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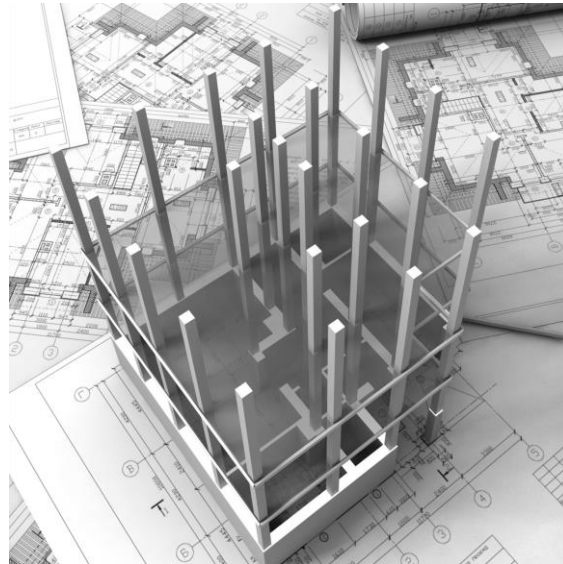
Toward The Ultimate Utilization Of Digitalization In The Construction

Fawwaz Hammad

Technology Talks / 21 Feb

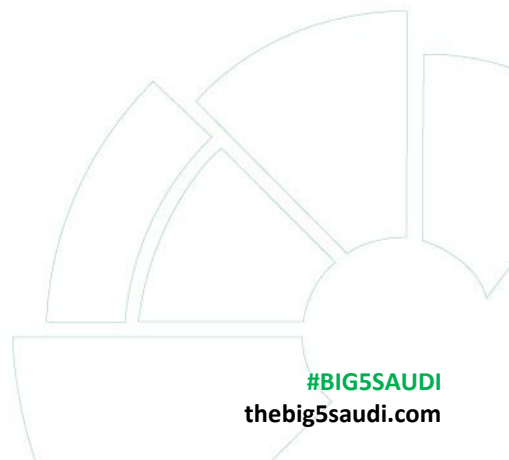
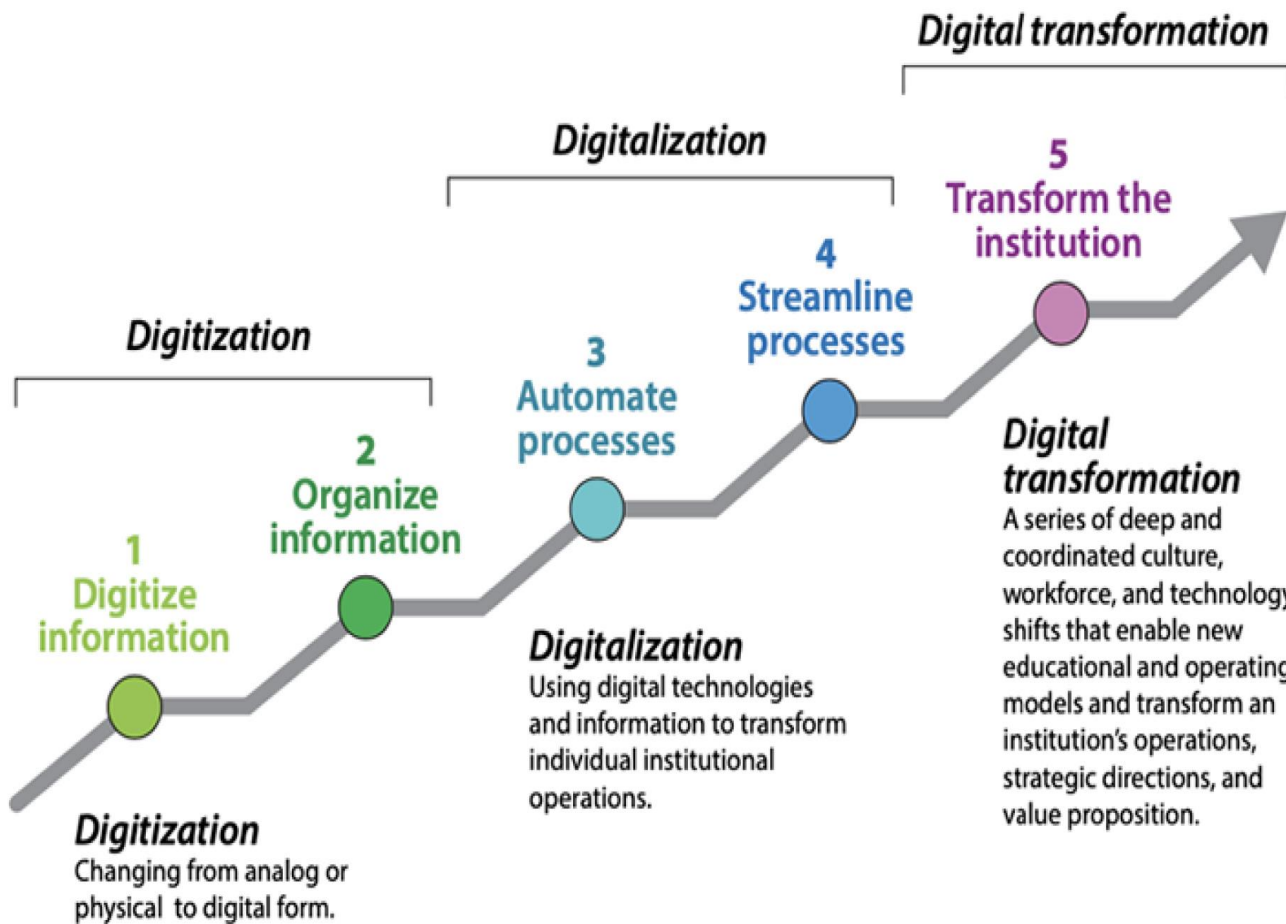
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Construction Digitalization is a dynamic process of integrating digital innovative tools to the entire lifecycle of a construction project. The construction sector needs to embrace new digital technologies and adopt new innovations in processes and organization in construction practices that will lead to new levels of productivity & efficiency. The talk will shed light on the necessity in the best utilization of the digitalized tools by the construction firms throughout the project lifecycle from inception to handover stages and the potential value at each stage.

