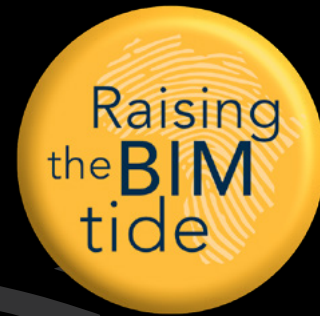




BIM
COMM
UNITY
AFRICA



Convention for a Digital eSouth Africa: CoDE-SA



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CONVENTION FOR A DIGITAL ESOUTH AFRICA: CoDE-SA

(The White Paper)

By

BIMcommUNITY.Africa

Authors:

Innocent Musonda, Amanda A. Filtane and Angela Lang

a. **Musonda, I.** Centre of Applied Research and Innovation in the Built Environment (CARINBE), University of Johannesburg, BIM Community Africa

b. **Filtane, AA.** Sustainability oriented + Cyber research Unit for the Built Environment (S+CUBE), University of Cape Town, BIM Community Africa

c. **Lang, A.** BIM Community Africa, Executive Director and Community Coordinator

This white paper is presented in part, towards a series of papers in the development of a South African digital infrastructure delivery, beyond Building Information Modelling policy.

This paper is intended to inform and guide in the development and implementation of a National South African Policy on Digital Infrastructure, Design, Delivery, Operations and Management.

August 2023

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1. About BIMcommUNITY.Africa

BIMcommunity.Africa was formed in 2018, as a community of BIM professionals and advocates, to collectively Raise the BIM tide. This purpose was premised on the adage of a rising tide lifting all boats. The intention was to find a way to collaborate by leaving badges and agendas at the door and engaging in activities and initiatives which would improve the overall environment for the adoption and implementation of BIM practices. It is a community that encompasses members from across the project life cycle, from owners all the way through to facility managers. The intent is to create a communal place that facilitates the sharing of information, knowledge and resources that enable the strengthening of each 'party's BIM efforts.

It is an NPC (non-profit company) which is overseen by four executive directors and a board of eleven business professionals. Over the 5 years since its inception, BIMcommUNITY.Africa has hosted two conferences, collaboratively staged and hosted BIMHarambee 2020 (month-long) and BIMHarambee 2021 (week-long), an online event with BIM Africa, a community based in Nigeria. We have also recently hosted BIMHarambee 2023 at the University of Pretoria. The community has also hosted podcasts and participated in the Big 5 Construct in Johannesburg in 2022 and 2023 as well as participated as speakers and facilitators at several industry events. All to promote the BIM message and encourage its adoption.

1.1 CARINBE - University of Johannesburg

The Centre of Applied Research and Innovation in the Built Environment (CARINBE) partnered with the BIMcommUNITY to produce this white paper. The centre is set up within the School of Civil Engineering and Built Environment (SCEBE) at the Faculty of Engineering and the Built Environment (FEBE) at the University of Johannesburg. CARINBE conducts research, train and support the industry towards going digital in infrastructure delivery.

1.2 S+CUBE - University of Cape Town

Sustainability oriented + Cyber research Unit for the Built Environment (S+CUBE) is a research unit housed within the Department of Construction Economics and Management at the University of Cape Town. S+CUBE research focus areas include the Implementation of Digital and Virtual Technologies in the South African Engineering and the Built Environment. Research topics cover Digital Education and Digital Implementation, including professional development, tertiary education, buildings and infrastructure, community development, sustainability and well-being as well as life cycle assessments. Within the unit, research projects include Digital Production Management, Digital Delivery and Management, Smart cities-precincts-rural spaces, Sustainability index for housing, among other 4.I.R related topics within the Engineering and the Built Environment.



Part: 1
The need for
BIM in SA

2. Current BIM state in SA and why BIM is so necessary for the Built environment.

The South African built environment, like many other nations, faces a range of challenges that have historically hindered the efficiency, quality, and sustainability of construction projects. The challenges include inadequate collaboration, high construction costs, poor project management, regulatory compliance issues, and ineffective stakeholder communication.

However, BIM has emerged as a powerful solution that can effectively address these challenges and revolutionize how projects are conceptualized, designed, constructed, and maintained. BIM has shown tremendous potential in the industry, providing a more efficient and effective way to manage construction projects. BIM enhances the creation and management of information about infrastructural projects throughout their entire life cycle. While BIM offers many potential benefits, its adoption has been slow in many countries, including South Africa.

The slow adoption of BIM in South Africa is due to several factors, including a lack of awareness and understanding of what BIM is and its benefits, limited government support, and the reluctance of the industry to invest in new technologies. The built environment is a major contributor to South Africa's economy, and the adoption of BIM could have a significant impact on productivity, costs, and infrastructure quality. Therefore, in this section we discuss the current state of BIM in South Africa and its necessity to the Built Environment.

2.1 Study Approach

In order to determine the current state of digital transformation in the built environment of South Africa and profile the response of stakeholders in the built environment to preferred methods of digital adoption, a mixed method approach involving a nationwide survey, undertaken by Centre for Applied Research and Innovation in the Built Environment (CARINBE), was carried out between 2022 and 2023 with 339 responses cut across all the South African provinces as shown in figure 1a. The consultative survey was validated with qualitative approaches, including stakeholders in the built environment (government departments, professional bodies, and built environment institutions). These approaches included semi-structured interviews and webinars. The workshops were organized and facilitated by the BIMcommUNITY.

2.2 Respondents Demographics

The demographic distribution of the respondents revealed widespread participation by professionals in the built environment, as presented in Figure 1a. The distribution of survey responses across the provinces corroborates the surveys geographic range and coverage. The respondents cover the nine provinces of South Africa: Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, Northern Cape, Northwest and Western Cape. The majority of the respondents were from the Gauteng region (51%), with fewer responses from the Western Cape (13%), KwaZulu-Natal (11%), Eastern Cape (6%), while the Northwest and Free State provinces made up 5% respectively. The spread is representative of the main economic areas in the country where firms mainly operate or have offices. While it is demonstrated that professionals are spread across the country, operations are undertaken mainly in the provinces of Gauteng, Western Cape and Kwazulu-Natal. This suggests that strategic interventions directed to these prominent areas will cover more professionals.

