Building Information Modelling in Urbanising Kenya

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ABSTRACT

With the largest economy is East and Central Africa, Kenya serves as a regional centre for banking, technology and infrastructure. In the last ten years Kenya has experienced strong growth and development, largely anchored in the Country's Vision 2030. Vision 2030 is a long term view of Kenya's development intended to transform Kenya into a middle income country with a high quality of life by 2030. The vision is anchored on 3 pillars; economic, social and political. For ease of implementation the vision is entrenched in the 2010 constitution and has been divided into 5-year mid-term plans (MTP's) coinciding with the electoral calendar. The current MTP was adopted in 2013 and includes a strong focus on digital transformation. This because, technology is increasingly playing a valuable role in communities, but also a highly disruptive role.

Our communities are changing as a result of technology. Increased technological possibilities are resulting in faster and cheaper production of goods and services; the advent of technology has seen a shift in the needs of our communities, from requiring basic provision of infrastructure to needing more advanced technology appropriate infrastructure; technology has changed how information is communicated and received in our communities, and finally technology and its rapid speed of change has meant that we now question the viability of our existing buildings and infrastructure, and a step further, the viability even of the plans we have for future development.

However, it is not all doom and gloom. It is possible through specific and deliberate strategies to harness the benefits of technology. To do this, communities and built industry professionals need to have a clear strategy that identifies where the biggest difference can be made with technology, and then align infrastructure and building provision goals and technology requirements with choices that are guided by a community-centred approach. To think, how will implementing this technology affect the community in which it is implemented?

Since 2011, The World Bank, through the Kenya Investment Climate Program in partnership with the Architectural Association of Kenya and four County Governments of Nairobi, Mombasa, Kisumu and Kiambu have developed and are now successfully running automation of all approval and administrative processes associated with Construction Permits. This integration of technology to construction permitting has had numerous benefits: reduced time and costs for regulators and investors, has encouraged best practice among professionals and raised the level of safety in construction projects.

In advocating for the integration of BIM to construction e-permit systems in urbanising Kenya, this paper demonstrates how technology can be harnessed to steer urbanisation while working for the good of the community. The ubiquity of technology is transforming how professional services are procured and offered. Full service models are being replaced by a new service framework, with either self or automated services, or, custom services becoming predominant. This necessitates a re-thinking of how we engage our communities in our quest to offer professional services against the backdrop of urbanisation.

The novelty of BIM use is the possibility to integrate various aspects of infrastructure and building provision from site surveys through to community feedback and local authority approval on one platform. This paper will explore best practice in BIM use around the world as a catalyst for harnessing technology to address the challenge of rapid change in urbanising communities. In advocating for BIM institutionalisation and integration with the existing e-permitting systems in Kenya, this paper will suggest ways in which these best practices can appropriately be applied to the unique community that is rapidly urbanising Kenya.

Keywords-- Building Information Modelling (BIM), Development Control, E-permitting, Technology

I. INTRODUCTION

With the largest economy is East and Central Africa, Kenya serves as a regional centre for banking, technology and infrastructure. In the last ten years Kenya has experienced strong growth and development, largely anchored in the Country's Vision 2030. Vision 2030 is a long term view of Kenya's development intended to transform Kenya into a middle income country with a high quality of life by 2030. The vision is anchored on 3 pillars; economic, social and political. For ease of implementation, the vision is entrenched in the 2010 constitution and has been divided into 5-year mid-term plans (MTP's) coinciding with the electoral calendar. The current MTP was adopted in 2013 and includes a strong focus on digital transformation. This is so because, technology is increasingly playing a valuable role in communities, but also a highly disruptive role.

Infrastructure development has been identified as one of the pillars for Kenya's vision 2030 development blueprint, GoK (2007). Infrastructure

development and an active construction industry are indicators of a thriving economy. These two activities also promote the development of other industries within the economy through backward linkages. Park [18], has confirmed that the construction industry generates one of the highest multiplier effects through its extensive backward and forward linkages with other sectors of the economy. Infrastructure development, and indeed the attainment of Kenya's vision 2030, shall be hinged on how technology shall be leveraged towards these goals. From technology perspective, a building information model is a project simulation consisting of the 3D models of the project components with links to all the required information connected with the project planning, design, construction or operation. [13]