Introduction



Objectives



Maximize using digital tools



Tasks Automation



Accuracy Enhancement



Improved collaboration



Increased Safety and Risk mitigation



**Staff Efficiency and
Increased productivity**



Cost Saving

Construction Key Areas

ENGINEERING

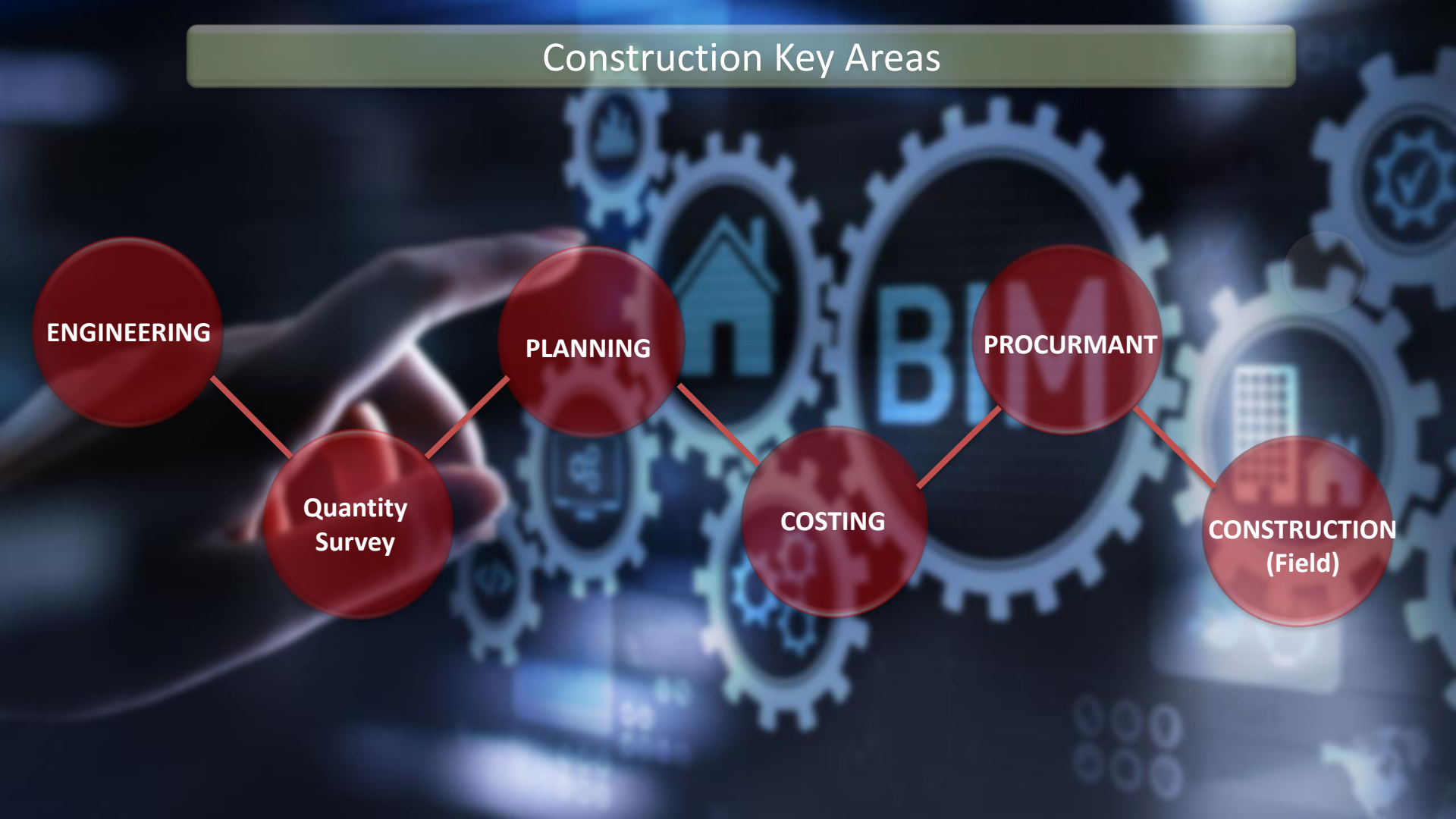
PLANNING

PROCUREMENT

**Quantity
Survey**

COSTING

**CONSTRUCTION
(Field)**



ENGINEERING

Design Collaboration
& CDE

Clash Detection

Dynamo & Generative
Design

Modeling Automation



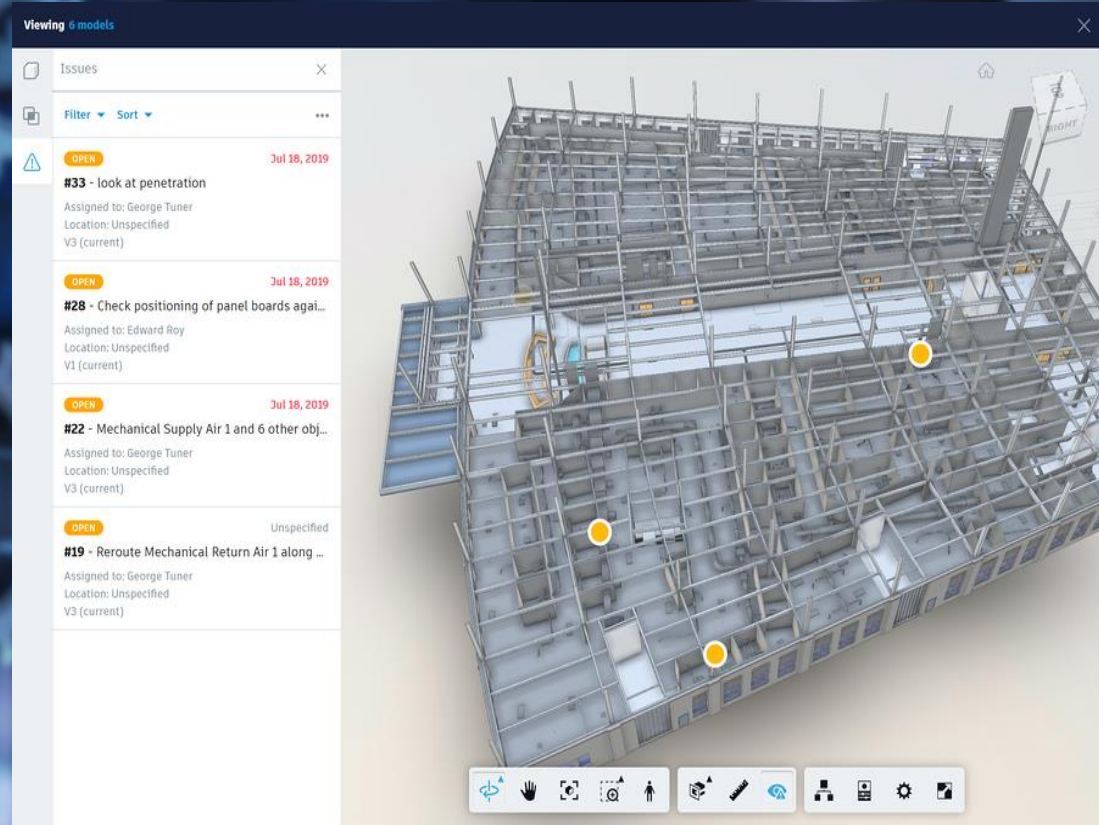
ENGINEERING

Design Collaboration & CDE

- Link all production team together including team at site, by sharing all BIM models on cloud base platform, This leads to have a single source for latest up-to-date information
- Having the BIM models published, project stakeholders will be able to review, comment and place remarks on the same platform. This will allow for better tracking of the flow of documents and reviews

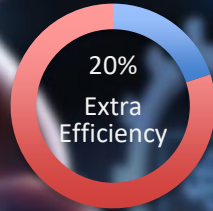
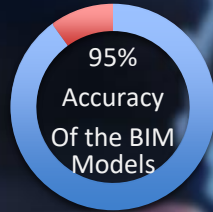
95%
Accuracy For
BIM Models

90%
Less Site
Reworks



ENGINEERING Clash Detection & Resolution

- BIM 360 model Coordination provides a collaborative environment to publish, review, and run clashes on 3D BIM models.
- When uploading the BIM models to BIM 360, the model coordination module will allow for locating any active clashes
- All project members can visit those clashes and start solving them on real time
- Automation of clash detection and resolution can be achieved through specific tools, which will allow for significant time saving in the coordination process

