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Developing BIM360 capability in Kenya to optimize construction of the largest waste recycling facility in East Africa

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Learning Objectives

1. Know all about the tricks and tips to prepare for a successful construction project using BIM 360.
2. Engage suppliers efficiently in the construction process to optimize information sharing and milestones delivery.
3. Recognise the potential challenges associated with utilising BIM360 in a low-tech or low-experience environment including understanding the interaction between BIM360 and construction law and common construction practices.
4. Articulate clear strategies to address the challenges and set the project on a path to delivery success.

Description

As cities in emerging economies expand rapidly, they are ill-equipped to handle their waste increase. In Nairobi, Kenya, 44% of solid waste generated every year is organic waste (~2,000T/day) that is not collected and left rotting, losing its potential for resource recovery. Additionally, 66% of the city's 1.3Mn tons of fecal sludge generated annually ends up untreated in Nairobi river or in the open environment. The city faces urgent pressure to develop waste management solutions, as increased population density and rapid industrialization increases the risk of air, water and soil pollution.

Sanergy is a social enterprise based in Nairobi, Kenya, which takes an innovative, circular economy approach to provide safe sanitation and waste management services while addressing the food security challenge in Kenya. We safely collect and treat 12,000 tons of waste annually – sanitation, municipal, and agricultural waste - and convert it into valuable products: insect-based proteins derived from Black Soldier Flies for animal feed, organic fertilizer, which restores soil quality and structure, and biomass fuel briquettes. This model provides a closed-loop, zero-waste solution that ensures waste that would otherwise harm the environment is transformed into high-quality sustainable products.

We are in the process of scaling up our production of insect-based animal protein to convert roughly 70,000 tons per year of organic waste into 3,600 tons of animal feed. This will be the largest facility of its kind in East Africa – a truly transformative technology that has the potential to improve domestic production of agricultural inputs and the livelihoods of thousands of livestock farmers.
Sanergy's team of young and passionate African engineers are working with a range of global equipment vendors and local construction experts to create a state-of-the-art facility. Sanergy is a devoted Autodesk user and this massive construction project has provided an ideal

opportunity to leverage the power of BIM360. However use of BIM360 was a learning curve not only for Sanergy, but also for our architect, engineering firm and construction contractors. In this session, we will review the training support provided by third party providers via the Autodesk Foundation, the challenges faced when rolling out an entirely new, technology-based way of working within an African context, and the benefits achieved from taking on this challenge. While not everyone will be initiating a construction project in Africa, there will be many occasions where the broader team involved in a project have limited experience with Autodesk, BIM360, or software-based construction management. This session will provide real-world examples of the issues that may be encountered, and how to not only address those issues but build capacity that leads to project delivery success.

Speaker

William Kemoli
Lead Civil Engineer - Sanergy Ltd

I am a Civil/Structural Engineer by training. I have experience with Civil/Structural Design as well as with practical site work. My experience has been strongly focused on Construction, Project Management, Engineering and BIM applications such as Revit, ROBOT, Advance Steel, Civil 3D and AutoCAD.

I have a Bachelor's degree in Civil/Structural Engineering from Jomo Kenyatta University of Agriculture and Technology JKUAT, Kenya. My studies provided me with a strong background in structural design, civil works design and water & sanitation. One of the key recurring themes in engineering is providing solutions that balance functionality and affordability. Incorporating this into my quest to improve livelihoods was the central focus of my thesis during my senior year at JKUAT.

Upon finishing my studies, I worked for 3 years for a design & build company running a construction project in Mombasa, along the Kenyan coast. I now work at Sanergy, a social enterprise focusing on solving the sanitation and waste management problems in slums, which I joined more than 2 years ago.

I am the Lead Civil Engineer, leading the design and implementation of a new factory that processes organic waste streams. This involved the conceptual, scheme and detailed design of the facility and taking this all the way to practical implementation. I am proud of the work we are

doing and excited to see the new factory complete as its success will see provision of access to safe sanitation for many low-income communities in Kenya.

At Sanergy, I got to explore the powerful tools available thanks to our partnership with Autodesk Foundation in regards to BIM implementation and integration. In particular, I use Revit, Analysis in Autodesk Robot and subsequent implementation and project management using BIM360. In my spare time, I am an amateur musician. I play the piano and hold a distinction in ABRSM Grade 8 Piano exams, an internationally administered graded exam for music from the UK. I'm also a keen boxing fan!

