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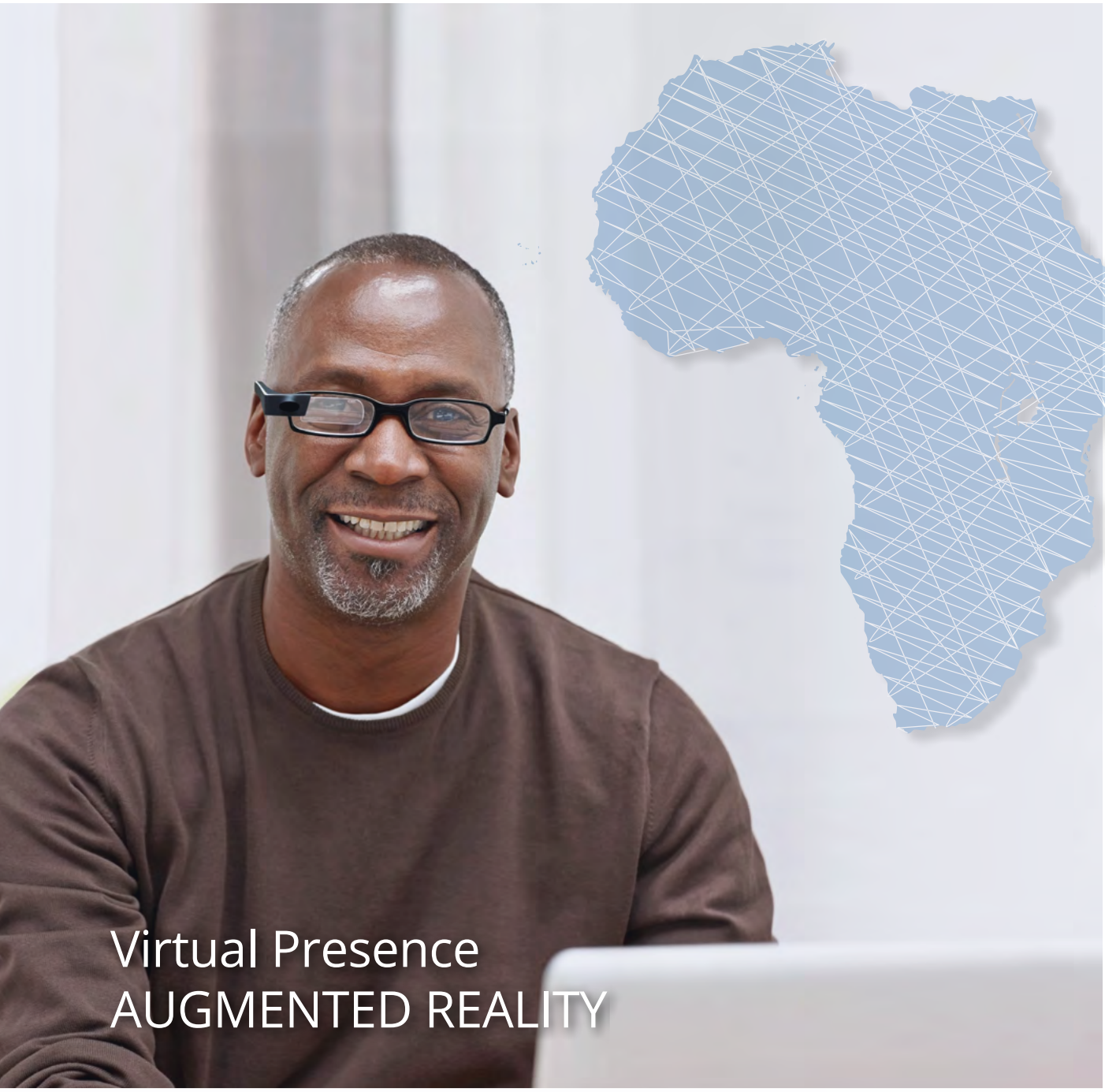

AUGMENTING CONFORMITY ASSESSMENTS, PEER EVALUATIONS AND AUDITS

A Paper written by Dr. Ronald Josias

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TABLE OF CONTENTS

ACKNOWLEDGEMENT

Dr Ron Josias prepared and published the first edition of very useful guidelines for Accreditation Bodies in Remote Assessment in December 2020. That guidance document was one way to show PAQI's attempt to provide guidance to accreditation bodies and conformity assessment bodies embarking on the optimization of digital technology to their assessment and audit processes.

It has become very obvious that COVID-19 has changed the way we conduct our day to day businesses, including accreditation assessment and conformity assessment activities. In this current piece of work, VIRTUAL PRESENCE – Augmented Reality, Dr Josias looked into how advances in technology and internet security have the potential to mitigate the impact of social distancing, limiting the conduct of on-site assessments and audits. He explored how augmented reality (AR), more specifically AR glasses, can help accreditation and conformity assessment providers transform how they conduct their business.