Over the years, a strong case has been made for the adoption of BIM in the construction industry and especially in Europe, North America and Australia. According to the National BIM Survey 2014, carried out in the UK, 'awareness of BIM is now almost universal at 95% and adoption rates are accelerating with more than half of respondents (54%), now using it in 2015 up 15% from 2014, and 93% predicting adoption by 2016'. (McGraw Hill Construction, 2014). Musyimi [16] discusses BIM adoption in the Kenyan context, the challenges faced and how adoption can be encouraged and finally concludes that BIM can provide an effective support for design and construction, as well as an effective collaboration and communication platform that can be used as a management tool within the construction industry. Of note is that the study found out that, there are no known Kenyan BIM standards or implementation guidelines, institutions in Nairobi County requiring BIM adoption on their projects or bodies driving BIM adoption in Nairobi County. This is despite the study reporting improved productivity, better project quality and performance, faster project delivery and reduced wastage after the adoption of BIM.

II.   HOW TECHNOLOGY IS CHANGING OUR COMMUNITIES

Our communities are changing as a result of technology. Increased technological possibilities are resulting in faster and cheaper production of goods and services; the advent of technology has seen a shift in the needs of our communities, from requiring basic provision of infrastructure to need for more advanced technology appropriate infrastructure; technology has changed how information is communicated and received in our communities, and finally technology and its rapid speed of change has meant that we now question the viability of our existing buildings and infrastructure, and a step further, the viability even of the plans we have for future development. It is possible through specific and deliberate strategies to harness the benefits of technology. To do this, communities and built industry professionals need to have a clear strategy that identifies

where the biggest difference can be made with technology, and then align infrastructure and building provision goals and technology requirements with choices that are guided by a community-centred approach. To think, how will implementing this technology affect the community in which it is implemented? In Kenya, as elsewhere in the developing world, rapid urbanisation processes and the unregulated physical growth of towns have emerged as major development planning issues. Controlling development effectively requires a range of measures. The Solution is to harness technology to steer urbanisation.

This paper delves into two main aspects of technology in Kenya, and how these can be harnessed to produce the best possible synergy to propel the country towards its vision 2030. The paper explores best practice in BIM use worldwide, informing technology use in addressing challenging rapidly urbanising communities. In advocating for BIM institutionalisation and integration with e-permitting systems in Kenya, this paper suggests ways these best practices can be applied to Kenya.

In the local authorities such as Nairobi, it is believed that upto 70% of the buildings are constructed without approval, despite the existence of many planning and development instruments, and their institutions (AAK, 2011a). Most growth in rapidly urbanising developing world cities, such as Nairobi, takes place on the urban edge; often existing settlements link to form extended urban corridors. Such growth presents a host of planning issues and challenges: settlements tend to be informal, unserviced and fragmented, with a mix of tenure systems and, in many cases, beyond the boundaries of single municipal governments. The challenge of development control in Kenya is highlighted in numerous incidences of building collapse and fire tragedies, [1], [6], [7], with the most recent collapse being in June of 2017, where a seven storey residential building collapsed in the residential area of Kware, Nairobi. The Architectural Association of Kenya, AAK in the run up to the 2017 General Elections carried a sustained social media campaign titled 'The Kenya We Want' in which the Association highlighted among other issues the need for effective development control as a way to make Kenyan cities and human settlements inclusive, safe, resilient and sustainable. According to the AAK, the city of Nairobi has only 15 enforcement officers who are expected to supervise 6000 live building sites in the county, a recipe for disaster. [2].

Agyeman [3] postulates that the challenges in acquisition of building permits contributes significantly to mushrooming of illegal structures and proposes an integrated permit system as a solution to this. A similar solution is proposed by Ng'etich [17]. According to Agyeman [3], the intrinsic challenges identified in building permit acquisition systems include: lack of integrated central database management system for permit agencies and analogous institutions involved in the permit processing system, too many processing steps,

increased cost of construction and loss of value due to bureaucratic delays, lack of coordination between the land agencies and the local authorities, differing land ownership practices, inappropriate feedback systems and inadequate number of staff for the field inspection and monitoring. These challenges are cross-cutting across Kenya, and indeed many developing countries.