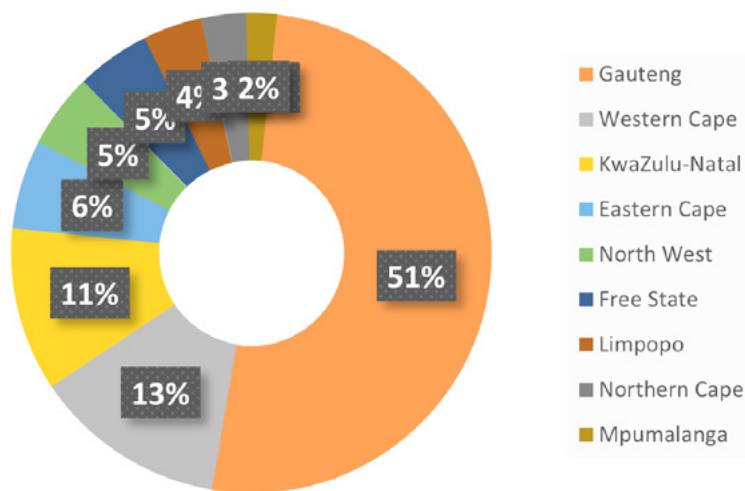


Figure 1a. Geographic representation of respondents.

The majority of the respondents were Project/Construction managers (37%), followed by Civil/Structural Engineers (29%), Quantity Surveyors (26%), while Architects made up 16% of the population, as presented in Figure 1b. Responses from contractors comprised about 15% of the survey feedback, and Academics were 15% of the responses. Other built environment professionals who participated and were indicated are; BIM Managers/Coordinators, Electrical Engineers, Land Surveyors, Facilities Managers, Mechanical Engineers, Construction Health and Safety Officers and Building Inspectors. Notably, Project/Construction Managers constituted the largest group, accounting for 37% of the respondents. This is not surprising given their prominent role in infrastructure delivery within the country and how other professionals such as Architects, Engineers and Quantity Surveyors are also registered as construction/ project managers. This highlights their prominent role in overseeing and implementing BIM-related projects, suggesting that their involvement in crafting BIM policies is critical to its adoption. Following closely, Civil/Structural Engineers made up 29% of the respondents, showcasing the importance of BIM in design and structural engineering processes. Quantity Surveyors, at 26%, also played a substantial role, indicating their interest in the relevance of BIM in cost estimation and project budgeting. Architects, comprising 16% of the population, are actively engaged in BIM adoption, underlining its significance in architectural design and planning. Contractors and Academics each accounted for 15% of the survey feedback, signifying the interest and involvement of these key stakeholders in the BIM discourse.

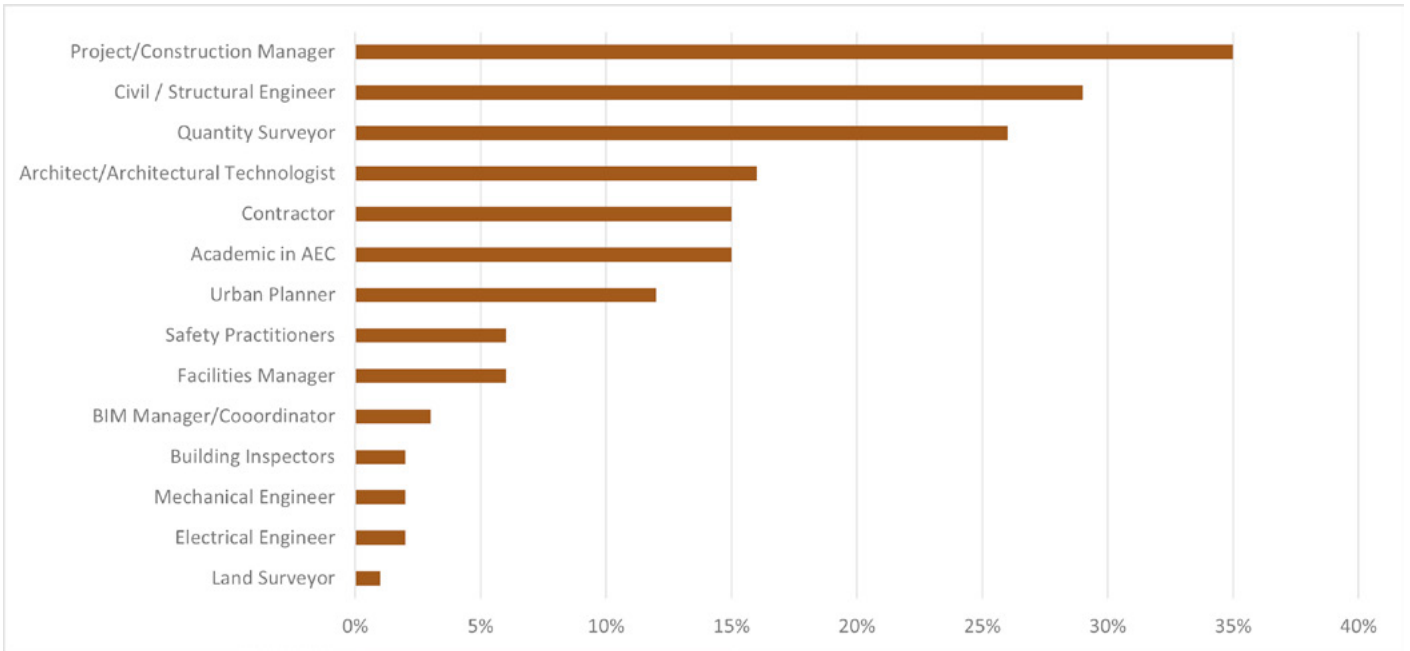


Figure 1b. Study Respondents

2.3 Level of Awareness of Building Information Modelling in the South African Built Environment

The survey revealed an average level of awareness of Building Information Modelling (BIM), with about (32%) indicating they are averagely aware of it and (28%) identifying a low level of awareness. 7% of the respondents identified a very low level of awareness as their experience. Only 16% and 17% of the respondents indicated a very high a awareness level, respectively.

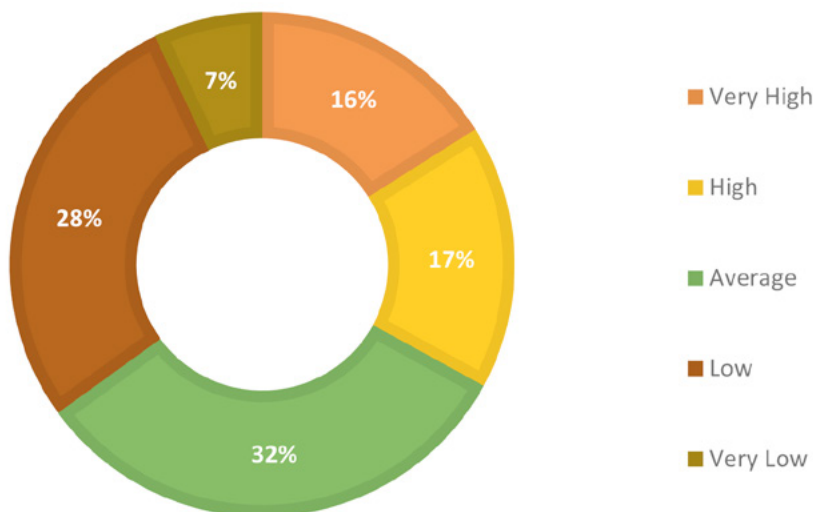


Figure 2. Level of awareness of Building Information Modelling (BIM) in the Built environment