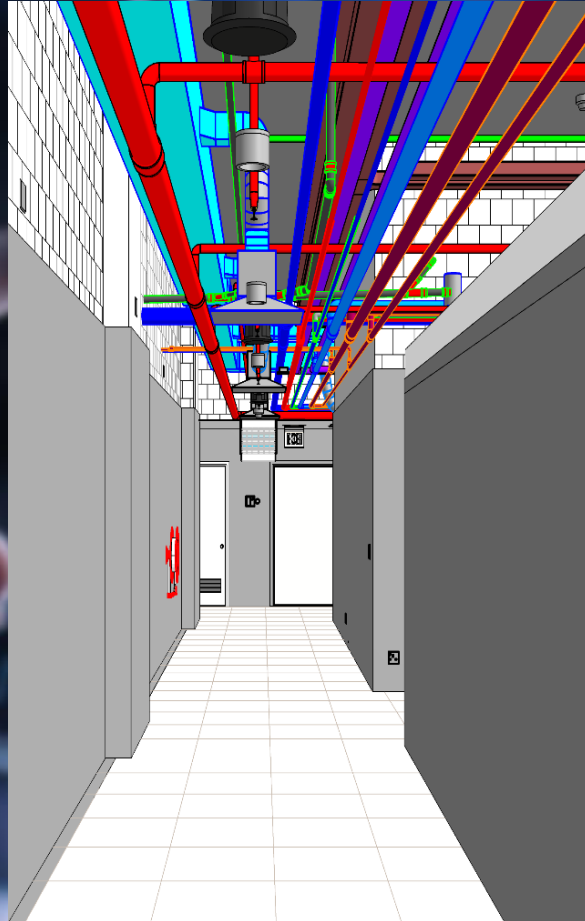


The screenshot displays the BIM 360 Model Coordination software interface. The top navigation bar includes "Model Coordination" and "MODELS", with a red box highlighting the "CLASHES" tab. Below this, there are tabs for "Active" and "Closed", and a "Space Coordination 03" dropdown. A search bar is present with the text "Search for models". The main area shows a 3D model with two yellow bars representing clash groups: "3D_Architectural model.rvt" with 3 clash groups and "3D_Electrical Model.rvt" with 4 clash groups. A red arrow points from the "3D_Electrical Model.rvt" bar to a detailed view on the right. This view, titled "Viewing 2 models", shows a list of clashes under the heading "6 CLASHES (2)". The list includes items like "Cable Tray with Fittings [557257]" (2 clashes with 1 other model), "Basic Wall [216130]", "Basic Wall [216092]", "Cable Tray Horizontal Bend [557311]" (2 clashes with 1 other model), "Conduit without Fittings [557777]" (1 clash with 1 other model), and "Cable Tray with Fittings [557284]" (1 clash with 1 other model). A 3D visualization of a clash is shown on the right, with a red arrow pointing to a green vertical structure.

Avoid MEP clashes for Revit

ENGINEERING

Clash Resolution
VIP Main Kitchens



REVIT MODEL

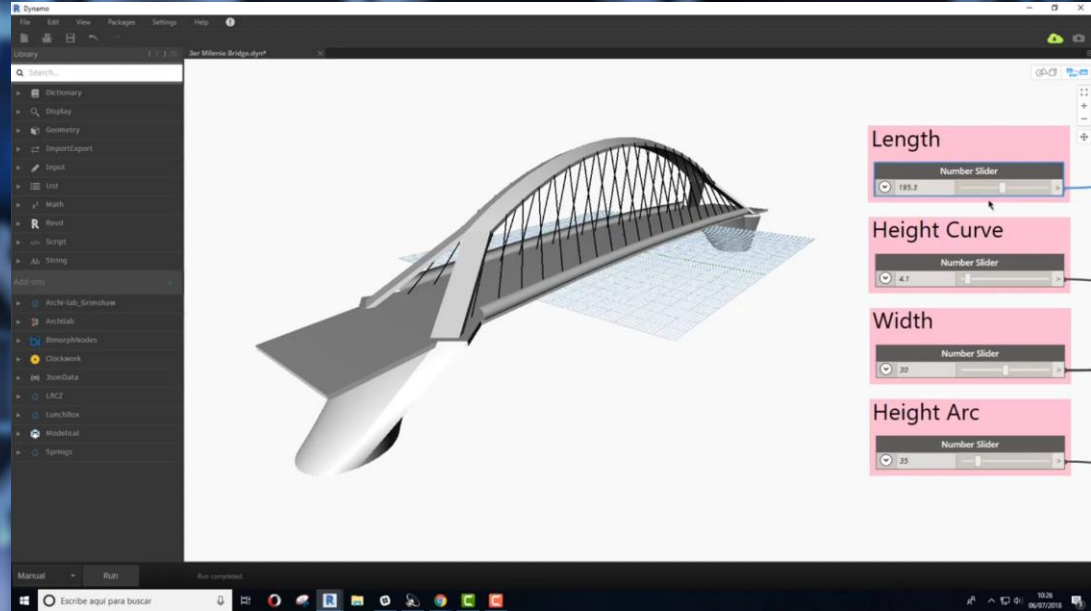


SITE

ENGINEERING

Dynamo & Generative Design

- Dynamo is an open-source visual programming language for Revit, by creating lines of codes and algorithm will automate a serial modeling actions which can significantly save modeling time
- Dynamo on the other hand, and by defining specific design criteria, will allow for generating several engineering design options in a click. This will allow for Design optimization & Value Engineering in a very short period when compared to traditional ways.



