrastructure integration specifically, and FMC in general, due to their roles within the industry. Respondents in positions that do not allow them to adequately respond to FMC and infrastructure questions may skew the results.
- c) The respondents answered questions honestly and openly to the best of their knowledge and experience. Withholding information affects the significance and accuracy of the study.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

This chapter reviews the available literature that is applicable and relevant to FMC generally and to the research question specifically. The structure of the literature review follows the components of the research problem and is broken down into two topics. The first topic deals with customer experience and its definition in the context of FMC. The next topic expounds on the definition of FMC and associated infrastructure integration requirements.

2.2. Background discussion.

FMC offers traditional fixed-line operators the opportunity to compete against the dominance of mobile operators through convergence of fixed and mobile services (Curwen, 2006). To offer FMC services, operators would require some level of network integration while the optimal timing for introduction of FMC services and its associated product roadmap is unclear (Rokkas et al., 2009; Wong et al., 2006). This places operators in a predicament. They have to ensure that the launch of their converged offerings are timeous so that they can avoid substitute products gaining a foothold in the market thus resulting in customer churn, but they have to also exercise caution since launching new converged services in the market could result in cannibalisation of traditional service revenue (Rokkas et al., 2009). This is compounded by the uncertainty operators face in terms of the dominant designs in service platforms and network designs, choice of technology, choice of strategy and customer demand thereby increasing the cost of getting it wrong and thus raising the stakes (Rokkas et al., 2009).

There are various definitions and interpretations of FMC. Generally, it speaks to the convergence of disparate networks or services based on different technologies within the fixed and mobile domains. One of the simplest definitions refers to FMC as the combination of previously separate fixed and

mobile services, networks and commercial practices (Yang, Kim, Nam, & Moon, 2004). To achieve FMC, operators are required to integrate infrastructure at various levels and understand what is required from a customer experience standpoint.

2.3. Customer experience requirements for FMC services

In order to address the business problem, it is necessary to first answer the question; what are FMC customer experience requirements? This is a necessary departure point because an operator needs to benefit in one of two ways to pursue a successful FMC strategy; an improvement in customer experience or a measurable reduction in the cost of developing and providing services (Mellin, 2009). This does not mean that the two benefits are mutually exclusive.

In order to answer the customer experience question one has to first launch an inquiry into the meaning of customer experience from the theoretical body of knowledge. Upon investigation, it was found that customer experience is an outcome of the interaction between a customer and a company, its product or any part of its organisation where a reaction is elicited from the customer on either an emotional, physical, rational, sensorial or spiritual level (Gentile et al., 2007). Another perspective indicates that customer experience is about a consumption situation providing meaningful or valuable experiences to customers (Chang & Horng, 2010). Customer experience however is not formed in an isolated instance; rather, it is a holistic concept that includes the total experience a customer receives at multiple interaction points with an organisation and not just at the point of product consumption. This holistic view includes activities from the search, consumption, purchase and post-sales phases of the experience (Verhoef et al., 2009). From a telecommunications industry perspective, given that operators are usually fixed-line or mobile operators, customers face specific inconveniences in relation to their fixed and mobile telecommunications service usage. Some of these are the use of two handsets or terminals for fixed-line and mobile services, subscription to two operators and receiving two separate bills (Wong et al., 2006). Furthermore,

delivering FMC offerings that meet the customer experience challenge requires an operator to develop a flexible and broad portfolio of services and products that meet customer needs and shield customers from the underlying technologies (Wong et al., 2006).

Other customer needs that affect experience centre on the availability portability and mobility which are driven by the trend of ubiquitous computing through the use of portable devices such as laptops, tablets and smartphones (Yang et al., 2004). Customers also expect high speed data on mobile connections that they have become accustomed to by using fixed lines (Yang et al., 2004). These customer experience requirements cause challenges for telecom operators the world over and are being driven by changing customer behaviour in line with changing lifestyles that are increasingly demanding mobility and access to services anywhere and at any time while also adopting more advanced services. The inference is that traditional telecommunications services from the fixed-line and mobile domains are not sufficient to accommodate the changing lifestyles of users (Rokkas et al., 2009). Adding to the complexity of FMC customer experience requirements is that customers expect reduced voice call prices from traditional PSTN voice operators as a result of becoming familiar with the cheaper voice prices offered by VoIP services (Rokkas et al., 2009).

In summary, we find that the available literature indicates that customer experience occurs at various customer interaction and usage points with an organisation. From an FMC point of view, we discover that customer experience requirements are driven by customers' demands for convenience and one-stop shopping together with lower cost and greater flexibility (Kim et al., 2010). This view can be further expanded to explain convenience and ease of use as the customer needs simplified processes when it comes to identification and billing, service transparency with mobility and being always best connected i.e. always being connected to the best network in terms of quality of service and mobility (Amer, 2009). We also find that cheaper prices factor into customer needs and therefore have a bearing on customer experience. It is plausible to expect that customer inconveniences and needs at any of the above mentioned levels

provoke emotional or other reactions from customers and therefore addressing them would elicit a positive, valuable and meaningful customer experience.

Important FMC customer experience benefits can therefore be distilled into offering customers:

- One subscription with a single bill
- One device/handset that can be used for all services and shields the customer from the underlying technology
- Higher data speeds irrespective of location i.e. best connected
- Mobility, portability and ubiquity
- More advanced services than traditional telecoms offerings
- A wider range of services than traditional telecoms offerings
- Cheaper prices
- Convenience
- Ease of use

2.3.1 Research Question 1

Based on customer needs and expectations, what are the customer experience requirements for FMC services delivered by integrated operators?

2.4. Infrastructure integration requirements for FMC

2.4.1 Fixed Mobile Convergence (FMC)

There are various levels of FMC starting with convergence of networks where the same physical infrastructure is used for fixed and mobile networks i.e. network convergence. There is also convergence that requires the integration of mobile and fixed organisational departments such as marketing, where resources are pooled i.e. commercial convergence. Finally there is the convergence of services where fixed and mobile telecommunications services are seamlessly offered to the customers irrespective of the underlying delivery technology i.e. service convergence (Yang et al., 2004). In order to elucidate

upon the various levels of convergence, the literature suggests that FMC centres on four basic levels that are layered on top of each other. These are:

1. *Device convergence*: Device convergence entails the development of devices that can access multiple access technologies through built-in multimodal and multifunctional capability. An example is a handset that can interact with various network access technologies such as GSM and WiFi (Raj et al., 2010).
2. *Application convergence*: Application convergence allows a user to have unified instances of data, multimedia and voice over heterogeneous network domains i.e. an application that includes multiple services over different access networks (Raj et al., 2010).
3. *Service convergence*: Service convergence is the creation of generic service frameworks that allow the deployment of services that are independent of underlying network technology such as fixed or mobile (Raj et al., 2010).
4. *Network convergence*. Network convergence is about delivering unified services across all networks independent of underlying access and core network technologies, based on IP technologies (Raj et al., 2010).

Continuing with the same line of thought we find that FMC services can also take various forms depending on an operator's choice of implementation. At one end of the spectrum there is full convergence that is achieved through total network and system convergence with fully integrated services offered over them. On the other end there are fixed-mobile bundled products that are offered over separate networks but allow the consumer to purchase one product containing fixed and mobile services (Wong et al., 2006). Bundling can also occur at various levels such as fixed and mobile voice, data or a combination. An example could be shared minutes over fixed and mobile connection on one account or shared data caps in a similar scenario (Wong et al., 2006). The trend in convergence among operators seems to be focused on service bundling in the form of triple-play offerings that include data, voice and video services and quadruple-play offerings that add the mobile dimension as well. In order to achieve this, operators are forced to converge previously separate customer

markets and business units in addition to networks (Rokkas et al., 2009). The evolutionary path of convergence will therefore follow a path from simple bundling of fixed and mobile services to true convergence that is delivered over a converged network with integrated commercial departments. Furthermore, it will start with bundling of voice products and then evolve over time to include data services that demand higher bandwidth (Rokkas et al., 2009). It follows then that the definition of FMC can therefore also be stated as the combination of previously separate fixed and mobile services, networks and commercial practices (Yang et al., 2004).

An interesting point to note, however, is that a customer may not necessarily notice the difference between the service experience of true convergence that is offered over a truly converged network and bundling that is merely a bundle of services that are integrated from separate networks (Rokkas et al., 2009). This makes the research question relevant regarding the minimum infrastructure integration requirements to offer FMC in order to meet what customers perceive as satisfying their needs.

A review of the available research on FMC indicates that it has various other benefits for integrated operators apart from those strictly linked to customer experience. It is found that FMC is a way through which the traditional fixed-line operators are able to leverage the infrastructure they already have while at the same time offering differentiated product offerings in relation to their mobile peers (Raj et al., 2010). Furthermore, in the present context operators are looking to reduce the costs associated with network deployment and maintenance through network optimisation. This approach reduces the need to have and maintain separate fixed and mobile networks, and compensate for the ever increasing revenue reduction of traditional fixed PSTN revenues by introducing newer converged and value-added services (Rokkas et al., 2009). From this it becomes apparent that FMC has potential for cost benefits as well as customer experience benefits. The cost benefits of FMC include cost savings in areas such as network infrastructure, distribution channels and customer support activities, while the market benefits include service enhancement (better data quality and speeds). It is therefore concluded that for integrated

operators, FMC has the ability to reduce operating expenditure (OPEX) by eliminating the need to maintain two networks, while also providing the platform to stem traditional fixed-line revenue reduction and customer churn through the ability to enhance services that improve the customer experience (Rokkas, Katsianis, Varoutas, & Sphicopoulos, 2007). It is also worthy to note that a further benefit of FMC for operators pursuing such a strategy is that it reduces the pressure placed on limited spectrum availability and on the last mile access network (Raj et al., 2010).

The implementation of FMC however, does not come without risk. Due to the infancy of FMC, many operators are still trying to find the right business models and strategies to carve out profitable market positions. Compounding this are the uncertainties operators face with customer demand, choice of technology and choice of strategy (Wong et al., 2006).

2.4.2 Infrastructure Integration

The major drivers for the investment in converged infrastructure from an operator perspective are the reuse of previous investments, use of proven technology that meets performance requirements and is scalable, shortening new service time to market, avoiding a silo approach in the organisation, accessing pre-integrated solutions that reduce project risk, integrating into legacy OSS/BSS infrastructure, deploying attractive new services that improve ARPU, having flexible and converged open infrastructure and reducing training and operational overheads for new services among others (Maes, 2008). This is especially true for an integrated operator, which is generally better positioned for FMC than either a solely fixed-line or mobile operator, that has invested significantly in legacy infrastructure and may not want to completely replace its infrastructure (Kumar et al., 2007). In fact, integrated operators are usually best equipped to capitalise on the benefits that FMC can bring since they own the required components to implement it. In order to accommodate FMC they are required to migrate from the traditional fixed circuit-switched PSTN networks to all IP packet-switched networks that can enable mobile and broadband services. However, as previously discussed, convergence can occur at different

levels. An operator can achieve convergence at the content and services level where end-user services are converged, or at the equipment hardware level, or at the network level (transport/software) where the fixed and mobile networks are integrated. Although there is a clear relationship between these levels for potential convergence, it does not mean that to integrate services an operator has to first integrate its networks, or that integrated networks are required to offer FMC services (Rokkas et al., 2009).

However, an operator may still have the objective of integrating networks as this can offer cost savings. In this case the journey towards offering FMC follows three distinct phases. The first phase is the move from legacy PSTN (circuit switched) networks to softswitch (IP) networks, the second phase is a move towards IMS architecture and the third phase entails the actual launch of FMC services (Amer, 2009). Transitioning through these phases entails a move towards next generation network (NGN) infrastructure since the decoupling of the network and service layers of the NGN makes it a natural fit with FMC. This enables users to access the network through different access technologies and allows operators to develop technology agnostic services. It does so by making services independent from underlying network technologies (González & Lozano, 2010).

NGN is usually based on the Integrated Multimedia Subsystem (IMS) architecture which is seen as the main platform for the deployment of full FMC and supports video, data, and voice over IP (VoIP), as well as being designed to integrate with PSTN networks. NGN networks with IMS architecture are able to offer carrier grade voice services using IP-based packet switching technology to offer mobility, portability and nomadic use of services over any device without limits based on location (Rokkas et al., 2007). However, the benefit of IMS to an operator is not a silver bullet solution that will generate significant competitive advantage but rather the capability to deploy many diverse services over various networks and device types that will allow the operator to capture the consumer's wide and varied lifestyle needs. This is ultimately what will drive the IMS business case (Amer, 2009). The most tempting concept to surface from the IMS architecture that may have a profound impact on operators is the

commercial of the shelf products (COTS) that can be customised and configured specifically for the operator. COTS generally tend to be procured from vendors and are usually supported by software development and integration activities (Goestl, 2006).

The benefits of NGN will not be fully realised even with flawless technical implementation unless there is a concomitant and equal redefinition of an operators' operational support systems (OSS) and business processes (González & Lozano, 2010). Effective OSS is vital to achieve solutions for business challenges associated with NGN, as NGN is made technology agnostic through the OSS. These challenges include the introduction of new technologies with greater speed and less cost, reducing the cost base through process automation and a flexible service integration framework (González & Lozano, 2010). To support the implementation of NGN which is a prerequisite for offering FMC, it is therefore necessary to change the OSS into a distributed, loosely coupled open-standards architecture (Lv, Kang, Chen, & Lei, 2007).

There are, however, opponents to IMS based NGN implementation that claim IMS is really just an internet IP network with hardcoded architecture with reference points and telco functions. This implies that by providing these functions on the internet an operator will be able to do all that can be done on IMS, meaning that there are no services that IMS is envisaged to enable that can't be implemented on the internet. This is evidenced by various internet applications that already exist. Furthermore, arguments are made regarding the cost of IMS based NGN implementation since it does not allow operators partial implementation to achieve the required functionality, thereby forcing substantial capital expenditure (CAPEX) commitment which may not achieve the required return on investment (Maes, 2008). Other opponents of IMS suggest that the cost and complexity mitigation promises of IMS have not materialised thereby leading to slow acceptance of the architecture among operators (Raj et al., 2010). FMC also poses significant organisational integration challenges as one of the primary objectives is to make traditionally separated parts an organisation integrate and work together (Curwen, 2006).

2.4.3 Research Question 2

What are the minimum infrastructure integration requirements that are able to meet the required customer experience in a sustainable manner?

