S A D I B A

SOUTHERN AFRICAN DIGITAL BROADCASTING ASSOCIATION
P. O. Box 6922 • Cresta • 2118 • South Africa
Tel: (+27) 11 471 4640 • Fax: (+27) 11 471 4752 • E-mail: secretary@sadiba.co.za
Web-site: www.sadiba.co.za

INTRODUCTION TO SADIBA RECOMMENDATIONS

SADIBA (the Southern African Digital Broadcasting Association) is a voluntary industry forum dedicated to promoting the co-ordinated market driven introduction of digital broadcasting technologies in the Southern African region. SADIBA was founded in 1997.

With the establishment of the Digital Broadcasting Advisory Body in March 2001, the Association committed itself to supporting the work of the Body, the Regulator and others looking into digital broadcasting within Southern Africa. SADIBA members researched international digital broadcasting trends and their application within the local context. Consensus positions on digital broadcasting systems, standards as well as policy and regulatory frameworks were defined and formulated into a set of recommendations.

These recommendations are made in good faith in an attempt to provide an industry view in support of current and future processes. The texts are not to be interpreted as critique of the status quo or as pre-empting the work of DBAB, the regulator or the bureau of standards. SADIBA trusts that these recommendations will be of value to all concerned.

ANALOGUE TO DIGITAL TELEVISION BROADCAST MIGRATION STRATEGY FOR SOUTH AFRICA

EXECUTIVE SUMMARY

The digital broadcasting proposition for South Africa does not readily pass the accessibility, affordability and take-up test criteria with overwhelming results. South Africa as a country faces more imposing challenges with higher budget priorities for education and health. However, it is crucial that the long-term benefits of creating an information society not be overlooked because of short-term budget and national priorities.

As there is no clear market demand for services at present and a forced or managed migration would be an effective way of achieving various goals within desired timeframes e.g. universal service, minimising digital divide etc. A managed market introduction that entails the following is recommended:

- Government imposing a moratorium on analogue roll-out
- Government announcing an early and fixed switch-off date for analogue.
- Push to leap-frog to digital networks and roll-out and as instantaneous way of providing access to multiple services and multimedia universal service of which education is a key component

- Large Network coverage to be provided in accordance with a managed approach in order to create a large market and induce economies of scale benefits (lower receiver cost)
- The choice of analogue services to be gradually be reduced once DTT services are widely available, nudging consumers towards digital.

Digital broadcasting, if implemented in such a manner so as to leap-frog technology can be deployed strategically –

- to meet national education objectives using distance education technology solutions
- provide the means to distribute public broadcast content to all South Africans (universal service) through DTT's increased transmission capacities.[1]
- present broadcasters with an opportunity to maximise additional revenue streams through DTT's increased transmission capacities

Thus government must acknowledge that South Africa is not in a state of readiness to easily meet the accessibility, affordability and take-up test criteria for digital broadcasting and attempt to address the underlying reasons for this.

The managed market uptake approach is not be to be mistaken for an unwelcome market entrance that is imposed upon public and industry. Rather, it is crucial that all stakeholders understand this approach to be the most suitable method to link into national objectives to grow the economy, achieve universal service and ultimately create an information society in South Africa.

It is recommended that government make a decision on the roll-out for digital broadcasting with a commencement date being 2002. This would allow sufficient time for proper and comprehensive planning that would take into account financial impact, staffing and skills impact, technology impact and impact on society amongst other factors.

The first roll-out should commence at the latest by late 2003. The analogue services should gradually be reduced and all analogue broadcasts terminated by 2012.

CONCLUSION

Digital broadcasting challenges existing business models for both service providers as well as content producers. Broadcasters, industry, policymakers, facilities and service providers are facing the greatest and most ominous challenge since colour TV. Digital broadcasting elevates audiences to a critical stakeholder position in the decision-making process. Technology factors, whilst requiring earnest consideration to ensure effective implementation, is the least influencing factor against the social and economic backdrop of South Africa where the country would gain vast benefit by adopting digital broadcasting solutions to meet national objectives

RECOMMENDATION

SADIBA recommends that digital television broadcasting services be introduced in South Africa using a managed market uptake strategy.

[1] refer to page 5 ±6M South Africans do not have access to broadcast signal

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1. WORK OBJECTIVE

The main objective of the study conducted by SADIBA DTT WorkGroup 3 (WG3) was to provide a high level examination of the factors for consideration for an Analogue to Digital migration strategy to be used for decision making for Digital Television Broadcasting in South Africa. This report also states to sufficient detail for the purposes of this report, how digital broadcasting would impact on the various stakeholders.

KEY ASSUMPTIONS

One of the key assumptions made by WG 3 is that HDTV would be omitted from the scope of this study largely due to the cost implications both in terms of content production for the broadcasters and consumer costs to purchase receiver equipment.

2. TELEVISION BROADCASTING IN SOUTH AFRICA TODAY

Analogue terrestrial broadcasting in South Africa is dominated by the South African Broadcasting Corporation (SABC) which operates three national services distributed via digital satellite and analogue terrestrial as well as 2 Pay-TV services via digital satellite. At the time of this report, BOP TV, managed by the SABC is a free-to-air television service available in Gauteng and the North West province. Media Group MIDI TV offers a free-to-air TV channel, eTV, distributed primarily via analogue terrestrial. Catering mainly for the middle and upper income viewers, the Multichoice group offers a variety of pay-TV services e.g. MNet and the more wider subscribed DSTV[2] bouquets via combined terrestrial and satellite delivery platforms.

2.1 Revenue models

The SABC's funding model consists of 16% revenue from TV licences with the remaining 84% derived largely off advertising and sponsorships. Piracy viewing levels have been reduced from 57% in 1996 to 36% in 2000.[3] The eTV business model is along commercial principles and is largely dependent on advertising and sponsorship revenue whilst the commercially run MNet and DSTV services revenue source is derived from user subscription and significant advertising.

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[2] The DSTV bouquet also incorporates Bop TV, the three SABC channels as well as eTV with encryption.

[3] source: SABC Annual Report 2000/2001

2.2 Population and Television Audience Demographics[4]

There are 9.551 million households in South Africa. Approximately 51.4% of South Africa's adult population live in rural areas with the remaining 48.6% living in urban areas.

Of this, 79.4% of households have electricity, 31.9 % have telephones at home, 66.9% have TV sets and 89.4% have radio sets. ±12% of households own decoders.