The low level of awareness of BIM is not surprising, and it is a major factor in the low level of adoption and implementation of BIM in South Africa. This is further supported by other findings discussed below. The low level of awareness confirms the need for this paper, which aims to provide strategic approaches to enhance adoption by driving awareness and usage. The level of awareness is significantly lower compared to developed economies such as the United States of America (USA), the United Kingdom (UK), some EU states, as well as prominent Asian countries^[1]. Therefore, a government position to drive adoption is imperative to improve implementation, as done by countries with high adoption rates^[2]. As a leading country on the Fourth Industrial Revolution (4IR) drive in Sub-Saharan Africa, implementing the positions suggested with reinforcing and establishing South Africa's vision as central to emerging digital technologies to improve socio-economic indices, empower people, and increase the quality of life.

2.4 Use of BIM-based cloud platforms

The use of cloud-based BIM environments indicates a high level of implementation and digitalization. Therefore, respondents were asked if they had worked on project(s) that had implemented a BIM-based cloud platform. Of those asked, about 66% indicated that they had never used BIM-based cloud platforms, while 30% stated that they were currently using a cloud-based platform (Figure 3). The high percentage of respondents who indicated that they had never worked or been exposed to cloud-based BIM platforms revealed a need for raising awareness, training and, education and support. Only 30% of the respondents indicated they had cloud-based platforms in their ongoing projects. This subset of professionals underscores the progressive movement towards leveraging the advantages of cloud-based platforms for streamlined BIM workflows. What this implies about the state of BIM adoption in South Africa is that while awareness is low, implementation is also low. These findings collectively underscore the importance of promoting awareness and providing support for cloud-based BIM adoption within the South African industry. By addressing the needs of the majority who have not yet ventured into cloud-based BIM and by learning from the experiences of the 30% who have, the industry can pave the way for broader and more effective implementation of cloud technologies in BIM projects, ultimately enhancing the state of BIM adoption in South Africa.

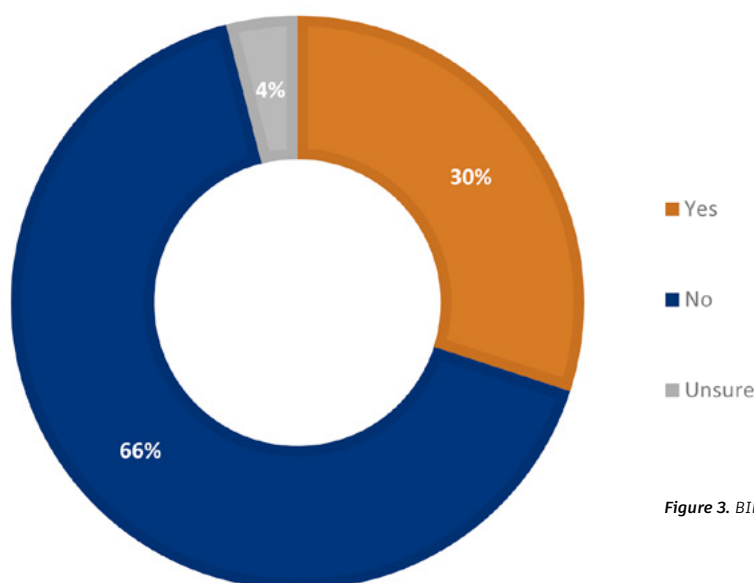


Figure 3. BIM-based cloud platform use

2.5 BIM Understanding/Knowledge

Establishing BIM knowledge is imperative in understanding the level of awareness amongst the participants and the industry in general as it relates to the correct application and appetite for the concept. The study revealed that 44% of the respondents indicated that BIM is a process, while others stated that BIM is 3D CAD (16%), not software (8%), a single building model (7%), and the rest (25%) said it was all the mentioned descriptors (Figure 4).

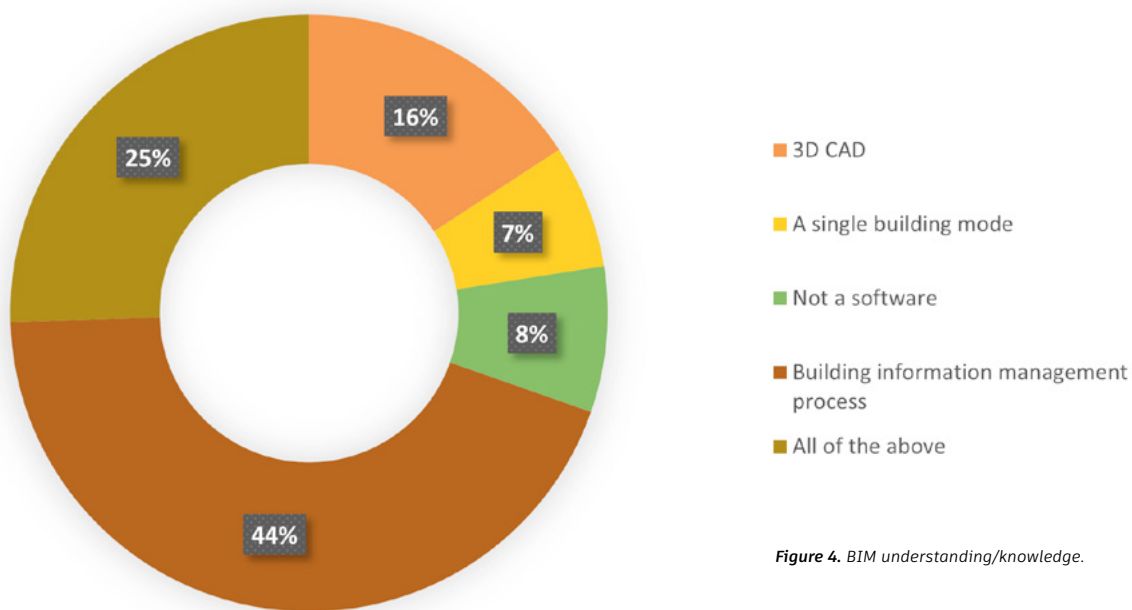


Figure 4. BIM understanding/knowledge.

