

BIM



NECESSITY IS THE MOTHER OF BIM

An advanced integration of BIM in a company process

BY ANTÓNIO RUIVO MEIRELES

ndBIM
VIRTUAL BUILDING



TOPICS:

ABOUT US

THE 7 BENEFITS

BIM IMPLEMENTATION STRATEGY

ABOUT US

REASON FOR OUR EXISTENCE

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**In times of change, learners
inherit the Earth. . .**

while the learned
find themselves
beautifully
equipped to deal
with a world that
no longer exists.

Eric Hoffer



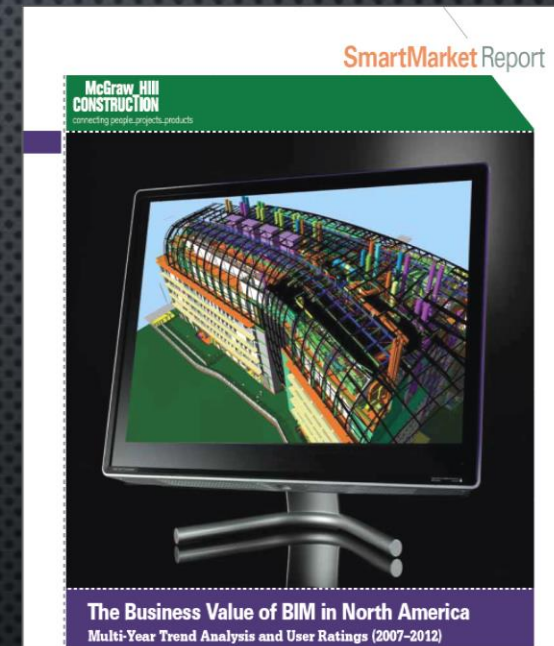
REASON FOR OUR EXISTENCE

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5D Models with Cost

Universally viewed as difficult, the integration of BIM models with schedule and cost data is one of the great promises of BIM. But at this point, even the very high E-Level users are cautious, with only 8% believing it is easy or very easy. However, the seamless integration of geometry with schedule and cost data has the potential to be a fundamental value proposition of BIM in the future if its difficulty can be surmounted.



ABOUT US

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ndBIM
VIRTUAL BUILDING

Consulting and Services company specialized in **BIM** methodology (...)

(...) founded in November 2013 (...)

(...) composed by professionals, Architects e Engineers, (...)

(...) with **over 7 years of BIM Implementation in the field.**

We believe that the migration process for 5D BIM (includes 3D and 4D) can be **achieved quickly and without risk** when it is carried in an oriented manner.

We know the industry, how the companies operate, their addictions, (...)

Our knowledge is not theoretical or was obtained from standard training of software houses, **it was on the other hand created from the knowledge gained from the Implementation of BIM in a construction company with an international dimension.**

ANTÓNIO RUIVO MEIRELES

FOUNDER OF NDBIM VIRTUAL BUILDING



- **BIMFórum Portugal Coordinator**
- **Guest Speaker at several international conferences BIM**
(Portugal, Italy, Paris, Holland, Hungary, Japan, Brazil, Norway, Denmark etc.) and participation in workshops (Finland, EUA, etc.)
- **Mentor of several BIM related master thesis**
- **Visiting professor of the course: "BIM: Concept, Design and Construction"** in the Master of Sustainable Construction and Rehabilitation, School of Engineering, University of Minho

Academic path:

- **Construction Management PhD (in progress)** at the Faculty of Engineering of the University of Porto (FEUP)
- **Business Management MBA** by IESF
- **Civil Engineering Degree** by the Faculty of Engineering of the University of Porto (FEUP)

Professional path:

- **BIM MANAGER** AT MOTA-ENGIL ENGINEERING
- **FOUNDER AND EX-COORDINATOR OF GTBIM** OF THE PORTUGUESE TECHNOLOGICAL CONSTRUCTION PLATFORM
- **INOVATION DEPARTMENT COORDINATOR** AT MOTA-ENGIL ENGINEERING
- **ENGINEER DESIGNER** STRUCTURES AND OTHER DISCIPLINES
- **IT STRATEGICAL CONSULTANT**

WHAT DO WE OFFER?