TV COVERAGE IN SOUTH AFRICA	
SABC 1	82.8%
SABC 2	85.5%
SABC 3	74.2%
e.tv	77%
MNET	57%
CSN	29%
BOP TV	8.9%

**method of access may vary*

table 1

Households with TV sets have increased from 5.4M in 1997 to 6.3M in 2000. Of the 6.3M TV-owning households in South Africa, only 64% are fully or partially paid up licence holders.[5] National access* to the television services described above are contained in table1.

The potential TV audience size in South Africa is ±29 million adults (16 years+). The average daily audience watching any TV is 18.85 million i.e. 65% of South Africa's adult population with 3.3 million watching pay TV. Of this, only 6.4% of have accessed the Internet in the last four weeks.

Analogue TV is thus the mass market TV delivery medium whilst PAY-TV is very much a niche market offering. The Internet audience in South Africa consists of ±3 million visitors where dial-up access is ±400K.[6] It is unlikely for this to swell to critical mass figures in the near future as the barriers to entry for mass-market take-up lie in the cost of computer equipment as well as the cost of the telephone line.

2.3 The Role of Broadcasting in South African Society

South Africa's monthly household income is shown in figure 2. 65% of South Africans in employment earn below R2500.00 per month.

[4] source: AMPS 2001A - Main, All Radio + TV
[5] source: SABC Annual Report 2000/2001

[6] source: BMI-Techknowledge

South Africa's TV audiences rely on the television medium for reasons varying from entertainment through to education and information dissemination e.g. news.

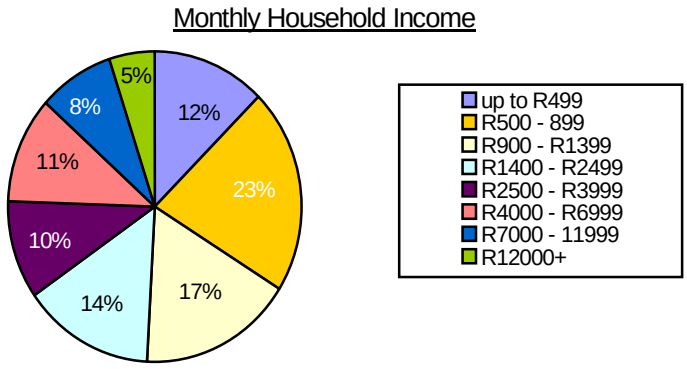

Figure 2

For obvious economic factors, the lower income groups do not have access to television and in some cases radio. Further compounding factors are:

- due to transmitter density ±6M people[7] in South Africa do not have access to the terrestrial radio and television signal
- It is difficult to achieve 100% universal service for Terrestrial radio and TV in South Africa due to cost factors

Income is also linked to literacy levels where the larger portion of the lower income groups have low literacy levels, thereby creating a demand for access to educational content via alternate and additional delivery methods.

Demographics in South Africa show that there is a need to steer South African citizens towards an information society in accordance with government objectives to educate, employ and uplift society.

[7] source: SABC

3. BROADCASTERS: THE TELEVISION BROADCAST CONTENT CHAIN

3.1 Digital Television

Broadcasting is very technology intensive from the content acquisition phase through to the final stage of content distribution. Figure 3 illustrates the various stages of content production and will be used as a key reference throughout this report.

Digital television or DTV is defined in two ways:

1. Digital transmission of television signals by TV operators using one of three transmission standards (Stage 5 in figure 3)
2. New TV formats eg high definition television (HDTV), standard definition TV (SDTV) and interactive television (ITV)

Stages 1 and 2 consist of hybrid analogue and digital solutions at all of the broadcasters and do not readily impact on the transition to digital broadcasting. Digital broadcasting will have major impact for all broadcasters from stages 3 through to stage 5. The area with most impact on audiences would be stage 6 - the final leg of the content distribution.

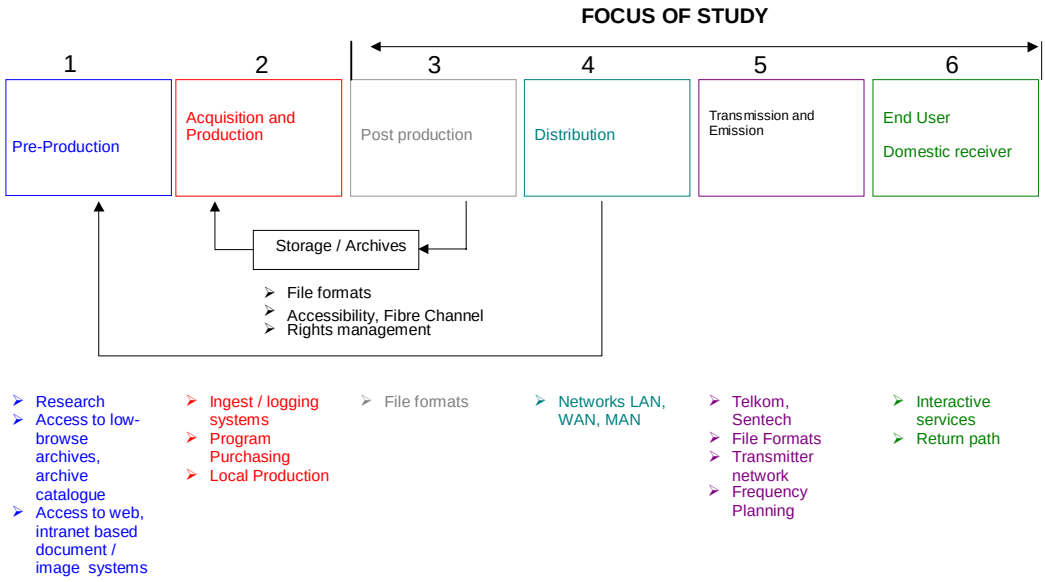

Figure 3

Table 2 highlights the implications facing the various stakeholders as the different stages of content publishing migrate from analogue to digital television broadcasting.

