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Article

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Factors affecting the adoption of Voice over Internet Protocol (VoIP) and other converged IP services in South Africa

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The authors embarked on this study to investigate factors likely to impact on the adoption of VoIP and other converged Internet protocol (IP) services in the SA market. The intention of this study was to lay the groundwork for a comprehensive understanding of the forces shaping the market, in order to help industry participants and new entrants position themselves correctly. This is achieved by evaluating technology adoption and diffusion models, in particular Moore's chasm model, which highlights the reasons why so many new technologies fail to break into the mainstream. Empirical research of business customers and potential customers shows that the two key factors hindering the adoption of these technologies in SA are high bandwidth costs/high costs of services and quality of service issues. The research also shows that the trend towards IP is well established in SA, with many companies having already invested in, or planning to invest in, VoIP and converged IP services.

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Introduction

The literature review of academic, industry and popular media suggests that a paradigm shift is underway in telecommunications. It is no longer a question of if Voice over Internet Protocol (VoIP) will overtake circuit-switched telephony but when. Media headlines worldwide have been littered with stories about the launch of VoIP services (often referred to as Internet telephony or IP (Internet Protocol) telephony) for businesses and consumers (Cox, 2004a and 2004b; Taylor & Budden, 2004; Leyden, 2004; Libbenga, 2004; Oates, 2004a and 2004b; Richardson, 2004a, 2004b and 2004c).

The concept of convergence is defined as the coming together of voice, data and video applications – as well as the integration of consumer electronic, computing, telecommunication and even broadcasting devices – on a single, broadband IP delivery platform.

Besides VoIP other converged IP services include:

- PC-based distance learning solutions;
- Video conferencing;
- Live webcasting;
- Video streaming;
- Collaboration and team-management software (such as 'white boards' and collaborative meeting software);
- Security surveillance;
- Contact centre applications;
- Remote multimedia access solutions; and
- Unified messaging.

Over the past year the industry has exploded with announcements of new VoIP deployments by technology companies such as Cisco Systems, Avaya, Nortel Networks and Mitel Networks, as well as telecoms operators like AT&T, MCI, Time Warner Cable, Verizon and others. (Cox, 2004a and 2004b; Taylor & Budden, 2004; Leyden, 2004; Libbenga, 2004; Oates, 2004a and 2004b; Richardson, 2004a, 2004b and 2004c; Hibbard, 2004; Edwards, 2004a and 2004b).

There are different types of VoIP, according to Juniper Research (Cox, 2004b), namely:

- Self provided: peer-to-peer offering such as Skype, which allows for free calls between PCs but cannot be used for PSTN calls. Mostly used by residential users.
- IP telephony, which is independent of an Internet or broadband access provider. These allow for PC or IP phone to PSTN calls (e.g. Vonage and Net2Phone in the US). Virtual numbers are available to users.
- Corporate local area network and wide area network services, where the traditional PBX is replaced with special adapters.

According to Synergy Research Group, the worldwide enterprise IP telephony market grew by 17% in the first quarter of 2004 and posted yearly growth of 56%. In comparison, the traditional circuit switched telephony equipment market posted respective decreases of 11.5% and 21.4%. Cisco, one of the biggest suppliers of VoIP solutions, expects the business and consumer market to

reach more than \$30bn over the next four years. (Taylor & Budden, 2004).

Jupiter (Cox, 2004b) says the overriding issue with the introduction of VoIP is matching the Quality of Service (QoS) experience with the PSTN experience. Multi Protocol Label Switching (MPLS) is important in VoIP networks as an enabling technology to deliver the required class of service. QoS is influenced by many factors and QoS providers must offer, among other things, 99,999% availability (this is considered 'carrier class' and means that the probability of the network failing is only five and one quarter minutes per year), as well as guaranteed throughput and bandwidth management. Kuhn, Walsh and Fries (2004) add that many security measures implemented in traditional data networks are not applicable to VoIP. They say the introduction of firewalls (which protect local and wide area networks, and computers against hackers) to a VoIP network complicates aspects such as call set-up procedures. They also point out that security firewalls have no defence against an internal hacker.