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Diagnosis

Studies on the potential Return
on Investment (ROI)

**Definition of a Strategic
Implementation Plan**

Definition of Work

Methodologies

Contracts preparation support

Training



CONSULTING



DESIGN

Urban Planning

Architecture Design

Interior Architecture

Stability and Foundations

MEP

3D Modeling

Coordination

Structural and Functional analysis

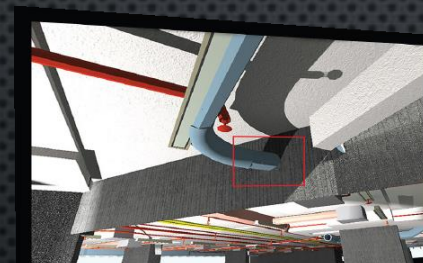
Clash Detection

Drawings Take off

Quantities Take off

3D Simulation

Renders and Animations



3D BIM - MODELING



4D BIM - SCHEDULING

Physical Scheduling

Physical Control

Physical Scheduling Forecast

4D Simulation

Estimating

Budgeting

Economic Control

Economic Forecast

5D Simulation



5D BIM - ESTIMATING



6D BIM - MAINTENANCE

Spaces Management

Assets Management

Tenant Management

Fault Management

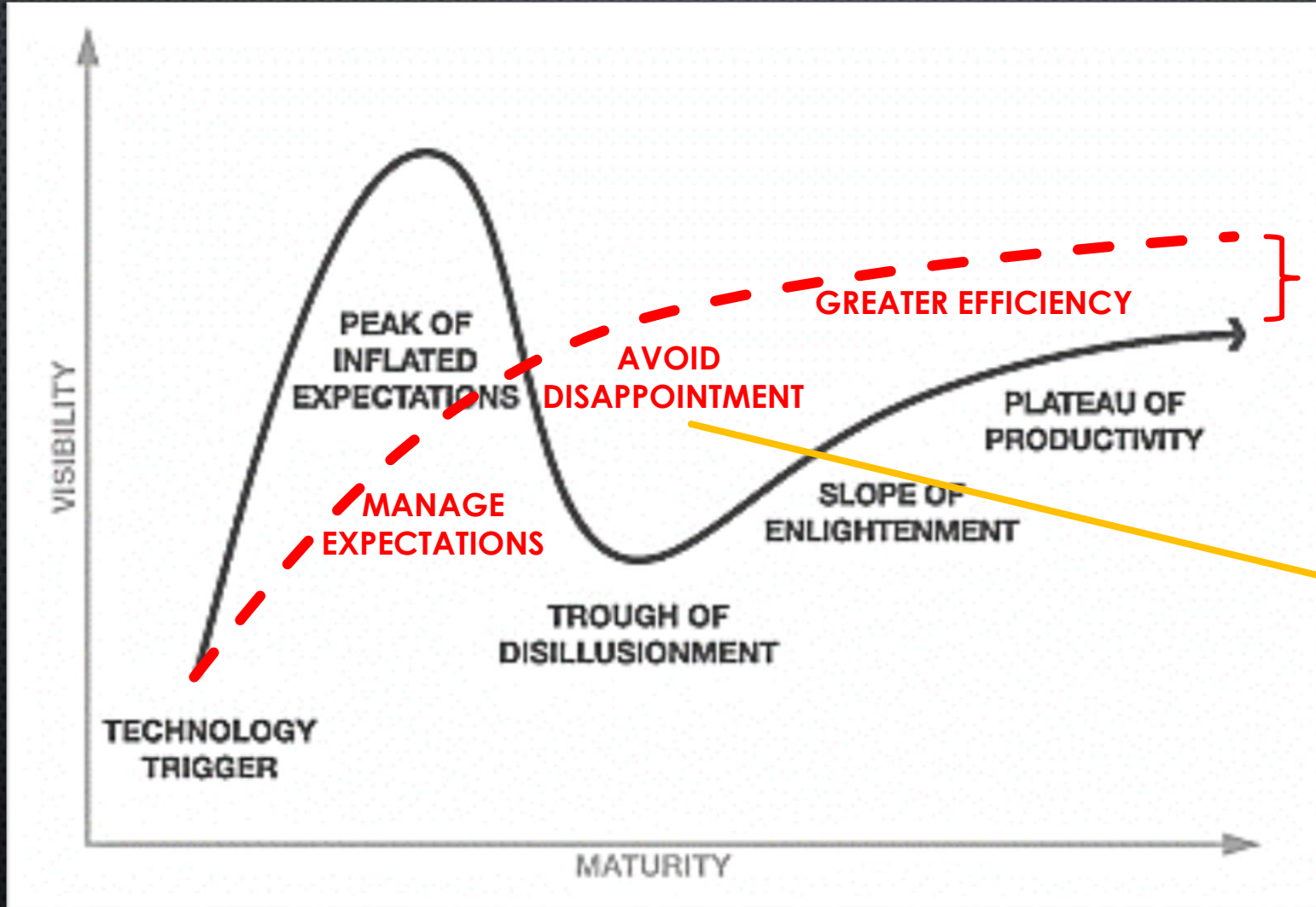
Preventive Maintenance

Reports

WHAT WE DO NOT OFFER?

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Δ RETURN ON INVESTMENT

Separate Reality from Fiction

The reality is exciting enough!!

Gartner Research's Hype Curve Model

WHERE ARE OUR CLIENTS?

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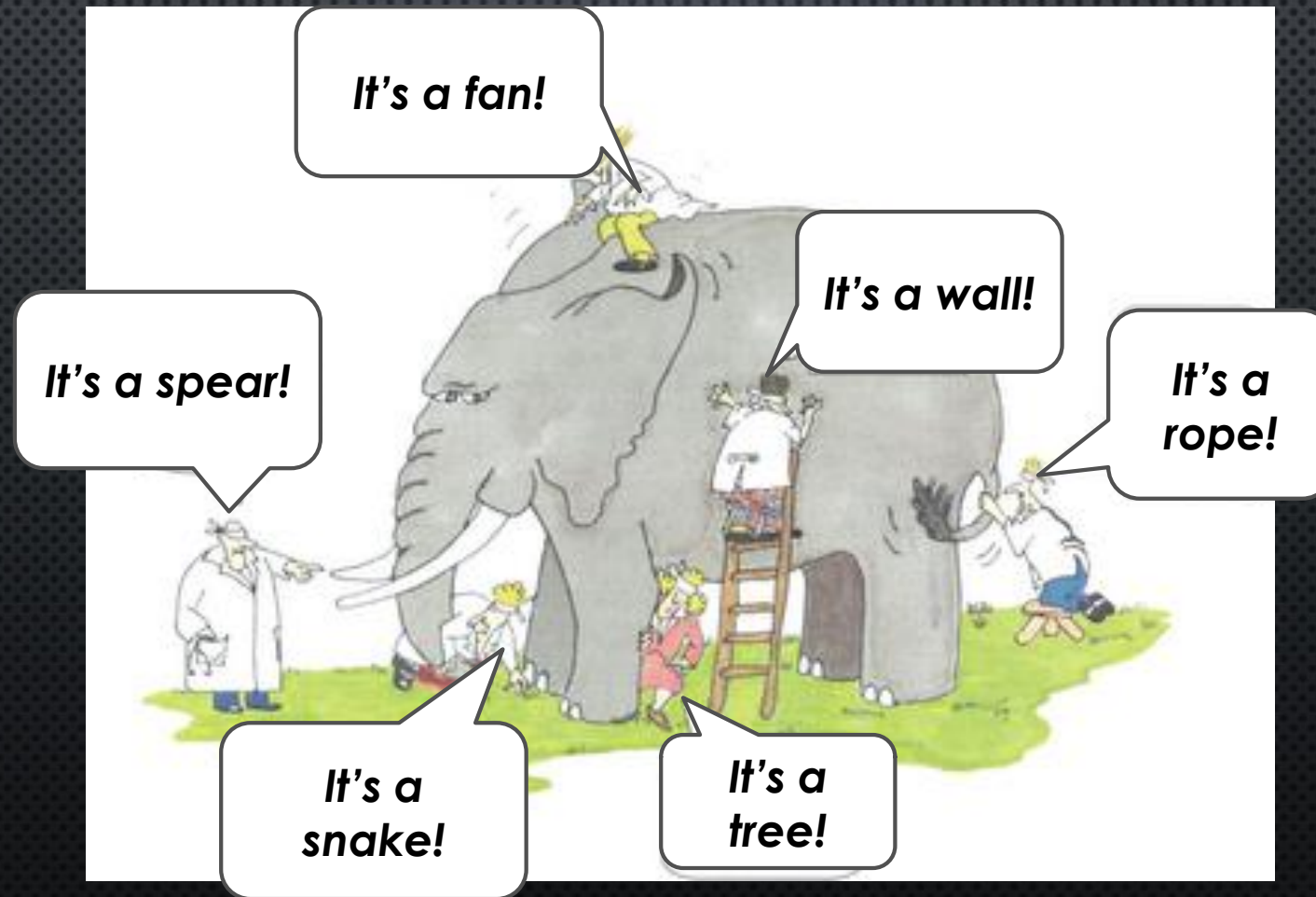
INTRODUCTION