3.2 THE IMPACT OF DIGITAL BROADCASTING ON BROADCASTERS

CONTENT PROCESS	IMPLICATIONS
1 - PRE-PRODUCTION Researchers, producers and commissioning editors use computer based systems to initiate the program cycle. Advanced scheduling and offline preparation is done on standard information processing equipment. Most video archive material is in an analogue format at present.	With migration to digital broadcasting, an area that could change is the storage of material in digital format according to file formats stipulated for transmission or production. As a result of this, access to digital storage would require low-browse editing workstations in a network configuration allowing producers and researchers to gain access to centrally stored digital content.
2 - ACQUISITION AND PRODUCTION The production process uses a wide variety of analogue and digital equipment, usually manually controlled in real time, with varying degrees of automated assistance. It is basically an analogue process.	As the rest of the world migrates to digital broadcasting, the format in which content is purchased as well as sold and distributed would be an area of change for South African broadcasters. Conversion equipment would be needed to change or playback digital format material.
3 - POST-PRODUCTION Most post-production in South Africa is digital.	As per the acquisition and production content phases, the final storage format of content will also apply to the post-production process. The packaging of digital content will also have to cater for metadata to be built into the content so that information about the programme can be used to direct processes either during transmission or through audience interactivity. An advantage of digitising the production chain is that content may be distributed on a server based networked system. The EBU/SMPTE Task

	Force for Harmonised Standards for the exchange of programme material recommended a networked broadcast infrastructure. MPEG-2:4:2:2P@ML data compression at up to 50Mb/s was identified as a compression standard.[8] The use of MPEG-2 during production and post-production enables production of high technical quality. The original high quality is preserved via the exchange of compressed data streams between devices during production, post-production, playout and archiving of content. Further benefits of digitising this phase of content production are, efficiency in workflow made possible by faster than real-time transfer of material and access to centrally stored content. ATM and Ethernet[9] networks are deployed to distribute content in the post-production environment.
4 - DISTRIBUTION The majority of video distribution is done in PAL-I analogue format. Telkom uses limited digital applications at present with plans to implement ATM in the near future.	The storage format of content influences the access and distribution of the content and similarly the transport technology influences the storage formats of the material. ATM can distribute 270Mbit/s MPEG-2 compressed video material suitable for post-production as ±50Mbit/s via a LAN configuration. Another typical use of ATM in broadcasting is to

[8] source: EBU Final Report: July 1998 by the Task Force for Harmonised Standards for the Exchange of Program Material as Bitstreams

[9] Leitch uses the Leitch Truecircuit© Ethernet network with a Quality of Service feature

	LAN configuration. Another typical use of ATM in broadcasting is to distribute MPEG-2 transport streams to the DTT Multiplex centres. (primary distribution). This would consist of ready to broadcast data streams that are transferred to a network operator. From here, the distribution of audio and video in the MPEG-2 format is sent to the transmitter station/s. This can consist of terrestrial transmitters, headends of cable TV networks or uplinks to satellite. The MPEG-2 transport stream of ±15Mbit/s to 40Mbit/s usually contains 5-15 programmes (video, audio and additional information) Testing, measuring and monitoring of parameters in such an environment would need to address the requirements of the various system layers involved. What needs emphasis for a digital distribution infrastructure is the introduction of artefacts through the concatenating effect of the various encoders and decoding equipment used in the transport chain. The principle to follow is to avoid multiple conversion processes as digital content is transported to the signal distributor.
5 - STORAGE The storage of material is done mainly in analogue form for post production and transmission. (does not include adverts)	A major crossroad facing South African broadcasters, in particular the SABC is the analogue formats used for archive content storage. The condition of this material is deteriorating with time and as production and

This is influenced by the present tape format and may even include digital tape formats. Archive content also exists on film and varying tape formats. ±99% of content is stored in analogue format at present.	condition of this material is deteriorating with time and as production and acquisition migrate to digital formats the efficiency with which this material is accessed and used decreases. The direct relevance of archive material to digital broadcasting is when broadcasters can exploit the advantage of digital broadcasting through a variety of programming offerings, viz the broadcaster may choose to launch additional programming which consists of recycled archive material. In this instance the stored format of the archive material for playout is a consideration. Typically, high speed network file transfer using Fibre Channel or Gigabit Ethernet preserves the MPEG stream between acquisition, production and archive systems in distribution of digital content. Access to digital archives may also become part of an interactive service offering.
6 - TRANSMISSION AND EMISSION Most of the SABC and e-TV transmissions are done in PAL-I. Multichoice broadcasts a digital signal via satellite.	The greatest impact for broadcasters and signal distributors occurs when Stage 5 of the content chain migrates to digital broadcasting. Much consideration has to be given to MUX operators and the licensing thereof. For deliberation: • How many MUX operators should there be? • Is it a natural progression that signal distributors migrate to becoming MUX operators?

	• Is it ideal for the broadcaster to have control over the performance of statistical multiplexing in order to ensure that content is transported over optimum bandwidth? This can be achieved by owning the MUX license as in the UK example or through a service level agreement with a MUX operator. When configuring bandwidth, flexibility must be built in to cater for the introduction of multimedia services. MUX operations will affect quality of content. Therefore, both content provider and MUX operator should have key stakeholder input into defining this process. This process must also tie into the frequency planning process. (see page 20) Further, broadcasters may have to operate dual distribution systems to distribute analogue and digital content unless the broadcaster chooses one distribution format , leaving the final conversion of content to take place before transmitter distribution. Analogue terrestrial and digital terrestrial transmitter systems would have to be operated in order to cater for audiences during the transition phase. Metadata incorporated during the production phases of content will be used during Stage 5 to be 'read' into electronic programme guides and other such relevant processes. The electronic programme guide (EPG) is part of the essential information required by customers of the digital

	television service. Finally, the area of SMS and CA needs serious consideration. At present, TV license collection is carried out by the SABC, whilst MultiChoice maintains its own customer base. With digital broadcasting, the issue of encryption, the must-carry-all rule as well as the maintenance of the customer base may require a fundamental shift in thinking. A decision could be taken to incorporate TV licences into the SMS and CA system. Further, the issue of whether the SMS business should be outsourced to a separate business entity would need to be debated.

Table 2

4. FINANCIAL CONSIDERATION

The introduction of DTT (Digital Terrestrial Television) technology represents a high investment for all players. This includes the content providers who invest in new transmission systems, the multiplex operator and SMS who invest in new MPEG encoders and lastly the public who would need to purchase set-top boxes and subscribe to content services and from whom costs are ultimately recovered.

The cost of digital equipment is higher than the equivalent analogue equipment in most cases and where the total cost of ownership method of evaluation is used. Digital Technology also requires a substantial investment in SMS services and support infrastructure. The technology required by the content and infrastructure providers is not locally available and would need to be acquired on the global market. The devaluation of the Rand would be a major barrier in the implementation, both to the consumer and the industry, but may encourage local manufacturers such as UEC to mass produce receivers (STB) for the local and international market.