Industry reports suggest wireless communication users (irrespective of whether they are using a cellular network, 3G mobile, Wi-Fi, Wi-Max or some other technology) will also in future be able to access a range of IP applications. (Green, Crockett, Rosenbush & Yang, 2004; Edwards, 2004a; Leyden, 2004; Tirone, 2002; Wearden, 2004).

Regulatory environment: situation in SA

SA's telecommunications industry is governed by the Telecommunications Act (Act 103 of 1996), which was amended with the Telecommunications Amendment Act, (Act 64 of 2001). However, there are also a host of Icasa regulations and license agreements which affect the sector. Complicating matters is that Telkom's public switched telecoms network (PSTN) license gives it additional rights, not spelt out in these Acts.

Restrictive regulations aimed at protecting incumbent operator Telkom has resulted in excessive tariff increases and limited bandwidth availability. This has been a major obstacle to economic growth, wealth creation and the creation of employment opportunities. (Roodt, 2004; Melody, 2002; Melody, Currie & Kane, 2004; Van Huyssteen, 2004).

Gillwald, Kane and Esselaar (2004) and Gillwald and Kane (2003) point out that the telecoms sector has been wracked by controversy and that developments have been characterised by a range of unintended policy outcomes and costly licensing and regulatory disputes.

Telkom rivals such as the value added network operators (Vans), which include the internet service providers (ISPs), have lodged many disputes against Telkom with Icasa, the law courts and the Competition Commission for anticompetitive practices (Bidoli, 2004). Vans have been prohibited from offering VoIP services and have been forced to lease infrastructure from Telkom.

High telecoms costs are also the reason for SA languishing on international benchmarking indexes. SA ranked only 30 out of 53 nations in the most recent Information Society Index (ISI), which shows a clear correlation between information wealth and economic prosperity (*The WorldPaper*, 2003).

Similarly, SA has fallen even further behind as an attractive destination for foreign direct investment. According to the fourth annual AT Kearney/Foreign Policy Globalisation Index, SA dropped 11 spots to 49th spot. In total 62 countries, comprising 96% of the world's GDP and 84% of the global population were surveyed. One of the key factors holding SA back, according to AT Kearney, was high telecoms costs (Foreign Policy and AT Kearney, 2004).

Fortunately, the market is set to be opened up to more competition, with Communications Minister Ivy Matsepe-Casaburri announcing on September 3, 2004 that government would revoke key restrictions in the telecommunication sector. The policy changes were published in the *Government Gazette* 26763 (Notice 1924 of 2002) in terms of the Telecommunications Act 103 of 1996 (Ministerial Determinations, 2004).

Though many entrepreneurial players in the industry have interpreted the minister's announcement as a 'free for all,' Telkom disagrees. Highlighting the high expectations for market liberalisation, 150 companies have applied for Vans licenses and 30 had applied for PTN licenses, according to an Icasa spokesman at the October industry colloquium (Icasa, 2004a & 2004b).

Further compounding the uncertainty is whether the recently-licensed second network operator (SNO), which has floundered for almost three years because of shareholder disputes and government interference in the regulatory process, will succeed as a viable, full-service competitor to Telkom. Also unclear is whether the under-serviced area licensee (Usal) operators will be able to provide competition in mostly rural areas. By November 2004, only four Usals had been licensed in areas designated as having less than 5 fixed-line phones/100 people. But there were questions about their viability (Icasa, 2004a & 2004b).

Despite these uncertainties, for SA businesses the telecoms picture has never looked rosier. The minister has opened the wholesale telecoms market to considerably more competition. International precedent shows that such liberalisation inevitably results in falling telecoms costs and improved broadband offerings. Also the regulator, Icasa, has indicated it is in favour of 'light touch' regulation (Icasa 2004b).

Research problem

The purpose of this study was to investigate factors likely to impact on the adoption of VoIP and other converged IP services in the SA market. The study also aimed to lay the groundwork for a comprehensive understanding of the forces shaping the market for VoIP and converged IP technologies.