I find in this publication yet another useful tool necessary for our continued efforts to adjust to our new realities in the business of quality infrastructure. Augmented reality reassures us that truly virtual presence is possible if we address a few identified challenges. PAQI leadership and her institutions will continue to provide evidence-based scientific support to African economies in the area of building confidence in our trade and minimising technical barriers to the trade of goods and services.

I wish to express my gratitude to everyone who made this publication possible. A special thanks go to PTB of Germany for their continued support to PAQI and specifically for initiating, contracting, and printing this publication.

I am grateful to the author of this publication. We are honoured to have in you a committed QI professional ever ready to share your experiences and continually contribute to the growth of accreditation and quality infrastructure globally.

I hope this article will expand the conversation adjusting to our new realities through optimizing technology within the quality infrastructure space.

Celestine O. Okanya
Chairperson, Pan-African Quality Infrastructure (PAQI)
and DG/CEO, Nigeria National Accreditation Service (NiNAS)

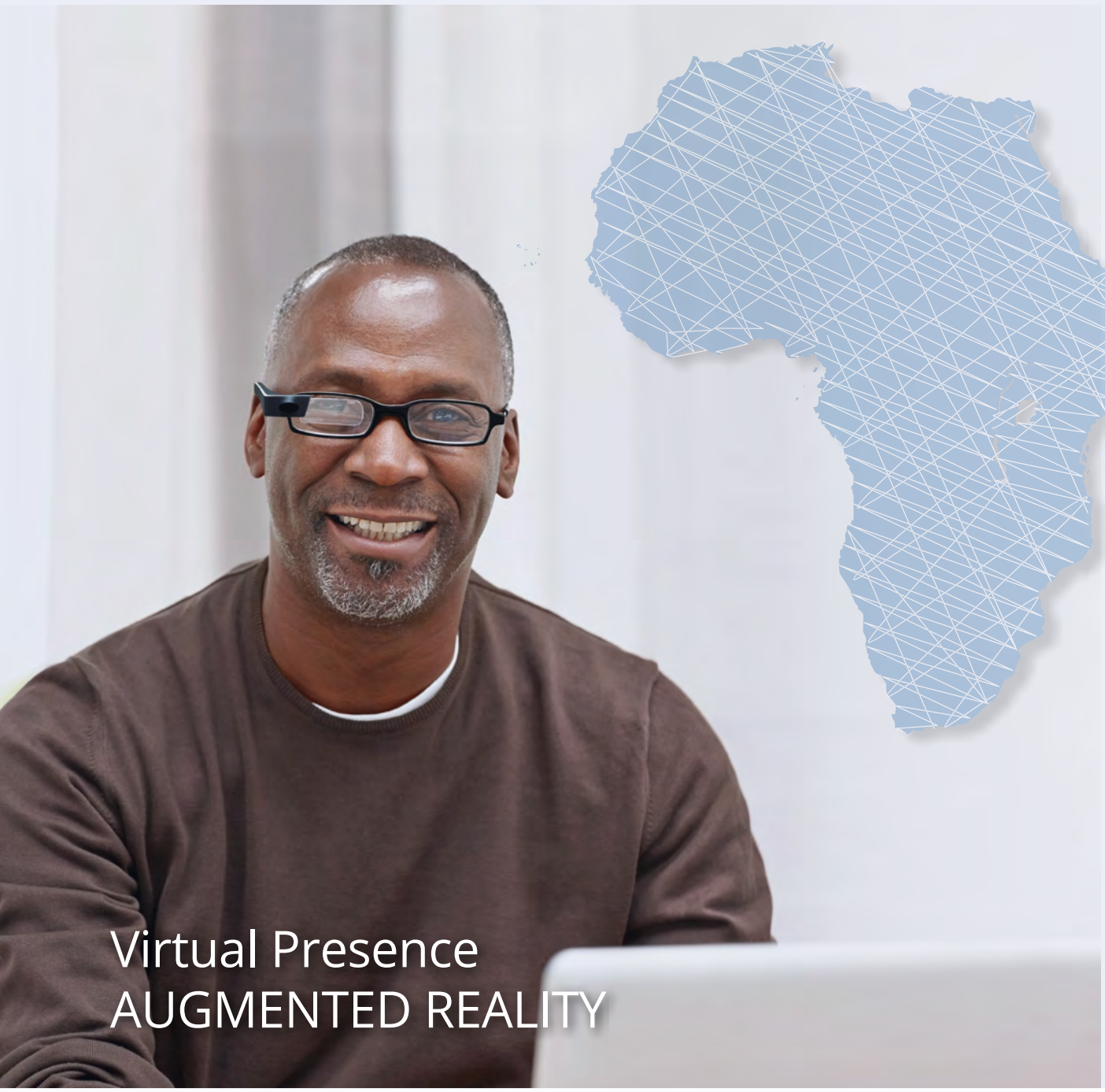
EXECUTIVE SUMMARY

Social distancing to contain the COVID-19 pandemic has hampered the ability of Accreditation Bodies, Regional Accreditation Cooperations and Conformity Assessment Bodies to perform on-site assessments, witnessing and audits. In the case of accreditation, on-site engagement, including witnessing of activities, is an integral part of recognising the conformity assessment body's competence to perform the work within its scope of accreditation.

