

The Adoption and Effects of International Telecommunication Trends in South Africa: Technology and Market Perspectives

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Abstract--The evolution of the telecommunication industry, from both technology and market perspectives, is increasing at a rapid rate. At the forefront of this evolution are the telecommunication standards organisations and vendors. However, the evolution of the telecommunication standards is based on international norms formed by the market requirements of developed countries.

The evolution of the telecommunication technology standards, as dominated by the developed countries, poses a definite challenge for emerging economies that hasn't been effectively managed till date. Similarly, it is imperative for the South African telecommunication industry to align definite market requirements with the technology deployed in the service provider networks. The objective of this research paper is to address the effects and required alignment activities between technology evolution (in terms of South African network operator involvement in standardisation) and the actual South African telecommunication market requirements.

The main contribution of this research paper is to highlight that the South African network operators should be actively involved in contributing to international telecommunication standards and establishing the required forums to address the concern of technology evolution for developing countries. This will consequently lead to the desired alignment between deployed technologies and market requirements in the telecommunication industry.

I. INTRODUCTION

Telecommunications is one of the marvels of innovation of the post-modern age, marked by the ability of the telecommunication environment to evolve at an ever-increasing rate, from both technology and market perspectives. The telecommunication standards organisations and vendors are at the forefront of the evolution of technology to meet the requirements imposed by the market on the associated service providers. However, this technology evolution is based on international norms, and predominantly led by the requirements of developed countries.

The dominance of developed countries - in terms of telecommunication technology evolution - poses a certain threat that should be managed in emerging economies, including South Africa. Therefore, it is imperative for the South African telecommunication industry to align definite market requirements with the technology deployed in the service provider networks.

A. From a market perspective

Service providers face many challenges in the South African market. Two main challenges are (as highlighted by Gillwald & Simon [2]):

- A large income discrepancy; therefore, the service provider's networks should cater for high-income customers requiring services such as high-speed broadband, while also catering for low-income customers only requiring a voice service. This leads to the associated service providers minimising their network investment to achieve the required return.
- The large distances between metropolitan municipalities. This requires the network's IP-backbone to cover large distances, and subsequently has an effect on the overall return on investment.

From a fixed line perspective, Table 1 highlights South Africa's ranking in terms of broadband penetration worldwide.

TABLE 1: FIXED LINE BROADBAND PENETRATION

Rank	Economy	Fixed line broadband subscriptions per 100 inhabitants (2011)
1	Liechtenstein	71.6
2	Monaco	44.2
3	Switzerland	39.2
4	Netherlands	38.7
5	Denmark	38.2
103	Morocco	1.8
104	South Africa	1.8
105	Nicaragua	1.8

(Source: Broadband Commission [12])

Similarly, from a mobile broadband perspective, Table 2 highlights South Africa's ranking in terms of broadband penetration worldwide.

TABLE 2: MOBILE BROADBAND PENETRATION

Rank	Economy	Mobile broadband subscriptions per 100 inhabitants (2011)
1	Singapore	110.9
2	Korea (Rep.)	105.1
3	Japan	93.7
4	Sweden	91.5
5	Finland	87.1
46	Georgia	20.5
47	South Africa	19.8
48	Antigua & Barbuda	19.7

(Source: Broadband Commission [12])

To be able to correctly determine the broadband market potential, network operators should also take note of the percentage of current Internet users within their market. Thus, Table 3 highlights the percentage of individuals using the Internet worldwide, and South Africa's subsequent ranking.

TABLE 3: PERCENTAGE OF INTERNET USERS WORLDWIDE

Rank	Economy	Percentage of individuals using the Internet (2011)
1	Iceland	95.0
2	Norway	94.0
3	Netherlands	92.3
4	Sweden	91.0
5	Luxembourg	90.9
108	Syria	22.5
109	South Africa	21.0
110	Bhutan	21.0

(Source: Broadband Commission [12])

As highlighted in the above tables, it is clear that the South African broadband market hasn't evolved to the level of the trends identified in developed economies. The International Telecommunication Union [5] also highlights that mobile broadband penetration in developed countries will constitute approximately 75% of the total active mobile broadband subscribers, whereas the developing countries will only be representative of approximately 25% of active mobile broadband subscribers. Hence, the threat imposed by the international telecommunication standards and trends being dominated by developed countries, introduces significant challenges for network operators in developing countries.