ENGINEERING

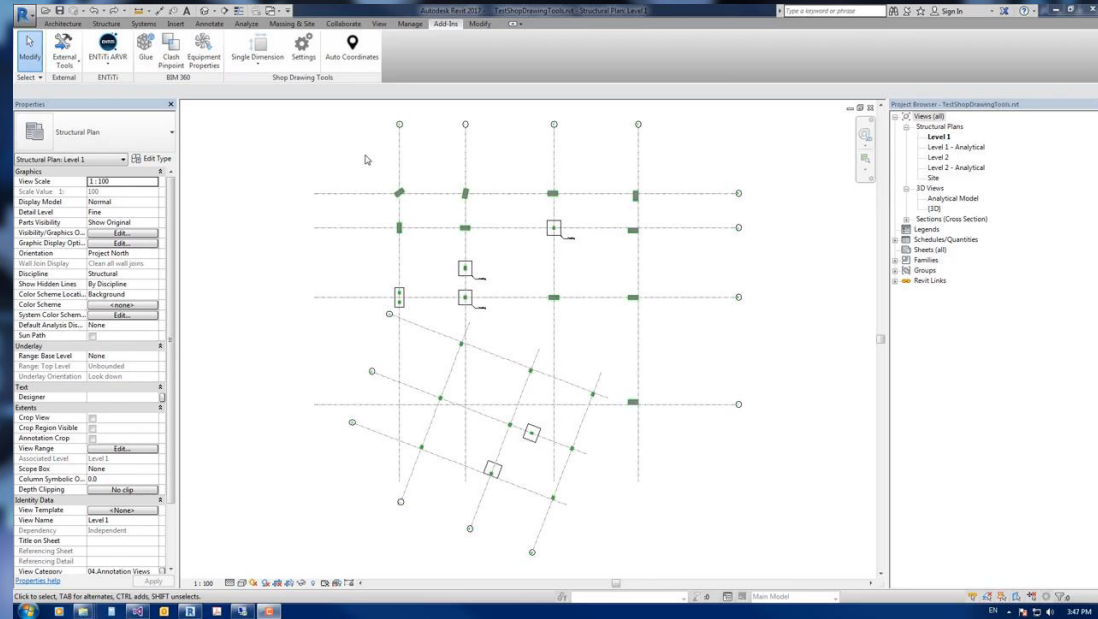
Modeling Automation

- Automating several modelling and annotating activities in shop drawings production, will potentially increase the efficiency in the production process.

20%
Extra
Efficiency &
Time Saving

Example of the Revit tools:

- Auto Hangers and support
- Auto dimensions
- Auto Annotation



Quantity Survey

Automated Visual
Quantity Takeoffs

Auto Generate Coded
BOQ

Smart Payment
Certificate



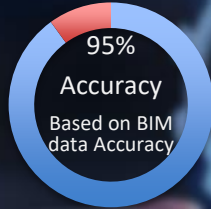
**QUANTITY
SURVEYOR**

Quantity Survey

Automated Visual QTO

Auto Generate Coded
BOQ

- By uploading the BIM models to a powerful Quantity take off tools, QS team will be able to do QTO automatically and they can visualize any of the project component
- QS team will be able to auto generate BOQ including cost with accurate quantities in one click



The screenshot shows a software interface for quantity takeoff. At the top, there is a menu bar with options like Information, New, Edit, Formal Review BOQ, Import, Download, Create Contract, Trash, View, and Help. Below the menu, the project name "My project Example Demo" and the current view "Concrete work BOQ" are displayed. A search bar is also present.

Code	Description	Quantity	Unit	Unit Price	Total	Def Spec Code	Type	Residential
	Bill of quantities				19,383.36 €			
	Section				19,383.36 €			
01.01	Sub-section				19,383.36 €			
01.01.0170	Reinforcing bars B500 Dia. 10-16mm strip foundation	0.144	t	1,684.820 €	242.61 €			Cost Sharing
01.01.0080	Formwork footing H 0.5-1m	102.783	m2	43.940 €	4,516.29 €			Cost Sharing
01.01.0100	Situ concrete footing reinforced concrete C20 / 25	41.972	m3	185.000 €	7,764.82 €			Cost Sharing
01.01.0090	Rebar B500A Dia. 10-16mm footing	-4.071	t	1,685.000 €	-6,859.64 €			Cost Sharing

Below the table, there is a section for "3D Model - Multiple selection (89)". It includes a search bar "Enter variable and formula" and a list of "Other Quantities" such as Area, Component 1 Component Cross Section Area, Component 1 Mass, Component 1 Rectangular Component Height, Component 1 Rectangular Component Width, Component 1 Skin/Component Volume, Elevation to 1st Reference Level, Elevation to 2nd Reference Level, Elevation to Linked Home Story, Elevation to Project Zero, and Elevation to Sea Level. To the right of this list is a 3D model of a building structure with various components highlighted in blue.

WALL QUANTITIES EXTRACT FROM BIM MODEL

Quantity Survey

Automated Visual
Quantity Takeoffs

KAUST
300 Villas



BIM MODEL

COST OF BLOCK WORKS BY
AL BAWANI CODE

BLOCK WALL AREA

<3-Wall Schedule>				
A	B	C	D	E
Type	Area	Function	Keynote	Cost
1	38 m ²	Interior	042211	77.00
1*	18 m ²	Interior	042211	77.00
2	283 m ²	Interior	042211	105.00
3	37 m ²	Interior	042211	121.00
3*	70 m ²	Interior	042211	121.00
4	16 m ²	Interior	042211	154.00
4*	18 m ²	Interior	042211	154.00
5	50 m ²	Interior	042211	143.00
6	27 m ²	Interior	042211	193.00
7	212 m ²	Exterior	042211	209.00
7*	14 m ²	Exterior	042211	209.00
8	102 m ²	Exterior	042211	116.00
8*	9 m ²	Exterior	042211	116.00
9	229 m ²	Exterior	042211	94.00
10	22 m ²	Exterior	042211	193.00
10*	3 m ²	Exterior	042211	193.00
12	9 m ²	Exterior	042211	
Grand total: 286	1157 m ²			

Quantity Survey

Smart Payment Certificate

- QS team will use the power of the smart platform, to identify the installed material at site by applying certain parameter to the BIM model, the fixed component will be extracted with the accurate quantity and to be attached with the payment certificate.
- This will lead to speed up the payment process while all site installations are reverted to the BIM models and visually presented