2.5. Conclusion of Literature Review

From the literature we find that FMC could result from convergence at various levels including network, application, service, device and commercial. FMC can therefore be defined as the combination of previously separate fixed and mobile services, networks and commercial practices (Yang et al., 2004). There are various benefits for operators pursuing FMC especially integrated operators. These benefits tend to centre on either improved customer experience through more sophisticated and better quality products or cost saving through the synergistic effects of the different levels of convergence. Customer experience benefits could be articulated as one subscription, single bill, one device/handset, higher data speeds irrespective of location, mobility/portability/ubiquity, more advanced services, convenience, ease of use and cheaper prices.

The literature is split according to the requirement for full network infrastructure integration in order to attain the benefits of FMC, specifically related to customer experience. There is more consensus on the cost saving benefits that full FMC may offer and also that some level of network integration would be required. The fact that the envisaged benefits of FMC are not guaranteed while the investment requires significant capital expenditure, lend credence to the research questions. Also, as previously stated, waiting for full integration of network infrastructure could result in lost opportunity if FMC customer experience requirements can be satisfied much sooner in the infrastructure integration journey.

2.5.1 Research Question 1:

Based on customer needs and expectations, what are the customer experience requirements for FMC services delivered by integrated operators?

2.5.2 Research Question 2:

What are the minimum infrastructure integration requirements that are able to meet the required customer experience in a sustainable manner?

CHAPTER 3: RESEARCH METHODOLOGY

This section discusses the selection and justification of the methodology used for this study. The theory and applicability of qualitative research is first discussed, followed by the research design and the research instrument selected. Issues around data collection, analysis and interpretation will then be discussed before the chapter is concluded with a discussion on validity and reliability.

3.1 Research methodology / paradigm

This research was based on an interpretive paradigm because the nature of the research undertaken necessitated understanding the views, interpretations and opinions of respondents in order to gain meaning and understanding around the research question. For the purpose of this research one has to understand the context and challenges faced by telecom operators in order to derive meaning from the research findings. The interpretive paradigm lends itself to this research goal as it seeks out the subjective opinions and viewpoints of respondents (Creswell, 2007). This approach is justified by the infancy of FMC as a subject and the fact that there are different views and opinions on the best method of implementation and the requisite level of investment. Going a step further, it was necessary to use the responses from participants to construct a view of the situation for comparison against the research questions. The interpretive method subscribes to this type of constructivism (Wahyuni, 2012).

Lastly, the complexity of views evident among practitioners was sought out due to the lack of consistency in understanding of the subject. The qualitative methodology was therefore adopted to conduct this study as it is well suited to locating the researcher in the world being studied so that he or she is able to make sense of, and interpret the meaning of responses while seeking out the complexity of views (Merriam, 2009).

3.2 Research Design

Data for the research was collected through a series of semi-structured interviews with open-ended questions. An interview was the ideal means for data collection as the phenomenon studied could not be understood by observation since it is based on what was in respondents' minds (Patton, 2002). This semi-structured design provided sufficient guidance to the interviewer in terms of topics or areas to be covered and also provided the flexibility to probe and pursue specific topics that were highlighted in the interviews (Merriam, 2009).

The advantage of a semi-structured interview lies in its flexibility and it allowed continual tweaking of the questions, topics and themes that were discussed based on the outcome of each interview. Furthermore, there was no need to stick to a rigid order of questioning in a semi-structured interview (Merriam, 2009). This was useful for the current research as respondents held various designations with different areas of focus and were keen to discuss their areas of strength first, or at greater length. The chosen methodology was sufficiently flexible to accommodate this.

The open-ended nature of the questions also complemented the research objective since the interpretive paradigm is concerned with searching for depth of meaning (Patton, 2002). The open-ended questions allowed ample room to probe for depth and explanation.

3.3 Population and sample

3.3.1 Population

The population for this research was individuals and practitioners involved with FMC and network convergence in the normal course of their work. Individuals either came from an integrated operator or consultants and engineers conducting work for an integrated operator. These individuals had different roles in the convergence value chain such as network engineering, network planning,

strategy development, marketing, consulting, etc. The diversity in the population supported a greater variety of views leading to a more robust set of findings.

3.3.2 Sample and sampling method

The sample for this study was selected using the non-probability purposive sampling method. According to Honigmann, as quoted by Merriam, non-probability sampling is best suited for qualitative research as it seeks to discover (Merriam, 2009). Purposive sampling suited this study as it is concerned with selecting a sample from which the most can be learned. Randomness was therefore not a criterion for selection because the aim was to locate and select the most knowledgeable and expert respondents (Patton, 2002).

The total sample for this research amounted to ten. This was deemed to be adequate since FMC is at the forefront of telecommunications innovation at present and the ecosystem and associated expertise are not as extensive as the more established telecommunications disciplines. This is supported by the fact that the study looks at FMC in South Africa from an integrated operator point of view and Telkom is the only true integrated operator in the country. To achieve balance in the responses at least half the respondents were selected to be external to Telkom in order to elicit an unbiased view that was not based on the outlook of one operator. Most external respondents were consultants while a few were technology service providers to operators in general. The respondents were all experts in the field of FMC, either in its entirety in relation to the research question, or at least for significant portions of its implementation i.e. the continuum between customer experience and implementation requirements related to infrastructure integration. Respondents were thus selected for their knowledge, experience and involvement in FMC deployment. All respondents provided their explicit approval for their names to be disclosed in this research report. The following table lists the interviewed respondents, their designations within their organisations as well as the organisations they belong to. The list is intended to provide confidence in the non-probability purposive sampling method chosen for this research.

Table 1: List of respondents

Number	Respondent	Designation	Organisation
1.	Dr. Brian Armstrong	Managing Director	Telkom Business
2.	Mr. Amith Maharaj	Senior Managing Executive	Telkom Mobile
3.	Mr. Dudley Crotz	Executive	Strategy Alignment and Standards: Telkom
4.	Mr. Alan Huang	Manager	Technical Product Development: Telkom
5.	Dr. Rolan Christian	Senior Specialist	Luminet
6.	Mr. David Vanucci	Chief Technology Officer	Telsaf Data
7.	Mr. Laurent Viviez	Partner	AT Kearney
8.	Mr Joao Sousa	Partner	Delta Partners
9.	Mr JB Goonahsylin	Senior Manager	Enterprise Architecture: Telkom
10.	Mr. Paul Ingelsby	Director	PI Telecoms

3.4 The research instrument

The research instrument that was used for this study was a semi-structured interview with open-ended questions. The duration of each interview was approximately 60 minutes. This instrument was ideal for this study as it was not possible to use observation as a data collection tool while the instrument allowed for sufficient structure and flexibility to adapt to responses (Merriam, 2009; Patton, 2002; Wahyuni, 2012). Respondents didn't have any reservations around the confidentiality of their responses and this was proactively mitigated by dealing with questions requiring them to take a stance towards the end. Thereafter each respondent's permission was obtained to disclose their personal details in this report. These details are highlighted in section 4.2. A research schedule is also appended in Appendix A.

3.5 Procedure for data collection

The interviews were scheduled in advance and took place at locations suitable to respondents. Most locations tended to be the work environments of respondents and occurred either in Johannesburg, Centurion or Pretoria, in the province of Gauteng, South Africa.

Interviews were recorded using a digital recorder and later transcribed using a word processor. Additionally, the interviewer took handwritten notes during the sessions for quick reference and immediate post-interview reflection. These notes were considered and compared against the transcribed interviews during the analysis.

3.6 Data analysis and interpretation

The data analysis technique used for analysing the responses was the constant comparative method due to its usefulness in revealing the overarching professional experiences that were critical for this study (Wahyuni, 2012). Furthermore, a process of coding and category construction was used where transcripts from interviews were coded and placed into categories based on

topics arising from the interviews. The units of data were compared and contrasted within an interview while being placed into the categories, and later against other interviews. Categories were derived from an examination of the data rather than being predetermined by the researcher. This is consistent with the application of the constant comparative method (Hewitt-Taylor, 2001). Additionally, the analysis followed a process of first fragmenting and then connecting the data from interviews which is also part of the constant comparative method (Boeije, 2002). The initial categories were then reduced to 3 mutually exclusive and exhaustive themes with 7 sub themes that resulted in, and form the structure of the findings (Merriam, 2009).

3.7 Limitations of the study

This research was dependent on a small group of people that were focused on a new and niche technology ecosystem. The risk was that if respondents were unwilling to offer their time for this research, there would not have been a great pool of alternate respondents to choose from. However, being an actor in the telecommunications industry, the researcher was able to secure the requisite number of respondents with appropriate skill and experience.

The research findings do not result in a quantification of the benefit to operators for finding the optimal infrastructure integration point for FMC, but may be of substantial importance to decision makers in the industry. This report recommends other areas of this topic as potential future research areas in light of the findings.

3.8 Validity and reliability

3.8.1 External validity

External validity is concerned with the transferability of the research findings i.e. the extent to which it can be applied to other situations (Merriam, 2009). However, qualitative research is usually criticised for its lack of generalizability (Wahyuni, 2012). The sample of this study is a non-random purposive sample

implying that the findings will not be generalisable from a statistical point of view. However, this does not mean that the results are invalid for any other setting. The selection and constitution of the sample, although within the South African context, make it plausible that an equivalent sample in another context could yield similar findings since the sample was selected for their knowledge and expertise on the subject.

3.8.2 Internal validity

Internal validity of data is about ensuring that the findings of the research are congruent with the real world. Typically, this is achieved through triangulation where findings from interviews are cross-checked with other sources of data (Merriam, 2009). Since the data collection method for this research was only interviews, triangulation was achieved by checking responses from one interview with that of others, as well as against the literature review in chapter 2. Another strategy used for internal validity is that of respondent validation. This is where emerging findings from the research are checked back with some of the respondents (Merriam, 2009). The findings of this study were checked back with selected respondents to gauge consistency with real world understanding.

3.8.3 Reliability

Reliability is generally perceived to be the extent to which research results can be replicated. This is difficult to confirm in qualitative research as it is by its nature subjective and personalised. Therefore, the more appropriate test of reliability in qualitative research is to test whether the results of the research are consistent with the data collected (Merriam, 2009). The reliability of findings for this research was tested using the same consistency method between the findings and data. To achieve this, as for internal validity, triangulation was used between data and findings.

CHAPTER 4: RESULTS AND ANALYSIS

4.1 Introduction

This chapter combines the presentation and analysis of the research data due to the qualitative nature of the study. It discusses and evaluates the findings from interviews conducted with respondents against each other and also against the literature. These qualitative interviews were semi-structured with open ended questions. The findings in this chapter were derived from interview transcripts that were transcribed from digital recordings after interviewing respondents, as well as from the researcher's own notes taken during the interviews. Interviews were compared and contrasted against themselves initially and against others subsequently to identify common themes and contradictions. This was further strengthened by evaluation against the researcher's own notes taken during interviews and against the literature review.

In order to comply to the standards of writing an academic research report, effort was made to discuss the research findings from the data first and then to compare it to the literature review afterwards for each theme. However, this was not possible in every case as some themes contained multiple ideas. In these cases, effort was made to discuss the literature review after the data findings for each idea within a theme. Notwithstanding this, there are some areas where portions of the literature review are interspersed within the analysis as in these cases, it either strengthens the flow of the argument or the richness of the analysis. For the same reason and notwithstanding grammatical issues, verbatim or paraphrased responses from interviewed individuals are presented where relevant.

This chapter begins by discussing the demographic profile of respondents. This is very important due to the non-probability purposive sampling method chosen for the research. For this method, it is critical to demonstrate that the chosen respondents embody the relevant specialist understanding of the subject matter since the object of the research is to discover meaning from a diversity of

viewpoints. The chapter then goes on to analyse and discuss the key themes emerging from the interview data which is logically structured according to the research questions. The customer experience benefits of FMC are discussed first and are categorised into four reduced categories namely Convenience & Simplicity, Cost, Quality and Innovation after which the section is concluded. Next, the infrastructure integration requirements to deliver FMC in a sustainable manner are discussed. This section begins with system (OSS & BSS) requirements followed by network requirements and organisational integration requirements after which the section is concluded. Due to the strong views of some respondents around FMC challenges and the intention to provide a complete analysis, these challenges are discussed next. The challenges provide areas of caution and consideration for management intending to pursue FMC. Finally, the findings of the chapter are summarised.

4.2 Customer experience requirements related to FMC

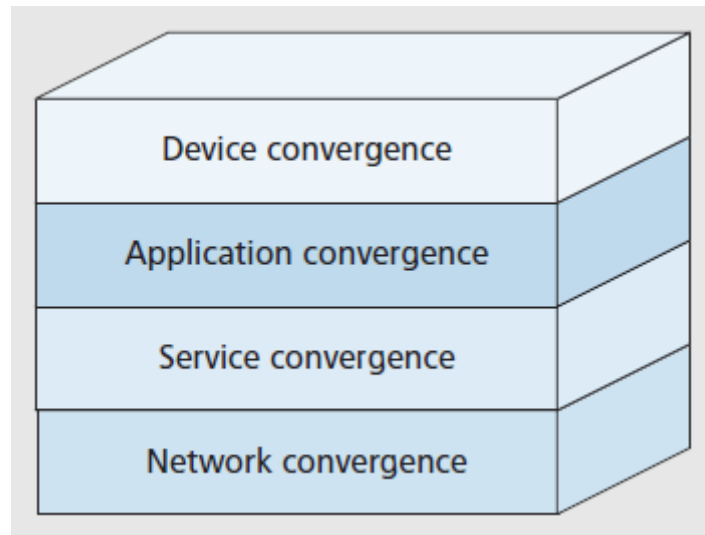
It is vital to recognise that any implementation of FMC by an integrated operator is only feasible if it is able to affect the customer experience of the operator's subscribers. This means that customer experience improvement is one of the key pillars for the success of FMC. This view is supported by literature wherein it is stated that to be successful, an FMC offering must demonstrate an improvement in customer experience or a measurable reduction in the cost of developing and providing services (Mellin, 2009). The key findings in this section are summarised in the table below.