As highlighted by the literature review, technology adoption depends on a variety of internal and external factors. For technology suppliers and potential suppliers the difficulty is reading the market accurately to decide when to offer specific solutions to customers. Too often suppliers have misjudged market forces, and in particular technology adoption cycles, resulting in dire consequences for themselves. There are dangers to being early adopters – for instance, regulatory uncertainty could result in market conditions suddenly changing. But there are also dangers in being laggards, particularly if organisations fall behind key competitors.

The literature review and interviews with key informants resulted in the authors selecting the following factors as those most likely to impact on the adoption of VoIP and other converged IP services in the SA market:

- High bandwidth costs and high cost of service;
- Complexity of deployment and high implementation costs;
- Too much confusion in the market – specifically as a result of too many suppliers entering the market, a lack of standards and a lack of clarity on which suppliers will survive;
- Security issues – which include concerns on how companies will protect their IP infrastructure from security threats;
- QoS issues;
- Poor quality of voice communications;
- No compelling business case to upgrade to IP technologies;
- Lack of regulatory clarity;
- Internal company politics;
- Unattractive timescales for return on investment;
- Privacy concerns;
- Satisfied with their present data and voice system(s);
- Concerns about jeopardising the business by upgrading;
- Concerns about being at the bleeding edge of technology; and
- Lack of skills internally, and industry wide.

To understand the market better, these factors were included in the questionnaire, which was emailed to businesses deemed to be key customers and potential customers of VoIP and other converged IP services. The authors maintain that the best way of understanding trends in SA's VoIP and

converged IP services market is through the eyes of customers (not vendors).

The literature review, theoretical models and industry interviews with key informants led the authors to compile the following main hypothesis for this study: the high cost of bandwidth is a key barrier to implementing VoIP and converged IP technologies.

Additional issues to be investigated during the study were as follows:

- Lack of regulatory clarity as a key barrier to implementing VoIP and converged IP technologies
- Low quality of service as a key barrier to implementing VoIP and converged IP technologies
- Security concerns as a key barrier to implementing VoIP and converged IP technologies
- SA businesses will shift their internal applications onto converged IP networks in the next five years
- VoIP/Internet telephony will be the front runner for converged IP technologies
- Converged IP solutions will be implemented incrementally inside the organisation
- Converged IP technologies will be used to improve services to customers
- Converged IP technologies will be used to cut costs of communications
- VoIP and other converged IP services are likely to be used with wireless access technologies in SA.

Research methodology

Qualitative interviews

The key informants were selected by means of purposive, non-probability sampling. Preference was given on account of their reputation and experience in the telecoms sector. This approach was chosen because it was deemed to be effective in highlighting key trends as well as being economical in terms of financial costs and time.

The 12 people interviewed were:

- Mike van den Bergh; chairman of the Communication Users Association of SA (Cuasa), face-to-face interview in Johannesburg and telephonic follow-up, September 2004.
- Africa Analysis Team; face-to-face meeting with analysts Andre Wills Dobek Pater and Mark Rotter in Centurion, Pretoria, in May 2004.

- Mandla Langa; chairman of Icasa, face-to-face meeting at the October 2004 industry colloquium in Sandton, Johannesburg, and at Icasa's offices in Sandton, Johannesburg. Both in October, 2004.
- Business Connexion; face-to-face meeting with Andy Brauer, chief technology officer for networks competency and group executive for strategic solutions Willem van Rensburg in Midrand, Johannesburg, in September 2004. Included a presentation.
- Internet Solutions (IS); the largest ISP in SA, partially owned by Dimension Data – telephonic interview with Hillel Shrock, head of new business development, in June and October 2004.
- Mike Brierley; CEO of MTN Network Solutions, telephonic interview in September 2004.
- Cisco SA telecoms expert Mark Baptiste; face-to-face interview in Sandton, Johannesburg, in June 2004.
- Telephonic interviews with Gartner Group analysts – UK-based Neil Ricard in August 2004 and US-based William Hahn in September 2004.