PAYMENT APPLICATIONS & EXPENSES

Effortlessly create and manage payment applications

- Create and manage payment applications for Owners and Suppliers
- Connect payments to contracts and automatically generate payment documents
- Log project expenses and seamlessly incorporate into Payment Applications
- Track pending and completed payments with detailed summary tables
- Incorporate approved payment applications into the overall budget summary view

Number	Name	Amount	States	Contract	Supplier	Billing Period
CT01-1	Owner Conting...	0.00	Draft	Owner Conting...	Owner's Inc	May 1, 2020 - May 31
CT01-2	Owner Conting...	0.00	Draft	Owner Conting...	Owner's Inc	Oct 1, 2020 - Oct 31

Payment Application Summary	
Original Contract Sum	100,000.00
Net Charged By Change Orders	0.00
Contract Sum To Date	100,000.00
Total Completed And Stored To Date	0.00
Total Retention	
Total Earned Less Retention	0.00
Less Previous Certificates For Payment	0.00
Current Payment Due	0.00

PLANNING

Scheduling & Planning

Construction
Simulation

Planned VS Actual

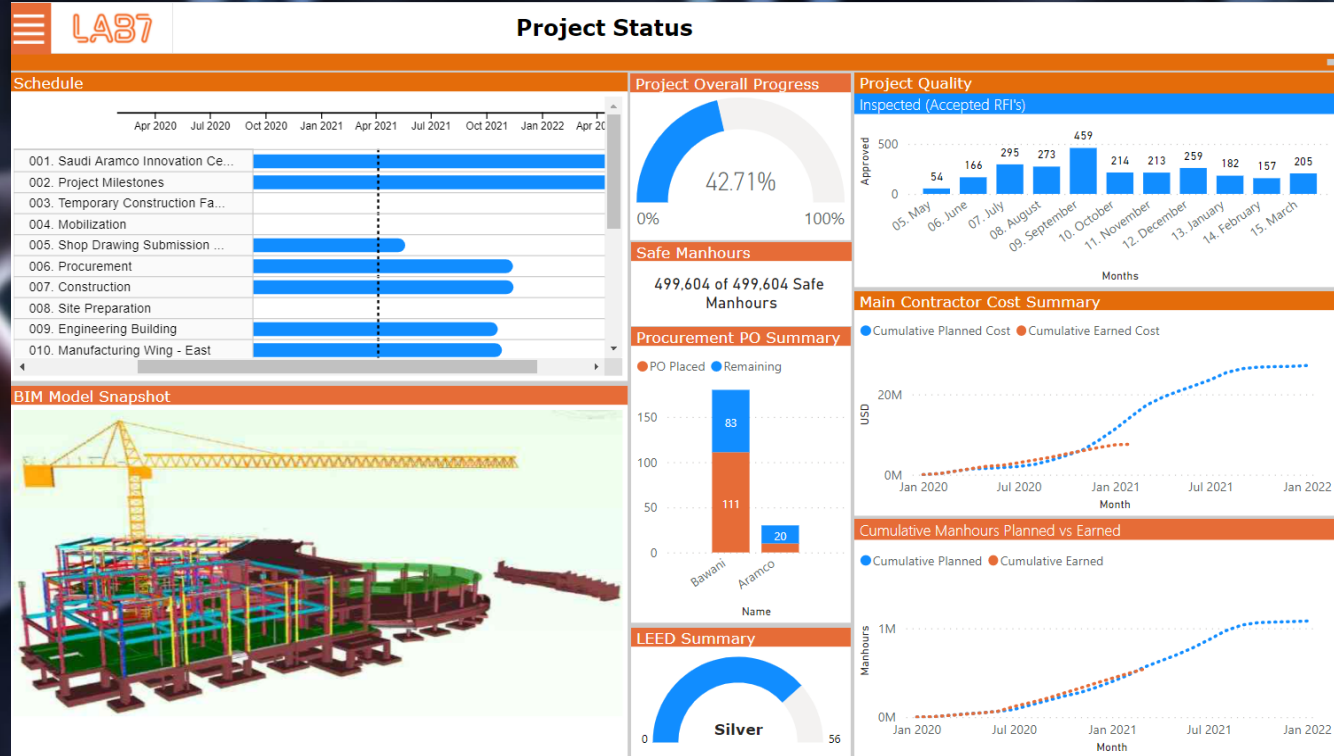


PLANNING

Scheduling & Planning

By uploading the BIM models to AI platforms, the planning activities will be connected to the BIM model elements,

- Planning team will use the power of BIM model visualization for better planning
- The AI can provide many planning strategies in no time.
- Can easily export the schedule from the platform and imported back to Primavera



PLANNING

Construction Simulation

Planned VS Actual

Creating 4D construction simulation will become faster & Dynamic

The AI platform will provide multiple construction options for optimized planning schedule.