B. From a technology perspective

As previously mentioned, the telecommunication technology evolution has been overseen by the associated international standards organisations with the assistance of specific technology vendors. From a technology perspective, the two primary telecommunication standards organisations are ETSI (European Telecommunications Standards Institute) and 3GPP (3rd Generation Partnership Project).

The fixed line telecommunication standards are predominantly overseen by the ETSI group. This standards organisation governs the evolution of fixed line networks from legacy TDM (Time-Division Multiplexing) to Next Generation Networks (NGN). The mobile telecommunication standards are predominantly overseen by the 3GPP group. This standards organisation governs the evolution of the mobile networks from legacy GSM (Global System for Mobile) to LTE (Long-Term Evolution).

In December 2005, the ETSI TISPAN and 3GPP standards organisations collaborated to form the IP Multimedia Subsystem (IMS) standard. This standard makes it possible to deploy a single network for both fixed line and mobile access methodologies. Therefore, the possibility of providing seamless communications by introducing Fixed Mobile Convergence (FMC) as a product can now be leveraged.

C. Background of the South African telecommunication industry

As described by Gillwald & Simon [2], South Africa is Africa's largest economy, and subsequently the most favourable market for the service's industry in Africa. From a telecommunication perspective, voice services are still the largest contributors to network operator revenues, with revenues associated with data services growing at an ever-increasing rate [2].

The South African telecommunication industry currently consists of:

- Two landline network operators; namely Telkom SA and Neotel.
- Four mobile network operators; namely Vodacom, MTN, Cell C and Telkom Mobile.

The landline market is currently dominated by the incumbent, Telkom SA, with the second network operator, Neotel (commercially launched in 2006), currently increasing its customer base. Both landline network operators offer services covering the wholesale, business and residential markets. Telkom SA currently covers 94% of the South African fixed line market share, whereas Neotel covers approximately 6% (based on subscriber numbers released between September and December 2012 – [6, 11]).

The mobile market is currently dominated by Vodacom (58%), followed by MTN (29%), Cell C (11%) and Telkom Mobile (2%) (based on subscriber numbers released between September and December 2012 – [8, 9, 11, 14]). Vodacom was the first mobile network operator in South Africa, and was launched commercially in 1994. Following shortly after Vodacom, MTN also launched commercially in 1994, much later Cell C was founded in 2001, and Telkom Mobile in 2010 (Telkom Mobile is owned by the landline incumbent Telkom SA).

The Independent Communications Authority of South Africa (ICASA) is the South African telecommunications regulator (regulating the communications, broadcasting and postal services sector). The regulator's authority is a dual jurisdictional structure with the Ministry of Communications [4].

The Independent Communications Authority of South Africa Act of 2000 saw the establishment of ICASA [3]. The Electronic Communications Act highlights ICASA's mandate in terms of the associated licensing and regulation for electronic communications and broadcasting services [4].

D. Objectives

The objective of this research paper is to address the required alignment between the South African market and technology introduction (deployment and evolution) within the telecommunication industry. In order to address the research problem effectively, it is proposed that:

- The adoption of technologies in the South African telecommunication industry, solely based on international trends, must be determined.

- The effects on the telecommunication industry when these technologies are adopted without ensuring alignment with specific market requirements should be determined.
- To highlight the impact when South African network operators are not actively involved in the standardisation activities for telecommunications.
- To propose active technology alignment activities between nations with similar market requirements and constraints (for example, between emerging economies such as the BRICS nations).

II. CONCEPTUAL METHOD

As highlighted by Salimian, Khalili, Nazemi & Alborzi [10], the functional departments in an organisation produces the product / service for the market. Therefore, the strategies developed on the functional level are of extreme significance to successfully achieve the organisation's objectives and goals.