Advances in technology and internet security have the potential to mitigate the impact of social distancing, limiting the conduct of on-site assessments and audits. This publication explores how augmented reality (AR), more specifically AR glasses, can help accreditation and conformity assessment providers transform how they conduct their business, engage with and add value to their clients whilst mitigating against disruptive risk.

The paper starts with an overview of augmented reality, followed by a discussion of the structural, social and economic considerations of adopting this technology. It then presents a case study based on a project piloting the use of AR glasses within the accreditation and conformity assessment space. It concludes with lessons learned and recommendations.

By considering relevant aspects of AR technology, this paper found that if AR technology constraints, such as internet connectivity, economic considerations and resistance to change, can be addressed, then AR technology is an economically viable alternative to on-site face-to-face evaluations, assessments, etc. that allows for the effective witnessing of on-site activities, remote training and remote assessments.



AUGMENTING CONFORMITY ASSESSMENTS, PEER EVALUATIONS AND AUDITS

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1 INTRODUCTION

There is no doubt that COVID-19 and significant advances in information technology have fast-tracked a new norm in virtual co-working. Augmented reality (AR) is part of this new trend and quickly becoming an integral part of many aspects of our daily lives. AR promises to improve our business processes, by making them faster and more effective and thus enhance our productivity.

The COVID-19 pandemic and technological advancement has increased our reliance on technology and lowered many acceptance and adoption barriers. As a result, AR technology is gaining momentum in healthcare, law enforcement, maintenance, mining, training and many other sectors. A study by PWC predicts that growth in augmented reality and virtual reality can boost the global GDP by 1.5 trillion USD by 2030 (PWC, 2020)[1]. Thus, augmented reality is here to stay and will change the way we live and work in the future.

In contrast to other sectors, the conformity assessment industry, such as accreditation, verification, inspection, auditing, testing, certification and others, has been slow to take advantage of augmented reality's opportunities.

This publication explores how augmented reality, and specifically augmented reality glasses, can help accreditation and conformity assessment providers transform the way they conduct their business, engage with and add value to their clients whilst mitigating against disruptive risk. It starts with an overview of augmented reality, followed by a discussion of the structural, social and economic considerations of adopting this technology. It then presents a case study based on a project piloting the use of AR glasses within the accreditation and conformity assessment space. It concludes with lessons learned and recommendations.

1 PWC, 2019. Seeing is believing; How virtual reality and augmented reality are transforming business and the economy

2 WHAT IS AUGMENTED REALITY?

Definitions of augmented reality and AR glasses abound. For the purposes of this publication, augmented reality is defined as an enhanced version of the actual physical world achieved using digital visual elements, sound, or other sensory stimuli delivered via technology.[2] AR glasses, also referred to as smart glasses, can be defined as wearable augmented reality devices worn like regular glasses or mounted on head wearables, e.g. caps, headbands, etc., that can merge virtual information with physical information in a user's field of view.

Virtual reality and AR are often erroneously used interchangeably. In contrast to virtual reality, which creates a virtual world, AR brings valuable information from the digital realm into the real physical world.

Currently, a wide variety of technology companies are developing and manufacturing AR glasses. Some well-known models include Google Glass, Microsoft HoloLens, VUZIX series of glasses, Toshiba dynaEdge, ThirdEye Gen X2 and many more.

2 Adam Hayes, 2020. Augmented Reality (AR) Definition (investopedia.com)

3 WHO USES AUGMENTED REALITY GLASSES?

The application of augmented reality glasses is expanding as more and more industries becomes aware of the value AR can add to their business and people's lives. Some of the first adopters are the healthcare industry, logistics management, automotive industry, and maintenance industries, applying augmented reality glasses in surgical visualisation, training, remote access to experts, patient education, laboratory support, law enforcement, inspection, logistics and equipment maintenance, to name a few.

Within the audit space, one of the adoptors is the Clorox Company, specialising in waste audits. The organisation cites cost saving resulting from reduced travel and personnel costs and increased efficiency as reasons for investing in AR glasses.

Diagram 1: AR glasses applications

4 WHAT ARE THE CRITICAL CONCERNS IN THE ADOPTION OF AR TECHNOLOGY?

As with many other technologies, AR technology is subject to numerous political, economic, social and technological constraints.

Political

AR has existed since the 1960s. The technology has experienced a renewed interest since the 1990s, as critical concerns such as data security and broadband internet were addressed. As AR technology advances with a rapid pace, governments, which are responsible for protecting human health and safety and safeguarding human rights such as the right to privacy and personal data protection, need to prioritize regulating the sector.