4.1 Financial Impact for Broadcasters and Signal Distributors

- Broadcasters could be faced with increased costs to change formats of content during purchase and selling of content to and from suppliers from countries with digital broadcasting. Similarly, depending on whether production suites upgrade to digital systems in order to reduce multiple content conversion, the actual cost of content production could increase.
- Double illumination – broadcasters would have to pay additional costs for signal distribution for both analogue and digital transmitters over the transition period.
- Marketing – Broadcasters may have to plan a marketing budget in order to inform and educate audiences on the switchover to digital broadcasting. However, this cost could be borne by other stakeholders e.g. government or equipment manufacturers who have a vested interest in encouraging the take-on of digital broadcasting in South Africa.
- Training – Broadcasters and signal distributors would have to embark on intensive training programmes for staff to operate and maintain digital broadcast equipment and systems
- Equipment – Capital budgets would have to planned in advance to cater for the purchase of digital broadcast equipment and systems.

- Archiving – As with content production, the digitisation of the acquisition, production and content playout systems would affect the archives storage technology and would present a huge cost consideration for broadcasters to implement a digital archive solution.
- Conditional Access and National Customer Support Centres - Call centres to manage customer databases as well as technical support for decoders would have to be set up.

4.2 Financial Impact on Consumers

South African viewers may be classified loosely into the following groupings based on the demographic data described in 2.2 :

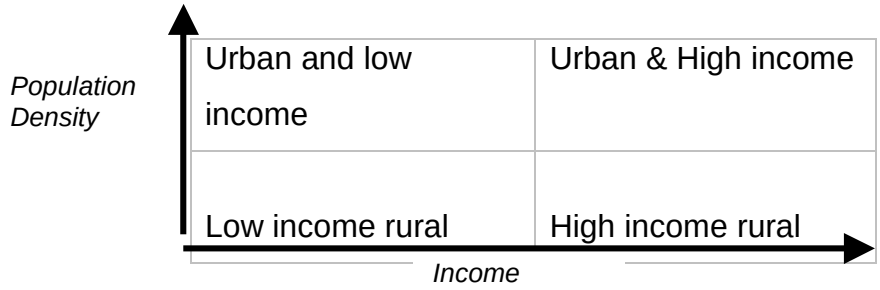

Figure 4

The expectation of most South African consumers is for an investment into a TV and VCR set to last for at least 5 years. Initially, therefore, the strategy to accompany the launch of digital broadcasting would have to be threefold viz:

1. encourage existing TV set owners to migrate to digital sets (16:9)
2. entice new owners to invest directly in digital receivers or
3. to cater for consumers wanting to use a use a set-top box with existing TV sets (4 : 3)

Audiences would have to purchase a receiver set, antennae and if necessary separate equipment capability for interactive services. A high definition television receiver in the US[10] is priced from US$ 6000 - US$ 10 000 plus an additional ATSC decoder box at US$ 1000 which is why HDTV was left out of the scope of this study. A viewer in the UK typically pays £100 for a receiver (STB) and 12 months subscription to six channels.[11]

[10] source: McKinsey Quarterly 2000:2 – Unscrambling Digital TV

[11] source: SADIBA Digital Broadcasting Industry Workshop: July 2001. These prices must be further analysed in context, as there is no indication whether marketing budgets or sponsorship of the receiver device are factored in.

For both the broadcasters and consumers, economies of scale would drive down prices as technology settles in and more consumers buy receiver equipment. Moore's Law by which average processing power increases as average prices stay relative and/or drop is also a contributing factor to making technology more affordable with mass production.

It is therefore important to choose a technology standard

- that is not too customised to the South African situation
- that is a uniform standard applied throughout South Africa and as widely as possible internationally
- where the equipment is either easily sourced or locally manufactured to meet customer demand with flexibility

in order to ensure that price is not a barrier to entry especially for consumers.

4.3 Funding Models for Broadcasters

Commercial broadcasters are unlikely to be largely affected by the launch of digital broadcasting in South Africa should the market proportions remain the same. However, commercial models could become threatened as spectrum use would allow broadcasters to offer greater content varieties thereby shifting or eroding market bases. The public broadcaster however, straining under the burden of problematic TV licence collection (refer to section 2.2 on page 4) is unlikely to meet the financial demands of dual signal distribution costs through the current funding model. This in turn would affect Sentech (the main SABC content carrier) as the signal distributor would need market or business incentive to invest in digital broadcasting transmitter infrastructure. As receiver equipment progresses to include personal video recorders, the advertising market and advertising revenue driven operations could face the threat of declining 'advert viewer' numbers as viewers would have the option of disabling adverts.

5. TECHNOLOGY CONSIDERATIONS

South Africa would need to make a strategic choice between the ATSC, DVB-T and the ISDB-T standards. After high level evaluation of the technology, pilot tests and case-study examination, the DVB-T option is recommended as it appears to be the most flexible choice. Refer to the WorkGroup 1 report for detail on the technology evaluation and recommendation.

5.1 Typical DVB-T Operation

For the purposes of this study, the DVB-T model (refer to figure 5 below) was chosen to illustrate the operational changes for broadcaster and signal distributors in a digital broadcasting environment.

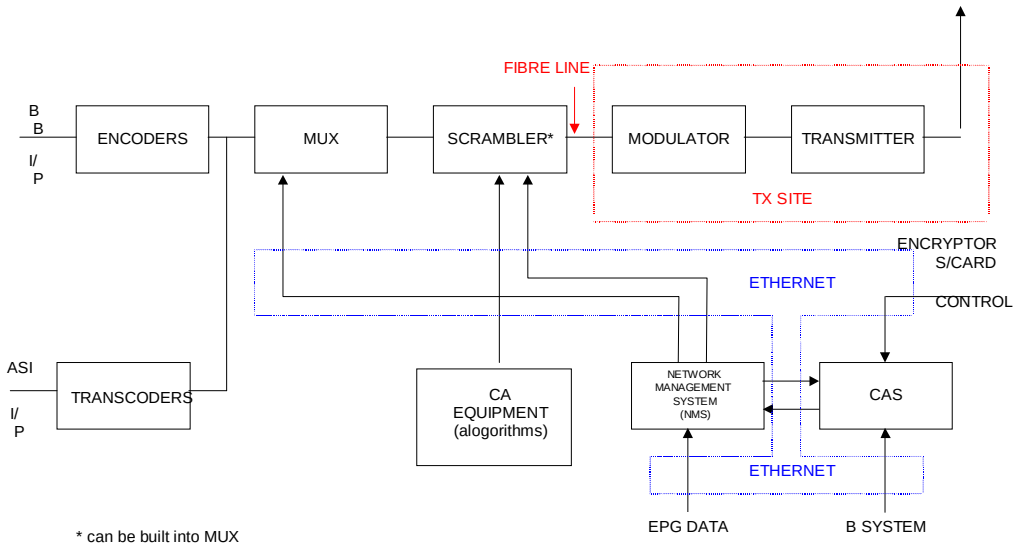

Figure 5

The technical issues for analogue broadcasting are controlled by a relatively few role players viz SABC, MNET, Telkom, Sentech, Orbicom and Multichoice. The future scenario could be significantly different where more operators and distributors are licensed and where the Network Operator license may include all linking and distribution facilities.