A notable 44% of the participants acknowledged that BIM constitutes a process. This recognition underscores an accurate understanding of BIM as more than just a tool, indicating a grasp of the holistic approach it embodies in the life cycle of a project. In contrast, 16% of respondents identified BIM as synonymous with 3D Computer-Aided Design (CAD). This viewpoint signifies a correlation between BIM and spatial representation, although it may fall short in encapsulating BIM's broader scope, which encompasses data integration and collaboration. Interestingly, 8% of participants disassociated BIM from software, suggesting an awareness of BIM as a concept that surpasses a singular technological solution. This perspective acknowledges BIM as an encompassing philosophy rather than a mere software application. A modest 7% of respondents characterized BIM as a solitary building model. While this view captures the foundational principle of using a digital model to represent a structure, it doesn't fully encompass the interconnected data-driven nature of BIM that enables enhanced project management. A subset of participants (25%) perceived BIM as encompassing all the options mentioned above. This comprehensive perspective recognizes BIM as a multidimensional concept that encompasses processes, 3D modelling, data integration, and more.

2.6 BIM Adoption Stages

Regarding the implementation of BIM in their organizations, 44% of the respondents revealed they were at the non-usage stage. This finding revealed a significant portion of the industry that is yet to embark on the BIM journey, signalling both potential for growth and a need for awareness and education. 20% indicated that they were at the trial phase, suggesting a growing interest and recognition of BIM's potential benefits as organizations initiate preliminary efforts to understand its practical implications. While only 5% had fully adopted and integrated BIM into daily built environment operations. This subset of pioneers serves as an exemplar for the transformative power of BIM, highlighting its capacity to revolutionize workflows, enhance collaboration, and yield efficiencies. Also, it demonstrates that there is a huge potential for BIM adoption in the industry. This, therefore offers service providers such as software and hardware suppliers a market to tap into and also an opportunity for growth for construction firms.

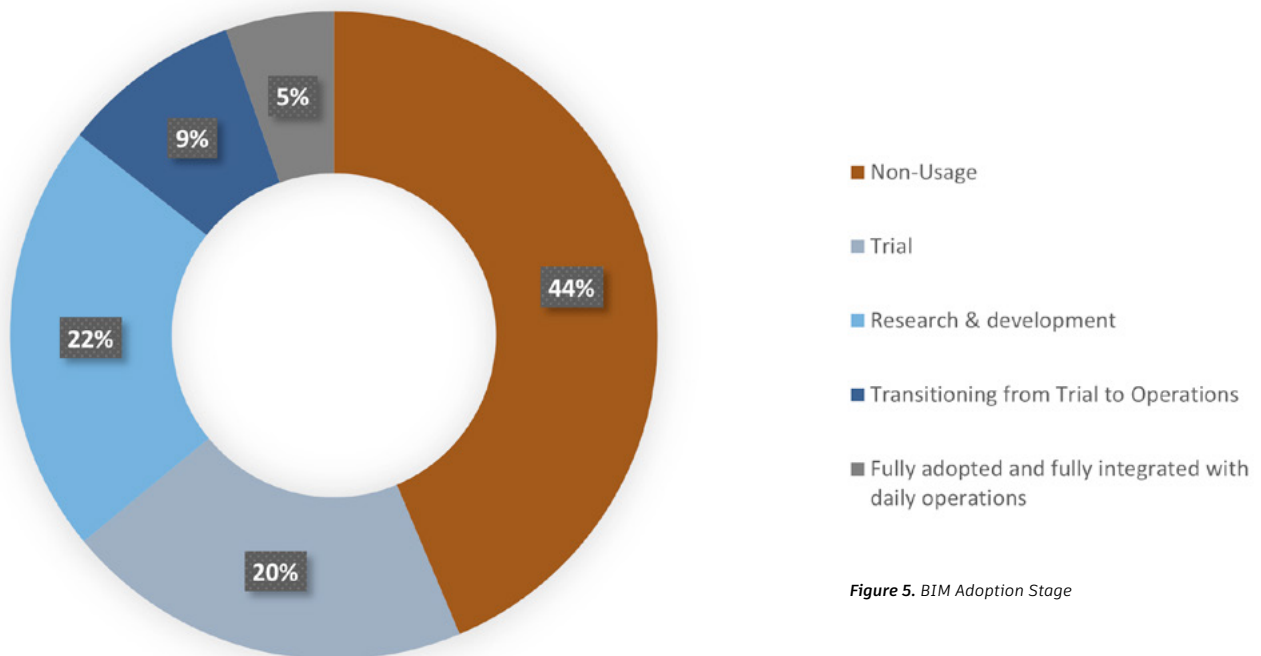


Figure 5. BIM Adoption Stage

2.7 Use of BIM Authoring and Management Tools

Various authoring and management tools were presented to the respondents to indicate how often they used them at the different project stages namely: inception, concept and viability, design development, construction and close-out/handover stages. The tools included Autodesk BIM360 (Construction cloud), Bentley ProjectWise, Hexagon Enterprise Project Performance, Trimble Connect, Leica GeoMoS, Archicad, Aveva E3D Design, BIM Cloud service, Cype Architecture, BIMx, Autodesk Revit, Vasari, Vectorworks, BricsCAD, Navisworks, Solibri Model Checker, Scia Engineer, Vico systems Onuma, and 4projects. Findings revealed that the Autodesk suite were the most widely used in South Africa.

Specifically, Autodesk BIM360 and Autodesk Revit were the most used software. The respondents also noted ‘ ‘Bentley’s ProjectWise as another tool that was mostly used in the industry (Figure 6). However, as usage represented is only a fragment of industry professionals. This represents an opportunity for the promoters of these tools to introduce strategic approaches in ensuring the widespread adoption of these tools tailored to the capacity of different organizations. This is imperative given the socio-economic divide typical of the South African economy and the widening digital divide between large firms and SMEs.