It is generally accepted that innovations fail due to poor communication, underestimating or ignoring the impact of change, lack of leadership and resistance to new technology. The evolution of prior technologies such as smartphones, social media, and many others has made the current generation more open to adopting new technologies. At the same time, new challenges emerge such as heightened awareness of privacy, intellectual property protection, information security and general health and safety.

On the one hand, existing regulations concerning intellectual property, health and safety and others have not kept pace with technological developments and are currently under review in many countries. On the other hand, new regulatory initiatives as under way. However, due to the fact that regulations take time to pass, technological developments will always be ahead of regulatory requirements.

Economic

The major strength of AR lies in its ability to provide relevant information when required at an ever-diminishing cost to businesses and individuals. Previously, the cost of AR contributed to the slow uptake of the technology, despite the fact that it promises numerous advantages. Although it can be argued that this is still the case today for most developing countries, the benefit of AR outweighs the cost of AR by far. The increasing global competition in AR technology exerts downward pressure on prices, making AR technology more and more affordable to the public and business. As models with new features enter the market, including opportunities to wear, hold or transport AR devices, more and more industries and individuals decide to invest in AR.

Social

The current workforce is predominantly made up of Generation X, the Millennials, and Generation Z. Each of these generations shares a different experience that has shaped its culture and worldview[3]. Changes in work due to technological developments affect each generation differently. Therefore, change management is becoming an essential part of an AR implementation strategy. Change management may include approaches to prepare, support and help staff, clients and relevant stakeholders.

Technological

Improvements in AR hardware, firmware and software produce an array of AR glasses models, quickly making relatively new hardware redundant. Although improvements are reasonable, they come at a cost to the users when improvements require hardware replacement. Most hardware requires software that is developed by third-party developers and made available on a subscription basis. The software is mainly designed for a specific industry or function, thus adding to the cost of AR glasses ownership. As with the hardware, competition in software development may also drive subscription costs down as trails and free limited applications are made available to AR users.

3 Note: A good example of generations can be found on YouTube created by Dream Reach Media (A Millennial Job Interview – YouTube)

5 WHAT ARE THE STRUCTURAL REQUIREMENTS?

Before adopting AR technology, it is important to understand its structural requirements and limitations. These requirements concern the Information and Communication Technology (ICT) infrastructure (hardware, software, firmware, networks, website, etc.), internet connectivity and human capital.

5.1 ICT Infrastructure

ICT infrastructure encompasses the ICT equipment and system, including software, hardware, firmware, networks, and websites used in an organisation. In the context of this paper, ICT infrastructure can be understood as the AR hardware, the associated software and infrastructure such as computers, ICT network and internet connectivity and the relevant protocols and procedures that are used to enable an organisation to work remotely.

AR hardware

AR equipment consists of both wearable and hand-held devices. Due to the need for hands-free operation in most technical fields, greater emphasis is put on developing wearable devices. Many major players in the communication space, such as Google, Samsung, VUZIX, Apple and others, continue to introduce wearable devices in the industrial, social media and other areas. The hands-free hardware typically consists of smart glasses with built-in applications and a main unit and battery. Battery life, suitability, ergonomics and cost play a significant role in selecting the most appropriate type of AR hardware.

AR firmware and software

Firmware refers to the software that runs the low-level control program of the device (AR glasses) and is usually an integral part of the hardware enabling basic operations. AR software, generally required in addition to the glasses, is usually proprietary software developed for a specific application. In most cases, it requires subscription to use and maintain the functionality. For example, audio and visual links between the glasses and a computer in most cases need proprietary software. Therefore, software and hardware developers conclude agreements to operate their software on a given manufacturer's glasses. An example of such a relationship is VUZIX and Wideum, a remote-service technology company, using "Remote Eye" software to allow two-way communication and visuals, cloud hosting and various other functionalities on VUZIX glasses.

ICT network and internet connectivity

Improved network speed, latency, bandwidth and internet throughput are key enablers of the renewed interest in AR and the broader

Definitions in context

1. In the context of this paper, ICT infrastructure can be understood as the AR hardware, the associated software and infrastructure such as computers, ICT network and internet connectivity and the relevant protocols and procedures that are used to enable organisations to perform remote work.

2. ICT infrastructure encompasses the equipment and system, including software, hardware, firmware, networks and websites used in organisations.

3. Limitations include the Information and Communication (ICT) infrastructure (hardware, software, firmware, networks, website, etc.), internet connectivity and human capital.