However, these functional strategies should be aligned with the higher level strategies; namely, the associated business strategy (vertical alignment), and also with other functional strategies (horizontal alignment). If this alignment is not achieved, the organisation runs the risk of introducing severe inefficiencies at a departmental level.

From a technology strategy perspective the conceptual method should include the following departmental responsibilities:

- Vertical alignment with the business strategy goals, and consequently with the organisational objectives.
- Horizontal alignment with the market strategy requirements to increase revenues, and subsequently address the threat of the decreasing rate of revenue growth.
- Perform the required technology audits of the organisation's current technologies that could be leveraged.
- Determine new technologies that should be developed or acquired. Associated with this process is the determination of the method of technology acquisition or development.
- Manage the respective technology lifecycles, and ensure that the current technologies will support the capabilities required by the organisation.
- Manage the associated technology operational costs to ensure organisational profitability.
- Become actively involved with international standards organisations to highlight the impact of standardisation on emerging economies.
- Leverage technology alignment activities with other emerging economies, such as the BRICS nations.

From a market strategy perspective the conceptual method should include the following departmental responsibilities:

- Vertical alignment with the business strategy goals, and consequently with the organisational objectives.

- Horizontal alignment with the technology strategy requirements so that current and future technology capabilities are fully understood.
- Gathering market intelligence regarding current and future customer requirements within the South African market, and the associated threat of competitors in the identified market.
- Develop the strategy that satisfies the specific customer requirements, and the required positioning of the associated product / service while keeping the competitive landscape in mind.
- Implement the developed strategy to gain potential market share growth, and thereby ensuring maximisation of shareholder value.
- Leverage market alignment activities with other emerging economies, such as the BRICS nations.

Based on the above mentioned technology and market strategy responsibilities the complete conceptual method used in this research paper to align the respective strategy requirements for the South African telecommunication industry is illustrated in Fig. 1.

III. RESEARCH METHODOLOGY

By using the proposed conceptual method (depicted in Fig. 1) as a framework for evaluation, the organisation's ability to address the market and technology challenges faced by telecommunication network operators in the South African industry can be accessed. This consequently leads to the research design and methodology that is used to determine the impact of international trends and standardisation. Aspects that will be addressed in the associated research are as follows:

- Perform the necessary market analysis to determine the actual current and future South African market requirements, and evaluate how this aligns with international trends.
- Investigate the strategy alignment processes applied by South African telecommunication network operators.
- Identify the level of associated network operator involvement in international standardisation activities.
- Identify any involvement with aligning strategies and processes with other emerging economies.

The data-gathering techniques used in this study must supply the identified aspects highlighted above. To successfully gather the required data, the following techniques were used:

- An Internet-based questionnaire to determine the actual current and future South African market requirements for telecommunication products / services.
- An email-based questionnaire to determine the network operator specific aspects.

The data gathered from the respective questionnaires was collected for the first time, and since the data is gathered electronically, it will initially be non-interactive primary data.

The respective high-level questionnaire designs are highlighted in Table 4.