Though qualitative interviews are generally poor predictors of the population, these key informants were deemed to have more information than the public at large, and therefore, were better able to articulate where the market was going. The authors were of the opinion that they provided a good understanding of the market and how it was set to change in February 2005, when Minister Matsepe-Casaburri's policy determinations take effect.

It was decided that open-ended, semi-structured interviews would be the most effective way of assessing experts' views of the future market. The danger of this approach, however, was that the interviews could divert into irrelevant discussion and that comparative analysis of findings would be difficult. As a result, the authors relied on written discussion topics as a guideline.

These semi-structured and in depth interviews were employed for explorative research to identify important trends and gain insights into the factors affecting adoption of VoIP and converged IP technologies in SA. This helped the authors design hypotheses and the questionnaire used in the empirical study.

The authors suggested the theme of discussion and posed further questions as the discussion developed. These were based on a broad written outline of key themes, like 'factors likely to impact adoption' and 'regulatory issues'.

The authors explained the purpose of the interview and highlighted the themes, interacting with the key informants in an informal discussion in an attempt to understand how they saw the market. The authors did not pre-empt answers. Each interview lasted about 30 minutes, and was conducted over the phone or in some cases face-to-face. This less formalised approach lent itself to the dynamics of an industry in transition.

The use of quantitative research was to provide numerical measurement and analysis. Standardisation was provided by means of a questionnaire, allowing for results to be aggregated and sub-samples to be analysed.

The questionnaire was designed to answer the research questions highlighted in the hypotheses. Where appropriate it was based on a 5-point Likert scale for easy analysis. Questions aimed to get an overview of the respondent's attitude to VoIP and other converged IP technologies (and thereby, collect data about behaviour of respondents' companies). They also aimed to determine business drivers and critical success factors needed to make a purchase decision. The questionnaire included demographic profile questions. It was expected that the participants would answer all the questions in the questionnaire.

The EIU '*Deploy or Delay? Converged Networks in the Enterprise*' global survey (Ernest-Jones, 2004) was used as a credible, international guideline for this questionnaire. However, the questionnaire was adapted substantially for the local market and for the purposes of this study.

The authors carried out a test of the questionnaire. Accidental (incidental) sampling was used as this was the most convenient method. Five people who were readily available were asked to 'pilot' the questionnaire and to identify possible problems in areas such as:

- Time it took to complete the questionnaire.
- Clarity of instructions.
- Unclear or ambiguous questions.

The authors relied on business contacts recommended by the Communications Users Association of SA (Cuasa), the Computer Society of SA, Financial Mail's Top Companies and Giants surveys, as well as other SA businesses known not to be in these lists. The sample comprised 170 large and small (formal) SA businesses. Welman and Kruger (2001) say that it is impossible to evaluate the extent to which non-probability samples are representative of the relevant population (in this case, all SA businesses). The sample was checked for duplication, so that there was only a single respondent per company. The authors were not able to ascertain an accurate figure for the population (number of businesses operating in SA). However, according to *McGregor's Who Owns Whom in SA: SA's comprehensive business encyclopaedia of information on listed and unlisted companies*: (McGregor, 2004) there were fewer than 900 companies for 2004. The authors also gave respondents an option of receiving a copy of the amalgamated results of the survey – 93% of the respondents wanted this option. The questionnaire included a demographics section and 22 other questions, aimed to answer the hypotheses. Respondents' answers were based on a Likert scale – for easy analysis, however, some questions were compound questions which made analysis more complicated. It may have been better to break these into sub-questions, but the authors were concerned that company executives would be stretched for time. The questionnaire took on average 10 minutes to answer, according to the test run. Data was captured

electronically and analysed using Microsoft Excel. With the background of the literature review, theoretical models and interviews with key informants, the authors were able to interpret the quantitative results. This was displayed in tables, matrices, bar graphs and using other descriptive statistics, with narrative where additional information was needed. Finally, the authors drew conclusions, highlighting key issues and questions, and made recommendations for future research.