4. AR firmware and software: While AR glasses come with various firmware pre-loaded to ensure its basic control and operation, AR software is, in most cases, proprietary software developed for a specific application.

adoption of AR technology. As AR technology requires two-way communication and data transmission (visual and audio), reliable and stable internet connection is required. Thus, bandwidth, latency and throughput need to be sufficient to allow for uninterrupted data transmission. For example, while using AR glasses, connecting via a guest account is not advisable as the company normally limits these bandwidths. Similarly, latency due to signal reach needs to be controlled. It is also advisable that a portable Wi-Fi router be considered, should a person move out of the range of the regular connectivity supply.

6 HOW CAN AUGMENTED REALITY GLASSES SUPPORT CONFORMITY ASSESSMENTS?

As with many industries, accreditation did not escape the impact of the COVID-19 pandemic. Although it is a growing necessity for trade, accreditation is generally perceived as expensive for most current or prospective clients. Some would argue that accreditation bodies have been under pressure for a long time to find solutions to the perceived high cost of obtaining and maintaining accreditation especially because accreditation clients consist mainly of small and medium-sized enterprises.

Technological developments, accelarated by the onslaught of COVID-19 and the positive experience in the application of AR technology in many industries, have provided an opportunity for accreditation bodies to address some of the cost and other challenges facing the accreditation industry.

The cost of accreditation is even more prohibitive for developing countries. Some organisations obtained accreditation through development agencies' technical and financial support, only to lose it after funding ceases. The extensions in accreditation scope between scheduled assessments, changes in the accredited conformity assessment bodies, such as relocations and staff changes, as well as time limitations to witness activities or part of activities between scheduled assessment further add to the challenges faced by accreditation bodies and justify an alternative means of conducting assessments. Therefore, AR technology deserves a renewed appreciation for offering increased productivity and cost effectiveness in delivering and maintaining accreditation. AR technology offers various advantages for accreditation bodies and their customers.

Pros	Cons
• Cost-effective service delivery possibilities; • Hands-free and comfortable to wear, allowing fewer interruptions; • Ease of scheduling and reduced costs and time (no travel, accommodation, courier cost); • Simplification of assessor monitoring through online monitoring; • Effective maintenance of confidentiality and data integrity; • Minimised "assessor burnout" as a result of long-distance travel before an assessment; • Increased assessor utilisation due to elimination of travel time; • Integrity based assessment due to recording/transcription data storage capabilities; • Value-adding supporting functions to CABs such as training, supervision, etc.; • Improved transparency and management controls; and • Solution for accessing remote locations.	• Omission of non-verbal clues; • Problems with internet connectivity; • Problems with evidence gathering/access to information: slow access or lack of electronic information (only hard copies); • Health concerns (e.g., screen fatigue, dizziness, etc.); • CAB staff commitment and unease with technology; • Risk of pre-recorded "staged" demonstrations vs real-time witnessing; • Lack of representatives for each assessor due to one shared connection by the CAB; • Unauthorised participants with access to information raising data protection and confidentiality concerns.

Table 1.1: Pros and cons of AR

	Item	Estimated cost saving	Additional expediture
1.	Administration	25%	
2.	Travel cost (road, train, flights, etc.)	100%	
3.	Visas (where applicable)	100%	
4.	Accommodation	100%	
5.	Per diem allowance (as applicable)	100%	
6.	Internet data	0%	100%
7.	Equipment (e.g. glasses, computers, AR software)		70%
8.	Training		100%

Table 1.2: Estimated possible cost savings and additional expediture

It can vastly improve productivity and cost savings beyond the application of assessments, training, technical support, and many other applications. To benefit from AR technology, users also need to be aware of its weaknesses. In addition to the challenges highlighted in Section 4, attention should be paid to the loss of personal touch, compared to face-to-face interaction, limited awareness of surroundings and other factors (See Table 1.1: Pros and cons of AR).

6.1 An economic argument for the adoption of AR technology

Benjamin Franklin once wrote that time is money, referring to the fact that time is a valuable resource. The statement is even more relevant today as we continue to combat the persistent COVID-19 pandemic and face the high cost of time spent on travelling, administration and associated activities.

Using AR glasses within the assessment, peer evaluation, audit, training and supervision fields has the potential to introduce significant time and cost savings. Time-saving in administration and travel, as well as direct cost saving in travel costs such as flight tickets, accommodation, visas, and per diem allowances favour the adoption of AR glasses. A relevant case study can be found here.[4]

Table 1.2 provides some insight into the possible costs and savings associated with the adoption of AR technology in accreditation and conformity assessment.

4 https://www.thecloroxcompany.com/blog/reimagining-waste-audits-to-be-simpler-faster-and-more-sustainable/

6.2 Concerns with remote AR assessment

Various forums on remote assessment highlight the increased risk of unethical conduct by conformity assessment bodies when assessed remotely. Such conduct may compromise the integrity and reliability of the assessment. Unethical conduct includes hiding non-compliance with requirements, selectively providing information and witnessing opportunities, misrepresenting individuals being remotely assessed, and others.