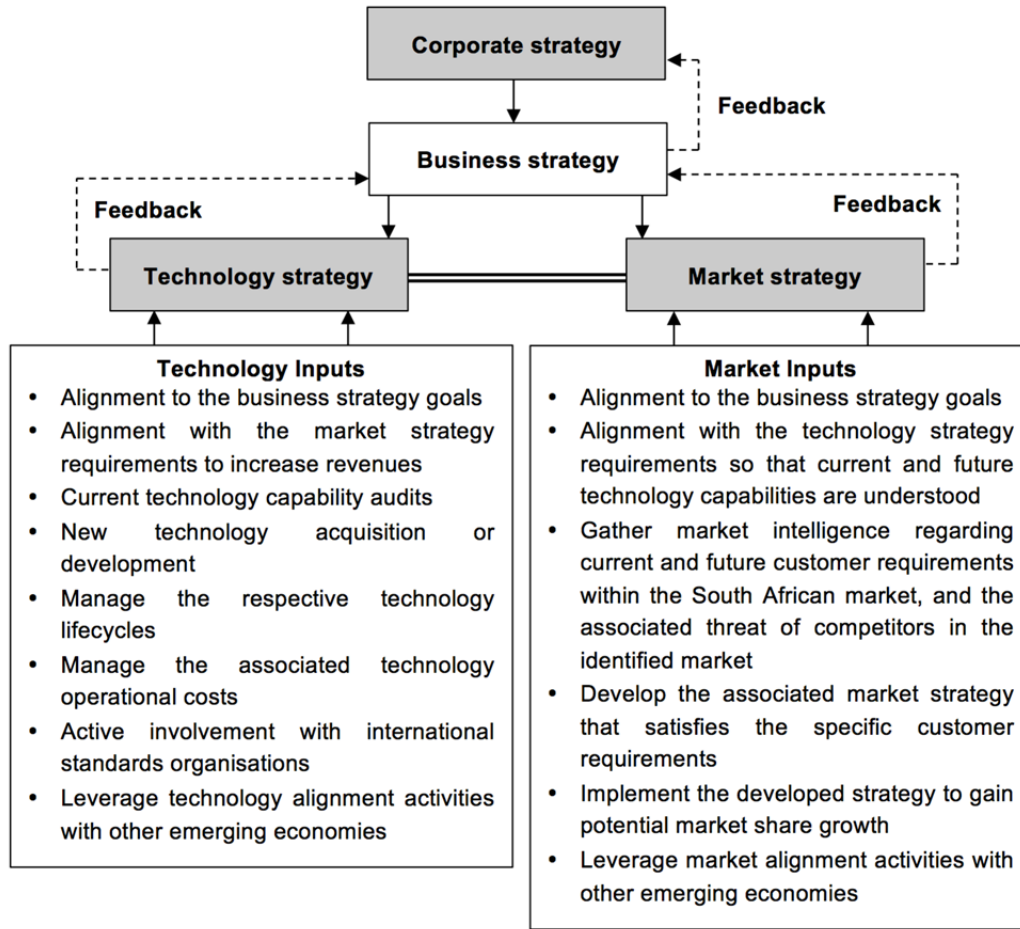


Fig. 1: Conceptual method to align technology and market perspectives

TABLE 4: MARKET AND NETWORK OPERATOR HIGH-LEVEL QUESTIONNAIRE DESIGNS

Questionnaire	Associated research questions to be addressed	Proposed sample size	Satisfactory response rate
Market related	<ul style="list-style-type: none"> • What is the market requirement regarding voice enabled products / services? • What is the market requirement regarding data enabled products / services? • What is the market requirement regarding multimedia based products / services? 	1500	Approx. 10%
Network operator specific	<ul style="list-style-type: none"> • Do South African telecommunication network operators adopt technologies solely based on international trends, and to what extent? • What is the effect on the telecommunication industry, within South Africa, if the required technologies are deployed exclusively on international trends without ensuring market alignment? • Are South African telecommunication network operators involved in drafting telecommunication standards, and to what extent is this involvement? • Are South African telecommunication network operators involved in alignment activities / forums with economies facing similar challenges from technology and market perspectives, and to what extent is this involvement? 	6	≥66%

The proposed sample size for the market related questionnaire (which is a large population questionnaire) is determined to be between 96 and 384 samples. To achieve this sample range and using a 10% response rate to the market related questionnaire, the questionnaire should be sent to between 960 and 3840 persons in the target population. Therefore, for the purposes of this study the market related questionnaire was sent to 1500 persons to ensure the received sample meets the above criteria.

The proposed sample size for the network operator based questionnaire is equal to the number of South African telecommunication network operators. There are currently six telecommunication network operators in South Africa. For the purposes of this research a satisfactory response rate of at least 66% (4 out of 6 respondents) is required.