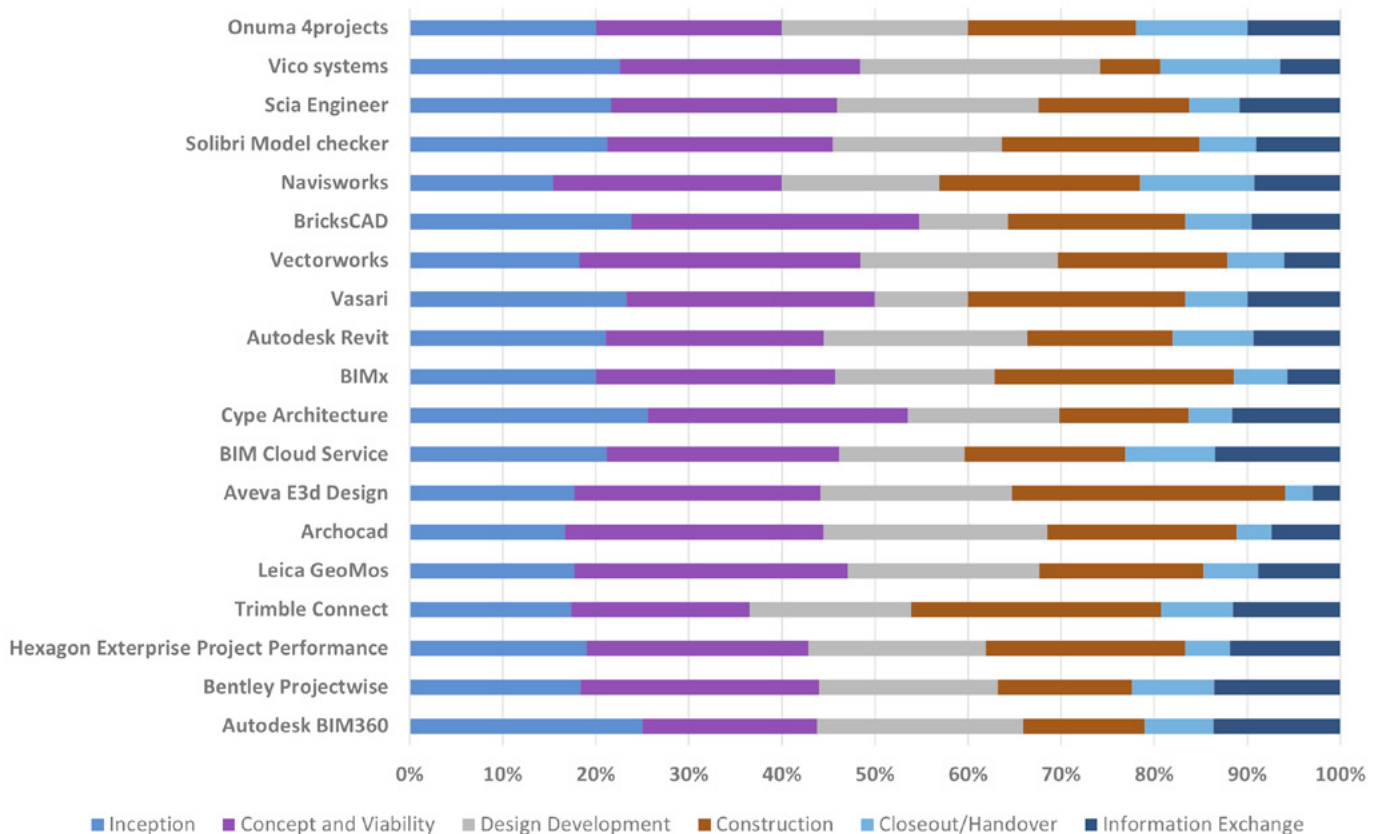


Figure 6. Use of Authoring & Analysis Tool

2.8 BIM Standards

Building Information Modelling (BIM) standards are a set of rules that define how BIM models are created, managed, and used. These standards ensure that BIM models are consistent and can be shared and used by different stakeholders throughout the construction life cycle. These standards cover various aspects of BIM, including data management, information exchange, modelling, and collaboration^[3]. The primary objective of BIM standards is to facilitate efficient and effective communication and collaboration among project stakeholders, minimize errors and rework, enhance project quality, and boost efficiency. Some of the most widely recognized BIM standards include ISO 19650, which provides a framework for managing BIM data, and the National BIM Standard-United States (NBIMS-US), which provides guidelines for BIM use in the US construction industry.

Using BIM standards can also enhance interoperability and use in the US construction industry. Using BIM standards can also enhance interoperability and make it easier for project teams to exchange data between different software and systems. This can help to improve collaboration and communication, and lead to better decision-making^[4]. BIM standards are continually evolving to keep pace with new technologies and industry requirements, and their adoption is becoming increasingly critical for successful project delivery. In giving indications of the level of usage in the South African Built Environment, 68% of respondents who have adopted BIM indicated ISO19650 as the most adopted BIM standard, while the others less used includes NATSPEC and BS/PAS 1192.

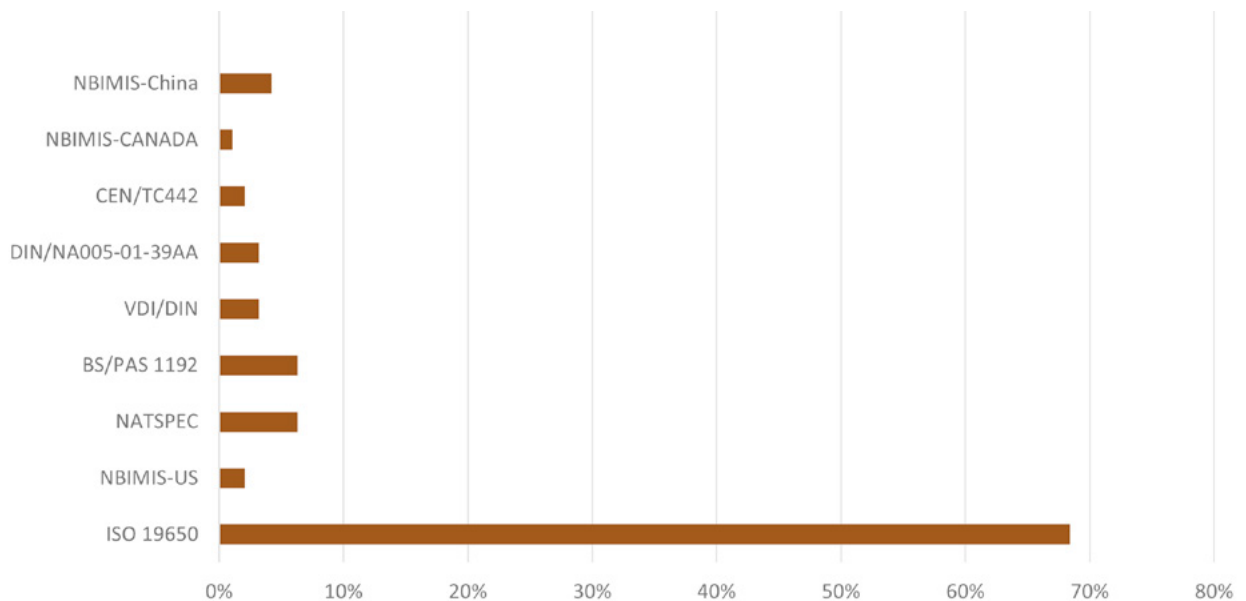


Figure 7. BIM Standards

2.9 BIM Adoption Barriers

With the low level of adoption as found regarding BIM adoption and digitalization, the respondents were asked to indicate the likely barriers from their experience on the impediments to BIM adoption. The respondents indicated Capital availability as the most pronounced barriers to adoption (53.1%), followed by Education/Training (47.5%), Lack of client demand (39.5%), low awareness (38.9%) and lack of financial resources (37%). Other main impediments indicated were the Availability of Incentives, Organizational Culture, Stakeholder influence, Complexity of BIM solutions, Lack of support from management, Lack of client demand and Lack of standards/guides. This implies the need for financial planning and investment strategies, comprehensive training programs and educational initiatives to bridge the knowledge gap, advocating for BIM among clients and demonstrating its value in project delivery, the need for awareness campaigns and outreach efforts to educate industry stakeholders about the advantages and potential of BIM. Also crucial is developing financing options and exploring cost-effective solutions to bridge the digital divide. Overcoming these barriers will be essential to drive increased BIM adoption and digitalization, ultimately transforming and improving the South African built environment.