Such risk is always present, even in a face-to-face assessment, although to a different degree. However, it should be noted that accreditation is not a "policing" activity but merely an attestation to a body or person's competence to perform specific tasks. The onus thus resides with the body or the person being assessed to be truthful in the demonstration of their competence. Nevertheless the accreditation body is responsible to put in place a mechanism to protect the integrity of the assessment. Such mechanisms should include transparency commitments in submitting information to the accreditation body, proof of competence verification and declaration by the conformity assessment bodies, and clarification of sanctions, should the conformity assessment body be found guilty of unethical conduct.

Accreditation attests to the competence of a body or a person and is thus not a "policing" exercise.

7 APPLICATION OF AUGMENTED REALITY GLASSES AND SOFTWARE

A PILOT CASE STUDY CONDUCTED IN SOUTHERN AFRICA

7.1 The context

The recently published international standard that lays down the requirements for accrediting conformity assessment bodies, ISO/IEC 17011:2017, introduced electronic means to conduct remote assessments. Remote assessment is defined as assessing a conformity assessment body's physical location or virtual site using electronic means.

The COVID-19 pandemic and the emergence of virtual sites, electronic document management systems and general application of ICT in the workplace have accelarated the need for the effective implementation of remote assessments to improve the effectiveness and efficiency of the accreditation assessment processes. In addition, the social distancing requirement to combat the spread of the coronavirus has challenged the conformity assessment body's ability to ensure compliance with the relevant accreditation requirements. More specifically, accreditation requires both administrative and technical verification of an organisation's ongoing competence.

Although the administrative component of the verification can be completed using tools such as *dropbox*, *zoom* and other teleconferencing platforms, the on-site verification poses a practical problem to the accreditation and peer evaluation process. Some have resorted to on-site cameras, cellphone recordings, and pre-recordings of practical components. These methods all introduce one challenge: it is disruptive and often prevents the person performing the work from using both hands.

Witnessing a conformity assessment body's competence to perform a specific task is a critical part of the accreditation process. It confers or confirms the technical competence and accreditation status of a conformity assessment body. The social distancing measures implemented to combat the spread of COVID-19 have severely impacted the accreditation body's ability to verify a conformity assessment body's competence on site.

Pilot site selection

The site for the pilot project was selected from some of the entities that might benefit from the use of AR glasses within the conformity assessment space. These include the accreditation bodies, certification bodies, and the regional accreditation cooperations.

As the AR glasses can also support training, technical support, maintenance, etc. other bodies may also benefit beyond enabling conformity assessment compliance.

In June 2020, the Physikalisch-Technische Bundesanstalt (PTB) assigned a project consultant to investigate the application of AR glasses to assist with the remote witnessing as part of an accreditation assessment and a certification audit.

After reviewing the current AR glasses on the market and their suitability for auditing, assessment and peer evaluation purposes, the *VUZIX 300XL* AR glasses and an annual subscription for the propriety Remote Eye software from *Wideum* were procured. Three sites with different applications were initially identified for piloting the software, namely an accreditation assessment, a certification audit and an evaluation of a Regional Accreditation Cooperation. In addition, another pilot was planned as a cross-border pilot. However, due to the COVID-19 travel restrictions and safety risk, this evaluation was postponed.

During the planning phase, key concerns regarding confidentiality, intellectual property and safety were resolved by signing a non-disclosure agreement. A short question and answer session addressing concerns was held.

During the preparation phase, concerns regarding the glasses' battery life, internet connectivity, and safety concerns resulting from blind spots came to the fore. Battery life for the

equipment used was estimated to be between one to three hours, depending on use. Provisions were made for changing batteries without losing connectivity. A built-in battery allows for an uninterrupted change of battery within 60 seconds. Internet connectivity emerged as the greatest challenge.

7.2 The exercises

The first pilot exercise was performed between an accreditation body (The South African National Accreditation System) and one of its accredited laboratories (The South African Bureau of Standards). The Consultant set up the exercise after a non-disclosure agreement was signed by all parties (Consultant, Accreditation Body and Laboratory). The Consultant hired an additional person to support both the laboratory and accreditation body staff. After a short training session and equipment setup, two-way audio and visual communication was established.

Although internet connectivity challenges only allowed for a rudimentary evaluation of the application, positive feedback was received from the assessors. More specifically, some of the advantages identified by the participants included the quality of the sound and picture and the possibilities for application of the AR glasses in various other areas of the accreditation process, such as approval of signatory between full surveillance or re-assessments and remote training.

The second pilot exercise was conducted in a certification audit, walking through the manufacturer storehouse. After signing the non-disclosure agreement, the organisation's employees received a quick overview of the glasses. Next, the Consultant set up the equipment and established a two-way audio and visual communication. The staff members then visited the storage room and clear communication between the Consultant's computer and the person wearing the glasses was established.