Table 2: Summary of customer experience requirements

Theme	Findings	Key Respondent comments
Customer Experience		
Convenience & Simplicity	Convergence happens at four levels i.e. Device, Application, Service and Network.	<i>"For me as the end user, I don't really care I just need broadband. I need a broadband service anywhere, anytime on any network. That's what I basically want, a single customer facing (interface), a single bill, if I query it, I query it through one customer centre".</i>
	FMC provides customers with a single bill and one account from one operator.	
	FMC provides the ability for shared capacity of voice or data across fixed-line and mobile services. Questions remain over a provider's ability to effectively implement shared bundles due to uncapped trend in fixed-line, and congestion on mobile networks.	
	FMC allows a user to be contactable on a single number on any device.	
	FMC provides one-stop telecommunication shopping.	
	FMC gives customers a single interface with an operator for all telecommunications services.	
	FMC enables priority customer segmentation.	
	FMC enables seamless integration across fixed-line and mobile services thereby enhancing the user experience.	
Cost	FMC allows WiFi offloading to be implemented thereby creating cost efficiencies that can be passed on to customers	<i>"...The fact that you are retaining the voice call in a cellular mode is fine so therefore you say you get seamless connectivity over a pure cellular network but with FMC, the fixed component is when you get to your house you no longer wish to use your GSM connectivity and switch over to a cheaper solution because at home you don't wish to make all of your calls over the more expensive GSM network but now want to use your Wi-Fi. So there is a cost implication..."</i>
	FMC enables an operator to rationalise its network equipment and infrastructure thereby reducing operating costs.	
	Further cost efficiencies can be obtained from rationalising customer sales and support channels for fixed-line and mobile services.	
	FMC offers a competitive advantage to an integrated operator who owns backhaul capacity and effectively has no incremental cost for its usage.	
	Customers expect discounted pricing when purchasing FMC products and services	
Quality	FMC offers customers better quality on a fixed-line network when required for bandwidth hungry applications but also mobility when needed.	<i>"The fixed network in terms of broadband, assuming that it is running on fibre, offers services or experiences that LTE cannot replicate. One LTE tower today delivers about a 100 megabits per second and you have fixed networks with fibre to the home that can go 1gigabit per second itself. One connection at home, if it is a good one, if for one home delivers same capacity as whole LTE tower".</i>
	FMC is suitable for rich content services that require better consistency of service.	
	FMC enables redundancy of service by virtue of bundled fixed-line and mobile services.	
Innovation	FMC enables the delivery of much more sophisticated products such as rich content, online gaming, home automation, multi-media set-top boxes, remote multimedia conferencing, presence, automated billing and cloud services.	
	Success of FMC service innovation is based on an operator's ability to differentiate its offerings from the market	

Before engaging in a discussion pertaining to the customer experience improvements related to FMC, it would be useful to remember that convergence can happen at four different levels. These levels are highlighted by the figure below.

Figure 1: Fixed mobile convergence framework (Raj et al., 2010)



The customer experience improvements as identified in the interviews with respondents are now discussed.

4.2.1 Convenience and Simplicity

When investigating customer experience benefits during the interviews, convenience and simplicity emerged as one of the key benefits that could be derived by customers from FMC services. There were several areas identified as points of convenience for customers. These will be discussed separately.

The first area of convenience was that of customers having a single bill and account to manage. Presently, customers have to subscribe to separate fixed-line and mobile services and receive separate bills from different service providers. One respondent elaborated on this by explaining that customers are looking to consolidate their telecommunications service spending by having one account to manage on a single bill with one operator. As supported by the

literature, having this convenience would be appealing to a customer and as a result would address the specific inconveniences that customers have been cited to experience such as two subscriptions from separate fixed-line and mobile operators and the receipt of separate bills (Wong et al., 2006).

Linked to the single account and single bill is the benefit of customers having only one contact number for both fixed-line and mobile services. This means that wherever the customer is, on whatever device, he or she will be contactable on a single number. Almost all respondents saw this as a clear area of convenience for the customer, given the evolution of devices in recent times, i.e. smartphones and tablets. These smart devices allow customers to be connected to multimodal services such as 3G, WiFi and Bluetooth anywhere and at any time. Respondents indicated that at present, customers have to support this behaviour with separate numbers from different operators, or sometimes even the same operator. A respondent who works for an integrated operator explained this benefit as follows;

" We know you can get Skype off the internet , we know you can get Amazon storage off the internet, but what you actually don't want Mr. customer is a whole lot of individual services which you have to couple together. You want a smart home. So come to us, we are the only people with the muscle and the ability to integrate and provide you with a smart home as a pre-packaged set of products".

This view from respondents was aligned to the literature that states customers are looking for the FMC convenience benefit of one-stop shopping (Kim et al., 2010) as well as the removal of the inconvenience of having two separate handsets for fixed and mobile services if the customer so chooses (Wong et al., 2006).

The simplicity that FMC provides was also espoused as an enhancement of the customer experience by most respondents. One simplicity factor identified broadly among respondents was the ability of FMC to offer customers a single cap or shared voice minutes that could be used across their fixed-line and mobile services. This means that instead of a customer having five gigabytes of

data available on a mobile service and ten on a fixed-line service, the customer can have fifteen gigabytes of data available to use on either his or her fixed-line or mobile services as they require. This would make the management of service usage for the customer simpler and more convenient but as pointed out by one respondent, the experience of the user at every point of usage needs to be the same. This was somewhat contrasted by another respondent who doubted whether this was actually feasible, although possible. He argued that capacity constraints between fixed-line and mobile infrastructure had to be accounted for specifically because uncapped fixed data is already a reality in South Africa and globally. He stated there is no way that mobile operators can offer uncapped services due to the capacity constraints on their mobile networks. The simple explanation for this contrast is the fact that with a fixed-line connection the customer has a dedicated line coming into the premises that is used exclusively by that customer. On the mobile network, all customers in the range of a certain tower are contending for the same capacity available on the tower and are therefore using the same limited spectrum. The implication is that uncapped mobile offerings that are purchased through uncapped converged offerings will incentivise greater usage of data on mobile networks, thereby increasing the contention for capacity on mobile networks and place a further load on already strained limited spectrum. Therefore, challenges exist with respect to the creation of services based on shared caps in an environment where customers demand uncapped offerings. However, there is nothing to stop integrated operators from introducing converged services with limited shared capacity while offering separate uncapped fixed-line offerings. There are merits to the arguments for and against shared capacity and each can be realised depending on customer behaviour which is unpredictable. Therefore, it is inferred that FMC provides opportunities for an integrated operator to provide shared capacity across fixed-line and mobile services, however, the success of the operator's value proposition lies in its ability to account for customer expectations and develop offerings that meet these expectations. A respondent with extensive local consulting experience provided perspective on the debate between the value of shared capacity in relation to mobile network congestion. His lucid view was that if an integrated operator's mobile network becomes congested, it is no worse than the dominant mobile operators since they experience the most

severe network congestion due to their large subscriber bases. Having the shared capacity on the other hand places the integrated operator in a privileged position as it can offload traffic where possible, while offering a differentiated proposition at the same time. This, he argued, results in competitive advantage for the integrated operator. It was found that the literature supported this argument by suggesting that FMC allows integrated operators to reduce pressure placed on the last-mile spectrum by giving the operator the ability to offload traffic onto its fixed network where possible (Raj et al., 2010). This is generally achieved by using WiFi technology. The challenging nature of developing appropriate services that meet customer expectations also finds support in the literature where it is stated that operators are still trying to find appropriate business models for FMC due to its infancy (Wong et al., 2006).

A respondent with international consulting experience who has worked extensively with many operators worldwide highlighted tariff and pricing simplicity as another potential benefit of FMC. This is somewhat linked to the convenience described in the preceding discussion but basically removes the complicated and varied tariff structures that customers experience with traditional telecommunication services that is compounded by having multiple services from multiple operators. According to the respondent, it would therefore be appealing to customers to have one product that meets all their telecommunication needs across fixed-line and mobile voice and data with simple tariff plans.

A number of respondents raised another convenience factor that FMC allows integrated operators to offer. This is the opportunity to offer customers a single interface to the service provider. Respondents claimed that upon subscribing to an FMC offering, customers would benefit from a single point of contact to resolve queries with their service provider. A quote from one of the respondents regarding this issue is quoted verbatim as follows;

“For me as the end user, I don't really care, I just need broadband. I need a broadband service anywhere, anytime on any network. That's what I basically want, a single customer facing, a single bill, if I query it, I query it through one customer centre”.

Also, for a customer purchasing all telecommunication services from one operator, he or she could expect priority service. This thinking is linked to customer segmentation based on customer spending patterns with the organisation. This view is succinctly captured in the words of one of the respondents;

“Now, because FMC does not exist today, the customer's expectation might be multi-pronged, he might expect to bring all his eggs in one basket and by investing more money with the service provider, he would like a better quality of service than he is getting from the individual parts; maybe bigger prioritisation as a customer because his spend has now increased with one vendor”.

Priority segmentation for FMC customers could invariably only strengthen the FMC proposition and this demonstrates the evolution of thinking around FMC in industry. Support for the linking of FMC to customer segmentation was not found in the literature review and was a novel idea elicited during the interview.

Finally, convenience and simplicity as it pertains to FMC was described by respondents as the seamless integration of services across different networks i.e. fixed-line and mobile. An example of seamless integration given by one respondent was that of a consumer on a live data session using the mobile network on the train home. As the customer gets home the session automatically switches to a WiFi connection at home without disconnecting and reconnecting the session. Alternatively, if the customer disconnects the session when getting off the train and assuming he/she was watching a Youtube video, the video would start from where he/she stopped it in the train. Additionally, when using multiple devices such as smartphones, tablets and laptops, respondents highlighted another area of convenience related to seamless convenience that users could experience. Seamless integration makes it possible for a customer to change account settings such as parental control on one device which then updates on all other linked devices without the need for the customer to manually update each device. This is consistent with the definition of FMC found in the literature review (Raj et al., 2010).

The preceding discussion make convenience and simplicity sound like tangible benefits that customers can experience which will entice them away from their current service providers and move to the integrated operator. However, this does not answer the question of why the customer cannot experience the same convenience of one account, one bill, simplicity, and seamless integration albeit without fixed-mobile integration, by just remaining with a mobile service provider. This question is made all the more relevant with the advent of LTE technology globally and in South Africa. Theoretically, LTE can provide data speeds as good as an ADSL fixed-line notwithstanding the mast contention discussed earlier. Indeed the mobile operators can provide this type of convenience and simplicity, however, there are additional benefits around cost and quality that when viewed together with convenience and simplicity differentiate FMC offerings from pure mobile offerings. These are discussed in the subsequent sections.

4.2.2 Cost

The cost advantage of FMC according to respondents is perceived to be a key success factor for the FMC offering. As previously argued, the capacity constraints on mobile networks driven by bandwidth contention and the scarcity of spectrum make it more expensive for customers to retain all their connectivity on a mobile network. Additionally, the fact that it is infeasible for mobile operators to offer uncapped services over their networks while fixed operators can, means that the cost per megabyte of data or minutes of voice on a fixed-line network can theoretically be offered at a cheaper rate compared to mobile networks. This will result in a differentiation offering coupled with a cost advantage. A paraphrased response from one of the respondents is noted below to further elaborate the point.

“...The fact that you are retaining the voice call in a cellular mode is fine, so therefore you say you get seamless connectivity over a pure cellular network but with FMC, the fixed component is when you get to your house, you no longer wish to use your GSM connectivity and switch over to a cheaper solution because at home you don't wish to make all of your

calls over the more expensive GSM network but now want to use your Wi-Fi. So there is a cost implication..."

This was further supported by the view that having integrated infrastructure with next generation equipment allows an integrated operator to implement real time least cost routing. As an example, if a customer is on a mobile device connected to a certain tower, but is also in range of a public WiFi hotspot installed by the operator, the session can be seamlessly handed over to the WiFi connection without the user knowing, thereby improving cost economics. These ideas are supported by the literature wherein it is stated that offering FMC will allow fixed-line operators to compete with mobile operators while leveraging their previous fixed-line investments that is related to the capability for WiFi offloading (Raj et al., 2010). Apart from leveraging existing infrastructure for competition, the literature further supports the idea that integrated operators would realise cost benefits from the implementation of FMC (Kumar et al., 2007; Rokkas et al., 2009). Additionally, the literature supports the view that these cost advantages are timely and relevant as it would prove valuable to an integrated operator offering FMC in a competitive market where customers are beginning to expect cheaper voice call prices resulting from the familiarity and usage of cheap VoIP services (Rokkas et al., 2009).

During the interviews, further drivers of the cost advantages of FMC were uncovered. The introduction of FMC requires an integrated operator to integrate its fixed-line and mobile networks. This implies the installation of common network equipment to manage the fixed-line and mobile networks, thereby reducing the cost of maintaining duplicate equipment, maintaining different technology platforms and duplicated training of staff to maintain various network technologies. Having a common network platform to support FMC will realise network efficiencies and bring down the cost of providing services to customers. A respondent explained that having duplicated networks that provided more or less the same services required the development of duplicated interfaces between various environments, duplicated processes and duplicated resources; all of which had a direct effect on the cost to an operator. Efficiencies however, can also be realised on the customer facing areas of the business such as

combined sales channels, marketing, etc. This possibility of synergies will have a positive effect on the profit margin of an integrated operator. One respondent, while acknowledging this fact, pointed out that in order for these cost efficiencies to translate themselves into a cost benefit for the customer, the operator must demonstrate the will to pass savings on to the customer through lower prices. Essentially, he explained, it was the competitiveness of the market that would determine whether the cost benefit reaches the customer or not. Given the dominance of the mobile operators in the South African market, it would be reasonable to assume that an integrated operator would pass on the cost savings to customers in order to be more competitive and stem the tide of revenue erosion as a result of customers churning. Furthermore, respondents claimed that due to the congestions on the mobile networks the mobile operators need to offload traffic onto a fixed network wherever they can. Traditionally, mobile traffic is carried via a fixed transmission network between masts. This is known as backhaul and is traditionally provided to the mobile operators by incumbent fixed-line operators. Using this argument, a respondent from an integrated operator stated that there would most certainly be a cost benefit from FMC as the integrated operator owns the backhaul while the mobile operators lease backhaul that has a direct cost implication to them. He further stated that with the advent of LTE this will increasingly become a problem for mobile operators as their capacity requirements will increase. Going further, respondents from an integrated operator as well as from external consulting houses held the view that customers would only subscribe to an FMC offering if it was discounted vis-à-vis holding separate fixed and mobile services. This trend was also observed in developed markets where such offerings were introduced. A respondent from a consulting background put it this way;

“Going forward, what is the use of offloading broadband traffic that gives benefit for a consumer in terms of experience?... pricing”

Another put it this way;

“So on the consumer side, at a very basic level there is some appetite, some interest for bundles, fixed mobile bundles, but I don't think when you do the research and you talk to clients. I don't think that there is a huge appetite unless you deliver a strong benefit, for example savings”.

From the above evidence, we conclude that FMC will result in cost savings for an integrated operator which they will have to then pass on to customers through discounting to realise a competitive advantage. The literature is in support of this view and clearly states that customer experience benefits aside, FMC has clear cost benefits driven by the convergence of network infrastructure, distribution channels and support activities (Rokkas et al., 2007). Additional literature support was found for the pursuit of FMC cost advantages by an integrated operator where it was suggested that customers were becoming accustomed to cheaper voice calls through the use of VoIP services (Rokkas et al., 2009).