Ng'etich [17], discusses the challenges faced in implementing development control in one Kenyan town jurisdiction, Eldoret. These include: high cost of design, processing and approval, inordinate delays, bureaucratic ambience or paper chasing, too many actors and instruments, conflicting institutions and duplication of efforts, discretionary decision making, lack of premises for development control decisions, political interference and vested interests, increased planning disputes; paucity of data on plot ownership, limited resources and personnel for development control. Ng'etich proposes an urban development control Agency should be created with the sole purpose of coordinating and harmonizing all urban development control activities and initiatives. This again points to the implementation of an integrated permit system. For such a system to operate effectively; there will be need to harmonize all instruments and standards of development control present in Kenya, including; Kenya Civil Aviation regulations, Public Health, Physical planning Act, Cap 286, KURA regulations, Urban Areas and Cities Act 2011 and EMC By- Laws 2008. The model which is replicable elsewhere brings on board, EMC /or the Municipal Board, Public Health, Physical Planning, National Land Commission(NLC),County Government, County Land Boards, Kenya Urban Roads Authority (KURA),Kenya Civil Aviation Authority, National Environmental Management Authority (NEMA) ,the Neighbourhood Associations/ or Area Development committees, and the National Building Authority. Numerous forms and schedules for applications and approval processes and for fees charged should be harmonized.

Some progress has been made toward the stemming of ad hoc development in Kenya, evidenced by the launch of the first ever National Spatial Plan on 1st March 2017. The National Building Inspectorate, whose mandate is the audit of buildings for conformity with land registration, planning zoning, building standards and structural soundness, has also been able to carry out an audit of 5000 buildings countrywide, with 640 being found to be structurally unsound. [2]. The relatively young National Construction Authority, enacted by the National Construction Authority Act in 2011, has also been able to stem rogue contractors and reduce malpractice by registering about 25000 contractors within the Kenyan building industry. All indications are that the stage is being set in Kenya for more effective and efficient development control.

III.   E-PERMITTING

According to the Study on Development control framework in Kenya (2011), 70 per cent (or more) of construction in all local authorities are carried out without permission especially in low income neighbourhoods. The rate is lower (40-50%) in higher income neighbourhoods. To reduce the number of illegal constructions, Nairobi City has been trying since 2006 to improve the permit system including change in evaluation process by establishing Technical Committees and re-organizing the office for efficient process. The Technical Committee, composed of departments in Nairobi City and professionals (Architectural Association of Kenya, Kenya Institute of Planners, Nairobi Water Supply Company, etc), meets every two weeks to discuss and approve applications. These efforts have shortened the process to less than 30 days. In addition to these efforts, in 2011, Kenya benefitted from the first sub-Sahara's automated construction permit management system outside of South Africa, in an attempt that cut down costs and time both for applicants and for the regulator. Popularly known as the E-Permit system.

Electronic permitting (E-Permitting) is a set of computer-based tools and services that automate and streamline the building permit process. IFC and the World Bank supported Kenya's efforts to establish the new system by advising on its design and installation, training city council staff on its use, and raising awareness of the system among relevant stakeholders. Kenya's E-permit system has so far been launched in four counties, that is, Nairobi, Kiambu, Mombasa and Kisumu, with plans underway for launch in three more counties. This electronic approval system has significantly improved operations resulting in: improved communication between relevant departments thereby reducing approval delays; improved transparency through the electronic submission and processing of all documents; and it has enabled these counties to keep accurate information on the investments in real estate (commercial and residential) in their counties.

Kenya's e-permit system has been deemed so successful, Rwanda, Iraq and Afghanistan are using it to benchmark their own processes. With support from the World Bank Group, both Kenya and Rwanda have instituted ICT reforms related to e-construction permitting. These reforms have demonstrated that low- and middle-income economies can introduce successful ICT platforms with a relatively wide range of solutions from the start. The new automated system launched in September 2011 by the City Council of Nairobi (CCN) was developed in less than two years and included training of the CCN staff and building code officials. The training reduced time of approval by 80 percent and transaction costs for the private sector by 60 percent. The City Council surpassed its revenue targets after it

registered a 300 percent increase in permit applications.[9].

Despite challenges in the prevalent ICT and legal infrastructure in Kenya, the web-based software application introduced by the City Council of Nairobi (CCN) enabled eight major functions that radically transformed the management of construction permitting and inspections in Nairobi after 2011. These key functions included: Online registration of building professionals and property developers; Online submission of building plans; Workflow management, specifically concurrent review and evaluation; Online issuance of permit upon approval; Document management and archiving; Support for field inspections using mobile devices; Client interactions through SMS/email notifications and online tracking and Management reporting and oversight. [9].

In Rwanda, the plan is to scale up the system to serve all District One Stop Centres. Already successful in Kigali, further system deployment will start with the Secondary Cities (Rubavu, Musanze, Muhanga, Rusizi, Huye and Nyagatare) and later on move to the remaining Districts until the whole country gets covered. The Rwandan E-permitting system has gone a step further to include:

***Profiling of Ongoing Constructions for Inspection Process*:** The system allows building inspectors to review ongoing constructions and decide those which make the most monitoring sense to inspect.