INTRODUCTION

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THE IMPORTANCE OF DEFINING WHAT IS BIM



INTRODUCTION

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The locals of Shinar decided to build a city that would touch the sky.

In consternation at their impertinence, the Lord intervened, sowing discord and unease among men, depriving them of their original language.

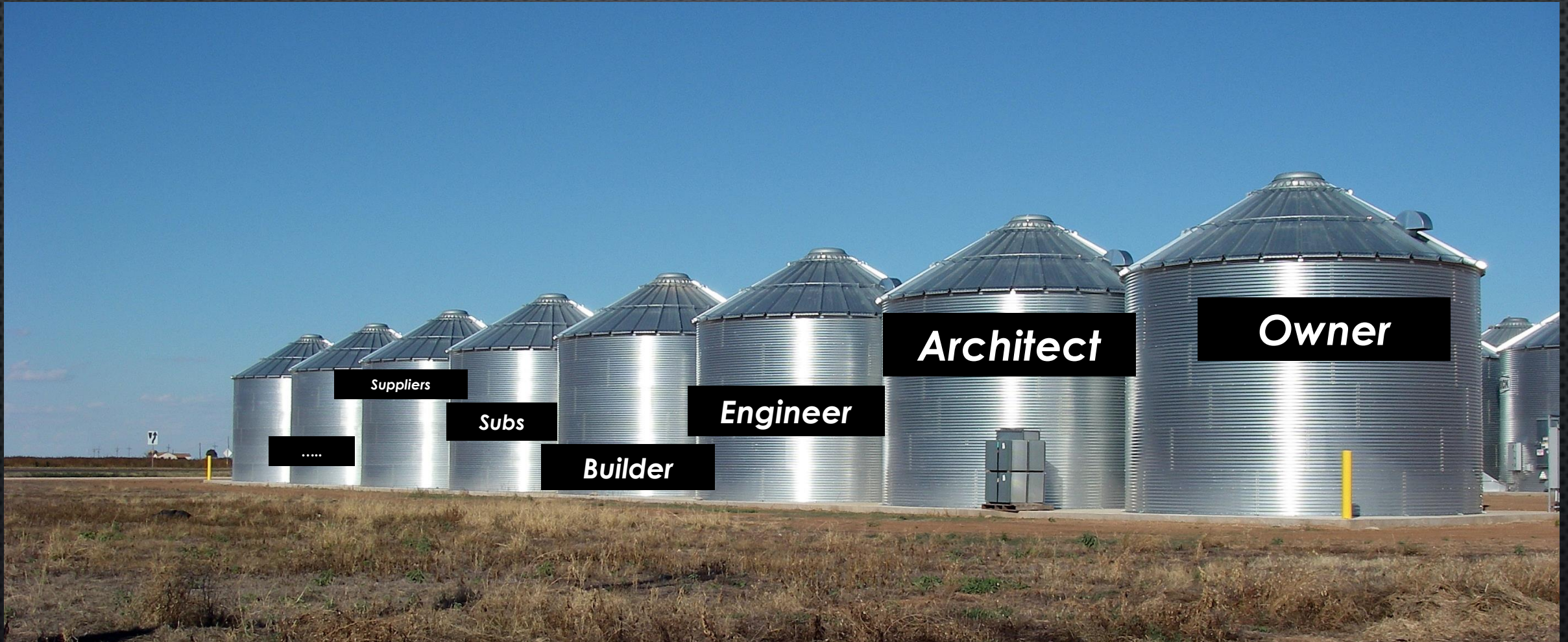
Culturally divided and unable to understand each other and join forces, the human nations have never been able to finish their major project which triggered a conflict.