By connecting the BIM models to the planning schedule, the planning team will be able to:

- Easily provide detailed 4D task reports
- Planned VS Actual
- Look ahead analysis
- Resource monitoring



COSTING

Cost Management

Change Orders

Tendering & Bidding
Process



COSTING

Cost Management Change Orders

- Assigning the cost information to the BIM models and share it on Cost management platform.
- Enable cost and finance team to manage project budget, track change orders & track all payments and payment requests

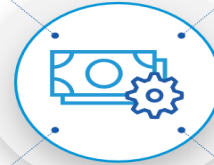
Connected Cost Management

Centralize and manage construction costs on one platform

Budget Creation and
Contract Administration



Change Orders



Cost Forecasting



Payment Applications

CHANGE ORDERS

Create clear accountability and streamline the change order workflows

Understand the origin of the change order by linking or create a PCO from an RFI

Keep the budget balanced and connect PCOs to the budget

Create and send Owner or Supplier Change orders

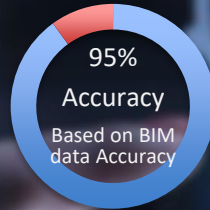
Customize workflow rules for Change Orders approvals

Number	Name	Scope	Type	Budget Code
1-P-0001	Additional Sub Openings	Out	Owner Change	
1-P-0002	Revised Egress Scheme	Out	Owner Change	
1-P-0003	Revised Entrance	Out	Owner Change	
01	Slabing - Revised Entrance	Out		09871000800000...
02	Cladding - Revised Entrance	Out		09871000742000...

COSTING

Tendering & Bidding Process

- Tendering process with all bidders can be over the models, and the bidders will be able to include their corresponding rates in the models. This will allow Automated bid evaluation and cost comparison



My project Example Demo | Cost Estimate my cost estimate | Cost Groups (Net) | Search ...

CG	Designation	Quantity	Unit	Unit Price	Total Net	UNIFORMAT II	Work Category	Comment
	Net				66.737,84 €			
▼ Site-1	Site				66.737,84 €			
▼ Building-1	Building				66.737,84 €			
▼ Storey-1	Foundation				20.195,87 €			
▼ Columns	Columns				966,08 €			
▼ Column-1	FND-001				120,76 €			
	Floor solve footing store W 3-4m 15-20m L L...	0,179	m ²	17,59 €	3,15 €	A1030 Slab on Grade	29 Earth work	
	Formwork footing H 0.5-1m	1,300	m ²	43,94 €	57,12 €	B20 EXTERIOR CLOS...	32 Concrete work	
	Reinforcing bars B500 Dia. 10-16mm strip f...	0,018	t	1.684,82 €	30,33 €	B20 EXTERIOR CLOS...	32 Concrete work	
	Situ concrete footing reinforced concrete C2...	0,163	m ³	185,00 €	30,16 €	B20 EXTERIOR CLOS...	32 Concrete work	

3D Model - Multiple selection (9)

PROCUREMENT

Automated MTO &
QTO

Auto Linking Materials
With Project Schedule

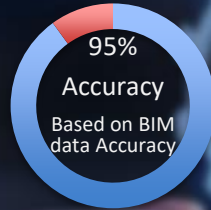


PROCUREMENT

Automated MTO & QTO
Auto Linking Materials
With Project Schedule

By uploading the BIM models to a powerful Quantity take off platform, Procurement team will have access to the autogenerated BOQ linked with the BIM model

- Material tracking list can be customized and auto generated, MTO will be created.
- All materials will be linked to the project schedule
- Better tracking of Material delivery to site and actual accurate quantities



MMC variant with time and type *

Search Hide Filter Bar Restore Filters (3) Go

*Shortage Definition: Material: Individual Segment: Time till Shortage: WBS Element:

Project:

Materials (30) View Settings

Project hierarchy	BIM model	Material Description	Individual Segment	First Shortage On	Shortage Quantity	Shortage Duration (Working Days)	Stock Availability	Procurement Type Description	In-House Production Time (Working Days)	Planned Delivery Time (Calendar Days)
		SEM1224.MTO.PD.Subassembl	ProjSI E00000-022	23.04.2017	300 PC	92	<div style="width: 100%; height: 10px; background-color: #28a745;"></div>	In-house production	1	0
		NH	ProjSI E00000-033	27.04.2017	1 PC	999	<div style="width: 100%; height: 10px; background-color: #dc3545;"></div>	External procurement	0	10

CONSTRUCTION

3D Laser Scan

Augmented Reality
"AR"

Virtual Reality "VR"

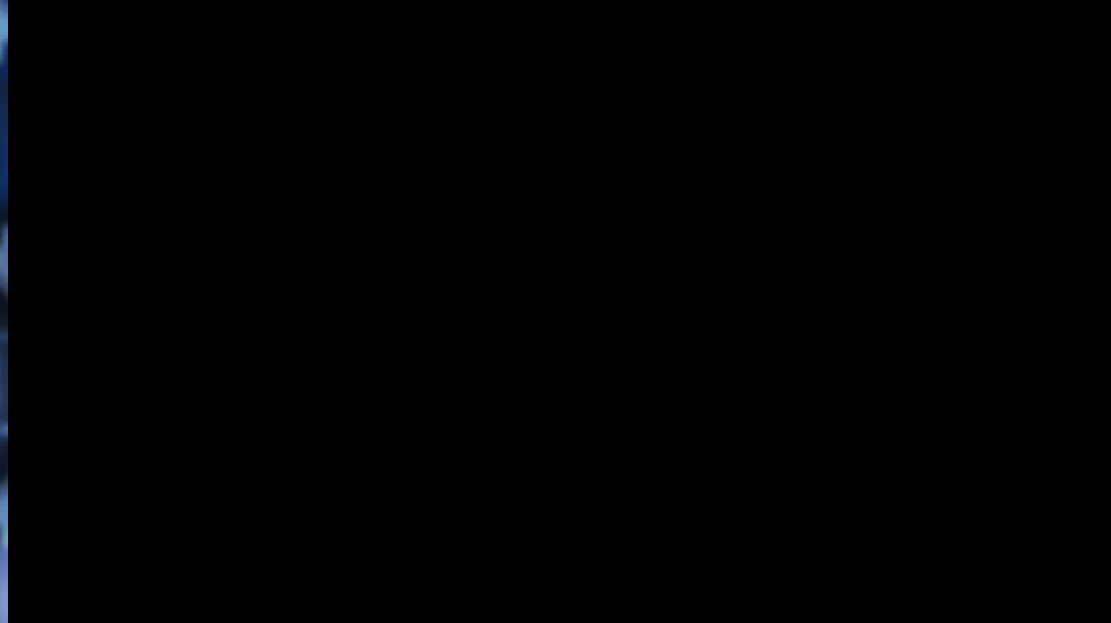
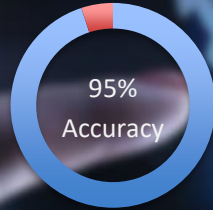
BIM CAVE