Findings

This study shows that there are a number of key factors that will affect the adoption of VoIP and other converged IP services in SA. These factors include:

- High bandwidth costs and high cost of service;
- Complexity of deployment and high implementation costs;
- Too much confusion in the market – specifically as a result of too many suppliers entering the market, a lack of standards and a lack of clarity on which suppliers will survive;
- Security issues – which include concerns on how companies will protect their IP infrastructure from security threats;
- Quality of Service (QoS) issues;
- Poor quality of voice communications;
- No compelling business case to upgrade to IP technologies;
- Lack of regulatory clarity;
- Internal company politics;
- Unattractive timescales for return on investment (ROI);
- Privacy concerns;
- Satisfied with their present data and voice system(s);
- Concerns about jeopardising the business by upgrading to IP;
- Do not want to be at bleeding edge of technology; and
- Lack of skills internally, and industry wide.

Empirical research of business customers and potential customers has shown that the two key factors hindering the adoption of these technologies in SA are *high bandwidth costs/high costs of services* and *quality of service issues*. Key informants expected both these factors to reduce as barriers as a result of impending market liberalisation.

The quantitative research has shown that the trend towards digital IP platforms and applications is well established in

SA, with many companies having already invested in, or planning to invest in, VoIP and converged IP services. The findings of this study also suggest that the SA market for VoIP and converged IP services is ripe for new entrants and infrastructure investments.

Insights from semi-structured interviews with key informants

Interviews with key informants, comprised of local and international industry experts, highlighted that though it was still too early to know how the market would pan out, indications were that technology vendors would compete aggressively to offer VoIP and other converged IP services, resulting in more choice and lower costs to businesses and consumers. Experts agreed that the momentum towards IP architecture (both at the telecoms operator level and within the customer's premises) had gained strength.

They also agreed that there were a number of key internal and external factors likely to impact the adoption of VoIP and other converged IP services in SA.

Though peer-to-peer IP telephony products (such as Skype) had popularised Internet telephony, these were not of high enough standard for businesses. However, technology advances were resulting in increased reliability and improved quality of service, making VoIP suitable for business environments. However, the VoIP business driver in SA had been diluted by the cost of bandwidth. Key informants believed this would change with market liberalisation. Some said that because of the high cost of bandwidth organisations' tended to either ignore the opportunity, 'under-specify' the network bandwidth requirement, which resulted in inconsistencies and companies attempting to compress data, which in turn hampered quality. All of this, led to negative perceptions (which in some instances was the reality) around the stability of the technology. Key informants said rapidly falling costs for IP telephones would change the business landscape. Though circuit switched analogue telephony would not be replaced immediately, demand for traditional PBXs was weakening. Other factors said to be driving adoption were increasing availability of multimedia/IP applications, as well as lower costs, more services and improved management and scalability of using a single IP infrastructure (instead of separate networks for voice and data).

Key informants said the key factors holding back adoption were high bandwidth costs, regulatory uncertainty, market uncertainty and quality of service concerns. Expert interviews highlighted that increasingly mobile devices, including cellular phones, would be IP-enabled. In the future all applications and devices would operate over a common IP infrastructure. Not only would this result in lower capital expenditure and cost of ownership (more efficient network maintenance through common tools and skills), but it would also allow companies to improve employee productivity (through technologies like unified messaging) and provide better services at a lower cost.

Key informants agreed that to maintain one IP network in the enterprise would be cheaper and more efficient than maintaining different infrastructure for voice and data. However, risks could increase as a result of such convergence. Security, privacy and related issues (such as protection, spam and viruses) remained a concern. Key informants agreed that the trend to IP convergence was creating tremendous new opportunities for entrepreneurs. They also agreed that after the initial market euphoria (what Moore referred to as the 'tornado' phase), there would be consolidation. Suppliers offering poor quality of service would go out of business and businesses would tend toward established suppliers, with proven track records.