4.2.3 Quality

FMC also has the potential to provide customers with a better quality of service. Respondents found that the quality factor between fixed and mobile networks is markedly different. This is linked to the congestion on masts and the associated contention for bandwidth between customers connecting to the mobile network. As indicated by respondents, fixed-line services have a higher consistency compared to mobile. Consistency is described as the reliability and frequency with which certain connectivity speeds can be realised. Even with the advent of LTE in mobile technology, the theoretical speeds will rarely be realised due to network congestion. Fixed-line, on the other hand, will realise speeds closer to the theoretical speeds due to the dedicated fixed line to the premises. The quality issue gains greater importance when viewed together with the change in consumer behaviour and the demand for the use of rich applications such as content services like streaming video and online gaming. Respondents indicated that it is easier to provide a guaranteed quality of service with fixed-line networks as opposed to mobile networks. This is because it is easier to

plan for the load on the network and grow the network with increasing loads on fixed-line networks since you know how many premises you are installing lines to. With mobile you can have a mast and cell in a specific location but if it is densely populated or there are shopping centres in the area where people come and go it becomes difficult to plan for network load. One respondent remarked;

“The fixed network in terms of broadband, assuming that it is running on fibre offer services or experiences that LTE cannot replicate. One LTE tower today delivers about a 100 megabits per second and you have fixed networks with fibre to the home that can go 1gigabit per second itself. One connection at home, if it is a good one, if for one home delivers same capacity as whole LTE tower”.

Adding to the quality a customer receives from FMC services is the ability to implement hierarchical quality of service to certain customers. In other words, if a customer is a heavy data user or using the connection for specific purposes such as online gaming, the integrated operator is able offer those customers high bandwidth-low latency services. Latency refers to the timing between sending and receiving data and the lower the latency the more ‘real-time’ the customer experience is. In contrast, users that download a lot require high bandwidth but possibly not a very low latency as the interaction is mostly one way. It can however be argued that this can be offered by a fixed-line only service so it is not a pure FMC benefit. There is merit to this argument, therefore quality issues must be seen in the broader context of convenience for the customer where it is coupled with mobility and cost. Having an FMC offering will provide users with mobility as required but also cater for their need for rich applications in the home at cheaper prices.

Further enhancing the quality argument of FMC is the issue of redundancy. Respondents have indicated that having an FMC connection provides users with a backup alternative known as redundancy. This simply means that if the fixed-line network goes down the user will still have service on the mobile network and vice versa. The literature supports the findings in the data, where trend of consumers adopting more advanced, content rich services is observed

(Rokkas et al., 2009). The quality aspects of FMC related to the consistency of the fixed-line component and the portability of the mobile component together with the associated redundancy also finds support in the literature where it is suggested that FMC will allow operators to meet the customer need to always be best connected, whether the need at the time is quality and speed of service or mobility (Amer, 2009).

4.2.4 Innovation

FMC will allow the integrated operator to offer much more innovative services to the market than it presently does. According to respondents, the primary innovation will take place with triple-play and quad-play offerings. Triple-play offerings are basically packaged services that include fixed-line voice, data and video services. Quad-play adds the mobile dimension to the offering. Respondents also mentioned more advanced services such as home automation where the integrated operator provides a device such as a set-top box that controls all the home connectivity, entertainment and multi-media services. These boxes are more than the simple modems available in South Africa today. They have a lot more multi-media functionality over and above internet connectivity. A respondent argued that this is only possible with FMC since the customer will have the ability to access the home control devices remotely via mobile, but only a fixed-line connection is able to provide the stability of connection in the home. Other possibilities highlighted by respondents were home security with remote monitoring and the example of some Asian countries where fibre to the home allows individuals to set up their own cloud services and storage at home while streaming whatever media they require from these clouds remotely. Furthermore, innovation in telecommunications is being driven mainly from the device and service layers. The device manufacturers are ensuring that the new smart devices are multi-modal and multifunctional, thereby making them platform agnostic. On the other hand, Over the Top (OTT) providers such as Google are developing services and applications that remove the tight integration with one type of hardware platform. The IP layer in telecommunications networks allows the device manufacturers and OTT players to decouple the actual services from the

underlying hardware platforms. Therefore, respondents generally argued there will be more opportunity for integrated operators to converge their fixed and mobile networks in order to capitalise on the innovation being driven at the device and service levels. A respondent described this scenario by explaining that a person requiring multimedia conferencing from a remote location using a smart device should have access to a telecommunications platform that is integrated and ready to support that use. This is what is referred to as unified communications. Nevertheless, the connectivity for these services may be through either fixed-line or mobile networks and respondents from an integrated operator hold the opinion that to capitalise on their fixed-line and mobile infrastructure, integrated operators need to offer these devices as part of their value proposition. Cloud services and remote storage are additional areas identified as opportunities where integrated operators are able to capitalise on FMC although this is more of convergence between telecoms and IT. The idea of triple and quad-play offerings is supported by the literature wherein it is suggested that these offerings are what operators tend to focus on (Rokkas et al., 2009). The idea that customers are increasingly using much more multimedia services that require high capacity and speeds is also supported by the literature that over and above mobility, FMC customer experience is partly driven by users' expectations of high speed data on mobile that they have become accustomed to when using fixed-line services (Yang et al., 2004). In fact, the literature further elaborates on the impact of devices where it asserts that the customer experience is based on mobility and portability which is driven by the use of portable devices such as laptops, tablets and smartphones (Yang et al., 2004).

Another vision into the future of FMC was described by a respondent using the scenario of smart billing, where a device is able to read the electricity meter on premises and send it to the cloud storage facility of the operator where specialist software is able to consolidate and integrate all the records for the electricity service provider. The billing platform can then issue the invoice and collect payment for the bill. Granted, this is a solution still some way away, but it illustrates the power of FMC when infrastructure, platforms and services are integrated. Integrated platforms will also allow operators to implement real-time

billing and other dynamic services where customers are offered discounts and incentives based on activity and behaviour related to their usage patterns in real time. In this scenario, a customer could potentially be rewarded with additional mobile calling minutes for having made substantial fixed-line calls services etc. This ability for integrated operators to reward customers for loyalty and usage would translate into customer stickiness. Some nearer term applications for FMC reported by respondents pertain to Presence. This where the network is able to locate your presence and ensure that you are contacted via the most efficient means i.e. if you are at home, your home landline will ring, if you are at work your office line will ring, if you are out and about your cellular device will ring and all this will be based on having one number.

In summary respondents generally saw a lot of innovation potential with the advent of FMC and were excited at the opportunity it presented, however, some were quick to point out that its success was based on the quality and differentiation potential of service offerings that an operator could develop. If done correctly, this would meet changing customer requirements since the literature states that traditional fixed-line and mobile telecommunications services are no longer sufficient to accommodate the changing lifestyles of users (Rokkas et al., 2009).

4.2.5 Conclusion

In conclusion, it was found that respondents mostly agreed with the literature regarding the customer experience benefits that FMC could provide. As a start, it was found that FMC can provide convenience and simplicity to customers via single bills, one account and shared capacity over fixed-line and mobile networks among others. However, this on its own would not be sufficient to entice customers to leave their mobile service providers and take up FMC offers with integrated operators since as previously argued, customers can get these convenience factors with their mobile service providers anyway, and this will be further enhanced with the implementation of LTE.

It therefore follows that an FMC offering will strengthen an integrated operator's value proposition and provide a competitive advantage only if the convenience

and simplicity factor is viewed in conjunction with the factors of cost, quality and innovation that FMC can bring.

Integrated operators will save substantial cost and obtain synergies from integrating its fixed-line and mobile platforms. These savings will arise out of managing common infrastructure for fixed-line and mobile networks, having integrated channels to service all customers and rationalising support functions for the network. This cost can be passed on to the customer and may prove enticing because, as one respondent noted, the value to be obtained from an integrated offer must be more than the sum of the parts. Looking forward, the market also seems to be generating demand for content rich services and this is where the quality of the fixed-line component of FMC will come into play. FMC will also provide the platform for integrated operators to offer much more innovative services than they currently do. Altogether, the customer experience benefits envisaged by respondents was aligned to the view in the literature that customers sought convenience through one-stop shopping coupled with lower cost and greater flexibility in FMC (Kim et al., 2010).

There is, however, a caveat. Some respondents indicated that in order for the FMC business case to make sense, one had to be convinced of the services ability to generate incremental value for an integrated operator over its network. One respondent explained this by asserting that OTT players are already providing applications and services to users that are platform agnostic. The innovation is happening at the level of these players in conjunction with the device manufacturers. A case example is Skype. It provides cheap Voice over IP (VoIP) services without concern for the underlying hardware platform being used by the customer, and as indicated by a respondent, holds around 80% of the VoIP market in Europe. Furthermore these companies have grown through innovation and some respondents questioned the DNA of integrated operators and their ability to innovate and monetise their investment in integrated networks given their legacy and culture. Supporting this argument, another respondent argued that an FMC service is more of a customer retention solution than a customer acquisition solution. This has an impact on the business case for an integrated operator which needs to be carefully considered before the

investment is made. However, this does not mean that there is no case for the FMC investment due to the perceived limited revenue upside. Another respondent advised that a prudent approach for investment would be to make multiple short term investments and realise benefits from them before the next step is taken. He elaborated that market forces are dynamic and what is held as true today may no longer be true in a years' time. Notwithstanding this, an operator needs to make infrastructure investments in order to embark on the FMC journey and this has to be understood. Sometimes infrastructure investment in telecommunications infrastructure has to be done at scale and as such, requires bold management decisions. Even if this situation is true, the business case still holds since the two primary benefits of FMC for an operator identified in the literature refer to an improvement of the customer experience and a measurable reduction in the cost of developing and providing a service (Mellin, 2009). The inference being that despite a risk of limited revenue generation potential with FMC, the cost reduction potential still warrants investment.

4.3 Infrastructure integration requirements for sustainable FMC

Infrastructure integration is necessary to enable integrated operators to offer FMC services, although it also has other benefits for the operator. These, among others, are reusing legacy investments, using proven technology that is scalable, shortening new service time to market, moving away from a silo based organisation, deploying attractive new services to improve ARPU, having flexible and open infrastructure and reducing training and operational overheads for new services (Kumar et al., 2007). This section explores the infrastructure integration requirements that an integrated operator needs to consider in order to deliver FMC services sustainably. The key findings in this section are summarised in the table below.

Table 3: Summary of infrastructure integration requirements

Theme	Findings	Key Respondent comments
Infrastructure Integration		
Systems (OSS & BSS)	FMC first begins with bundling of fixed-line and mobile services that do not require full system integration. They are achieved with bridging solutions and are considered low hanging fruit.	<i>"...but to get there, this is the issue , you need to get there today but you can't just turn off everything, I said Swisscom was going to turn off all their old systems, but you don't do that, I mean you can't. That is your heart and soul of your company, you can't just suddenly lose all those bills and if people are making calls you have to carry on billing them, OSSs have to carry on running. So that is the issue around the OSS/BSS".</i>
	Using bridging solutions to deliver FMC services is valuable to capture quick market opportunities but introduces increasing complexity the more it is used. Bundling through bridging solutions should be pursued with a long-term infrastructure integration strategy in mind that will ultimately reduce the complexity and improve speed-to-market.	
	The sequence of OSS/BSS integration tends to be less important than the areas that require integration, and is context specific.	
	The clean-up of customer data across the fixed-line and mobile systems is important for OSS/BSS integration. So is the integration of the customer management system.	
	The billing systems are another important area for OSS/BSS integration.	
	Together with systems, the associated processes are an important consideration for OSS/BSS integration.	
	The integration of OSS/BSS systems is a complex exercise due to the existence of multiple system platforms obtained from multiple vendors, which results in multiple instances of the same customer data across the fixed-line and mobile systems. This is further complicated by the difficult choice of a suitable migration path.	
Network	The sequence of network integration was found to be less important than the areas of network that require integration to offer FMC services sustainably. The sequence is context specific.	<i>"...because the (IMS) issue is now if we have a very agile and flexible network solution, we will be able to create new services that are required in the market whether be mixed multimedia services, whether it be video services, it doesn't real matter right. In a time frame that typically happens in month or two instead of a half a year or a year. The idea is you would be able to create the building blocks in a very modular way so that for instance if you make a change here, it has very little that you need to change on top, it is fairly tightly integrated you always do the abstraction on the higher layer."</i>
	Converting the entire network to an IP network is an important step towards offering FMC services.	
	New equipment at the access layer of the network that can integrate multiple access technologies is another important step towards offering FMC services sustainably.	
	An integrated common core using IMS architecture that is based on NGN principles is another important area of network integration that is required to deliver FMC services sustainably. Opponents of IMS argue that it is more effective in achieving cost efficiencies but agree it speeds up time-to-market of new FMC services.	
	Full network integration is required to offer FMC services sustainably.	

Theme	Findings	Key Respondent comments
Organisational Integration	Organisational integration is important to the delivery of FMC services but is highly challenging to implement.	<i>"You are now marketing your company as a fully converged company that offers fixed converged type services and that message has to be embedded in the minds of each and every member of your staff , the culture of the company and the way it works. And that is what actually will eventually enable you to succeed".</i>
	Organisational integration starts with strategy alignment across business divisions in order to avoid organisational value destruction.	
	The organisational structure should follow a customer oriented structure but is dependent on the maturity of FMC, and the mobile and fixed-line business.	
	Integrated sales and customer support channels are also required to provide one customer interface to the organisation.	

4.3.1 Systems (OSS and BSS)

The first area of infrastructure integration was identified as OSS and BSS integration. To begin the discussion on OSS and BSS integration, a quick reminder of their definitions may prove useful.

- Operational Support System (OSS) - Software (occasionally hardware) applications that support back-office activities which operate a telco's network, provision and maintain customer services ("OSSline," 2012).
- Business Support Systems (BSS) - Software applications that support customer-facing activities. Billing, order management, customer relationship management, call centre automation, are all BSS applications ("OSSline," 2012).

Most respondents believed that the start of FMC offerings in the market begins with simple bundling of fixed and mobile services, first with voice, then with data and finally voice and data. One respondent referred to this as the "low hanging fruit", and by that meant that there was no need for real integration of the system platforms to be able to offer this. However, it did become clear from responses that in order to capture these low hanging fruit and offer FMC bundles to the market, there would need to be at least some level of system integration at the OSS and BSS levels, albeit not full system integration. This integration could take the form of simple bridging applications between the

fixed-line and mobile systems that draw usage and billing information from the separate systems and consolidate the data onto one bill. It was thus postulated that the billing systems were a critical area of development to enable the bundling of fixed and mobile products. This idea is given credence in the literature where bundling offered over un-converged networks and platforms is seen as the starting point for FMC (Rokkas et al., 2009).