IV. RESULTS

Following the high-level questionnaire structure presented in Table 4, the results of the complete questionnaires for both the South African telecommunication market trends (representing current and future trends) and network operator adoption of standardised technologies (based on international standards) are discussed further in this chapter. The questionnaire results will then be verified and discussed using the conceptual method illustrated in Fig. 1 in the following chapter.

A. South African telecommunication market questionnaire

The market related questionnaire determines the current telecommunication market’s service usage and the future end-user requirements. The results received from this analysis will also assist with determining the actual technologies required to deliver the associated end-user needs.

The response rate of the market related questionnaire stabilised with 265 responses. Therefore, the confidence interval (margin of error) achieved for this research study, with a confidence level of 95%, is 6%.

The market related questionnaire structure and associated results are as follows:

- Ensuring that the responses received will cater for short-, medium-, and long-term strategies. This is addressed by

determining the associated age and monthly household income of the respondents (depicted in Fig. 2).

As confirmed by the Bureau of Market Research [13], the respondents to the market related questionnaire cover the spectrum of household income brackets with special emphasis on the emerging and realised middle class (monthly income between R 10 500 and R 27 000, and above R 27 000 respectively). Similarly, the age distribution of respondents is representative of the current market requirements for short (above 35 years old), medium (between 25 to 34 years old) and long-term (below 25 years old) strategies. The respondents to the research questionnaire therefore satisfactory cover the required target population for market research in the telecommunication industry.

- The geographical representation of the questionnaire should be determined since it is essential for South African telecommunication network operators to ensure that 70% of the population has the required coverage after 48 months from the commercial date of issuing a licence to the licensee [3].

The respondents to the questionnaire are predominantly from the Gauteng region, and according to the Bureau of Market Research [13], the Gauteng region has the highest regional personal income in the South African market. Thus, from a market perspective, the network operators should primarily focus on the region that will justify sufficient Return-on-Investment (ROI). According to Fig. 3 the respondents in the questionnaire evidently satisfy this requirement.