The sending of a digital TV programme therefore implies the possibility of many more stakeholders and changed processes:

- The service or content provider who operates the individual TV, radio or data service.
- The multiplex operator who creates the DVB multiplexes and gives access to the end user, sometimes through subscription (eg MultiChoice) in the existing situation. With the migration to digital broadcasting, the MUX operator could merely be the commercial entity that runs the business of the multiplex. The MUX operator could outsource the engineering activities that create the data stream, the CA and the SMS. This may become specifically relevant to smaller local and regional MUX operators that would not be willing to or unable to fund and hold the expert skills required. Thus having a network operator provide the Multiplexing function (as well as CA and SMS management) to the MUX operator is a very likely model for South Africa. New licensing categories and/or legislation should provide for this.

- The Network Operator that operates the DVB-T network by taking the DVB multiplexes, modulating them and sending them on the air. (E.g. Sentech, Orbicom). The MUX operator could also be a purely commercial operator of the platform where the MUX operator would aggregate content and sell the multiplex. The Network provider could in this instance be responsible for engineering the compilation of the multiplex in addition to the network. Therefore, full value chain analysis would have to be done before defining licences and legislation, to safeguard against infrastructure providers gaining share in the content publishing market.
- The network operator/s that connects the content station to the regional broadcast centres e.g. Telkom in the current situation ie prior to the SNO commencing operations.

Thus in order to implement technology solutions for digital broadcasting, all players would have to work closely together in order to redesign processes, in particular SI Management.

Technology implementation implies broadcast redesign!

Figure 5 highlights the importance of applying known and tested technical standards in both the choice and configuration of systems. The advantages of this would materialise in the quality of skills and technical support of digital broadcasting as well as the availability of equipment.

5.2 Interactive Services

Provision must be made for multimedia services, which must include a return path for user-interaction. Digital signals must be 10dB less than the analogue signals if transmitted from the same site (+/-15dB if adjacent channel). This sets the power for the digital service. There are advantages to this, but it becomes a problem when interactive multimedia is introduced. The decoder's low power radio return channel has path coverage of +/- 35km.

ADSL / GSM – 3G technology can also be used for the return channel, but it could also delay the implementation of multimedia services because of cost and spectrum dependency factors. ADSL is not commercially available at this stage and is likely to be introduced to metropolitan areas first. If radio is the medium of choice, then the cellular concept for coverage planning is more advantageous. DVB–RCT is another technology option to cater for user interaction. PTSN networks can also be used as a return path for interactive television. Most interactive applications do not require a high data rate for a return path which

makes the normal telephone line ideal. The disadvantage of using the telephone line is that the user would be unable to make or receive calls. A possible solution then would be to install a second PSTN line or use either an ISDN or ADSL facility.

5.3 Sound

The UK market shows that consumers like surround sound with rapid acceptance of Dolby Digital on DVD. As DVD becomes a standard for home entertainment, so are television services expected to deliver digital surround sound as well. Digital television (DTV) programming is therefore increasingly using Dolby Digital 5.1 channel sound to create a cinema-like experience in viewers homes.

Dolby digital offers a new approach for broadcasters to deliver high quality multichannel audio to the home whilst catering for both mono and stereo sets. The use of metadata provides for better control of transmitted audio e.g. it would no longer be necessary to control sound levels via compressors because the ideal replay level of the programme can be transmitted to the decoder.

Thus metadata has significant advantage for DTV. Audio can still be created optimally by the audio professional and the accompanying metadata be encoded with the audio to create the Dolby E stream in an AES/EBU pair which can then be recorded onto VTR's and/or servers. At the final transmission point (refer to figure 1 and figure 5) the metadata can be encoded directly onto the Dolby Digital encoder for final delivery to the home. In this way the consumer is able to appreciate audio off DTV as it was intended by the audio production professional.

MPEG 2 – Layer 2 or Musicam are the main sound standards used for DAB and DTT. The data rate can be varied according to the need and availability option for broadcasting and is used in the multiplex. It is also used in multimedia applications and can be transmitted over ISDN lines.[12] Dolby AC 3 is also an option to transmit audio accompanying video. AC3 is backward compatible to stereo by using a six-channel surround sound mixer. [13]

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[12] source: Digital Audio - BBC Training Notes 1999

[13] ***source:*** ***www.dvb.org*** **–** Articles 25 / 08 / 1999 (Facts about DVB–T p11)

Before choosing an audio standard for television it is important for content producers to analyse the requirement for transfering old material into digital format. The MPEG 2 – Layer 2 appears to be the safer format to choose in this instance.

5.4 Receiver Specifications

The crucial defining factors for the choice of receiver specifications lie not so much in technology capability as in the need to adopt a universally applicable minimum receiver specification for South Africa. For detail on the recommendation for a receiver standard see the Report by WorkGroup 1.

A major advantage in South Africa is that digital broadcasting would start off from a relatively clean sheet. Therefore, by adopting a universal minimum receiver standard, market confusion would be avoided, and technical support would be easier. In addition, a minimum receiver standard would lead to standard API's as well as relatively easy implementation of CA. Further studies may have to be done to establish the implications/advantages for adopting a common API and CA. (Refer SADIBA Recommendation on the Management of Service information (SI) for Digital Terrestrial Television (DTT)). The minimum receiver specification should ensure a modular approach whereby additional software or hardware upgrades to the minimum receiver would cater for additional features for niche market audiences. (Refer to the SADIBA recommendations on DTT standards, the recommended guidelines for a minimum receiver specification.)