Introduction

Construction is all too familiar with the risks associated with siloed information. In each project, information is constantly coming in from multiple project stakeholders in varying formats. In a paper world, it takes a monumental effort to prevent complete disorganization. Today, job sites are more digitized than ever with new technology playing a huge role in how construction projects are designed and implemented yet information still remains fragmented across different systems due to a lack of integration between the various technology platforms.

BIM360 provided a platform that could help effectively manage construction projects and solve many of the information sharing challenges we anticipated to better manage our construction project.

This paper looks to give insight into why we decided to use BIM360, how we tailored the software to be a good fit for our project and explores the challenges faced.

Why BIM360?

Technology has been growing in leaps and bounds in recent years with the advent of powerful design tools that Architects and Engineers employ to help them work faster and better to achieve construction goals. However, this raises challenges when it comes to integration and coordination of information. Much of this information runs the risk of being fragmented due to being siloed in individual areas of the project.

The fragmentation of information is due to a lack of systems that can efficiently distribute important information to stakeholders who require it in a timely manner. This due to the manual effort that is required to collect, process, store and share the information. This leads to a significant amount of time loss and errors in design and construction due to a lack of coordination of the correct data required.

With over 400 people involved in the design and construction of the Sanergy plant there was a need for a system that can efficiently help in managing information sharing and storage such that we can generate, store and manage the construction process efficiently to ensure we stick to the desired time, budget and quality.

Project Description

Sanergy is constructing the largest waste recycling facility in East Africa. This plant will be able to manage 72,000 tons of waste each year. This will play a huge role in assisting Nairobi to solve some of the biggest challenges we face now in the 21st Century. These are:
Access to Sanitation in urban slums
Solid and sanitation waste management
Supporting the agricultural industry through provision of safe and useful agricultural products

The plant itself consists of typical portal frame structures that house our main processing area. We also have climate controlled greenhouses that support our processing activities. We also have utility areas such as a Reverse Osmosis plant that purifies the borehole water on site,

transformer rooms, generator room, storage facilities and a Biomass Boiler for producing steam for our processes.

The plant itself sits on a piece of land that is 50,000 square metres in area. The build up area is 15,000 square metres. We have a large area of 35,000 square metres for performing our composting activities.

Given that the land is nearby a river, we employed flood protection measures to protect our site. These take the form of earthen levees. We also raise our site by 1.5 metres such that the site is above the 100-year flood level.

Set up of BIM360

Given that Sanergy had never undertaken a project of such magnitude before, we needed to ensure that the project is managed carefully. We recognised the need for tools that would help us in quickly collecting and processing project data. To do this we turned to Autodesk's BIM360.

BIM360 was a completely new software both to Sanergy and the external consultants we employed. This meant that we needed a way of learning how to exploit the key features of BIM360 in order to manage the project effectively. With support from Autodesk we were able to partner with Excitech on this learning journey.

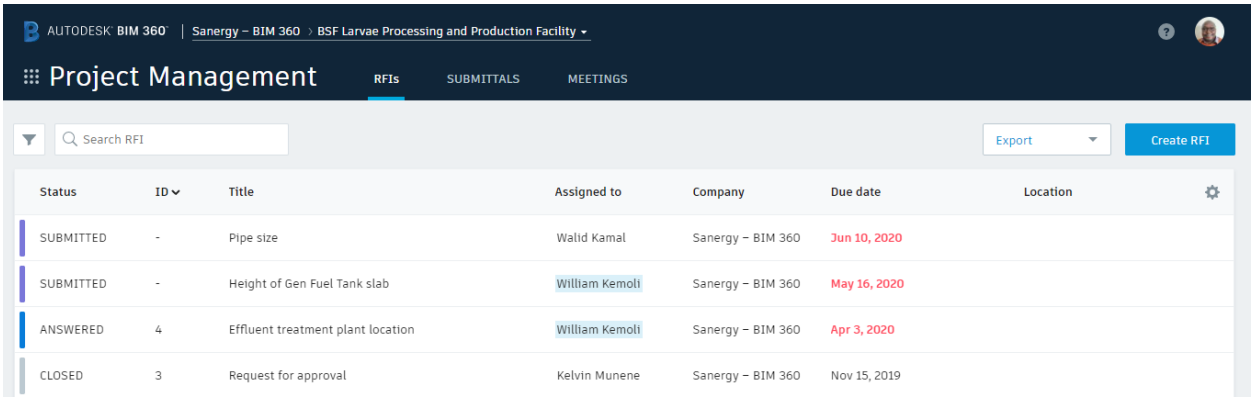
Excitech is the largest Autodesk Platinum partner in the UK! They provided valuable support in both understanding and setting up BIM360 such that it's tailored to the needs of our project.