INTRODUCTION

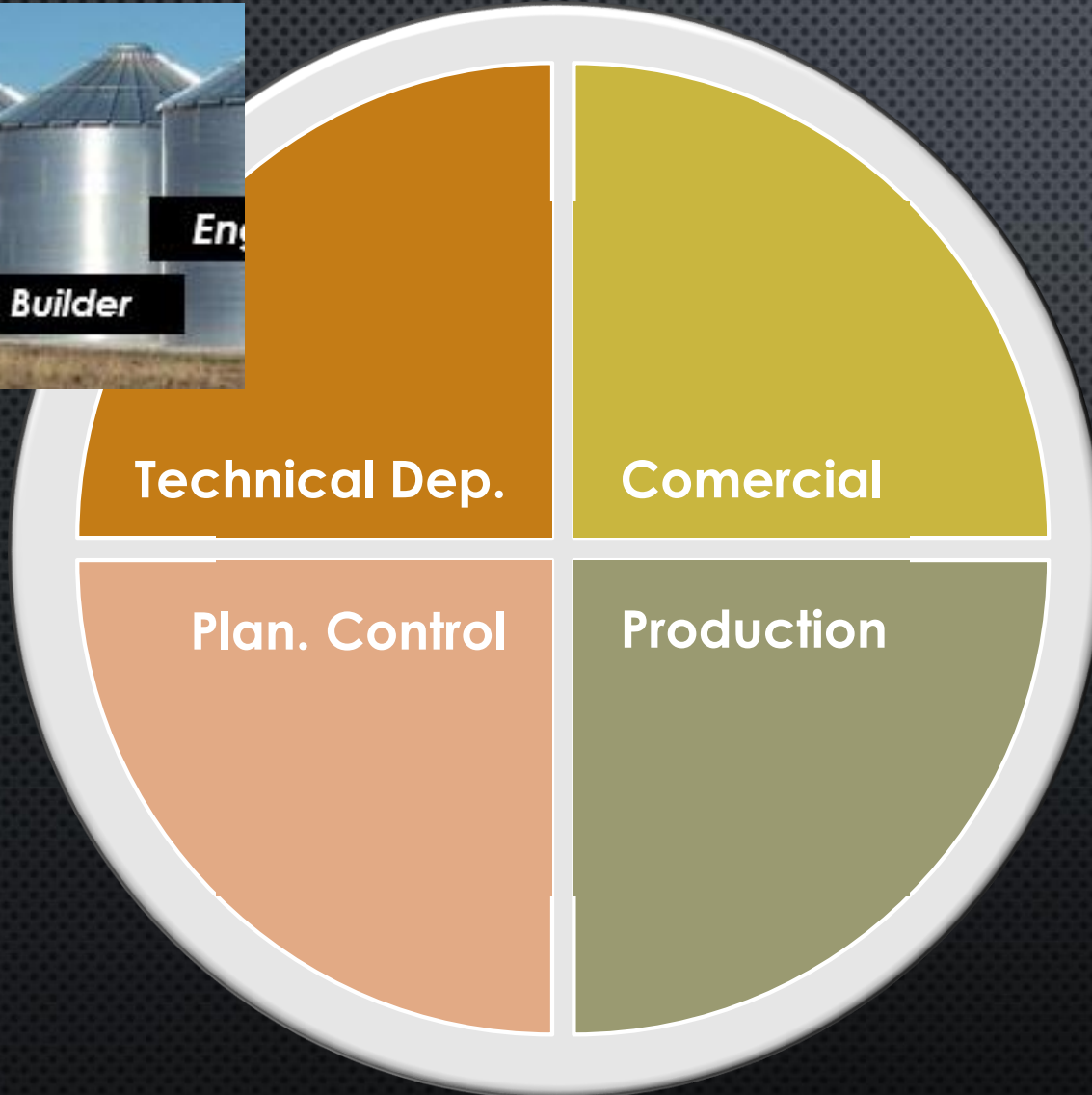
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INTRODUCTION