6. PLANNING CONSIDERATIONS

New services such as DTT and DAB would require additional spectrum allotments whilst analogue services remain operational. Deployment of digital broadcast services thus necessitates a migration plan that would indicate how analogue and digital services would co-exist and share spectrum until the eventual closure of analogue services. In order to plan effectively for such a migration it is essential to determine how and where the new digital services will be deployed.

6.1 Frequency Planning Considerations

- Protection of existing analogue services in terms of interference levels is of utmost importance. As DTT transmissions are able to function on channels adjacent to digital or analogue services, such allocations should be proposed where needed. The existing

spare UHF frequency spectrum only allows a limited number of digital multiplexes to be introduced. Should it be necessary for additional digital services to be deployed, a prerequisite is that existing UHF analogue services be migrated to the digital medium to free spectrum resources.

- The first step would therefore be to determine which frequencies could be used between existing analogue services as per the ICASA frequency plan. To effectively plan such a rollout, access to an accurately updated national database of spectrum utilisation would be essential.
- During the migration process, it would be important to have a period of dual illumination during which services would be carried on both digital and analogue formats. Only after the public is equipped in terms of the appropriate receiver equipment, should analogue frequencies be made available for further digital utilisation. This excludes underserviced areas where digital transmitters could be rolled out as a priority to achieve universal service targets.
- In order to relinquish more spectrum for digital applications, it is proposed that existing analogue pay TV services be migrated to digital as a first option thereby affecting a relatively smaller audience segment. (refer to page 5)
- In all cases, protection ratios stipulated in recommendation ITU-R BT 1368-1 should be used to verify the compatibility of digital channels with existing analogue services.
- Deployment may constitute high power stations with possible gapfiller stations (such as existing analogue networks) or can be done in a cellular fashion. While a cellular approach would be advantageous when interactive services are considered, it would take longer to establish and could be more expensive.
- Utilising existing infrastructure such as transmission sites, masts and antennas would keep deployment costs low.
- As a result of increasing pressure from telecommunication services such as Professional Mobile Radio (PMR) etc. to relinquish certain parts of the UHF band, cognisance should be taken of such considerations when planning for digital services in the UHF band. An attempt should therefore be made to allocate frequencies for DTT purposes in the middle of bands 4 and 5 where possible.
- Single Frequency (SFN) mode should be considered for main stations and their associated gapfiller stations to operate in or as on-frequency repeaters, so as to make maximum use of the available spare frequency spectrum.

6.2 Coverage Planning

Coverage planning should factor in fixed reception, which necessitates the use of an outside fixed antenna installation. The choice of digital system needs to satisfy the receiver requirements for fixed reception. (outdoor rooftop antenna – Ricean channel) Portable reception (indoor antenna – Rayleigh channel) should be possible in areas close to transmitting stations.

The determination of service areas for digital propagation differs vastly from that of analogue. As a minimum expectation DTT coverage could be expected to match that achieved by the current PAL analogue terrestrial network. However, the "cliff effect" of DTT makes the coverage non-identical. There would be some levels of lesser performance arising from the power limits imposed by non-interference to PAL, because of the expected extensive use of channels adjacent to the existing PAL services for DTT during the transition period. Conversely, for some aspects such as ghosting limitations, there would be areas of improved reception performance through DTT. International studies in Europe show that digital transmissions at powers of 10 dB less than analogue transmissions provide comparable reception areas.[14]

Minimum field strength for planning purposes is highly dependant on receiver parameters such as receiver noise figure and carrier to noise ratios. Recommendation of ITU-R BT 1368-1 should be used to derive minimum field strength values for reception.

7. LEGISLATION CONSIDERATIONS

A force approach has been adopted in the US where stations are being pressured to broadcast digital signals by 2002 in order to free up the analogue spectrum. In the UK, Digital Terrestrial Broadcast is regulated by the British Broadcasting Act 1996. Currently a network of 25 DTV sites and 150 transmitters provides 75% DVB-T coverage, expanding towards 95% in the next 3 years. Most systems operate below 10kw ERP. (Considerable

[14] The UK has just increased power by 3dB's to improve coverage.

power upgrades are, however, planned for 2002). The network utilises the DVB-T COFDM transmission standard (MPEG-2 MP@ ML 625/50, 1705 carriers, 64QAM, FEC 2/3 mode). [15]

It is not necessary to go to the extent of regulating technical specifications in South Africa. The MUX operator in co-operation with the network provider need to have the flexibility to change and manipulate the network parameters as content and market demands change eg the ability to change the configuration of a mobile service once the network has reached a significant size and gap fillers provide the ERP required. The system and network configuration may also be configured such to allow for dynamic allocation eg to cater for 2 mobile channels during drive time programming whilst catering for 10 fixed reception services at a later time slot.

7.1 Licensing Frameworks

With the introduction of digital services, the regulatory framework would have to make provision for a licensing structure that would be able to accommodate new and different services.

In a recent SADIBA survey, members gave an indication of how they would like to see the granting of licenses:[16]

1. Content providers
2. Multiplex operators and } 32%
3. Network providers } 28%

32 % wanted at least the content providers and the Multiplex operator licensed while 28% wanted all three categories licensed.

The definitions for these categories should be wide enough to allow all the possible market applications that may arise. This flexibility could allow for the operator choosing any network provider to provide the Multiplex, SA and SMS services or combinations of the services and infrastructure as selected by the operator.

[15] factor in the change that the UK has just increased power by 3dB's to improve coverage.

[16] source: SADIBA secretariat - www.sadiba.co.za

7.1.1 Proposed Definitions

Whilst it is important to note the differences between the existing and future broadcasting licences it is more pertinent to emphasise the need for new licensing approaches as well as a need for new license categories because the digital broadcasting value chain differs significantly from the analogue value chain.

7.1.2 Industry Players in a Digital Broadcasting Environment

Content Provider: A service participant on a digital broadcast multiplex that contributes to the content offering in that multiplex whether is be in the form of a audio or video or data service.

Multiplex operator: That entity that compiles operates and markets a content offering on a digital multiplex and that decides on the CA and SMS to be used. The Multiplex operator may choose to operate hardware called the Multiplexer as well as the SMS and CA on such a multiplex or to outsource these services to the network provider. Existing signal distributors could become the multiplex operators.

Network provider: That entity that operates networks and transmitters that distribute signals associated with a multiplex. This may or may not include the operation of the multiplex hardware as well as CA and SMS depending on a service agreement between the Network provider and the Multiplex operator.