Capturing of inspection data using smart phones: The system allows building inspectors to go to site and capture inspection data via mobile devices. Photos of key aspects of the construction can also be uploaded during such inspections.

***Intelligent Reporting*:** The system assists super-users to generate reports on different subjects depending on their wishes. It can automatically generate reports on urbanization growth rate of a given District basing on figures of permits issued over a given period of time.

***Inspection Feature*:** The system assists inspectors to access all documents related to a given site or plot inspected by use of QR Code scanning which directs straight to the concerned file in the system. Forged documents or permits can also be detected using QR Codes scanning.

E-permitting has been able to reduce to a large extent the endemic problem of corruption. According to Fleming (2019), about $1.26 Trillion is lost to corruption annually in developing countries. Whereas the cost of redressing Africa's entire infrastructure deficit is estimated at a fraction of that, $75 Billion per year. Kenya bleeds $6 Billion to corruption annually, Miriri, D. (2016). The best way to close the world's and Kenya's infrastructure gap is to stop corruption. E-permitting presents one way to do this. Corruption leads not only to economic losses but to loss of lives from dangerous and unsafe infrastructure as highlighted previously by the collapsed buildings and fire incidences. According to Transparency International, the current levels of corruption mean that any country with a development vision for 2030 will have to wait until 2035 to achieve their goals. Governments should therefore be re-doubling their efforts to remove any opportunity for corruption in the infrastructure sector across the project life-cycle, from procurement and financing through to operations and management.

In their Policy position paper of 2015 titled, 'Managing Building Development', the Architectural Association of Kenya recommended that Counties in Kenya need to adopt development control processes that are fast to discourage non-compliance which is abetted by the slow process. Development control should be made accessible to all citizens regardless of social class to enable all sections of the Kenyan societies to enjoy the benefits of effective development control regimes which lead to more liveable, sustainable and inclusive neighbourhoods. BIM offers the opportunity to do so. With BIM it is possible to integrate various aspects of development control and infrastructure and building provision, from site surveys, through to communication of feedback by client communities on one platform. Real time data of geospatial and engineering aspects can be analysed against the relevant codes and at the same time communicating feedback both to the developers and their consultants. Being able to make good decisions based on accurate data is critical to managing development control efficiently and effectively. And being able to harness the right data at the right time to answer the right questions is key in driving value. BIM allows real time mining of data on buildings and their associated planning contexts for effective management of the development control process.

In establishing the adoption of BIM use in Kenya, Musyimi [16] employed a research design method on BIM and world best practice that was both exploratory and descriptive. Exploratory where insights into the study were obtained though the review of literature and these insights then used as a guide for the descriptive study where individual respondents were asked about their perceptions and personal experiences as pertains BIM adoption. The main data collection tool was a semi-structured survey questionnaire that resulted in both quantitative and qualitative data. The study population was the 55 registered members of the construction management professional body with a response rate of 36.4%. The research found that 25% of those interviewed were using BIM. Of the 75% that were not using BIM, 80% were planning to adopt it within the next 5 years. This shows that there is interest in BIM and many firms are gearing up to adopt. This is therefore the right time for the institutionalisation of BIM by linking it to E-permitting in Kenya.

The AAK in their study on 'Managing Development Control' (2015) surveyed some 17 local authorities spread across 14 counties and four development control agencies were surveyed for the Study on Development Control Frameworks in Kenya.

These included Nairobi, Kiambu, Nyeri, Machakos, Moyale, Garissa, Marsabit, Kajiado, Kericho, Kisumu and Kakamega counties. Primary data was collected through questionnaires, interviews and observation. A sample of 143 members from the public, 51 practitioners from the built environment, 412 developers, 17 District Physical Planners, 34 officers from four public institutions, 12 Neighbourhood Associations, and the Director of Physical Planning were surveyed by questionnaire. The response rate was 62 per cent. A stakeholders' workshop was held to validate the preliminary findings of the study and seek feedback. The institutional framework for development control is reviewed and mapped against international best practices from Botswana, Switzerland and Singapore. Observed data was captured through photography. Physical development plans of the 17 Local Authorities were obtained from the Municipalities or the Ministry of Lands, and sample photographs of development projects mapped on to the development plans. Data collected was presented and analysed using the Statistical Package for Social Scientists (SPSS) and presented using descriptive statistics, tables and figures.