Respondents further argued that despite the possibility of offering bundled services to the market through fixed and mobile bridging applications, it was vital to consider the complexity and sustainability of developing such applications into the future. Especially if more and more of these applications were going to be built to offer solutions. It was asserted that in a disparate system environment, a new bridging application would have to be developed for each product or service in order to deliver the product to market. This would severely impact the product development cycles of the operator while increasingly creating additional system maintenance overhead for the operator. This is inefficient and unnecessarily complex. The overarching view from respondents was therefore to make use of these bridging applications initially in order to gain a competitive advantage in the market, but then to also take a longer term view of total integration between the fixed-line and mobile IT systems to ensure sustainability and cost effectiveness. The ultimate vision would be what is commonly referred to as One-IT, meaning there would only be one OSS and one BSS system for the operator that handled mobile, fixed and converged services i.e not a separate fixed-line voice, fixed-line data, mobile voice and mobile data OSS/BSS systems (stacks).

Given this overarching view of the relevance of OSS and BSS integration put forward by respondents, they were then requested to provide a view on the main areas of OSS and BSS that required integration. There were different interpretations of what the starting point would be but upon further inquiry in later interviews the sequence was found to be less important than the areas that were to be covered. Many respondents held the view that most of these developments are done in parallel anyway, however, it would have to be context specific and operators would have to start with the aforementioned low-hanging

fruit. As discussed, the point of departure tends to be product bundling but there were other areas highlighted for integration.

The first area highlighted was that of customer data. It must be stressed that this is not the customer system itself but just the customer data. It was argued that before an operator can even think of integrating the customer systems the data needs to be cleaned up since it wasn't uncommon to have many instances of the same customer on the various systems where they held different services. This was seen as the initial step to getting to a single view of a customer, which would then assist migration of data into a single customer system. It follows then that the customer management system, which handled order management and the like, is a key component of the OSS and BSS integration, with the ultimate goal of a single view of the customer, incorporating all the customers' services and data in one place, but that the starting point is a clean-up of existing customer data. No support for this idea as the first step was found in the literature review.

Another area highlighted was the billing systems. The billing systems consolidate customer usage information and generated an invoice against which payment is requested. With separate billing systems for fixed and mobile services, this is obviously done separately creating duplicated effort and cost, with no transparency between systems. Therefore, this area of integration is critical in the pursuit of FMC. Integral to the integration of the customer and billing systems is also the processes that go with them. A respondent explained that these processes are different for fixed-line and mobile services and needed to be aligned before integration could be accomplished. In fact, it was mentioned that even for different services within fixed-line, the processes were separate today i.e. separate voice processes and separate data processes. The two key processes described were the switch-to-bill and the order-to-cash processes. The first process accounted for network usage and how it translated into a bill, while the second process looked at the customer processes from when a service is ordered to the point of receiving payment for the service, including the installation and provisioning processes in between. The alignment of processes was seen as having paramount importance when integrating OSS

and BSS systems as a lot of efficiency and customer experience benefits would arise out of this. The literature supports this view and clearly states that customer experience benefits aside, FMC has clear cost benefits driven by the convergence of network infrastructure, distribution channels and support activities (Rokkas et al., 2007). The literature further states that the definition of FMC, as previously stated, is the combination of previously separate fixed and mobile services, networks and commercial practices (Kumar et al., 2007). It is fair to assume that support activities and commercial practices include processes.

After elaborating on the importance of the integration of OSS and BSS to FMC and highlighting the quick wins that could be gained therefrom, a few respondents stressed the challenge in achieving this integration. Some viewed this portion of the integration as the most complex area of integration faced by an operator. The enormity of this challenge is partly explained by the preceding discussion regarding the separate systems, processes and instances of customer data. Furthermore, as argued by respondents, this is complicated by the general use of multiple platforms that are procured from multiple vendors. It is not uncommon for an integrated operator to run fixed-line and mobile platforms from different vendors, or even multiple vendors within fixed-line and mobile. Logically, this adds significant challenges for OSS and BSS integration. Another challenge elaborated by a respondent was that of migration to new systems i.e. piecemeal or big bang by switching off the old systems and firing up the new one. One respondent described this challenge in the following way;

“...but to get there, this is the issue , you need to get there today but you can't just turn off everything, I said Swisscom was going to turn off all their old systems, but you don't do that, I mean you can't. That is your heart and soul of your company, you can't just suddenly lose all those bills and if people are making calls you have to carry on billing them, OSSs have to carry on running. So that is the issue around the OSS/BSS”.

The literature review did not yield specific information regarding the challenges of OSS and BSS integration.

4.3.2 Network

The network of an operator is made of the core, aggregation and access layers. The core network is the backbone that generally provides connectivity at a national level. The aggregation layer is the layer that connects various local exchanges to the core network, while the access network connects the customer to the local exchange on what is known as the last-mile connection. With this understanding of the various network layers as a basis, it becomes easier to understand the required network integration for FMC.

Again, as with the OSS and BSS integration, it was found that the sequence of integration of network layers is less relevant as operators have been known to integrate the various layers of the network in parallel. What is of greater importance is the question regarding what network integration is required to deploy FMC sustainably.

The first area of integration raised by respondents was that of converting the entire network to an IP network i.e. fixed-line and mobile. Traditionally, fixed-line operators used different technologies such as PSTN, etc. These different technologies resulted in the requirement for separate equipment at the various layers of the network to support them. So the move to a common IP network would allow operators to have common equipment on the same technology that becomes a precursor to the seamless connectivity between the fixed-line and mobile networks. It also provides an opportunity for operators to obtain cost efficiencies in network maintenance by removing the need to maintain multiple technologies, equipment and skill-sets. According to respondents, for operators generally, the core layer is already IP enabled.

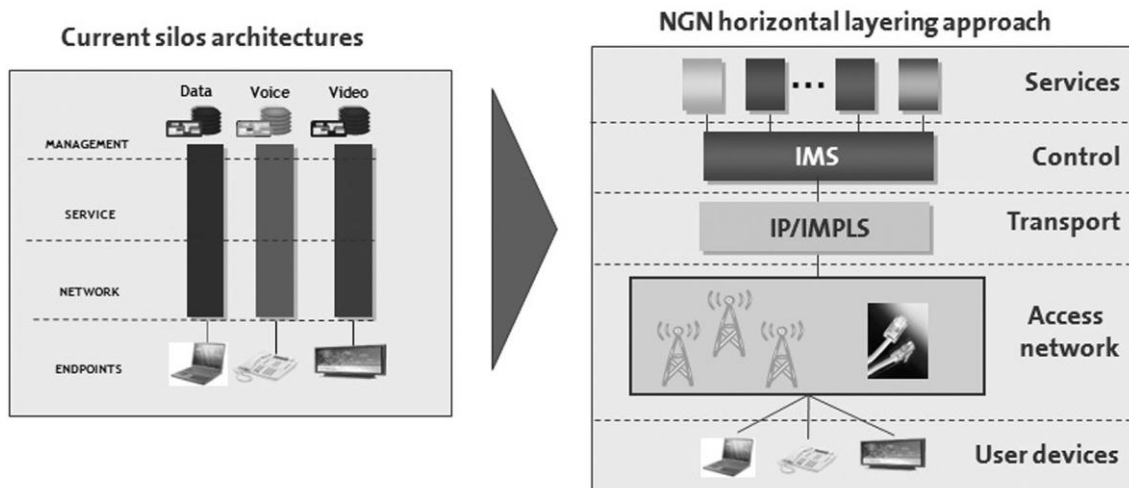
Concerning the aggregation layer, respondents mentioned the installation of next generation equipment such as multi-service access nodes (MSANS) that

would allow multiple access technologies to be integrated into the network from the access layer. This type of equipment would provide what one respondent referred to as access independence. There would also be the benefit of better quality and speeds of data as the MSANS are generally connected via fibre to the exchanges as opposed to copper.

The access layer could remain separated as the integration and equipment at aggregation layer would ensure seamless connectivity over a common platform.

The main area of integration raised by respondents, however, was that of implementing a common core network for fixed and mobile, with the IP Multi-media Subsystem (IMS) mainly touted as the way to go. IMS architecture is based on next generation network (NGN) and is designed to ensure a common core network for fixed and mobile networks that is built to handle content rich multi-media applications. It also separates the transport layer of the network from the services and application layers known as the service delivery platform (SDP), thereby enabling the development of services in a modular fashion that can be applied across different access media. In other words, a solution need only be developed once on a common platform instead of multiple times on different platforms. This is a major shift away from the traditional silo architectures prevalent in telecommunications operators. The diagram below clearly illustrates the difference between the traditional silo approach and the new IMS based on NGN principles.

Figure 2: From silos to the horizontal layering approach (González & Lozano, 2010)



This is also where the capability for session management is built in using Session Initiation Protocol (SIP) technology that would allow seamless handover of sessions between the fixed-line and mobile networks. Respondents further felt that IMS based on NGN would improve the speed-to-market of new products and services. A respondent described this idea verbatim as follows;

“...because the issue is now if we have a very agile and flexible network solution, we will be able to create new services that are required in the market whether be mixed multimedia services, whether it be video services, it doesn't real matter right. In a time frame that typically happens in month or two instead of a half a year or a year. The idea is you would be able to create the building blocks in a very modular way so that for instance if you make a change here, it has very little that you need to change on top, it is fairly tightly integrated you always do the abstraction on the higher layer.”

The IMS issue, however, did elicit a diversity of views regarding its relevance to FMC. As discussed, the proponents of the view saw it improving speed-to-market and the development of new multi-media services. The opponents on the other hand were not convinced of its value to FMC, as they argued that most of the service innovation was happening at the level of OTT players and device manufacturers while they were not confident that operators could lead in this space. That said, they did see value in IMS for an operator, however, the

value was seen more in the areas of capex and opex optimisation rather than FMC. A paraphrased response from a respondent illustrates the point;

“IMS is more linked to VoIP, it's more of a capex optimisation than convergence which is one integrated operator, instead of having two different switches for fixed and mobile uses one for both, So more than a way to converge it is to optimise capex and opex in the network...what is the operator offering? the operator is offering a big pipe of data, he can still offer voice but most probably there would be voice on top of the data and the operator can also offer billing functionality, the other services can be delivered by OTTPs which limits all old traditional services, like call barring, differentiating pricing on calls to family or business or acquaintance or whatever...”

A further opposing argument was that the user experience is actually determined by the devices and applications that were being used, so the device manufacturers actually controlled the experience instead of the operator. However, when opposing respondents were pressed about the ability for IMS to speed up delivery of services to market, due to the capability it provides for services to be developed in a modular fashion and be reused across service platforms, they conceded to it positively affecting the sustainability of FMC. Nevertheless, both sides of the argument saw merit in the implementation of IMS, albeit for different reasons. It would suffice to say that even if FMC service benefits could not be derived from the implementation of IMS, economic benefits would be gained as the economics in the mobile market are increasingly going to be driven by the ability to offload traffic onto the fixed network to relieve congestion and as one respondent indicated, you need an integrated network for this. Therefore, at least, these economic benefits could be passed on to customers through improved pricing. However, the best case scenario would mean that over and above this, integrated operators would be able to generate value from new and innovative services that are able compete with the OTT players. The identified areas of network integration raised by respondents is supported by the literature that identifies the migration to an IP network using soft switches, the move to an IMS architecture and the

development of FMC services as the relevant phases in the journey towards FMC (Amer, 2009). The concern that some respondents had regarding the benefits of IMS to FMC also found support in the literature, where it is suggested that the benefit of IMS to an operator is not going to be one silver bullet solution that will generate significant competitive advantage, but rather the capability of the operator to deploy many diverse services over various networks and device types that will allow it to capture the consumer's wide and varied lifestyle needs. This is ultimately what will drive the IMS business case (Amer, 2009). The literature also suggests that the cost and complexity mitigation promises have not materialised leading to slow acceptance of IMS among operators (Raj et al., 2010). It is thus concluded that an integrated operator is able to deploy FMC without full network integration, but when viewed from an on-going sustainability and competitive perspective, FMC requires full network integration. However, when deciding on the investment for integration, an operator must be clear about the value to be generated from the investment and how that will be achieved i.e. cost reduction, new services, etc.

4.3.3 Organisational integration

Another important area of integration raised by respondents, although not technical, was that of organisational integration. Commercial practices include the organisational processes and structures. Respondents predominantly felt that to ensure the success of FMC, an integrated operator had to deal with the proper integration of the organisation at various levels. Some respondents even indicated that this was far more important than the technical aspects as it would ensure an integrated approach to the customer wherein the competitive advantage of FMC lies. It was also highlighted as the point at which most operators fail in the FMC journey. A respondent indicated that the technology aspect was just one third of the convergence journey as the successful implementation of FMC had to account for people, process and technology. Various areas of organisational integration were identified.

At the highest level, respondents indicated that there had to be strategy alignment at the strategic apex of the organisation. Embarking on an FMC

strategy meant that an integrated operator could no longer view its fixed-line and mobile businesses as separate, each with their own strategies, and then develop another FMC strategy. There had to be complete strategic alignment where the FMC strategy is developed in line with the fixed-line and mobile strategies so that the expected customer value can be realised. This alignment would further ensure the various organisational business units do not compete with each other thereby destroying organisational value. It must be noted, however, that this does not mean that fixed-line and mobile services cannot have their own targets, but rather that both services as well as FMC services should be taken to market in a synergistic way.

Strategic alignment would then necessarily have an impact on the organisational structure and operating model. The integrated operator would no longer be able to function in the traditionally separated manner, where fixed-line is seen as a separate business vertical while mobile is seen as another business vertical. A more relevant structure would have to be applied to the organisation to ensure the success of FMC. A paraphrased explanation from a respondent to elaborate follows;

“From a customer perspective, obviously for me I would say that there needs to be one sales and marketing customer interface, it's very important, right. Within that you need to tackle your verticals and therefore your verticals would be for consumer and for business, those are the key verticals you need to worry about”.