Thus it should not be assumed that existing providers simply migrate to new business operations. Instead, well prior to implementing digital broadcasting in South Africa, the introduction, categorisation, regulation and business feasibility of the breed of service providers must be carefully planned.

8. ADVANTAGES OF DIGITAL BROADCASTING

BROADCASTER	AUDIENCE	GOVERNMENT
• Efficient use of spectrum through increased content offering over comparative bandwidth capacity used for analogue transmission leading to cost efficiencies over the long term. • Universal service target comparatively easier to achieve through local content and greater content varieties offerings thus catering for language and geographic distributions in South Africa. • New opportunities: Broadcasters would be able to offer multimedia and e-commerce services via digital broadcasting transmission • Chain Logic ie digitising the full broadcast content chain is inevitable and desirable	• Audiences have a greater variety of programming to choose from; • Audiences may also access value-added services or multimedia content as digital broadcasting also caters for supplementary and/or complementary data content. Therefore audiences would be able to access additional interactive services eg TV guides, news and information, educational content and games, shopping and travel services and pay per view movies / documentaries / sport coverage • Better quality of pictures • Content enhancements for people with disabilities. • Easier access to regional broadcasts with stronger local content in terms of	• Digital broadcasting would present huge social gains for government especially where the technology could be used for distance education. Eventually government would be shifting audiences to an information society. • As the different government utilities roll out with telecommunications and basic infrastructure so would the broadcasting universal service become aligned towards catering for all South Africans. • DTT can cost effectively deliver a multiple of information services in addition to entertainment

• By rolling-out DTT instead of analogue, access to 5 or more services can be provided whilst analogue would require a separate network for each service.	geographic and language distribution. • New services such as messaging, teleconferences, programmable VCR, (PVR) profiles, advertising, web surfing, t-commerce, etc. would become part of the wider data offerings giving users a greater opportunity to select video and data programming. • Simple installation and operation. No dish antenna required.	services. Eg Email, Internet etc. These services will in future form part of a universal service

Table 3

9. DISADVANTAGES OF DIGITAL BROADCASTING

BROADCASTER	AUDIENCE	GOVERNMENT
• Digitisation is capital intensive. Therefore the high cost of equipment in addition to recent capital investments in analogue technologies will pose financial strain to broadcasters. • Both analogue and digital services must be maintained for a long period	• High cost of receiver sets and equipment would be a barrier • A poor audience take-up has a negative influence on the success of digital broadcasting • No perceived advantages from the general public for the additional cost.	• Spectrum would not be freed up immediately due to the need for transition. Therefore government would not be able to optimise frequency allocations nor auction off spare capacity to reap financial benefit from

unless a forced migration policy is followed. This implies that the broadcaster would have to pay for dual illumination. • If market adoption to new technology is slow, this could hamper broadcasters business plans as well as project timeframes for switchover • None of the features of digital terrestrial broadcast makes it attractive enough from a commercial perspective in South Africa. • Cost to the viewer will increase. In addition the cost per viewer will increase	Therefore the public awareness campaign is likely to be costly due to the quality of awareness as well as the length of the awareness campaign.	frequency reuse

Table 4

10. MIGRATION OPTIONS

There is no evidence of any prominent driver influencing the introduction and/or take-up of digital broadcasting in South Africa. All studies currently focus on the feasibility of digital broadcasting and are not necessary dictated by the *necessity* of digital broadcasting in South Africa.

A review of international case studies show that there are different drivers for different countries. Research in the UK shows that the single biggest driver for the take-up of services was access to a wider variety of programming viz 73% whilst 48% of the non-adopters would only switch to digital for the free-to-air services.[17] The UK government, like most European countries also had strong reasons to optimise use of frequency as well as to raise revenue through spectrum auction to 3G service bidders. It is significant to note that none of the DTT licenses had been auctioned. The auctioning of the 3G licenses in Europe is not generally seen as having been a success. Operators were left extremely cash strapped after spending abnormally high amounts bidding for licenses, thus impacting on the rollout of 3G services which requires major capital investment. The 3G spectrum is in the 2.5GHz band. In the interest of economic sustainability and progress, it is therefore recommended that South Africa resort to a beauty contest model to select digital broadcasting operators.

South Africa demographic data show little flexibility to introduce more commercial broadcasters despite 'better' technology platforms. This then rules out with certainty the possibility of commercialisation being a driver to introduce digital broadcasting in South Africa. Neither are there compelling market forces in South Africa to suggest that spectrum freed up could be readily used by 3G or other services. The TRASA report on frequency allocation is to be released shortly where the planning considerations for spectrum use in South Africa would be described.[18] Against this backdrop, the various options that South Africa could adopt are outlined with the accompanying implications in table 5.

[17] source: UK Consumer Survey March 2001 – Consumer Association
[18] source: ICASA

OPTION ONE STATUS QUO BROADCASTING	**OPTION TWO** INTRODUCE DIGITAL BROADCASTING WITH MARKET FORCES SHAPING ENTRY AND EXISTENCE	**OPTION THREE – RECOMMENDED** **INTRODUCE DIGITAL BROADCASTING USING MANAGED MARKET TAKEUP STRATEGY**	**OPTION FOUR** INTRODUCE STAGED DIGITAL BROADCASTING USING A COMBINATION OF DEIVERY PLATFORMS
Broadcasting to continue as described in section 2 of this report via a predominately analogue terrestrial network. Satellite technology could be used for expansion into the underserved rural areas The lifespan of this method could be extended to a further 10-15 years before technology obsolescence would force broadcasters and audiences to migrate to digital broadcasting. <u>Perils facing Broadcasters:</u> Broadcasters would be faced with high cost per viewer budgets to meet universal service obligations through expansion of the existing analogue transmitter network. Thus digital broadcasting would eventually be thrust upon South Africa	Government to purely facilitate the introduction of new services and the granting of licenses. This could prove attractive to Pay TV services and smaller niche and regional operators that do not wish to be on satellite. This approach would not be linked to other national objectives to create an information society in South Africa. This approach would therefore not be directed by strong drivers to influence the shape of digital broadcasting in South Africa. Mostly upper income group South Africans would benefit from digital television services.	**There is no clear market demand for services at present. Thus a managed / forced migration would be an effective way of achieving various goals within desired timeframes eg universal service, minimising digital divide etc.** **A managed / forced approach also induces economies of scale benefits the most obvious of which is the driving down of costs through greater market penetration.** **Government would impose a moratorium on analogue roll-out as well as announce an early and fixed switch off date for analogue. This method is then a Leap Frog to digital and would be a more instantaneous way of providing access to multiple services and multimedia universal service of which education is a key**	An option is to introduce new services in metropolitans first with a plan to later expand services to the rest of the country, as frequencies become available. The profile of consumer and the disposable income in these areas could lead to successful commercial and advertising-revenue driven broadcast models which could in turn ease the financial investment for expansion. Such a migration plan should obviously bear the interests of the existing analogue broadcasters in mind. Therefore protection of existing analogue services in terms of interference levels would be of the utmost importance. Satellite technology could be used for expansion into the underserved rural areas. Signal could then be relayed to community viewing centres or multi –purpose