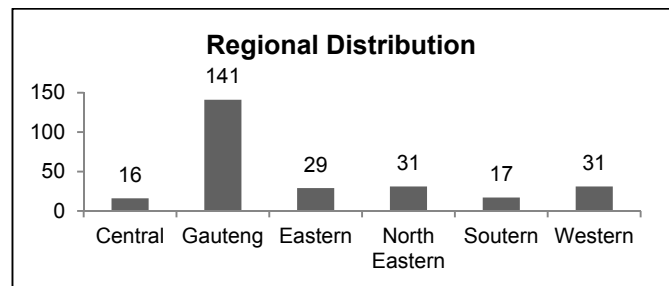


Fig. 3: Regional distribution of respondents

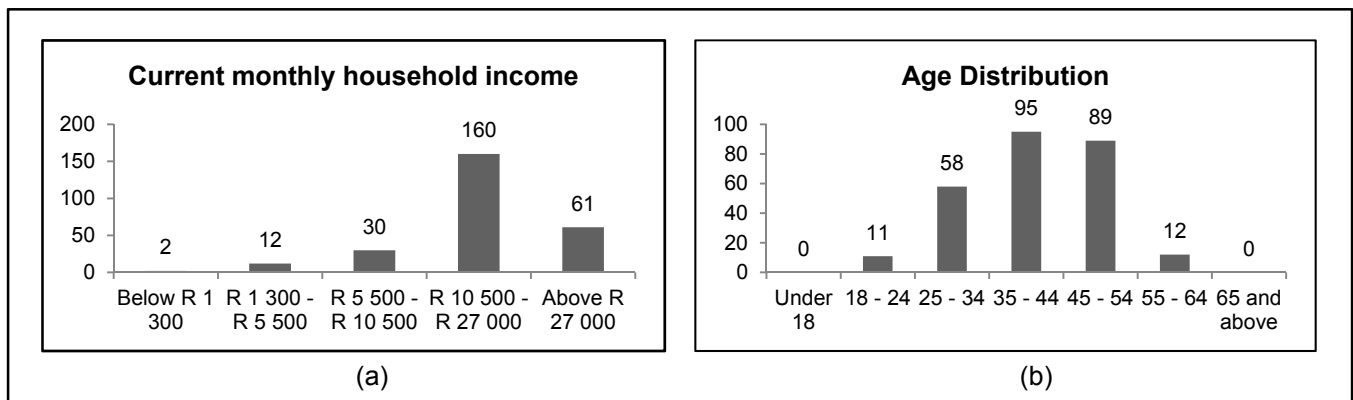


Fig. 2: (a) Current monthly household income, (b) Age distribution

- The respondents to the research questionnaire satisfactory covered fixed line and mobile services, with 197 making use of fixed line voice services, 248 making use of mobile voice services, 155 making use of fixed line broadband and 190 making use of mobile broadband. This emphasises the relevance of the research data for fixed line and mobile service offerings (including voice and data related offerings) within South Africa.
- The current monthly spend of the telecommunication market in South Africa, and similarly the market's willingness to pay for quality voice and data services was also determined. Since the international standards are evolving towards delivering high quality voice and data services, the associated network evolution will require a significant capital investment. Therefore, this evolution might enforce a marginal increase in monthly subscriptions for the associated customers.
From the results presented in Fig. 4, it is evident that the South African telecommunication market requires a considerable decrease on their monthly telecommunication spend. This represents the challenge faced by the network operators within South Africa; the international standards organisations and telecommunication vendors are developing technologies to enhance the quality of telecommunication services, however, the market requires a lower monthly spend.
- By assessing the current usage and future requirements of the end-user for data related service offerings the actual

access-specific technologies required to enable the associated market requirements can be determined. The data specific services with the required broadband speeds are [7]:

- Email and instant messaging – up to 1 Mbps (Megabits per second).
- Web browsing, audio chat, audio streaming, online gaming and active involvement in social media – 1 to 2 Mbps.
- Video chat, streaming standard definition video and Peer-to-Peer file sharing – 3 to 4 Mbps.
- Streaming high definition video, high definition telepresence and video conferencing – 5 to 9 Mbps.
- Digital (cloud-based) software distribution – 10 to 20 Mbps.
- Constantly downloading large files and internal communication (voice and data related) for businesses and corporations – 20 Mbps and above.

With the use of the broadband speeds defined above, and the results depicted in Fig. 5, the current broadband requirements predominantly necessitate bandwidth of up to 9 Mbps for consumer based services, and beyond 20 Mbps for corporate services. However, future requirements depict an even distribution for the specified broadband services. This necessitates bandwidth of beyond 20 Mbps for both consumer and corporate based services.