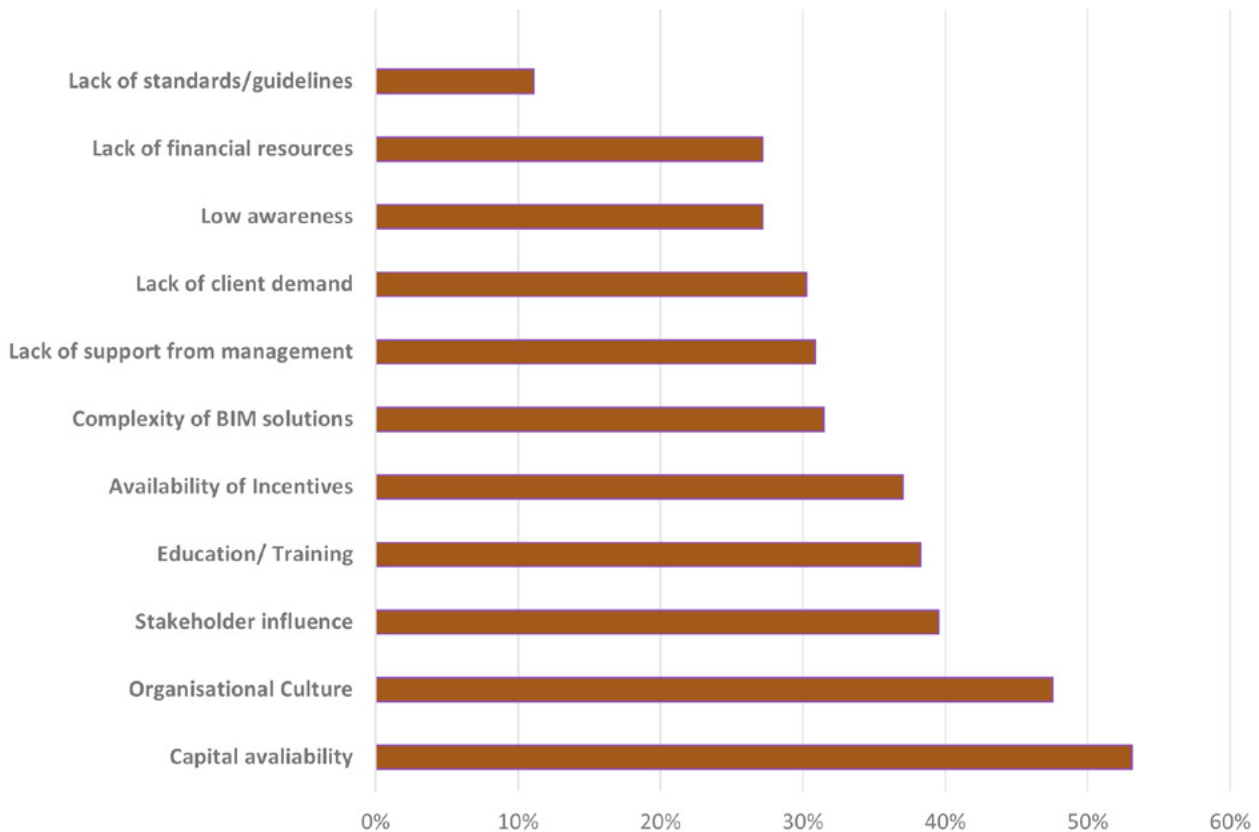


Figure 8. BIM Adoption Barrier

2.10 Proposed Road Maps

The built environment in South Africa is poised for transformational change as BIM technologies and applications become increasingly prevalent. However, there is a need for a coordinated and strategic approach to promote BIM adoption across the industry. In response to this need, we have proposed several road maps that can help South Africa develop a clear and effective strategy for advancing BIM adoption. Each roadmap is designed to address a specific area of need or opportunity, ranging from BIM implementation in government projects to upskilling the workforce and developing BIM standards and guidelines. By following these road maps, South Africa can establish a strong foundation for BIM adoption that supports innovation, collaboration, and competitiveness across the built environment. The road maps we have recommended for promoting BIM adoption in South Africa have been developed based on a range of inputs. These include feedback from stakeholders surveyed across the industry, an analysis of global best practices, and informed policy considerations. Each roadmap is designed to address a specific area of need, and we believe that by following these road maps, South Africa can develop a clear and effective strategy for advancing BIM adoption. The road maps are intended to provide a roadmap to guide the built environment towards a more collaborative and innovative future, where BIM technologies and applications can help to drive progress and competitiveness. The suggested approach is summarised in Tables 1 and 2 and discussed further with required action to be taken by built environment stakeholders indicated.

Proposed Road Map for South Africa

Key Areas	Best Practice	Status of South Africa	Gaps	Required Action	Period	Resource
Support	Public-Private Joint financing	Mostly Self-funded	No Government Finance	Dedicated Financing	Short Term	Budgetary Allocations Incentives
Standards	Alignment to existing / Self-Developed	No uniform Standard	No National Benchmark	National Roundtable	Short Term	Consensus Policy, OpenBIM
Common Data Environment	District Level Training	No usage of CDE	No Policy Direction	Dedicated Policy	Short Term	Defined Plans
Solution Providers	Talent Hubs, SME's Incentives / Product	Uptake is slow	No Synergy	Network Training Initiatives	Short Term	Secondary & Tertiary Education

Table 1. Proposed Road Map

Key Areas	Best Practice	Status of South Africa	Gaps	Required Action	Period	Resource
BIM Mandating Level	National, State, Authority Levels	No Mandated Levels	Mandated level required	Mandated at National, Provincial & Departmental Levels	Short Term - Long Term	Policy, Legislation, Incentives, Training
Government Role	Initiator, Regulator, Funding Agency and Driver	Not defined	Active Government Drive	Initiator, Regulator, Funding Agency & Driver roles	Short Term - Long Term	Policy, Legislation, Incentives, Training
Awareness	Government & Institutions Driven	Only Institutional Drive	No Government Synergy	Industry Engagement / Drive & Government Support	Short Term	Government Advocacy / R&D National Vision
Education / Training	Vocational Courses, Certifications E-learning & Degree Programs	Mostly, no formal training	Lack of Experts, Training & Initiatives	Vocational Courses, Certifications E-learning & Degree Programs	Short Term	Incentives, Policy, Accreditation, National BIM Requirements