[19] Australian ABC was able to roll-out Digital Broadcasting with strong government support in alignment with universal service goals. Source: ABC Public Broadcasting in the Information Age Report December 1997

OPTION ONE STATUS QUO BROADCASTING	**OPTION TWO** INTRODUCE DIGITAL BROADCASTING WITH MARKET FORCES SHAPING ENTRY AND EXISTENCE	**OPTION THREE – RECOMMENDED** **INTRODUCE DIGITAL BROADCASTING USING MANAGED MARKET TAKEUP STRATEGY**	**OPTION FOUR** INTRODUCE STAGED DIGITAL BROADCASTING USING A COMBINATION OF DEIVERY PLATFORMS
where the consequences would be the absence of proper planning. South African broadcasters and service providers would be affected by the availability of analogue technology, technical support and availability of analogue content should South Africa remain analogue whilst the rest of the world migrates to digital.		**component** **Subsidised receiver equipment for consumers could be used as an incentive and catalyst** **In addition government would have to subsidise the migration for the public broadcaster as the existing funding model (refer to page 3) would not be able to cater for digital broadcasting.** [19]	community centres. (MPCC) As costs come down and through financially successful roll-out in the metropolitan areas, DTT transmitters fed off satellite could be installed to provide local distribution. This method would be feasible even for the allocation of spectrum as this is not a scarce resource in the rural areas.

Table 5

11. RECOMMENDED OPTION AND STRATEGY FOR SOUTH AFRICA

The digital broadcasting proposition for South Africa does not readily pass the accessibility, affordability and take-up test criteria with overwhelming results. South Africa as a country faces more imposing challenges with higher budget priorities for education and health. However it is crucial that the long term benefits of creating an information society not be overlooked because of short-term budget and national priorities.

Digital broadcasting, if implemented in such a manner so as to leap-frog technology can be deployed strategically –

- to meet national education objectives using distance education technology solutions
- provide the means to distribute public broadcast content to all South Africans (universal service) through DTT's increased transmission capacities.[20]
- present commercial broadcasters with an opportunity to maximise additional revenue streams through DTT's increased transmission capacities

Thus government must acknowledge that South Africa is not in a state of readiness to easily meet the accessibility, affordability and take-up test criteria for digital broadcasting and attempt to address the underlying reasons for this. Clearly the major disadvantage of Option One is poor or no project planning which readily removes this Option from further consideration. This would lead to the option that the only manner in which South Africa could go towards constructive economic and social development would be to use a Managed Take-Up Strategy viz Option 3.

This approach is not be to be mistaken for an unwelcome market entrance that is imposed upon public and industry. Rather it is crucial that all stakeholders understand this approach to be the most suitable method to link into national objectives to grow economy, achieve universal service and ultimately create an information society in South Africa.

It is further recommended that government make a decision on the roll-out for digital broadcasting with a commencement date being 2002. This would allow sufficient time for

[20] refer to page 5 ±6M South Africans do not have access to broadcast signal

proper and comprehensive planning that would take into account financial impact, staffing and skills impact, technology impact and impact on society amongst other factors.

The choice of analogue services should gradually be reduced once DTT services are widely available, nudging consumers towards digital. (refer to the reasons why most consumers in the UK moved to digital see page 28). The first roll-out should commence at the latest by late 2003. Analogue broadcasting may then be terminated in 2012 coinciding with capital replacement plans for existing transmitters as well as giving the consumer market ample time to orientate to the new technology. South Africa would also gain the benefit of technology maturity by adhering to this proposed timetable.

Option 4 is recommended as a second choice. Areas with high roll-out priorities are metropolitans, educational institutions and learning centres as well as areas with no access. Consideration needs to be given to the subsidisation of minimum base receivers that can provide access to DTT at a minimal entree cost. Option 3's faster and forced migration would yield significant savings in double illumination transmission costs as analogue services may be switched off sooner and/or reconfigured in accordance with commercial and/or universal service targets.

For successful implementation, the coming together of political, regulatory, frequency planning, network planning, programme content and marketing stakeholders is a vital precursor. Technical issues must be dealt with before implementation or commencing with public information campaign to avoid confusion in the market.

In addition, the following factors must guide the adoption strategy:

- South Africa is part of the global market and as such must follow the best-proven trends.
- A single STB approach should be promoted for digital services. Due to the practical constraints of achieving this, the recommended minimum specification receiver should be adopted to allow for the reception and decoding of free to air DVB-T television services. (refer to the SADIBA WG1 report) A digital to analogue converter which conforms to this minimum receiver specification can be used when migrating from analogue to digital. The cost of such a converter would decrease as a high demand for the units will meet economies of scale production

- The benefits of using CA for TV licence collection must not be overlooked
- The new DTT technology must allow for a migration from SDTV to wide screen and HDTV as part of a long term plan as is possible with DVB-T
- In the interest of minimising the Digital Divide over the short to medium term, consumers must be encouraged and incentivised to use interactive services.

CONCLUSION

Digital broadcasting challenges existing business models for both service providers as well as content producers. The decision matrix is complex, requiring comprehensive consideration of all related factors. Broadcasters, industry, policymakers, facilities and service providers are facing the greatest and most ominous challenge since colour TV.

Digital broadcasting elevates audiences to a critical stakeholder position in the decision-making process. Technology factors whilst requiring earnest consideration to ensure effective implementation is the least influencing factor against the social and economic backdrop of South Africa where the country would gain vast benefit by adopting digital broadcasting solutions to meet national objectives.

IN VIEW OF THE ABOVE, IT IS RECOMMENDED THAT SOUTH AFRICA PURSUE OPTION 3 AS A FIRST CHOICE WITH OPTION 4 BEING THE SECOND CHOICE.