This view simply means that an integrated operator would have to take a customer led or segmentation view instead of the traditional technology view. The technology enablement departments of the business should become, as one respondent described, the factory, while the organisation is structured according to the customer. This does not mean that an operator has to neglect the specialist nuances of the support of fixed-line and mobile businesses. Within these customer verticals there could be specialist fixed-line, mobile and FMC departments that supported the different services, but belonging to the same division would ensure alignment as depicted by the Belgacom example that was pointed out by one respondent. Although respondents added that traditional

organisational silos should be broken down, they viewed this as potentially the most difficult part of the convergence journey since they envisaged there would be resistance to such integration from the different business units. Respondents almost unanimously agreed on the issue of alignment of organisational structure, however, some cautioned that structural change was a matter of timing. One respondent explained it by saying it was a matter of the maturity of FMC in the organisation and it would be prudent to have a separate department running FMC initially, however, in the longer term structural integration would be necessary. Another respondent alluded to the issue of maturity, but maturity of the separate fixed-line and mobile businesses rather than FMC services. Some integrated operators are relatively new entrants to the mobile market and have been fixed-line incumbents for a long time before that. Very simply, the respondent argued that an operator had to be good at delivering fixed-line and mobile services if it had a chance of being good at FMC and that being a new entrant in mobile and thus still building mobile capability could indicate premature timing. The verbatim response has more impact;

“..., if you want to be successful in FMC, surely you need to be successful in F and M”

This explains the strategic and structural alignment at the highest level of the organisation. There are, however, other areas of the organisation where integration is required. These are areas at which the customer interfaces with the organisation.

The first of these areas identified were the organisation's sales channels. Respondents argued that the channels had to be integrated and show one face of the organisation to the customer. This implied that a customer would enter a channel with a specific telecommunications need, not knowing what the underlying technology is, and the sales agent would sell the customer the most suitable product based on that need whether it was fixed, mobile or FMC. This meant that sales systems, staff training and incentives needed to all be integrated and aligned to the FMC strategy.

The next customer facing area identified was that of customer support. Respondents explained that irrespective of the service a customer held with the organisation, there had to be one point of contact with the organisation to resolve queries i.e. one call centre number. They argued it would be untenable for a customer to have many different numbers to call depending on the nature of the query or type of service. Respondents, however, appreciated the complexity of the various services that could be offered by an integrated operator and conceded there would have to be separate departments that dealt with different types of queries. They were, however, firm on the view that this only meant the call centre operator should be well trained on where to route the customer to best resolve the query but the customer's point of entry to the organisation should be through one number only. Other respondents went further to say that if the CRM systems were sufficiently integrated, customers could be tiered according to priority segments and their call to the contact centres could be treated according to different priorities driven by predetermined service level agreements.

Lastly, some respondents were of the opinion that another area of organisational integration required for the success of FMC, although not tangible, was that of organisational culture. Within the industry, it is commonly understood that even within integrated operators the culture of the mobile and fixed-line businesses were markedly different. Some respondents held the view that in their experience they found that mobile personnel generally wanted to remain separate. They also observed that generally, due to historical factors contributing to a dynamic mobile industry on one hand and a more static fixed-line industry on the other hand, mobile businesses tend to have many younger employees and more progressive cultures. Moving towards FMC would require a shift in the mentality of both the fixed-line and mobile business towards one of convergence. A respondent explained it as follows;

"You are now marketing your company as a fully converged company that offers fixed converged type services and that message has to be embedded in the minds of each and every member of your staff , the

culture of the company and the way it works. And that is what actually will eventually enable you to succeed”.

That said, it was cautioned that attempting to merge two vastly different cultures comes with substantial risk. One respondent went as far as saying that if organisational integration were forced prematurely, the organisation would risk killing its mobile culture and as a result, the mobile business.

The inclusion of organisational integration as part of FMC is supported by the literature that defines FMC as the combination of previously separate fixed and mobile services, networks and commercial practices (Yang et al., 2004). This is further supported by the literature where it is stated that one of the primary objectives of FMC is to make traditionally separated parts an organisation integrate and work together (Curwen, 2006). The view that the organisational structure of an FMC operator should take a customer segmented approach also finds support in the literature wherein it is stated that technology, whether fixed, mobile or converged becomes merely the enabler to the services the customer requires and as such the customer should be shielded from the underlying technology (Wong et al., 2006). An integrated operator must however, consider all the above mentioned points of organisational integration in accordance with customer experience theory where it is stated that customer experience is not formed by isolated instances but by the total experience a customer receives at multiple interaction points with the organisation (Verhoef et al., 2009). This goes beyond the product consumption level and necessarily includes all customer touch points, people and processes.

4.3.4 Conclusion

In conclusion, it was found that various areas of infrastructure integration had to be taken into account for an integrated operator to offer FMC in a sustainable manner. Generally, respondents indicated that the sequence of infrastructure integration did not matter as the integration was context specific, while a lot of integration could be done in parallel.

In order to offer the billing and bundling elements of FMC among others, it was found that there is a definite need to integrate and operator's OSS and BSS systems. The starting point would have to be rationalisation of customer data so as to obtain a full and comprehensive view of the customer base and the services held by customers i.e. one view of the customer. At the system level, integration would have to take place at the CRM and billing system levels while the processes for customer fulfilment, assurance and billing had to also be reengineered for efficiency and effectiveness. A suitable migration path from the disparate system environment to the integrated environment would also have to be defined to ensure business continuity and the minimisation of migration risk. System integration was seen to be a highly complex exercise due to the number of different systems, processes, technologies and vendors that made up the OSS/BSS ecosystem of a typical integrated operator.

At the network level, it was found that the network had to be converted to an all IP network so that seamless integration of customer sessions could be performed with greatest efficiency. The aggregation layer had to have next generation equipment such as MSAN's installed so that the interface between the core and access networks could become technology agnostic. Simply put, this would allow for various access technologies to interface seamlessly with the core network through this equipment. The main integration highlighted at the network level was that of integrating the core networks for both the fixed-line and mobile businesses. The IMS and associated NGN was seen as the benchmark for integration into a common core network for both fixed-line and mobile networks, while it also provided the advantage of separating the transport layer of the network from the service layer. The IMS is geared toward handling rich media services and allows for the development of modular solutions that are built once and applied to different services. At this level, the capability for seamless session handover would be built using SIP technologies. There were also contrarian views to the implementation of IMS. Some respondents observed that it opened the door further for OTT players to dominate the service or intelligent layer with innovative applications. Others saw IMS mainly as a capex and opex optimisation solution stating that the success of FMC depended mainly on the services that operators were able to offer over

their networks. These respondents did however concede that IMS improved the time to market and efficiency of service development thereby improving the sustainability of FMC for an operator.

The other key integration area identified was the organisational components of the organisation. This started at the level of strategy to ensure alignment between the fixed-line, mobile and FMC strategic objectives, and went further to highlight the organisational structure and operating model as areas that required integration consideration. The prevailing view was that of a customer segmented organisational structure with fixed-line and mobile technologies playing a back-end technology enablement role. The structure issue was also viewed as being linked to the maturity of FMC within an organisation and the maturity of the operator's fixed-line and mobile businesses respectively. Further areas of organisational integration highlighted were the sales channels and customer support channels, each with system, process and people considerations. Finally, many respondents viewed organisational culture and its effects on organisational integration as both vital and challenging for an operator embarking of the FMC journey.

In light of the data it is concluded that although it is possible to deploy FMC with bridging applications at the system level and partial integration at the network and organisational levels, complete integration of all levels is required when the sustainability of FMC over time is considered. Notwithstanding this, it is prudent for integrated operators to start with partial integration and gradually move towards full implementation in line with context and organisational readiness.

4.4 Challenges associated with FMC for integrated operators

During the interviews respondents highlighted many challenges relating to the implementation of FMC. Although the identification of challenges was not a specific research objective, it may be valuable to discuss them in order to provide a comprehensive view on the subject. Although mentioned in the preceding discussion, a view of all challenges in one area may prove useful to the reader. The key findings in this section are summarised in the table below.

Table 4: Summary of challenges

Theme	Findings	Key Respondent comments
Challenges		
Organisational Integration	Operators will find it difficult to integrate their fixed-line and mobile organisation due to the complexity associated with fusing the fixed-line and mobile business cultures.	<i>"I would go so far as to say 80% to 90% of the operators challenges are embedded in historical processes and cultures and mind sets that are in the operator, so if the operator from board level is not bought into FMC then the operator will not converge".</i>
	Mobile culture tends to be more progressive due to industry dynamism while fixed-line culture tends to be less so.	
	This is compounded by the trend of mobile organisations wanting to remain separated from their fixed-line counterparts.	
	The risk of forced integration could lead to the demise of the competitive strength inherent in the mobile business.	
Competition with device and OTT players	There are questions around and integrated operators ability to compete at the application and service layer as the customer experience is generally controlled by the devices and applications they used. These devices and applications are designed by the device manufacturers and OTT players.	
	It is postulated that user behavior is driven by these devices and applications.	
	An integrated operator's strength lies in providing connectivity and it is argued that by investing in large scale infrastructure integration they will only make it easier for the device manufacturers and OTT players to compete.	
Complexity of tariffs	The complexity of tariff plans and different customer purchase decision cycles for fixed-line and mobile services makes it difficult for integrated operators to develop compelling FMC value propositions.	
Regulatory mechanisms	Regulatory mechanisms such as Wholesale/Retail Separation introduce significant risk for an integrated operator wanting to achieve competitive advantage through the investment in infrastructure to deliver FMC services.	
Customer Education	Customers tend to not understand the complex benefits of the various telecommunication services. They mostly understand price and customer service. This may make it difficult for FMC services to gain a foothold in the market.	
CAPEX requirement	In light of the risks associated with making the introduction of FMC services successful, substantial capital expenditure is required to integrate infrastructure.	

As mentioned, the main challenge raised by respondents when discussing organisational integration is the issue of the vastly different cultures of the fixed-line and mobile businesses even within the same operator. Respondents held that the mobile market has historically been more dynamic and as a result has a younger, more progressive mind-set and culture whereas fixed-line incumbents

are the opposite due to the historical lack of dynamism in that market. The successful outcome of trying to fuse these two cultures according to some respondents is tenuous at best and may kill the mobile business at worst. They also argue that in many integrated operators, the mobile group wants to remain separated from the overall group as they feel constrained by the parent. The view of one respondent is alarming;

“I would go so far as to say 80% to 90% of the operators challenges are embedded in historical processes and cultures and mind sets that are in the operator, so if the operator from board level is not bought into FMC then the operator will not converge”.

Another challenge observed by some respondents was the appeal of services that operators are able to provide in the face of innovation being driven by the device manufacturers and OTT players. They observe that user behaviour is driven by the types of devices and applications they use and these rarely have anything to do with the operator. They assert that the operator merely provides connectivity, notwithstanding isolated cases where operators own set-top box type devices with limited success. Relating this to infrastructure integration, they further argue that the implementation of IMS that separates the network layer from the service delivery platform will only make it easier for other players to come in and control the intelligent layer i.e. the service layer.

The complexity of developing compelling FMC value propositions was another challenge raised specifically because mobile operators had many different tariff plans with countless deals linked to different handsets or devices. A respondent with international consulting experience indicated that FMC proved successful only in markets where there was single flat-rate pricing in the market. This made comparison between fixed, mobile and FMC products easy while making the benefit of FMC products lucid. This complexity was further complicated by the different decision cycles evident in purchasing fixed-line and mobile products. It was argued by a respondent that fixed-line purchase decision points are generally when a customer moves home or if there are special promotions while mobile decision points are driven by contract expiry or handset upgrades. Finally, the complexity of developing FMC value propositions is compounded by

the trend of uncapped data in fixed-line and capped data on mobile services due to spectrum limitations. A balance must be found between these two before an FMC offering is considered compelling.

Regulatory mechanisms have also been raised as a threat to the success of FMC for integrated operators. In cases where there is strict implementation of Wholesale/Retail separation, the competitive advantage of the integrated operator will be removed. Wholesale/Retail separation forces fixed-line incumbents to offer other operators wholesale services at the same price they offer it to their own retail arms. In the case of FMC where the competitive advantage of an operator will come from the ability of the operator to offload traffic from the mobile network to the fixed-line network, it will not be enough to differentiate the offerings of the operator if all other players are able to purchase backhaul capacity at the same price. In fact, with some investment of their own, other players will also be able to offer FMC type services with similar cost and quality.

Compounding the regulatory risk is the fact that significant capex is required to get to a point where an operator is able to offer FMC sustainably. Some respondents, although convinced by the cost efficiencies that will be realised from this investment, are not convinced of the envisaged revenue upside.

Customer education and understanding of technology was also raised as a possible challenge. A respondent plainly stated that only a small percentage of customers truly understood the customer benefits of telecom products and it will be no different with FMC. He further asserted that all customers really understand is price and customer service and if this is the case then the fixed-line portion of FMC would actually be a hindrance to product take-up since the service levels of fixed-line incumbents are generally worse than mobile operators.

4.5 Summary of the results

FMC has the potential to significantly enhance customer experience. It does so by primarily affecting four dimensions of customer experience. These are convenience & simplicity, cost, quality and innovation. With respect to convenience & simplicity, FMC is able to positively impact customer experience through its ability to offer customers a single bill with one account from one operator. It can also provide shared capacity over fixed-line and mobile network services. It was found that mobile operators are able to offer similar convenience & simplicity benefits over mobile networks, therefore convenience & simplicity as a dimension on its own is not sufficiently enticing as a value proposition. However, if viewed together with the other dimensions, the FMC proposition is strengthened. FMC provides an operator with substantial opportunity to reduce the cost of providing services. This stems from the elimination of duplicate networks with the resultant duplicated maintenance overhead and also extends to the consolidation and rationalisation of customer channels and organisational departments. FMC further provides an integrated operator with the ability to offer better quality services by integrating the fixed-line and mobile networks and offering the stability and consistency of the fixed-line network when required and mobility and portability of the mobile network when required. An integrated operator is also afforded significant innovation opportunity with many advanced and rich content services made possible by FMC. There are some concerns around the ability for FMC to generate significant new revenue for an operator due to the innovativeness and dominance of OTT players. Despite this, the value of FMC is clear from the cost reduction and efficiency viewpoints.

In order to offer FMC in a sustainable manner, various areas of infrastructure integration are required, spanning the systems, network and organisational domains. The order of integration was found to be less relevant and context dependent while the actual areas of integration were found to be of greater importance. OSS and BSS integration was seen as vital to the enablement of bundled services and offering single bills. Bridging applications were suggested as solutions to achieve this initially but true integration was found to be required

if FMC services were to be offered in a sustainable manner. Customer data was identified as a critical departure point for integration together with customer and billing systems. Also identified as critical for integration were the processes for service fulfilment, assurance and billing that managed the customer acquisition, fulfilment and billing cycles. The managed migration of systems and processes was identified as an important consideration as well.

From a network standpoint, the conversion of the entire network to IP, the enhancement of the aggregation layer with next generation equipment to accommodate multiple access technologies and the implementation of a common core using IMS architecture and NGN that separates the transport layer from the service delivery platform were seen as the key areas of integration. IMS found some opposition in relation to FMC, however, the question of sustainability linked to complexity and time to market of delivering new services tempered the level of opposition, leading to respondents conceding to its relevance to FMC.