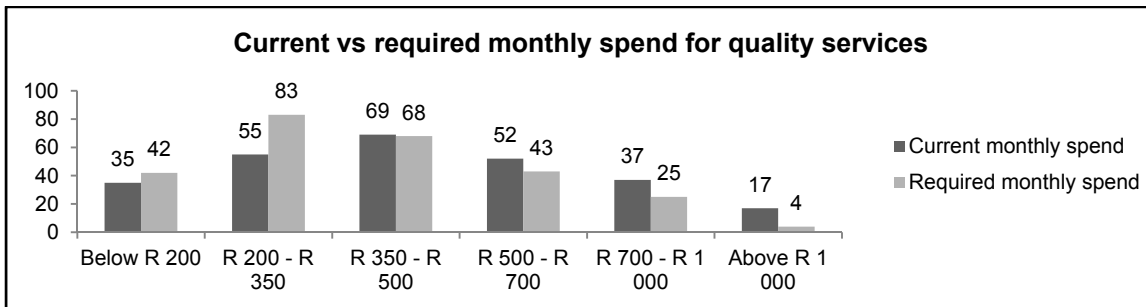


Fig. 4: Current and required monthly spend for telecommunication services

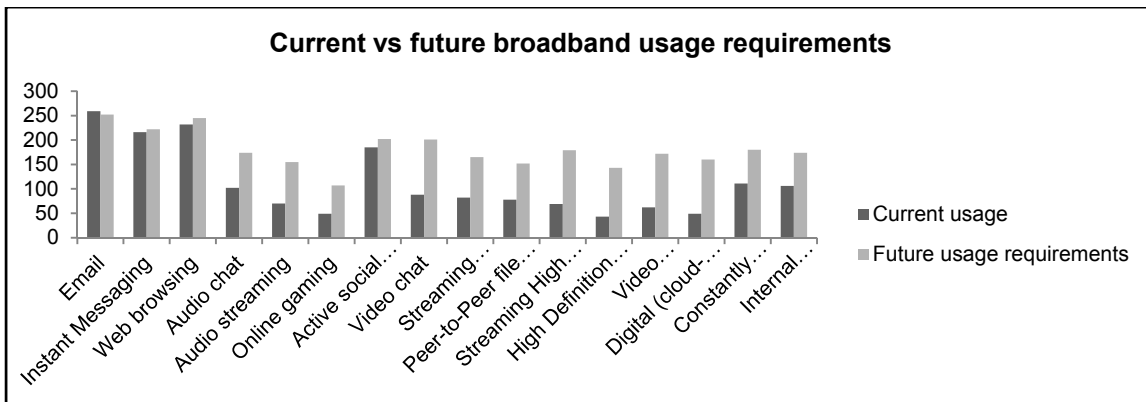


Fig. 5: Current and future broadband usage requirements

TABLE 5: BROADBAND SPEED METHODOLOGIES

Access method	Access technology	Period	Bandwidth speed
Fixed line	ADSL	2000 – 2002	8 Mbps
	ADSL2	2002 – 2004	10 Mbps
	ADSL2+	2003 – 2006	24 Mbps
	VDSL2	2005 – 2007	100 Mbps
	GPON	2006 onwards	1 000 Mbps
Mobile	GPRS	2001 – 2003	115 kbps
	UMTS	2003 – 2006	512 kbps
	HSPA	2006 – 2009	4 Mbps
	HSPA+	2008 – 2010	24 Mbps
	LTE	2010 onwards	100 Mbps

(Source: Festraets [1])

As discussed by Festraets [1], the evolution of broadband speeds, as specified by international standards organisations, is presented in Table 5. From these specified bandwidth speeds, it can be concluded that the consumer and corporate requirements can be satisfied with ADSL2+ (fixed line) and HSPA+ (mobile) access technologies. However, the required technologies associated with the market requirements defined above are not aligned with the standards evolution (highlighted by the “Period” column in Table 5), therefore highlighting the negative effect of adopting international telecommunication trends and standardisation in a developing economy.

- From the responses received, the possibility of customers to subscribe to data related (multimedia and cloud-based services) and converged service offerings are definite. Converged service offerings incorporate fixed line and mobile services from a single network operator. Concerning the provisioning of multimedia and cloud-based services the network operators should ensure alignment with the access technologies specified in Table 5.

B. Network operator questionnaire

The network operator questionnaire determines the adoption of international technology standardisation and trends in South Africa. The network operator questionnaire in

conjunction with the market based questionnaire will effectively highlight the associated effects of adopting international technology trends in the South African context.

The questionnaire continued for a period of six weeks, with data representing four of the six network operators. Two network operators supplied complete information during an interview process while data was received via a web-based interface for the other two network operators.

The network operator questionnaire structure and associated results are as follows:

- Two network operators responded to the question covering the deployment of technologies solely based on international standards. Both network operators responded in the negative, however, both network operators confirmed using international standards extensively when deploying new technologies. Therefore, these deployments should be carefully managed to ensure that the deployed technologies don't ultimately affect the organisation's required ROI.
- Fig. 6 highlights the involvement of network operators in terms of market intelligence and technology alignment activities. As is evident from the results, not all network operators are actively involved in market intelligence activities. This will subsequently result in the specific network operators not aligning true market requirements with their deployed technologies.