Musyimi [16] found that information on construction projects comes in a multiplicity of formats and from multiple sources. The more this information can be communicated from a single source, the better. BIM allows precisely this. By enabling central information management, BIM makes the project management process more efficient, therefore adding even more value to the delivery of construction projects. From the study, it was found that improved productivity, better project quality and performance, faster project delivery and reduced wastage were the greatest advantages reported after the adoption of BIM. In conclusion the study recommended that Construction industry regulators in Kenya should actively take up the mantle on BIM implementation and provide support to construction practitioners by way of institutionalizing BIM implementation procedures and timelines for the country.

AAK (2015) on its part recommends measures at different levels where action is expected to spark efficient development control practices. These are policy, legal framework, governance and institutional framework, the process of development control and capacity development. In particular, and on the process of development control, the recommendation is that Counties need to adopt development control processes that are fast to discourage non-compliance which is abetted by the slow process. Development control should be made accessible to all citizens regardless of social class to enable all sections of the Kenyan societies to enjoy the benefits of effective development control regimes which lead to more liveable, sustainable and inclusive neighbourhoods.

IV.   BIM AND E-PERMITTING: THE DEVELOPMENT CONTROL SOLUTION TO RAPID URBANISATION

According to the World Bank [21], the potential offered by ICT solutions has been only marginally tapped in the area of building code administration systems, specifically in permitting and inspection procedures. The slow adaptation of ICT solutions for building code administration perpetuates inefficient practices and postpones such advances as easily accessible archives; coordinated inspections; integration of land titling, cadastral, land use, and building information; improved documentation; and effective mechanisms to relay inspection results back to builders and owners. Although many of these deficiencies can be addressed through legal, regulatory, and process reforms, information technology has a key role in improving efficiency, transparency, and accountability in building code administration. enya's information and communication technology (ICT) sector contributed about 12% to GDP in 2015, showing a steady growth from 2006 when it made up 9% of the economy. KoTDA says that by 2020, ICT will create 100,000 jobs and bring in Kshs 1Billion annualy. Kenya has 32.3 Million mobile subscribers with 79.2% mobile penetration rate, according to KCA. Many of the country's projects focus on developing products that reach Kenya's poorest through SMS services available on basic mobile phones. These same platforms can be harnessed to help the urban poor especially report on buildings that contravene building regulations and standards by the development of a product linked to the County E-permit systems. This will help institutions such as NBI that have limited capacity to go out in the field and identify these buildings to build their data base. This can later be used to determine improvements or demolitions as may be deemed necessary. The challenge of rapid urbanisation is also that it requires planners, developers, owners and governments to think holistically about the needs of a community. This necessitates a direct connection with the communities in question. Mobile phones present a good solution to this.

By linking BIM with E-Permitting and hinging largely on the mobile phone platform, Kenya can pioneer in a development control system that is not only one-stop, but one that connects directly to the communities in question with real time feedback via mobile phone networks. The following section describes how.

V.   PROPOSAL FOR IMPLEMENTATION OF BIM FOR E-PERMITTING IN KENYA

It is proposed that BIM can be integrated to E-permitting in the outlined steps as follows:

I. Integration of development control into a one stop function: this will allow both the authorities offering the service and the citizenry to have access to al relevant information without physically moving from one office to another. A One-stop shop is a data storage bank/unit with various linkages which can be accessed by land agencies and other stakeholders [10]

II. Coordination of approving agencies: Harmonize and coordinate institutions and related agencies that deal with development control process and management. This will help in reducing political interference and lengthy circulation processes which make the process tedious and expensive. AAK (2015).

III. Capacity building: this will be a concerted effort of approving authorities, technical institutions and professional associations to ensure capacity right from the approving staff to the private technical professionals making development submissions for approval.

IV. Digitization of records: this will involve making all documents relating to land use and land tenure available online for ease of access and reference. From national spatial plans to survey plans and details of ownership and use of individual parcels of land.

V. Integration of design code and building code checks into BIM software rendering it capable of evaluating approval submissions for permitting.

There are basically 5 stages through which compliance of a new construction with building standards can be assured. The section below suggests ways in which BIM can be integrated to each of these steps as an aid to E-permitting.

1. Submission of building application to the local authority: BIM can be employed as the platform for submission, which means that submissions will no longer be of 2-dimensional information but rather of 3 dimensional models that carry with them various metadata on the proposed developments such as environmental performance and other analysis.