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INTRODUCTION

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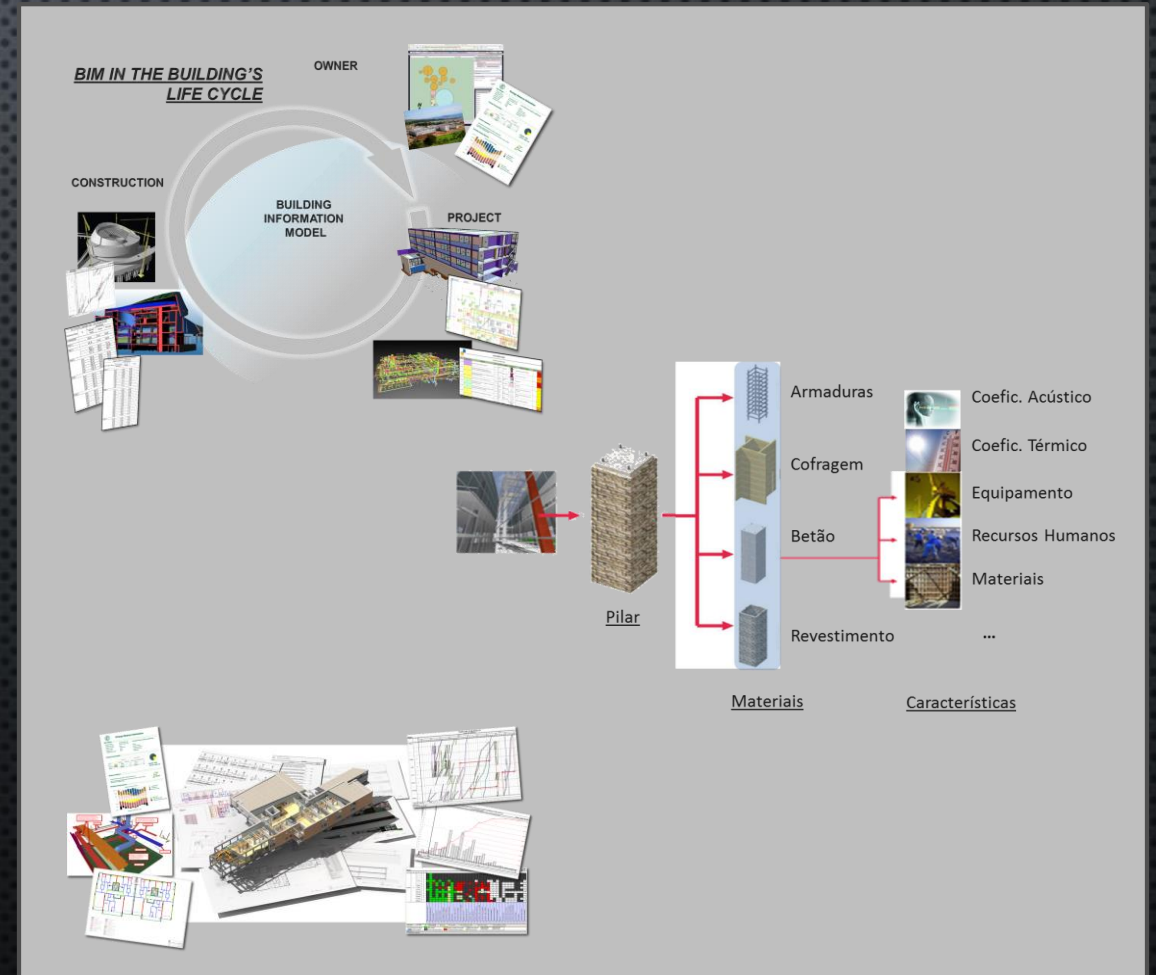
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FOR US... WHAT IS BIM?