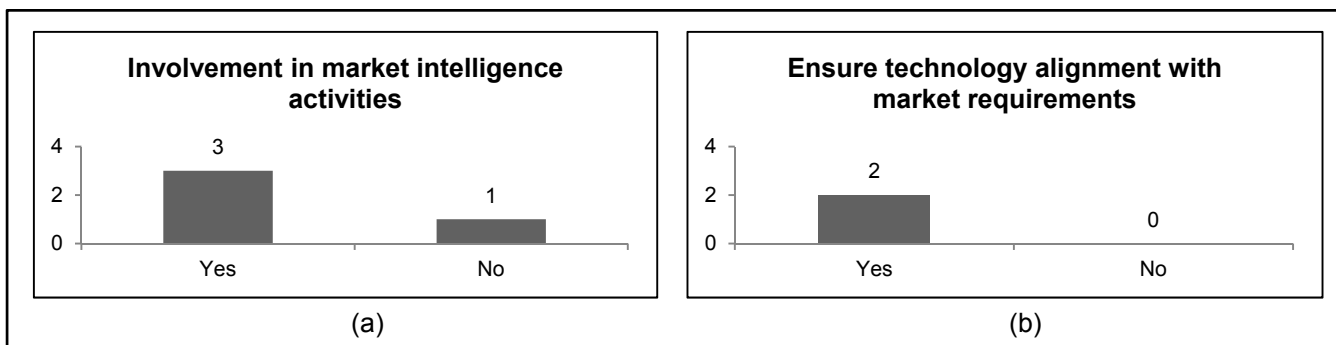


Fig. 6: (a) Market intelligence involvement, (b) Technology and market alignment

- Concerning the involvement of network operators in contributing toward and editing international telecommunication standards, it is noted that the South African network operators are actively involved. However, from the responses it was determined that none of the network operators are actively involved at the 3GPP and ETSI standards organisations. The 3GPP and ETSI standards organisations are regarded as the leading telecommunication network standards organisations, consequently highlighting a certain possibility of the South African network operators deploying technologies based on developed economy requirements.
- The South African network operators are actively involved with other network operators in developing economies; however, this is predominantly with economies located in the African region (through active involvement in the African Telecommunication Union). The South African network operators should therefore extend this involvement and leverage from the relationship formed with the BRICS nations. This involvement (and leveraging) should subsequently initiate technology and market alignment forums with the network operators from these nations.

V. CONCLUSIONS AND RECOMMENDATIONS

As a result of the proposed conceptual method (depicted in Fig. 1), the success of South African telecommunication network operators is dependent on the following:

- All market- and technology-related inputs are considered when compiling the respective functional strategies.
- Ensuring horizontal and vertical strategy alignment principles are applied in the functional strategy development process.
- Network operators are actively involved with telecommunication standardisation activities.
- A working cooperation should be leveraged, from a technology and market perspective, with other emerging economies (such as the BRICS nations).

In this study it was noted that the involvement of South African network operators in standardisation activities is limited. The South African telecommunication network operators should become actively involved with highly regarded standardisation organisations such as 3GPP and ETSI. This involvement will assist with introducing technology standards aligned with developing economies' market requirements.

Strategic alignment activities within telecommunication organisations are critical for assuring long-term profitability. Organisational alignment activities include vertical and horizontal alignment. To govern this process, it is recommended that the organisation's group strategy department should take responsibility for horizontal

alignment activities between functional strategy units, and vertical alignment activities between functional, business and corporate strategies. This strategic alignment process will therefore ensure that the developed technology strategies will satisfy the organisational objectives and goals, and fulfil the associated market requirements as specified by the market intelligence department.

This study also justifies the importance of an effective market intelligence department for telecommunication network operators. This market intelligence department should also be actively involved with alignment activities between other network operators from developing economies. This will ensure that the technologies being specified in international standards, and subsequently developed by telecommunication vendors, will be aligned with the actual market requirements of developing economies.

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