Overall, the feedback from participants in the second pilot was positive, noting similar advantages as the first pilot. However, the exercise highlighted the need to match the equipment with the intended purpose. For example, due to the high noise levels in the factories, industrial-type AR glasses would be more suitable for such assessments. Industrial-type glasses are more robust and control background noises much more effectively than standard AR glasses. Furthermore, the glasses limit the peripheral vision, which requires higher safety awareness when wearing the glasses and walking in high-traffic areas, such as a factory.

Internet stability, background noise levels, safety concerns and concerns of a possible reduction in Assessors/Auditors benefits previously derived from travelling and per diem allowances to witness assessment/certification activities and equipment cost were crucial concerns raised during the audit.

The third pilot was conducted in a small industrial research laboratory to witness a test being conducted. During this pilot a laboratory staff member and an observer, both on site, were joined by another observer from a remote location. The on-site participants walked through the laboratory and focused

User Feedback

- Will definitely make auditing from a distance advantageous, and insight can be obtained from the process view.
- You are able to communicate clearly with someone and seeing what they are doing and reading without having to be with them in one room. The emergence of COVID-19 has made this technology even more important for organisations like ours.
- The function of remote viewing and interaction is very useful. Lower cost for certain functions due to the ability to remotely connect, interact and communicate.

on certain laboratory activities. The laboratory staff member demonstrated various functionalities of the glasses including reading fine print, picture quality as he walked through the laboratory, and clear communication with both observers.

In addition to the challenges identified by the previous pilots, two further ones were pointed out during this pilot: issues with the battery life and the ability to adjust the sound on the glasses.

7.3 Lessons learned

Overall, the use of the AR glasses received positive feedback from the participants. In particular, the participants recognised the potential of using the glasses in various processes in and outside the accreditation process, such as avoiding expensive travel and accommodation, maintenance and remote assistance, training, etc. However, the following issues should be addressed before adopting the use of AR glasses:

Internet Connectivity

In two of the three pilot exercises, internet connectivity presented the biggest challenge. However, in both cases, connectivity problems could have been avoided. In the first case, a dedicated internet connection was created for the pilot. However, the signal's reach was limited, and thus, every time the person was observed moving out of range, connectivity was lost. Unfortunately, the signal loss occurred in the laboratory under evaluation, and thus a complete evaluation could not take place. In the second case, connectivity was secured via a guest connection. However, as companies usually restrict bandwidth on guest connections, latency and dropped connections occur frequently. Therefore, the main lessons learned concerning internet connectivity are:

- Ensure internet connectivity with sufficient bandwidth is present in the area where the equipment will be used. If going outside, it is recommended that a portable router with adequate bandwidth is used to connect the glasses. Furthermore, some AR glasses, such as the VUZIX glasses, can accommodate a WIFI extender.
- Avoid "guest" connections unless the company allows for sufficient bandwidth. It usually is better to connect to the company's WIFI network.

Safety

All glasses are built with safety in mind. However, when users have to move around, especially in high-volume areas, caution should be exercised as the glasses introduce a blind spot and wearing them can be distracting. Thus, awareness of one's environment is crucial.

Excessive background noise

Although in most cases accreditation assessment and conformity assessments are performed in spaces with relatively acceptable noise levels, in some contexts, such as workshops, mechanical plants, etc., noise levels can be excessive. Therefore, it is essential to understand the environment in which the AR glasses will be used before procuring the glasses. Fortunately, the AR market offers an array of glasses suitable to different environments.

Loss of staff benefits

As previously stated, AR technology makes new modes of working possible, which may influence staff benefits. Remote assessments supported by AR glasses reduce the need for travel, accommodation and per diem allowances usually paid to Assessors when conducting assessments outside a predetermined area. Over the years, these payments have become an attractive motivation for conducting assessments. To address these changes, organisations need to invest in change management processes, understand their legal obligations towards their staff and find ways of accommodating staff's concerns.