CONSTRUCTION

3D Laser Scan

- Site team can capture the as-built
- Exported as 3D point cloud
- Superimposed to the design BIM models to track any site changes
- Used for renovation projects by capturing the existing building
- Drone Laser scan can be used for large



CONSTRUCTION

3D Laser Scan

Sample of 3D Scan Showing
the Difference between the
as Built & Model

Comparing the design model
with the as-built at
construction site



As Per BIM Model No Opening



3D Points Cloud with Opening

CONSTRUCTION

Augmented Reality "AR"

- This technology will bring the 3D BIM models to the actual site, by uploading the BIM models to the I Pad and walk through the site, the team will see all design elements and can detect any required penetrations through the walls.
- Site team will have a complete vision for coordination specially for MEP utilities



CONSTRUCTION

Virtual Reality “VR”

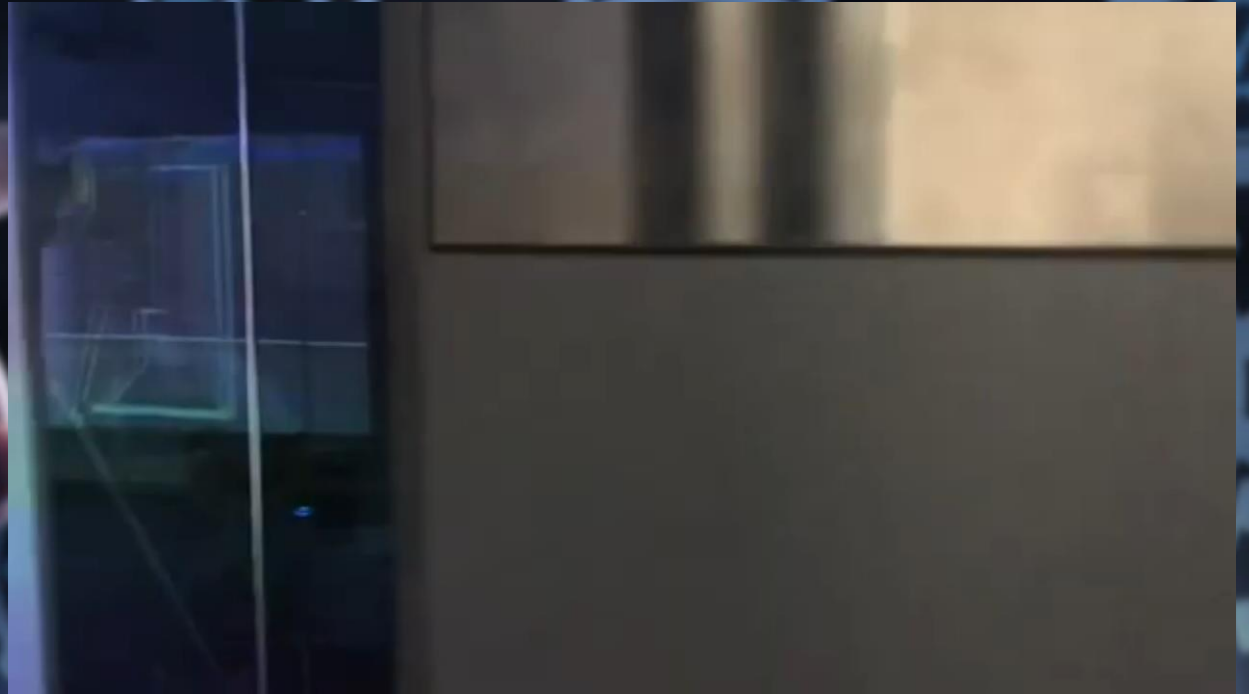
- This technology is a very powerful collaboration tool, by doing a walk through the BIM models, review the design, check clashes & reporting design issues.
- Can be linked with the online meetings.
- Doing a full demonstration to the client by walking inside the project, this also can be done before project award for excellent marketing.



CONSTRUCTION

BIM CAVE

- This technology enables projects to be realized in an immersive, interactive and collaborative virtual environment.
- Rapid identification of any project issues or complications
- Capability to deliver interactive public engagement and consultation sessions



Challenges

- **Staff Competency that leads to Cultural or Technical Resistance.**
- **Financial related issues.**
- **Data Management.**
- **Lack of alignment.**





WHAT'S
NEXT

?



THANK YOU