Useful Features and Tips

BIM360 provided us with a host of useful features that we could employ to solve much of our construction management processes. These include:

1. RFI and submittals

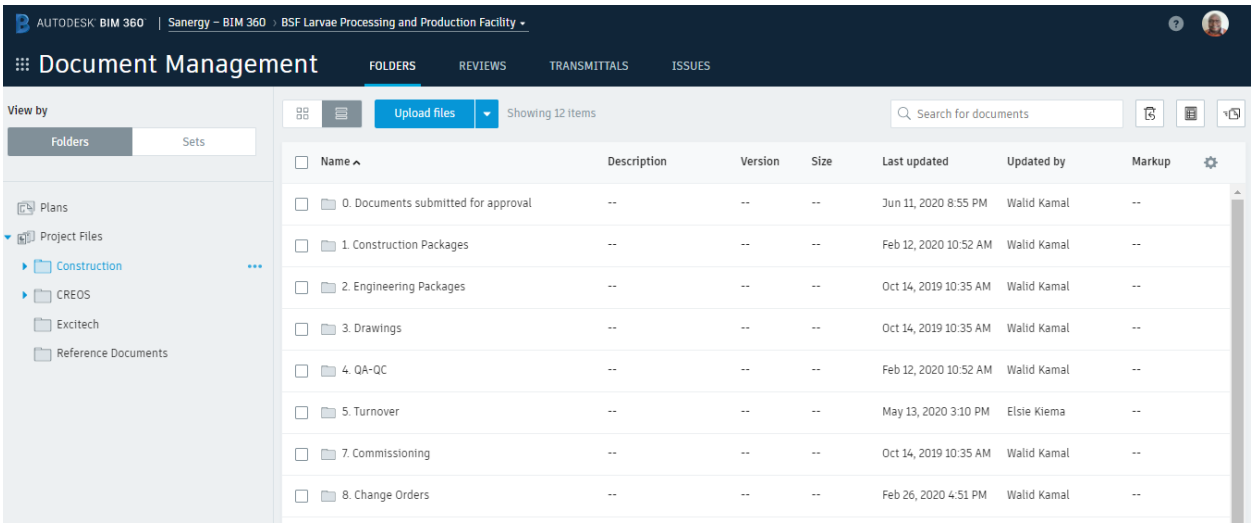
RFI's and submittals are a crucial part of any construction project and are indeed contractual obligations of all parties This feature allows Streamlining and management of Requests for Information (RFI's) and Submittals that meet contractual obligations. The latest BIM 360 Project Management release allows Project Management Admins and RFI Managers to create an RFI directly from an Issue, streamlining workflows and creating a bi-directional link between records. We employed this feature successfully in our project management.



2. Document Management

The Document management portal allows for streamlining construction document management by using a single cloud-based platform for organizing, distributing and sharing files. This feature allowed us to create and organise folders such that the updated project information is stored in a centralized location allowing for quick retrieval of the most up to date project documents.