Industry experts agreed that in SA, as in other developing countries, the lack of broadband Internet access would mean that wireless access technologies would be used to provide VoIP and other IP services to businesses and consumers. They highlighted concerns that Icasa might not have the skills, experience or resources to efficiently regulate the newly liberalised telecoms market. Without a powerful regulator, market liberalisation would be problematic, and could result in dominant players continuing to call the shots. Complicating matters was the lack of certainty in the minister's policy determinations (Ministerial Determinations, 2004).

Key informants interviewed agreed that business customers and consumers should not underestimate the cost of offering high quality VoIP/IP telephony that would interconnect with existing fixed-line and cellular phone customers. Technical and regulatory challenges, including high interconnect costs, would limit the number of Vans and other entrepreneurs looking to offer such services to consumers in future. One area where experts disagreed was in whether voice would be implemented before video on IP networks. Gartner's UK-based vice president Neil Ricard disagreed with the EIU's findings (Ernest-Jones, 2004) that companies would first move onto VoIP. He maintained that video deployment would more than likely outpace VoIP. Ricard maintained that VoIP involved high risk for companies. 'Everyone is excited by VoIP. But often huge efforts are needed in the regulatory regime. Companies need to tread carefully in this environment. Companies depend on their voice systems and are reluctant to meddle with what already works.' In contrast video allows for experimentation and new activities. It has the potential for big rewards at lower risk, he said (Ricard interview, 2004). Other key informants interviewed disagreed, saying that in SA, businesses would more likely implement voice before video. The reason is that SA businesses are unaccustomed to cheap broadband and that there is pent-up demand for cheap voice services. The findings from the questionnaire in the empirical study concur.

Key informants agreed that liberalisation of the telecoms market would be beneficial to businesses. If regulated properly, it would result in new competitive services, more service providers, and lower costs, both for voice and data services. Contact centres (including those providing back office and call centre services to offshore companies), Vans and ISPs, software developers, and new telecoms suppliers were highlighted as big potential beneficiaries of the newly liberalised environment.

Factors affecting adoption of VoIP and other IP services in SA

Below are the amalgamated findings for question 10 – which outlines responses to key factors likely to affect the adoption of VoIP/IP Telephony. These factors were chosen from the literature review and interviews with key informants.

In reading the Figure 1, note that the higher the arithmetic mean, the higher the score. In other words, respondents saw *high bandwidth costs/high cost of service* and *quality of service issues* as the key barriers to adoption of VoIP/IP telephony.

Above are the amalgamated findings for question 11 – which outlines responses to key factors likely to affect the adoption of other converged IP services. Respondents saw *high bandwidth costs/high cost of service* and *quality of service issues* as the key barriers to adoption of converged IP services.

Key factors are discussed in some detailed further down. However, it is worth noting that the EIU global survey (Ernest-Jones, 2004) also asked respondents what they regarded as the key barriers to converged IP services (The EIU did not split converged IP services from VoIP. The authors split these questions because of SA's restrictions on voice services). The EIU survey found the main barriers were: *doubts about security; implementation costs; lack of compelling business case; concern about quality of voice communication; and expensive to implement*. The EIU survey did not ask whether *high bandwidth costs* was a key barrier – possibly because most respondents would have been in liberalised telecoms markets where this would no longer be a concern.

Responses to questions 10 and 11 showed that *High bandwidth costs*, *High cost of service* were the key barriers. Telkom, operating as a de facto monopoly, therefore, was seen as a key barrier to implementing VoIP and converged IP technologies.