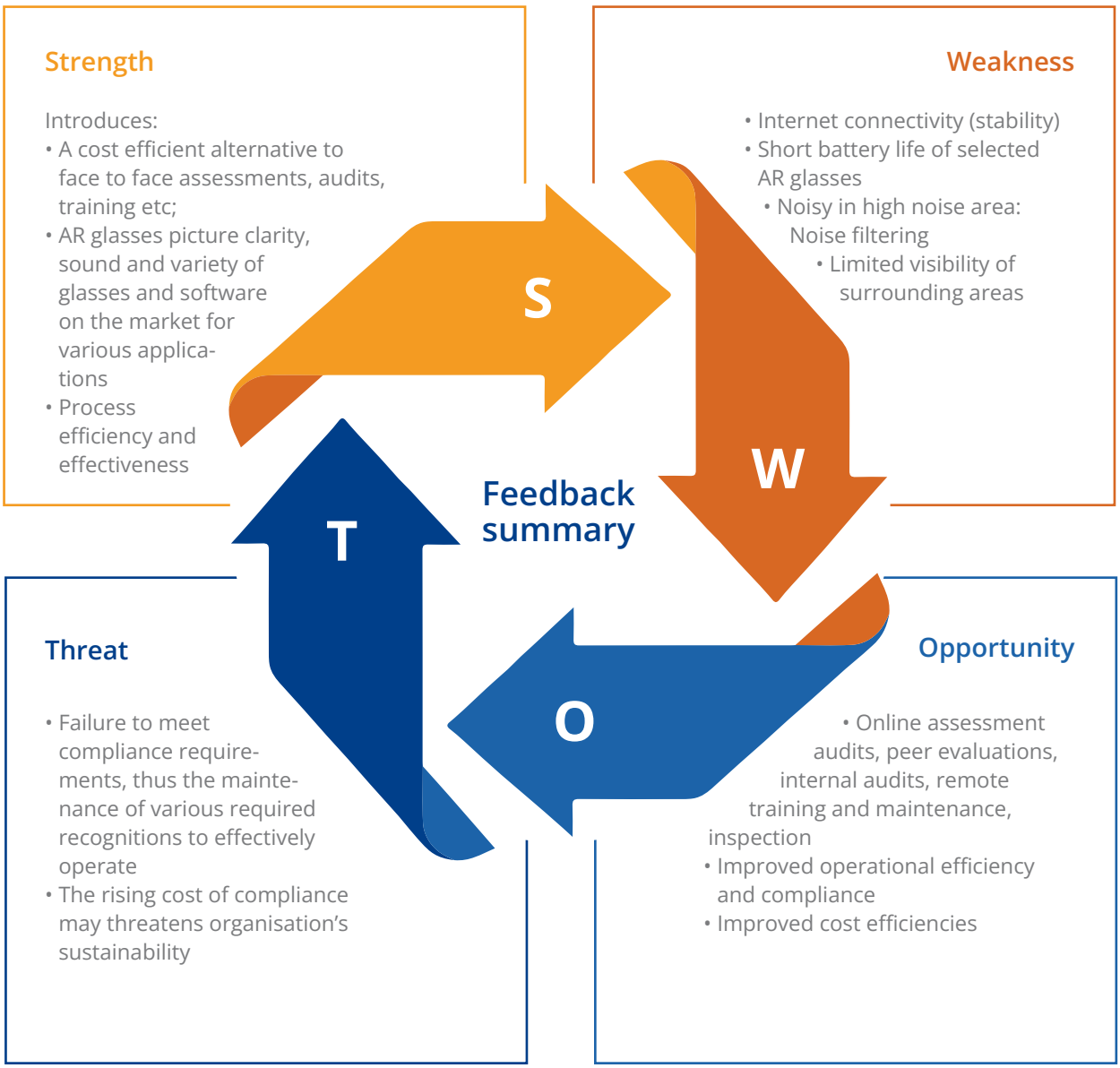

Diagram 2: Summary of feedback received

Economic considerations

The economic benefit of using AR technology and the downward pressure on the price of AR devices is gaining traction due to increasing competition in the AR technology space. The cost of AR glasses can be offset against the cost of travel, accommodation, other associated costs and the possibility of using the glasses in for other purposes such as training, remote support to field workers, internal audits of remote sites, etc. However, it can be argued that the initial cost for small enterprises could be prohibitive as they will have to procure the glasses for their own use. Possibilities exist for Accreditation Bodies or independent providers to rent out AR glasses on a daily or monthly basis, as needed. Thus, the use of AR glasses could become more affordable.

7.4 Recommendations

Although limited in its implementation, the pilot project provided some helpful insights into using AR glasses to support the assessment, peer evaluation, and audit processes.

To fully exploit the benefit from the use of AR technology, the following recommendations need to be considered:

- The weaknesses identified should be addressed;
- A complete evaluation should be undertaken to test the full extent of the use of AR glasses;
- The type of AR glasses should be selected to match the environment in which they will be used;
- The conformity assessment body should preferably buy AR glasses. However, the benefit and the diverse application of the glasses should be promoted by the regional body, the accreditation body and the auditing company, e.g. certification body; and
- Should the procurement of the glasses be a challenge for the conformity assessment bodies, the AB should consider making such glasses available for rent at a nominal daily fee to the conformity assessment body.

8 CONCLUSION

The correct application of AR can introduce cost efficiencies and improve productivity of the accreditation, audit assessment and evaluation processes. For the client of these services, the AR smart glasses can provide additional advantages such as training, remote technical support, and internal audits.

The pilot study's outcome is overwhelmingly positive; however, the participants also expressed some key concerns. The main one relates to the need for a stable and reliable internet connection with sufficient bandwidth to accommodate both visual and two-way audio communication. Furthermore, safety concerns require attention. Depending on the environment in which the glasses will be used, caution should be paid to safety, especially in areas with heavy machinery such as a factory with forklifts. Lastly, background noise can interfere with two-way communication. Selecting the most suitable glasses to match its application is thus essential.