2. Review process by local authority: By the integration of design code and building codes into BIM software, development application review can be digitised through the simplified programming that introduces customised algorithms and design checks to enable the software carry out prerequisite checks on the submitted 3- dimensional proposals and their associated Meta data.

3. Issuance of building permit: this shall be recommended based on an evaluation report generated after all desired checks have been made on the submitted development proposal by the software.

4. Inspection of construction: By linking submission information available to the authorities with information on location, linked to existing mapping systems, it will be easy to locate live sites remotely and to allocate inspection and enforcement staff appropriately. Construction progress can then be recorded on digital devices such as tablets and uploaded onto the one-stop system for record and reference.

5. Issuance of occupancy permit: based on the recorded information on progressive inspection and progress of construction, the system will be able to generate a report upon which occupancy permit may be granted. This can be relayed electronically to the developer, eliminating the need for physical trips to the authority and reducing paper based transactions.

Beyond integration of BIM and E-Permitting the following measures are recommended to support the integration and enhancement of development control.

1. Use of the private sector in compliance checks in order to build capacity: private professionals across the divide from planners to Architects should be certified by the regulatory Authorities to provide 3rd party review services as a good number of them are now conversant with BIM. This can be done in liaison with professional Associations such as the AAK.

2. Continued strengthening of the legal and administrative capacity of regulators in the development control sphere: has highlighted in earlier sections, Kenya has and continues to set the stage for more efficient and effective system of development control. This should also be supported by building the capacity of civil staff before they are exposed to the demands of the new systems.

3. Offer compliance support: Rather than just enforce, building regulators should take it to the next level and reach out to stakeholders to offer advice and guidance, which is touted as a sure way to improve compliance. [21]

4. Increase transparency in building code administration: by use of online and mobile phone platforms to make available, land use plans, guidelines for the permitting process and requirements for permit applications. This will increase access to regulatory information by the stakeholders, which is associated to greater trust in regulatory quality according to the World Bank.

5. A coming together of larger regulatory context institutions to support the integration in each of their spheres. These are: education and training institutions, accreditation bodies, professional associations, the financial sector, the political regime, and industry practitioners both in the public and the private sector.

6. Establishment of a legal basis for online transactions and digital signatures, as this will be the basis of the integrated online system.

7. Adopt the integrated system incrementally, to allow for adjustment to changing context and to take care of arising issues. The use of open-source technologies with no licensing cost will also reduce the associated capital investment.

8. Make use of public building programs as entry points for the integrated BIM E-permit system such as proposed public housing projects: This will ensure that the system is allowed to take advantage of the technical capacity and budgetary allocation already available to such projects. This will also provide a platform to demonstrate successful implementation and use of the system.

9. Sensitize and educate the public on the need for development control compliance: this will create demand for compliance among the populace, who in turn can pressure professionals and developers to comply.

This paper has proposed the integration of BIM and the E-Permitting process in Kenya. It advocates for BIM institutionalisation and goes further to suggest ways in which the integration can be done. The challenges prevalent in development control in Kenya have been discussed and possible ways of alleviating them highlighted, among them the current E-Permitting system. Still some challenges persist such as the need for a speedier approval process. The integration is posited to cure these. Below is outlined a proposal for the implementation of this integration as a demonstration of the practicability and applicability of this work in the Kenyan context.

BODY	ACTION	ACTIVITIES
Level 1:National Level Adoption		
National Level legislation and institutions	The development of national BIM standards and legal framework for use of online transactions on development control. In partnership with previous partners such as IFC and World Bank.	• Define national priorities and develop a national implementation plan • Establish legislation on online transactions and BIM standards • Review existing legislation in relation to BIM in E-Permitting • Budgetary allocation
Level 2: National Level to County Level Scaling		
County Level legislation and institutions	The scaling of national BIM Standards and legal framework for online development control to county level. Customisation to particular county codes and policies.	• Scale national implementation plans to counties • Establish institutional capacity at county level • Engage county stakeholders for buy-in • Budgeting at county level
Level 3: County Level Adoption		
Implementation at county level	Theroll-out of BIM integrated E-Permitting systems in the counties, supported by local institutions and professionals and private sector	• Sensitisation of both the public and regulators • Training of on the ground staff to enhance their advisory and enforcement capacity • Funding to support procurement and installation of ICT infrastructure and integration into existing Huduma Programme infrastructure.

Table 1: BIM E-permit Implementation Matrix. Source, *Author*

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