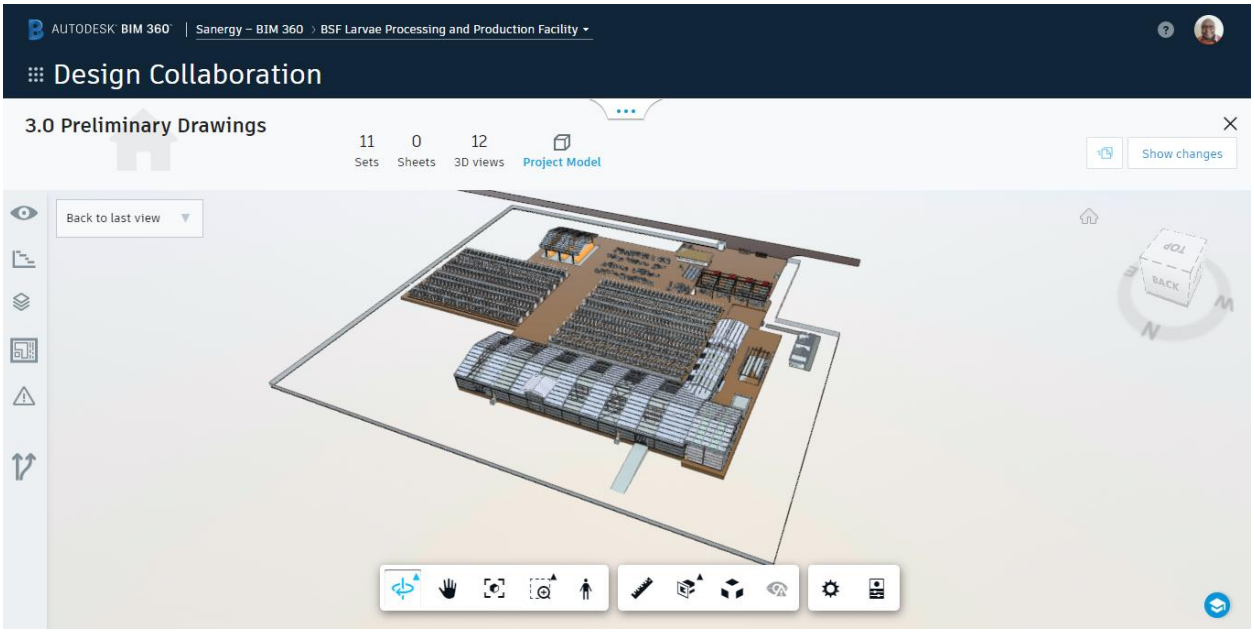
This feature also allowed the transmittal of documents as well as reviews of documents and raising of issues. One unique feature that came in handy was the ability to create a folder for preliminary documents and automatic transfer of these documents once they have undergone the review process and been approved.



3. Coordination, Constructability and Design Collaboration

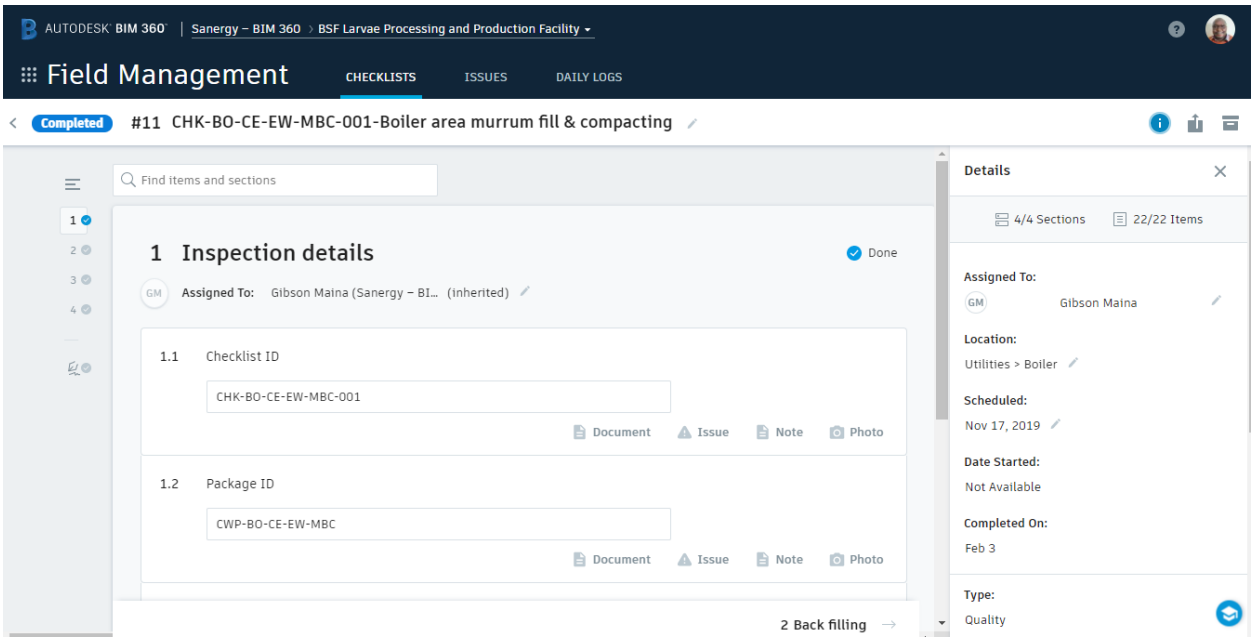
We leveraged BIM coordination and collaboration to accelerate reviews and identify and resolve clashes earlier. We managed to model all equipment and structures in Revit and perform clash detection. By being able to co-author the same model in real time we identified clashes between

equipment and structures as well as inter-equipment clashes. Additionally, through constructability reviews we were able to review versions of drawings and automatically identify construction issues early.