Organisational integration was also identified as an often overlooked but no less important area of integration. This integration started at the strategic alignment level, through to the organisational structure and operating model, and also to the customer sales and service channels. Another important but challenging area of organisational integration highlighted was organisational culture.

Although caution was raised in relation to the pace and evolution of infrastructure integration, it was overwhelmingly asserted that for FMC to be successful and sustainable in the long term, full integration had to be achieved. This, however, comes with significant challenges. As mentioned, the fusion of mobile and fixed-line organisational cultures is fraught with complexity. So too, is the ability of legacy integrated operators to innovate at the service level and find compelling business models that are able to compete with OTT players. Compounding this is the ability to simplify tariffs and align fixed-line and mobile customer purchase decision cycles. Externally, regulatory threats related to Wholesale/Retail separation introduced additional risk to the success of FMC. This was further complicated by the general customer's limited ability to discern complex product features and pricing plans from one another. Underpinning

these challenges is the enormous capital investment required by integrated operators to integrate their infrastructure for FMC without any guarantees for a return on investment.

CHAPTER 5: CONCLUSION

5.1 Introduction

This research set out to identify the customer experience benefits of FMC and the required infrastructure integration for an integrated operator in South Africa to be able to deliver the defined customer experience sustainably.

Research question one attempted to identify the various customer experience benefits of FMC, and specifically the form it would take in affecting customer experience. To achieve this, various areas identified in the literature were used as a departure point and prompted the line of questioning in the interviews. In the final analysis these areas were reduced to the dimensions of convenience & simplicity, cost, quality and innovation. These dimensions, reduced through logical grouping, were found to adequately encompass all the areas of customer experience identified in the literature review.

With the abovementioned customer experience as a reference point, research question two then sought to understand the required infrastructure integration for an integrated operator in South Africa to be able to deliver this customer experience while also attempting to identify the point in the infrastructure integration journey at which these customer experience benefits could be delivered sustainably.

The resultant understanding derived out of the results and analysis of the data is envisaged to provide integrated operators with a comprehensive view of the considerations to be undertaken when embarking on the costly FMC journey, and in so doing, limit the potential for unfeasible or risky investments.

5.2 Findings related to research question one: Customer experience

Research question one: Based on customer needs and expectations, what are the customer experience requirements for FMC services delivered by integrated operators?

Generally, the customer experience benefits extracted from the interview data seemed to be largely in line with those identified in the literature. The four dimensions elicited from the interviews were convenience & simplicity, cost, quality and innovation. It must be clarified that although the customer experience benefits identified in the literature review amounted to more than these categories, these categories arose out of a process of reduction and it was shown that all the key elements from the literature review relate to one of these categories.

5.2.1 Convenience & Simplicity

The first area of FMC customer experience benefit identified during the interviews was convenience & simplicity. Within convenience & simplicity, various areas were suggested as contributing elements. Of these, the first was that of a customer having a single bill with one account instead of multiple accounts and multiple bills from different service providers. Coupled with the single bill and single account was the convenience of having only one number through which a customer could be contactable irrespective of location or device. Linked to this was the idea that a customer subscribing to an FMC service would have one interface with a service provider irrespective of the type of query i.e. whether the issue is on the fixed-line or mobile side of the FMC service. Respondents further identified the use of shared capacity between fixed and mobile services as an area of convenience and simplicity. Also raised, was the simplicity of tariffs that FMC services were able to offer. Mobile services come with a myriad of tariff plans and devices that lead to countless configurations of products. One respondent spoke in way that made this specific benefit seem like a critical success factor for FMC; an area that FMC offerings

could use to differentiate themselves from traditional fixed-line or mobile products.

It was suggested by some respondents that FMC services also provided integrated operators with an opportunity to bolster their customer segmentation activities. It was argued that FMC customers, who would tend to be higher value customers by virtue of them holding fixed-line and mobile services, could be given priority status when interacting with the company as a result of their value to the company. As an example, these customers could have their queuing time at the call centre limited to 30 seconds and this performance could be enforced through a service level agreement (SLA). Finally, convenience & simplicity was identified as the customer experiencing seamless integration between fixed-line and mobile networks when using services and this meant a seamless connection without interruption of usage sessions. This would allow a customer to obtain the portability and mobility benefits of a mobile service and also the cost and quality benefits of a fixed-line service without any inconvenience or interruption.

The following customer experience benefits identified in section 2.3 of the literature review are suggested to conform to the stated convenience and simplicity factors:

- One subscription with a single bill
- One device/handset that can be used for all services and shields the customer from the underlying technology
- Convenience
- Ease of use
- Mobility, portability and ubiquity

It was asserted that the convenience & simplicity dimension of customer experience was not sufficient to differentiate an FMC offering from a traditional mobile offering because with enough focus and effort, a mobile operator could achieve these benefits using pure mobile technology. It therefore became important to view the convenience & simplicity dimension together with other dimensions of customer experience that FMC could enhance.

5.2.2 Cost

The next area of customer experience identified by respondents was that of cost. Respondents largely accepted that the cost of providing services is cheaper over a fixed-line network than a mobile network. This is due to the limitations of spectrum and contention ratios on the masts of a mobile network. FMC would allow an integrated operator to offload traffic onto its fixed-line network using WiFi technology so as to optimise network usage at any given point. In fact, it was also asserted that next generation technology would allow the network to automatically implement least cost routing on an integrated network where any given connection is routed over the most cost effective route with respect to cost optimisation. This would require the integrated operator to build WiFi infrastructure in many public spaces.

Further cost efficiencies from FMC would be derived from the actual integration of an integrated operator's fixed-line and mobile networks that would result in the management of a common network platform, common equipment and reduced staff and training cost to maintain the common equipment. More cost efficiencies would also be realised from the removal of duplicated customer facing infrastructure such common sales and customer care channels. Additionally, an integrated operator has the advantage of owning the backhaul from its mobile base stations to its core network. This means that the integrated operator doesn't really have a cost issue when implementing offloading strategies as it need not pay another operator for the use of backhaul links like mobile operators have to since it owns the links. This provides the integrated operator with another cost benefit when FMC is implemented. All these cost efficiencies can be passed on to customers via competitive pricing of FMC offerings vis-à-vis separate fixed-line and mobile offerings and in fact, would meet the demanding customer expectation of reduced telecommunications cost identified by respondents and supported by the literature (Rokkas et al., 2009).

The following customer experience benefits identified in section 2.3 of the literature review is suggested to conform to the stated cost factor:

- Cheaper prices

5.2.3 Quality

Quality was another area identified by respondents where FMC is able to enhance customer experience. Respondents suggested that the quality of fixed-line services is substantially superior to mobile services due to the dynamics and nature of each technology. At its simplest, the explanation for this discrepancy identifies the congestion on mobile networks and the dedicated provision of a fixed-line as the differentiating factor. This higher quality or consistency on fixed-line networks becomes all the more relevant when viewed in conjunction with the usage patterns of consumers, specifically the increasing trend of content rich applications such as video streaming and online gaming. FMC offerings, therefore, will allow customers to get the benefit of mobility and portability through a mobile connection while also catering for their advanced quality requirements by offering them a fixed-line connection when required for data and content rich applications.

The following customer experience benefit identified in section 2.3 of the literature review is suggested to conform to the stated quality factor:

- Higher data speeds irrespective of location i.e. best connected

5.2.4 Innovation

Innovation was the final area identified by respondents where FMC had an effect on customer experience. Respondents were fairly unanimous in highlighting the innovation opportunity that FMC could offer an integrated operator. These opportunities ranged from triple and quad-play offerings to the much more advanced innovations such as home automation, cloud services, remote storage, presence, real-time billing and home security. Suffice it to say, the innovation potential for FMC is enormous.

The following customer experience benefits identified in section 2.3 of the literature review is suggested to conform to the stated innovation factor:

- More advanced services than traditional telecoms offerings
- A wider range of services than traditional telecoms offerings

5.2.5 Conclusion for research question one

From the data elicited during the interviews it is concluded that FMC has the potential to provide many customer experience benefits. These centre on convenience & simplicity, cost, quality and innovation.

5.3 Findings related to research question two

Research question two: What are the minimum infrastructure integration requirements that are able to meet the required customer experience in a sustainable manner?

There are various areas of infrastructure integration required for an integrated operator intending to embark on an FMC journey. These were generally aligned to the literature review and centred on OSS & BSS integration, network integration and organisational integration.

5.3.1 Systems (OSS and BSS)

The first area of infrastructure integration identified by respondents was the area of systems integration that included the OSS and BSS layers of an integrated operator's system domain. This included different areas of system integration, however, it was established through the interview process that the order of system integration was not important since it was context specific and many areas could be integrated in parallel. Instead, the more important consideration was to ensure the right areas of integration were identified.

The first areas of system integration identified were those that related to the enablement of bundled products which were considered low-hanging fruit. This integration was not true integration between systems but rather bridging applications that allowed communication between disparate systems resulting in the consolidation of billing and usage information onto a single bill. This capability provides the basis for integrated operators to offer bundled products. It was, however, suggested that these bridging applications were not sustainable as their proliferation would negatively affect time to market of new

services as well as complexity and maintenance overhead. Due to this unnecessary complexity and cost overhead respondents generally held the view that despite this being the starting point, a longer term system integration view based on One-IT had to be taken to ensure sustainability. To move towards the One-IT vision, various areas of integration were identified.

The first of these was the area of cleaning and consolidating customer data in order to get a better view of the customer base. Once the customer data is clean, the operator can then move towards the integration of the CRM and other customer systems. Next, the billing systems were highlighted as a key area of system integration so that one billing system could consolidate customer usage information from both the fixed-line and mobile networks and generate consolidated bills. Together with these areas of system integration, associated processes were identified as a critical area of integration so that the customer engagement with the organisation could also occur in a converged manner.

Respondents, however, did concede that getting to the One-IT vision was a complex exercise as it is common for operators to have multiple vendors running various systems in their organisations. This multi-vendor ecosystem compounds the complexity of the integration effort.

5.3.2 Network

The second area of integration highlighted by respondents was network integration. The network requires integration at various levels. As with OSS and BSS, the order of integration was not seen to be important since multiple areas of the network could be integrated in parallel and these generally tend to be context specific. More important to respondents was the identification of the actual areas of network integration required.

The first area of network integration was the migration of the entire fixed-line and mobile network to an all IP network. This will result in cost efficiencies and support better integration between the fixed-line and mobile networks. Next, an integrated operator would have to install next generation equipment on the aggregation layer that allows the network to interface with multiple access

technologies. The core area on integration, however, was identified as the migration of the network to a common IMS architecture using an NGN platform that will enable the network with a multi-media core while separating the transport layer from the service delivery platform. Opponents to IMS as an FMC enabler assert that IMS is not required for FMC enablement as the benefits are mostly linked to capex and opex optimisation. Upon further investigation, however, it was found that IMS actually speeds up the delivery of services to market as it provides the capability for services to be developed in a modular fashion and reused across service platforms. It is thus concluded that IMS supports the sustainability of FMC in this way, however, it is left to the innovation capacity of the integrated operator to deploy valuable services over its network to ensure the success of FMC.

5.3.3 Organisational Integration

Another area of integration highlighted by respondents was organisational integration. They argued that integration was required at various levels of the organisation in order to ensure the success of FMC, but also indicated that this was the area where most integrated operators failed in the FMC journey.

The primary area of organisational integration was identified as strategic alignment of the various business units in the organisation to ensure that the business units of the organisation do not compete with one another, thereby destroying organisational value. This strategic alignment would then feed into a revised organisational structure and operating model that is based on the customer and not technology i.e. fixed-line and mobile. It was however, cautioned, that structural change was extremely difficult due to organisational politics, and that the timing of this change had to be right.

Other areas of organisational integration were identified as integrated sales and support channels, where the customer interacted with a single point in the organisation. That single point has to be able to address the entire customer needs even if it only means being able to efficiently route the customer to the correct specialist department. Finally, the area of organisational culture was identified as a key area of integration. It was argued that the fixed-line and

mobile businesses of an integrated operator generally had significantly different cultures and that this integration was vital to the success of FMC. It was also noted that cultural integration was quite challenging and risky and needed to be treated with the utmost caution.

5.3.4 Conclusion for research question two

Respondents identified many areas of infrastructure integration that an integrated operator must consider when treading the FMC path. These range from the various elements of OSS and BSS integration, the different components of networks integration as well as the multiple facets of organisational integration. However, when prompted to identify the point in the infrastructure integration journey that an integrated operator could stop at in order to deliver FMC in a sustainable manner, respondents overwhelmingly asserted that to ensure successful and sustainable implementation of FMC, an operator had to undertake complete infrastructure integration. There were some arguments that asserted FMC could be delivered without the implementation of IMS, however, when pressed about the benefits of speed to market and the efficient service development that IMS offered, opposing respondents conceded that for the sustainable deployment of FMC, IMS is required.

5.4 Other considerations and challenges

During the interviews many respondents were keen to point out the infrastructure integration challenges faced by an integrated operator when implementing FMC. Although this was not one of the key questions intended to be answered by this research, it was found to be useful and as such, may be helpful for integrated operators pursuing FMC strategies to consider.

The main challenge highlighted by respondents was the cultural challenge associated with the integration of fixed-line and mobile businesses. There is a risk that organisational integration, if not timed and managed properly, could kill the dynamism of the mobile business culture. A further complication is the

general separatist mentality found in the mobile businesses of integrated operators worldwide.

Another challenge highlighted was the ability of integrated operators to compete with OTT players who were born out of innovation and have innovation in their DNA. Legacy telecommunication operators were generally perceived to have the opposite DNA by respondents. Therefore, an operator's capacity to innovate and thus compete was seriously questioned.

The ability of operators to develop simplified FMC products with simple tariffs was another challenge raised by some respondents. Compounding this was the different decision cycles for the purchase of fixed-line and mobile services and the viability of a different FMC decision cycle.

An external challenge highlighted was the threat of regulatory mechanisms; specifically the threat of Wholesale/Retail separation. This, if realised, could jeopardise the viability of FMC by removing the integrated operator's potential to differentiate using FMC. This is compounded by the significant capital investment required by an integrated operator to enable FMC. The question thus arises; is this investment the best allocation of scarce capital?

A final challenge to note is customer education or customer understanding of telecommunication products. It was suggested by a respondent that only a small number of customers can truly differentiate between the product features and tariffs of various telecommunication services and that the battle for the customer is won on price and customer service. If this is true, he asserted that FMC is more of a customer retention tool than an all-out customer acquisition tool. This throws the ability of FMC to generate new value for the company into question.