10. What do you see as key barriers to implementing VoIP/IP Telephony? Rate each item on a scale of 1 to 5 where 1=Has No Significance, 2=Relatively Insignificant, 3=Uncertain, 4=Significant Barrier, 5-Very Significant Barrier (and will therefore not purchase/implement)	Arithmetic mean	Standard deviation	No significance	Uncertain	Relatively insignificant	Very significant barrier	Significant barrier
Internal company politics	1,95	0,97	42%	23%	28%	0%	7%
Privacy concerns	2,33	1,06	26%	28%	33%	2%	12%
Don't want to jeopardise business	2,37	1,05	21%	23%	40%	2%	14%
Do not want to be at bleeding edge of technology	2,51	1,16	23%	21%	30%	2%	23%
Other	2,60	1,52	20%	20%	40%	20%	0%
Satisfied with present systems	2,60	1,14	19%	28%	30%	5%	19%
Lack of skills	2,60	1,18	16%	19%	40%	7%	19%
No compelling business case	2,95	1,33	14%	19%	30%	16%	21%
Security issues (how do you protect your IP infrastructure from different security threats?)	2,98	1,30	12%	12%	35%	14%	28%
Lack of regulatory clarity	3,02	1,20	12%	28%	23%	12%	26%
Timescales for return on investment	3,02	1,12	12%	26%	21%	5%	37%
Complexity of deployment/implementation costs	3,05	1,34	12%	14%	33%	19%	23%
Too much confusion in the market (too many suppliers, lack of standards, not sure which suppliers will survive)	3,05	1,29	12%	21%	28%	16%	23%
Poor quality of voice communications	3,21	1,08	5%	23%	26%	9%	37%
Quality of Service issues	3,56	1,10	2%	14%	21%	19%	44%
High bandwidth costs, High cost of service	3,77	1,21	7%	9%	12%	30%	42%

Figure 1: Factors likely to affect adoption of VoIP/Ip telephony

11. What do you see as key barriers to implementing other converged IP services? Rate each item on a scale of 1 to 5 where 1=Has No Significance, 2=Relatively Insignificant, 3+Uncertain, 4=Significant Barrier, 5=Very Significant Barrier (and will therefore not purchase/implement)	Arithmetic mean	Standard deviation	No significance	Uncertain	Relatively insignificant	Very significant barrier	Significant barrier
Internal company politics	2,02	1,03	12%	37%	37%	0%	14%
Privacy concerns	2,56	1,18	21%	19%	37%	7%	16%
Do not want to be at bleeding edge of technology	2,58	1,05	23%	16%	35%	0%	26%
Don't want to jeopardise business	2,60	1,18	26%	19%	33%	7%	16%
Other	2,67	1,37	33%	17%	33%	17%	0%
Satisfied with present system(s)	2,77	1,21	28%	19%	23%	7%	23%
Too much confusion in the market (too many suppliers, lack of standards, not sure which suppliers will survive)	2,86	1,23	28%	16%	23%	9%	23%
Lack of skills	2,88	1,29	19%	16%	28%	12%	26%
Lack of regulatory clarity	2,91	1,11	35%	9%	28%	9%	19%
Poor quality of voice communications	3,12	1,28	23%	12%	23%	16%	26%
No compelling business case	3,14	1,30	16%	12%	26%	16%	30%
Timescales for return on investment	3,14	1,13	23%	12%	16%	5%	44%
Complexity of deployment/Implementation costs	3,26	1,18	14%	7%	26%	12%	42%
Security issues (how do you protect your IP infrastructure from different security threats?)	3,28	1,20	21%	7%	23%	16%	33%
Quality of service issues	3,53	1,05	19%	5%	14%	14%	49%
High bandwidth costs, high cost of service	3,98	1,08	2%	5%	9%	33%	51%

Figure 2: Factors likely to affect adoption of other converged IP services

Other findings were that:

- Lack of regulatory clarity is not a key barrier to implementing VoIP and converged IP technologies.
- Low quality of service is not a key barrier to implementing VoIP and converged IP technologies.
- Security concerns are not a key barrier to implementing VoIP and converged IP technologies.
- SA businesses will shift their internal applications onto converged IP networks in the next five years.
- VoIP/Internet telephony will be the front runner for converged IP technologies.
- Converged IP solutions will not be implemented incrementally inside the organisation.
- Converged IP technologies will be used to improve services to customers.
- Converged IP technologies will be used to cut costs of communications.
- VoIP and other converged IP services are likely to be used with wireless access technologies in SA.