4. Quality Management

Quality is a crucial aspect of any construction project. BIM360 through field management module allowed us to develop quality checklists and track their progress and close out. This allowed us to keep track of all issues identified in the project for quick rectification.



Challenges faced with BIM 360 Implementation

1. The main challenge faced with rolling out BIM360 locally is primarily slow uptake by stakeholders due to the following:

    a. Unfamiliarity with software and slow learning curve due to fear of apparent complexity of software

        i. BIM360 is a powerful tool that provides many options that address most of the typical challenges faced in Project management. These varieties of options and their terminologies are not typically expressed locally. This gives first time users the perception that the software is complex and this hesitance leads to an aversion to spending time understanding the software.

b. Difficulty integrating software with local construction practices due to risk involved and concerns around access control and maintaining data integrity

    i. It is well known that construction is a high risk industry. Furthermore, construction mistakes tend to be very expensive. This has led to the development of strict contractual procedures that ensure all parties involved in the construction project are protected. Given the gravity that is assigned to clear communication, email is preferred as a ubiquitously agreed upon mode of communication. Furthermore, the fact that the project admin was the client in this particular instance and the recognition that the project admin has the ability to manipulate the records in BIM360, this led to lack of trust of the integrity of BIM360 as a record.

c. Difficulty employing real time capturing of issues/creation of punch lists with mobile devices due to unreliable internet connectivity

    i. Nairobi is quickly growing as a Tech hub in East and Central Africa. This has led to a fairly reliable internet and cell phone connection. However, there are still connection issues especially in remote areas such as where we constructed our facility. This lack of connectivity led to significant issues when using the feature of real time capturing of issues and filling of checklists. Furthermore, the mobile application is rather heavy for phones that are mid-range or lower leading to an arduous experience when attempting to use it on the field.

d. Integrating BIM with different software used by vendors and external consultants was difficult especially with 3D models and clash detection

    i. We noted that different consultants rely on different software for execution of their work. Some of these are incompatible with BIM360 in that some crucial information is lost in transmitting these from their softwares to BIM360. This posed a challenge in coordination of models as we had to

re-model elements critical to the construction in Revit and other Autodesk softwares such that we could perform clash detection.

2. Lack of a BIM management plan

BIM360 has many powerful features that are useful in the management of projects. However, we noted that in order to fully reap the benefits of the software it is important to have a plan of how to manage the use of the software.

This entails developing workflows for communication and approvals with various stakeholders. It also involves having to align early on with all stakeholders on how to use the software and sensitising them on the need to collaborate on the platform.

Some solutions to the challenges

1. Conducting tutorials together with all team members
    a. In our project we realised it's important to have tutorials and also provide access to easily accessible resources for learning more about how to manage and employ BIM360. Tutorials help familiarise and sensitise stakeholders on the project about the advantages that BIM360 is able to provide and how they can take advantage of them.
2. Relying on mobile hotspots to collect data on site
    a. Given the unreliable WIFI connection in remote areas we had to rely on mobile hotspots to make the field management Module work. As connectivity continues to improve in Kenya, it's possible to make use of this increasing capacity to ensure successful use of BIM360.
3. Providing greater access to most stakeholders to be able to view all relevant project data
    a. Given the risks in construction there is a need to allow all project stakeholders to access relevant data and be able to use it solve challenges in the project. Perhaps even a central management of BIM360 and access to information would go a long way in ensuring all stakeholders feel comfortable utilizin BIM360 in managin projects without aversion.
4. Work around to software integration
    a. Use of pdf comparison feature
        i. PDFs are fairly ubiquitous throughout the world. BIM360 has a very useful feature of being able to compare versions of different pdfs. This worked well in our project as it allows sharing of information with different stakeholders regardless of the source softwares they typically use.

b. Remodelling the plant in Revit

    i. It was extremely helpful to be able to model our plant using Autodesk software. This allowed us to be able to take advantage of key features such as clash detection and quantity take of in our project.

Conclusion

BIM360 is a very powerful tool and presents solutions to many Project and Construction Management Challenges. With enough familiarity and sensitisation of how it can be employed efficiently should allow for a successful uptake in Kenya.