The abovementioned challenges, although significant, does not lead to the forgone conclusion that FMC cannot be successful. Rather, it provides areas of consideration for an integrated operator to assess before making an FMC investment decision. Being aware of the challenges also provides the operator with the awareness to think of innovative ways to overcome them upfront, thereby enhancing the chances of success for FMC.

5.5 Recommendations

FMC promises great opportunity for integrated operators but in reality poses many challenges with regard to its implementation. Operators are required to commit vast amounts of capital expenditure to implement FMC but there is no certainty regarding the return on investment due its infancy. Furthermore, there seems to be a threat from mobile operators who are perceived to be able offer adequate substitutes for FMC products. The findings of this report therefore go some way to clarifying some of the differentiated customer experience benefits of FMC and also the benefits that could potentially be obtained from investing in infrastructure integration. These benefits however, can only be achieved if integrated operators consider various factors that could affect the success of FMC offerings. These considerations are presented below as separate recommendations to management of integrated operators pursuing FMC.

- It is not sufficient for an integrated operator to simply offer FMC services to customers despite the customer experience benefits they provide. It is important for these operators to get a consistent level of customer service across the fixed-line and mobile areas. The user needs to experience the organisation in the same way at every point of contact and ignoring that this fact would threaten the success of FMC services for an integrated operator.
- Integrated operators offering FMC services should exercise caution and think through the implications of certain services before launching them. Specifically, services that provide shared capacity between the fixed-line and mobile networks due the different capacity constraints of the respective networks. Services should be structured and developed in a way that encourages the offloading of traffic onto the fixed-line network wherever possible through the provision of proper incentives to shape customer behaviour. This can be further supported by customer education campaigns regarding the benefits of such behaviour, and marketing activities to promote the same behaviour.

- Since FMC offerings are a relatively new proposition in the market, it would serve integrated operators to grasp the opportunity to simplify its pricing and tariff structures so that customers are able to easily understand what they are paying for and what they will receive in return. Contrasting this with the complex pricing and tariff structures of traditional telecommunication services, it may prove to be a significant differentiating factor that leads to increased customer take-up of FMC services.
- Linked to the simplicity of FMC pricing is the actual pricing strategy. In order to strengthen the prospects of FMC success, integrated operators should ensure that FMC services are priced in a way that makes the combined FMC service cheaper to the customer than the sum of the individual products. This is a factor that could entice customers to migrate to FMC products initially before they are able to experience the other customer experience benefits i.e. convenience & simplicity, quality and innovation. Implementing this requires an operator to take a deliberate decision to sacrifice short-term profit to ultimately grow value through increased subscribers. With the usual short-term corporate performance management, this may be easier said than done, however, business executives will be well advised to remain resilient in the face of short-term pressure in order to generate longer term value.
- FMC offers integrated operators ample opportunity and capability to innovate at the product and service levels, however, incumbent operators are not viewed as innovators in this space. In fact, the OTT players and device manufacturers are leading innovation at the service level while operators only dominate at the connectivity level. Integrated operators pursuing FMC should therefore be clear about the customer services and business models they are going to use up front to compete before embarking on the capital investment required for the enablement of FMC. If not, they risk spending vast amounts of capital merely to provide connectivity for services that generate high-margin revenue for other players.

- FMC can be offered without full infrastructure integration, however, partial integration impedes the operator's ability to do so in a sustainable manner. Without full integration, complexity and time to market will be increased while cost advantages to the operator and customer will be lost. In spite of this, it is not prudent for an operator to expect fully integrated infrastructure before deciding to offer FMC. It would be reasonable for an operator to initially offer FMC services such as bundling and combined billing as a start and slowly progress to more advanced offerings that require full infrastructure integration. Furthermore, the dynamic nature of the telecommunications industry means that customer expectation, needs and behaviour, together with technology advancements are constantly changing. Therefore, operators should to the extent possible, focus on discreet infrastructure integration steps together with a long-term view in order to establish flexibility to be able to respond to changing market conditions.
- Infrastructure integration does not necessarily require a specific sequence of events for FMC to be enabled. Integrated operators should pursue an infrastructure integration roadmap that is context specific and returns the greatest value to the organisation at a particular point in time. Also useful to note is that many areas of infrastructure integration can be done in parallel, while the actual integration should consider the impact of present and likely future regulatory regimes on the potential return on investment for the infrastructure integration.
- In pursuing FMC, integrated operators should provide as much focus to the organisational processes and structures as they would to the technical infrastructure integration. This is critical to achieving a positive customer experience and obtaining cost efficiencies. However, it is fraught with complexity due to cultural and political issues so it should be done carefully and in a phased manner that takes the fixed-line and mobile organisational maturity into account. Strategic alignment at the organisational level should also be considered and applied to ensure incremental value growth even if that means sacrificing some value in

individual business areas. It is untenable for an integrated operator to have its various business units competing with each other in an unmanaged way, thereby destroying value.

- When a company pursues FMC, it must ensure that the organisation is marketed as such internally and externally, and that company management and operational staff adopt an FMC mentality in all activity and decision making. Without this, it is likely that the organisational vision will be disconnected from its activity, thereby leading to suboptimal implementation with suboptimal results.

5.6. Suggestions for further research

This research was interpretive in nature and sought to explore the prevailing thinking and diversity of views regarding FMC, its customer experience and infrastructure integration requirements. In exploring the subject, the findings of the research pointed to further areas of academic research that can be done in order to add to the richness of understanding around FMC in general. These are:

- Understanding and defining specific business models that integrated operators can adopt in order to ensure a successful return on investment for the capital employed for infrastructure integration. This could include an analysis of the device and application manufacturers in order to understand how best to compete/cooperate with these players to generate incremental margin i.e. direct competition, partnerships, joint ventures etc. This research should also include a view on OTT players.
- Understanding the specific critical success factors for customers to take up FMC services relative to traditional fixed-line and mobile telecommunication services.
- Quantifying the return on investment for an operator that undertook an FMC infrastructure integration programme.

- Defining a set of differentiated FMC products and services that integrated operators can pursue to gain competitive advantage vis-à-vis traditional telecommunication products. This is different to the available view of perceived product possibilities.
- Understanding the impact of cultural factors and its implications for organisational integration for an integrated operator.

REFERENCES

- Amer, A. (2009, 20-25 April). *A Phase Based Solution for the Rollout of Fixed Mobile Convergence*. Paper presented at the Fifth International Conference on Networking and Services, Valencia, Spain.
- Boeije, H. (2002). A purposeful approach to the constant comparative method in the analysis of qualitative interviews. *Quality & quantity*, 36(4), 391-409.
- Chang, T. Y., & Horng, S. C. (2010). Conceptualizing and measuring experience quality: the customer's perspective. *The Service Industries Journal*, 30(14), 2401-2419.
- Creswell, J. W. (2007). *Qualitative inquiry & research design: Choosing among five approaches*. Thousand Oaks, CA: Sage Publications, Inc.
- Curwen, P. (2006). Fixed-mobile convergence. *info*, 8(3), 3-11.
- Gentile, C., Spiller, N., & Noci, G. (2007). How to Sustain the Customer Experience::: An Overview of Experience Components that Co-create Value With the Customer. *European Management Journal*, 25(5), 395-410.
- Goestl, H. (2006, 6-9 November). *Using NGOSS Principles in todays OSS/BSS Projects NGOSS meets IMS/SDP*. Paper presented at the 12th International Telecommunications Network Strategy and Planning Symposium, New Delhi, India.
- González, J. M., & Lozano, J. A. (2010). Next generation network management: An opportunity for telcos to reinvent themselves. *Journal of Telecommunications Management*, 3(1), 51-65.
- Hewitt-Taylor, J. (2001). Use of constant comparative analysis in qualitative research. *Nursing Standard*, 15(42), 39-42.
- International Telecommunications Union. (2013, February 2013). Termité 6L - Terminology of Telecommunications - V.7 from <http://www.itu.int/terminology/index.html>

- Kim, S., Nam, C., Jung, H. K., & Ryu, M. H. (2010). Adoption of Fixed-mobile Convergence in the US Telecommunication Industry. *Journal of Research and Practice in Information Technology*, 42(3), 207-218.
- Kumar, K., Rokkas, T., Varoutas, D., Kind, M., Von Hugo, D., Harno, J., . . . Heikkinen, M. (2007, 14-15 June). *Fixed-Mobile Convergence: An Integrated Operator Case Study*. Paper presented at the 6th Conference on Telecommunication Techno-Economics, 2007, Helsinki, Finland.
- Lv, W., Kang, J., Chen, W., & Lei, R. (2007, February). *Integration and application platform of service-oriented telecom businesses*. Paper presented at the Fourth European Conference on Universal Multiservice Networks, Washington DC, USA.
- Maes, S. H. (2008, 7-11 April). *Pragmatic Approaches to True Convergence with or without IMS*. Paper presented at the Network Operations and Management Symposium Workshops, Salvador da Bahia, Brazil.
- Mellin, J. (2009). Creating competitive advantage from an FMC strategy in a traditional telecoms environment. *Journal of Telecommunications Management*, 2(1), 14-19.
- Merriam, S. B. (2009). *Qualitative research: A guide to design and implementation*. San Fransisco, California: Jossey-Bass Inc Pub.
- MTN Unipresence. (2013). Business anywhere with one number Retrieved February 2013, from <http://www.mtnbusiness.co.za/ProductsServices/CallingMessagingSolutions/Pages/MTN%20UniPresence.aspx>
- Newton, H. (2009). *Newton's Telecom Dictionary*. New York: Flatiron Publishing.
- Nielson, B., Falconer, C., & Mashinini, F. (2012). SA Telecommunications Services Changing Landscape 2012 *SA Telecommunications Services Changing Landscape*. Johannesburg: BMI-TechKnowledge Group.
- OSSline. (2012) Retrieved 7 August, 2012, from <http://www.ossline.com/2010/12/definition-oss-bss.html>
- Patton, M. Q. (2002). *Qualitative research and evaluation methods*. Thousand Oaks, CA: Sage Publications, Inc.

- Raj, M., Narayan, A., Datta, S., Das, S. K., & Pathak, J. K. (2010). Fixed mobile convergence: challenges and solutions. *Communications Magazine, IEEE*, 48(12), 26-34.
- Rokkas, T., Katsianis, D., Varoutas, D., & Sphicopoulos, T. (2007, 3-7 September). *Fixed mobile convergence for an integrated operator: a techno-economic study*. Paper presented at the 18th International Symposium on Personal, Indoor and Mobile Radio Communications, Athens, Greece.
- Rokkas, T., Varoutas, D., Katsianis, D., Smura, T., Renjish, K., Heikkinen, M., . . . Monath, T. (2009). On the economics of fixed-mobile convergence. *info*, 11(3), 75-86.
- Verhoef, P. C., Lemon, K. N., Parasuraman, A., Roggeveen, A., Tsiros, M., & Schlesinger, L. A. (2009). Customer experience creation: Determinants, dynamics and management strategies. *Journal of Retailing*, 85(1), 31-41.
- Vrdoljak, M., Vrdoljak, S. I., & Skugor, G. (2000). Fixed-mobile convergence strategy: technologies and market opportunities. *Communications Magazine, IEEE*, 38(2), 116-121.
- Wahyuni, D. (2012). The Research Design Maze: Understanding Paradigms, Cases, Methods and Methodologies. *Journal of Applied Management Accounting Research*, 10(1), 69-80.
- Wong, C. C., Low, A. L. Y., & Hiew, P. L. (2006, 24-28 April). *Fixed-mobile convergence: Creating values with appropriate business models*. Paper presented at the Information and Communication Technologies 2nd, Damascus, Syria.
- Yang, D. H., Kim, S., Nam, C., & Moon, J. S. (2004). Fixed and mobile service convergence and reconfiguration of telecommunications value chains. *Wireless Communications, IEEE*, 11(5), 42-47.

APPENDIX A

Letter to Respondents

Dear Respondent,

I am an MBA student currently undertaking my studies at the University of the Witwatersrand Business School (WBS). The topic for my MBA dissertation is fixed-mobile convergence (FMC) and the minimum infrastructure integration requirements thereof. In order to gather data for my dissertation, I would be grateful if you grant me an interview of approximately one hour in duration so that I may gain insight into your thinking on the subject. I am aware that you have a lot of demands on your time and your acquiescence will be greatly appreciated.

The interview will not require you to divulge any company sensitive information but requires general input on the subject instead. Every effort will be taken to ensure confidentiality while the final output of the dissertation is for academic purposes only.

I am available to meet you at a location and time of your preference.

Many thanks for your assistance.

Sincerely,

Farhaad Gany

SA Mobile: +2781 362 4645

APPENDIX B

Actual Research Instrument

Interview Questions

- What are the customer experience requirements for an FMC offering from an integrated operator i.e. customer needs and expectation?
- Describe the logical roadmap towards delivering all the defined customer experience requirements i.e. product/service roadmap.
- Which of those customer experience requirements (to what level) can be offered without any infrastructure integration and how?
- Describe the different levels of infrastructure integration required towards total convergence i.e. integration roadmap
- In order to fulfil the total defined customer experience requirements, what level of integration is required?
- If the level defined in the previous question is not total convergence, what will the remaining infrastructure integration towards full convergence achieve in terms of business benefits?

In summary, in your estimation, what is the optimal point of infrastructure integration that meets total customer experience requirements and why?

APPENDIX C

Time-table

Table 5: Time-plan for completion of research report by 28/02/2013

	28/09/12	10/11/12	30/11/12	15/12/12	28/12/12	30/01/13	28/02/13
Finalise proposal							
Gain approval							
Gather data							
Do data analysis							
Write report							
Finalise report							

APPENDIX D

Consistency matrix

Table 6: Consistency matrix

Research problem: Identify the minimum level of infrastructure integration required for integrated telecommunication operators to offer FMC that meets customer experience requirements.					
Sub-problem	Literature Review	Hypotheses or Propositions or Research questions	Source of data	Type of data	Analysis
Identify the required customer experience for FMC services delivered by integrated operators	(Gentile et al., 2007), (Rokkas et al., 2009), (Yang et al., 2004), (Wong et al., 2006)	What are the customer experience requirements informed by customer needs and expectations for FMC?	Respondents in semi-structured interviews	Qualitative data	Constant comparative method (Wahyuni, 2012)
Identify the minimum infrastructure integration requirements that will meet the required customer experience in a sustainable manner	(Rokkas et al., 2009), (Amer, 2009), (Raj et al., 2010), (Yang et al., 2004), (Maes, 2008), (Rokkas et al., 2007), (González & Lozano, 2010)	What are the minimum infrastructure integration requirements that can meet the required customer experience in a sustainable manner?	Respondents in semi-structured interviews	Qualitative data	Constant comparative method (Wahyuni, 2012)