Table 2. Proposed Road Map



Part: 2
BIM CODE-SA
Workshops

3. Qualitative findings from the BIM CoDE-SA workshops

BIM Community Africa is founded and rooted in the principle of meaningful collaboration, whilst appreciating the benefits of specialization, thus, the initiation and facilitation of the development of a BIM Policy for the South African Built Environment, through the BIM CoDE-SA workshops. The vision of the BIM CoDE-SA is to engage with key contributors within the South African AEC industry and all its governing constituents and co-produce the BIM policy, for adoption by the Cabinet of the Republic of South Africa. The policy is intended to define the Roadmap for meaningful implementation of BIM in the Built Environment of South Africa, for the benefit of its citizens.

3.1 BIM CoDE-SA, The Pilot

The first BIM CoDE-SA workshop was held in Johannesburg, South Africa on the 20th of April 2023, just one week prior to the nation's commemoration of Freedom day, a day in which the country's new constitution was introduced, post-apartheid. Founded on the principles of the Convention of a Democratic South Africa (CoDE-SA), the BIM Convention of Digital eSouth Africa (BIM CoDE-SA) aims to carry the attributes of the first collaborative and historic bodies, that lead our country in the transition to Freedom. CoDE-SA (1991) committed to bring about an undivided South Africa, with one nation sharing a common citizenship, patriotism, loyalty, diversity, equality and security, for all. BIM CoDE-SA mimics these attributes as it seeks to lead the nation in the transition to an optimum, Digital Built Environment. The Building Information Modelling project delivery methodology seeks to create and a rich and common data environment with the highest levels of loyalty amongst project stakeholders, loyalty and the highest levels of transparency, whilst ensuring data integrity and security. The BIM CoDE-SA aims to be an inclusive digital movement, that is aware of the socio-economic status of South Africa, thus ensuring that the development of the BIM Mandate is not driven by monopoly, rather, ensures that no one is left behind on this route to digital transformation.

3.1.1 BIM CoDE-SA One: Themes

The mammoth task of the pilot BIM CoDE-SA was the co-development of the need of BIM in South Africa. Whilst there is numerous research on the key benefits of this digital project delivery approach, did the practitioners within the South African industry find the need for it? (Figure number to be inserted at final formatting) below shows the key themes and terminologies that emerged from the discussions.

3.2 BIM CoDE-SA TWO: The Progress

The second BIM CoDE-SA workshop took place in July 2023, Johannesburg, South Africa, with the intention of continuing the tasks highlighted in the UJ-CARINBE survey findings, the CIDB brief on BIM mandate and the BIM CoDE-SA' 's first workshop. The second workshop was also a follow-up on the consensus reached at the first workshop, that a national policy was needed for the Digital Delivery of infrastructure projects in South Africa.

3.2.1 The Construction Industry Development Board brief on BIM implementation

The CIDB reported the following as a working brief for the BIM CoDE-SA 2:

- CIDB mandate to create a standard for RSA - a BIM Standard and Policy.
- Noted the support mechanisms that are required to develop a BIM policy.
- Emphasized the need for Construction industry to adopt Digital collaboration processes.
- The BIM Framework to be developed to create the environment for implementation of BIM in RSA.
- Participation of the emerging sector - important to be inclusive.
- Improved performance and best practice.
- Consider procurement - how we buy BIM and cater for the roles, relationships and duties.
- CIDB is looking at BIM as being one part in the bigger picture. BIM is one of many standards.

One of the related projects CIDB was involved in, is the development of the Register of Projects (RoP). The register captures what is going on in the country in terms of infrastructure development and will be used for project assessment and promotion of performance metrics. The performance metrics will be a key consideration on how to implement BIM - Performance and best practice. The key considerations include:

- How you measure will determine how you perform on BIM implementation .
- BIM requirement – for projects of a value > R20m and or Grade 7 rating.
- The need to hold an Industry Focus Group to determine the BIM threshold - Is Contractor Grade 7 right?
- SANS 19650 - Part 1 and 2 have been published. Part 3 is in progress, and therefore may need an ANNEXURE for RSA.
- CIDB mandate to create the National Annex of the ISO 19650. The Community will be invited to participate in the creation of the Annex. Annex – The question to consider is whether Part 2 and 3 should be together or separate?
- Part 2 - Annex to be developed, to be a best practice guideline, to start using and get accustomed to.

The key question addressed in this process was how the CIDB approach compares with the international journey? In which the response was for South Africa not to re-invent the wheel but to select best practice guides that fit our PESTELE context, especially in light of difference socio-economic standards. The CIDB emphasized the need for an Industry focus group to drive the development of the BIM national Annex, to ensure relevance, relatedness and contextual application.

3.4 Recommendations, The Future

The key task of BIM CoDE-SA 2 centred around the actual input needed for policy development. It is worth highlighting that the tide is rising! The first BIM CoDE-SA also gave rise to the collaboration with a key stakeholder in the South African Built Environment Industry - the Construction Industry Development Board (CIDB) - shared with the BIM Community the work the organization has been tasked with in terms of developing BIM Policy for South Africa.

Key Action Areas

Establish a National BIM Task Force: The government should create a specialized team consisting of industry professionals, academics, and government officials to promote the adoption of BIM in the country. This team would be responsible for developing a national strategy for BIM adoption, identifying key challenges and opportunities, and coordinating the efforts of various stakeholders.

Develop BIM standards and guidelines: The National BIM Task Force should collaborate with industry experts to create BIM standards and guidelines that are customized to the South African environment. This should include direction on BIM Levels 1-3, which sets out particular requirements for BIM implementation in government and industrial initiatives. It should include a process for getting feedback from industry stakeholders, conducting research and analysis, and establishing a governance structure for BIM standards development.

Provide funding for BIM research and development: The government should provide funding for research and development in BIM technology and applications. This can help to drive innovation and support the development of new tools and applications that are specifically designed for the South African market.

Dynamic Capacity Development to Upskill the workforce: The government and the industry should work together to provide training and upskilling opportunities for the built environment workforce in BIM technologies and applications. This can include training programs, workshops, and certification programs that will help workers develop the skills and knowledge they need to work with BIM tools and applications. Dynamic capacity development is an approach to capacity building that focuses on the ability to adapt to change and respond to new challenges. It emphasizes the importance of continuous learning, innovation, and collaboration to develop the skills and knowledge needed to succeed in a rapidly changing environment.