Conclusion and recommendations

This study was designed as a management resource for customers, industry participants and new entrants who need to evaluate IP technology adoption and diffusion. The aim was to help them better understand market forces and how to position themselves in different stages of the technology life cycle. Primary and secondary research indicates that the common infrastructure for voice, data and video is increasingly based on IP. Though the market is still using a combination of analogue and digital infrastructures, the trend is clear. We are moving to a new, converged digital environment.

The market for VoIP and converged IP services is growing strongly in SA according to the empirical survey. There are many factors driving diffusion of these technologies. But in SA there are also key barriers, namely high cost of bandwidth and quality of service issues, as highlighted by the empirical study. Key informants expect both these factors to reduce as barriers with impending market liberalisation, which would result in increased competition. The findings of this study lead the authors to conclude that the market for VoIP and converged IP services is ripe for new entrants and infrastructure investments.

Assuming Icasa succeeds in creating regulatory clarity, the authors maintain that there will be increased competition, as Vans, private telecoms networks, the second network operator, the cellular phone operators and other entrepreneurial firms start offering new IP-based services (including voice) at lower bandwidth prices. This will result in SA businesses moving fast to adopt VoIP and converged IP services.

Should Icasa not be given the teeth to regulate effectively, or should it prove incompetent in creating fair competition, particularly for newcomers, there will not be sustainable competition in offering new telecoms services. This uncertainty will hold back customer adoption.

It is realistic to conclude that the perceived usefulness of VoIP and converged IP services will have highest value when low-cost broadband infrastructure is widely available. Primary research shows that this is likely, with many respondents expecting wireless local access technologies to complement traditional fixed-wire broadband offerings.

The authors maintain that SA is also likely to benefit from overseas experiences, and will not need to reinvent the wheel. This will influence the speed of take-up in SA. Vendors and consumers can tap into the global body of knowledge. However, those vendors that succeed in crossing the 'chasm' should be warned. The market is expected to quickly move into Moore's 'tornado' stage, with all its pitfalls and opportunities for land grab.

In the qualitative interviews, key informants highlight the likelihood of 'fly by night' operators, entering the market in a bid to offer new VoIP and IP services. Many are unlikely to survive. Also, corporate respondents highlight the importance of suppliers with proven track records. It's likely that in the VoIP space, corporates will look at suppliers that are able to offer 'carrier class' quality of service. This means that big corporations may also possibly only look at players that can show competence in billing systems and those that can offer multi protocol level switching (MPLS).

Quality of service will become paramount, according to the empirical findings and interviews with key informants. At present, business customers can expect some deterioration in the quality of a VoIP connection (as the packets of voice data have to be compressed in order to be transmitted). Increasingly, they will demand carrier-class services that are controlled by good technology to allow uninterrupted speech.

Vendors with strong partnerships and distribution channels, and large corporate customers will have competitive advantage. As highlighted in the primary research, business users prefer to use vendors with an established track record. The game is likely to favour the big, established vendors (what Gordon Moore dubs the 'gorillas').

It is also reasonable to conclude that some companies will try to get the highest ROI out of existing infrastructure and technology for as long as possible – however, the empirical research suggests most are looking to migrate to converged IP networks, or have already started to do so.

The authors believe that the telecommunications industry will become a more interconnected marketplace. As the industry becomes more fragmented, more companies will attempt to become value-added intermediaries, such as billing platform providers. Industry leaders will focus only on their companies' core competencies and will seek other players to fulfil non-core activities.

The authors maintain that this will create new opportunities, particularly as the market is still in the early stages and the industry has not yet presented technologies to businesses and consumers in a meaningful, attractive and simple package. Industry players will have to position themselves in this new market, by judging their relative position of power with the stages outlined by Moore. This will not be a simple task. With market liberalisation nigh, entrepreneurs are expected to enter the market in droves, and Moore's model is likely to occur with all the chaos and opportunities outlined in his 'tornado' stage, resulting in eventual market consolidation.

Having highlighted where the industry is heading, this research study provides the basis for understanding the market dynamics better.

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