Establish a BIM Centre of Excellence: The government should establish a BIM Centre of Excellence to provide technical support, training, and guidance to stakeholders across the built environment. This centre should also be responsible for promoting awareness and understanding of BIM across the country.

Pilot BIM projects: The government should launch pilot BIM projects in various sectors of the built environment to showcase the advantages of BIM adoption and generate momentum for wider adoption. This can assist in overcoming resistance to change and establishing faith in BIM technologies and applications.

Monitor and evaluate progress: The National BIM Task Force should regularly monitor and evaluate progress in BIM adoption across the country. This can help to identify areas of success and areas that require further attention and support.

Government Leadership on Projects: This guidance should outline a step-by-step process for implementing Building Information Modelling (BIM) on government-built environment projects. It should include guidelines on BIM deliverables, workflows, and quality assurance procedures. This roadmap can help to ensure consistent and high-quality BIM implementation across government projects.

BIM maturity roadmap for built environment companies: This roadmap should help built environment institutions assess their current BIM maturity level and develop a plan for advancing to the next level. It should include guidelines on developing a BIM implementation plan, establishing BIM standards and workflows, and upskilling the workforce. This roadmap can help to build BIM capability and competitiveness among built environment companies in South Africa.

Central BIM Data Management Infrastructure and Guidelines: This approach should outline a strategy for managing Building Information Modelling (BIM) data across the built environment in South Africa. It should include guidelines on data ownership, data sharing, and data security. This roadmap can assist in ensuring that BIM data is managed securely and effectively, promoting collaboration and innovation across the built environment.

BIM Tools Affordability & Incentives: Licensing is an important aspect of the suggested road maps for promoting Building Information Modelling (BIM) adoption in South Africa. Incentive programs designed to encourage built environment stakeholders to invest in BIM software and applications will improve the efficiency and effectiveness of their operations. These incentives will be implemented through a variety of measures, including financial incentives, procurement requirements, and public recognition. Financial incentives can be given to businesses that invest in BIM software and applications, such as tax breaks, grants, or subsidies. Procurement requirements can be used to prioritize projects that use BIM software and applications, such as requiring government agencies and private sector clients to use BIM for all new projects. Public recognition can be given to businesses that have successfully implemented BIM software and applications, such as highlighting them in industry publications or awarding them prizes.

The incentives for BIM software and applications will be developed in cooperation with industry stakeholders, including software developers, built environment businesses, and professional associations. These stakeholders will provide input into the development of incentive programs to ensure that they are in line with industry needs and trends. The incentives for BIM software and applications will provide several benefits to the South African built environment. Firstly, they will encourage built environment stakeholders to invest in BIM software and applications, which will improve the efficiency and effectiveness of their operations. Secondly, they will promote the use of standardized BIM processes, which will improve interoperability across different projects and stakeholders. Thirdly, they will provide a mechanism for publicly recognizing companies that have successfully implemented BIM software and applications in their operations.

Small and Medium-sized Construction Companies: To help small and medium-sized enterprises (SMEs) adopt Building Information Modelling (BIM), the roadmap proposes a variety of initiatives. These initiatives include training and capacity-building programs, financial assistance, and access to technical assistance. Training and capacity-building programs will be developed specifically for SMEs to help them acquire the necessary BIM skills and knowledge to adopt BIM effectively. Financial assistance may be provided in the form of grants or subsidies to help SMEs invest in BIM software and hardware. Technical assistance will be available to SMEs to help them overcome any challenges they may face during the adoption process.

To ensure the effectiveness of these measures, the roadmap proposes that they are developed in collaboration with SMEs and their representative bodies. This collaboration will ensure that the measures are relevant to SMEs' needs and are delivered in a manner that is accessible to them.

The assistance provided to SMEs in adopting BIM will provide several advantages to the South African built environment. First, it will promote the adoption of BIM by SMEs, which will contribute to the overall success of the BIM adoption strategy. Second, it will promote the development of a more inclusive and diverse built environment, with SMEs playing a more important role. Thirdly, it will support the development of a more skilled workforce, which will improve the overall competitiveness of the industry.

Legislation and Policy Change: Legislation and policy are crucial components of the roadmap for promoting Building Information Modelling (BIM) adoption in South Africa. A supportive regulatory framework can provide a clear and consistent set of guidelines for the industry, leading to more efficient and effective adoption of BIM. To promote the adoption of BIM, the roadmap suggests developing legislation and policy that mandates or incentives BIM adoption. This legislation and policy will provide a clear and consistent set of guidelines for the industry, making it easier for stakeholders to adopt BIM.

The roadmap presented in section suggests that the government collaborate closely with the built environment to create and implement appropriate legislation and policy. The development of these policies should be influenced by input from stakeholders, global best practices, and policy considerations. In addition, the roadmap proposes the development of a certification system for Building Information Modelling (BIM) professionals and software. This certification system will guarantee that BIM professionals and software meet specific standards, ensuring the quality of the BIM adoption process. The certification system will also provide clarity for stakeholders, assisting them in identifying certified professionals and software and encouraging the adoption of certified BIM professionals and software. The roadmap also recommends that the government should support the development of open BIM standards, which will allow for greater interoperability and collaboration among stakeholders. This support could include funding for research and development, technical assistance, and collaboration with international organizations that develop open standards. Finally, the roadmap suggests that the government should encourage public-private partnerships to promote the adoption of Building Information Modelling (BIM). These partnerships will provide a mechanism for the private sector to collaborate with the government and other stakeholders to promote the adoption of BIM. Public-private partnerships may also provide a source of funding for BIM-related initiatives, such as training and capacity-building programs.

3.5 Closing Remarks

The aim is to encourage BIM adoption across the continent. Our BIMcommUNITY.Africa is open to anyone passionate about driving and promoting the adoption of BIM across the continent, across all sectors and industries, from the smallest practitioners to the largest Government departments.

The community is vendor-agnostic. It's about bringing all technologies and solutions to the table and allowing the Community to choose what suits them and their context best. We believe that, together, we have the wisdom, knowledge, expertise and passion to collectively Raise the BIM Tide throughout Africa. There is no registration fee. **BIMcommUNITY.Africa is built by its members, for its members.** Our CommUNITY was birthed towards the end of 2018 by some of pioneering souls ' 'who've thrown their weight, talent and commitment into raising the BIM tide across Africa. Join us!

We follow our GIVE principle:

G : Generous and Discreet (be generous with your knowledge, time and resources and exercise discretion when sharing information).

I : Inspirit (cheer each other on, Stimulate engagement and collaboration).

V : Value (every voice counts, regardless of years of experience).

E : Equality (leave your shoes, ego and agendas at the door)

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