BIM is an integrated process that stores and streamlines the exchange of design, construction and operation information between the various stakeholders, ...

... creating three-dimensional models that represent all the physical and functional characteristics of the building ...

... that **have a great potential in supporting decision making in the various stages of a project.**



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BIM Stages

Both are valid and bring results to a company...

... however the future is a social BIM.



Pablo Rodon

lonely BIM



Castells, Arbol de la Vida 177

social BIM

The 7 Benefits

1. Better Communication
2. Optimized Crews
3. Problem Identification and Resolution
4. Design Optimization
5. Shop Drawings
6. Quantity Extraction and Cost Estimation
7. Better scheduling

Summing up, more data to help decision making.

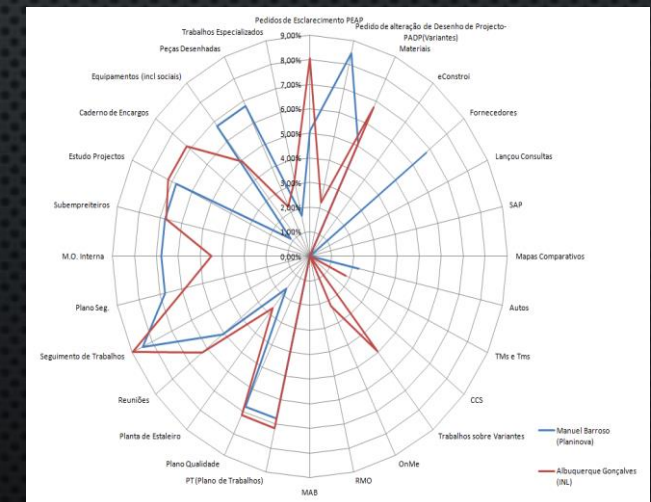
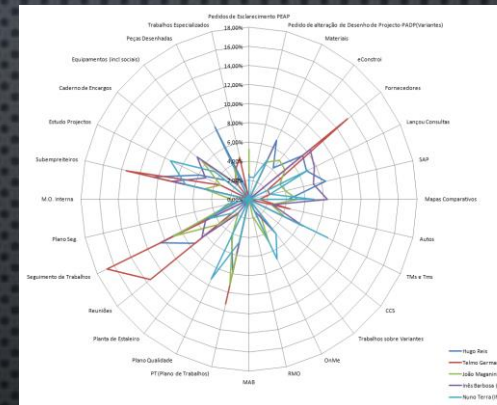
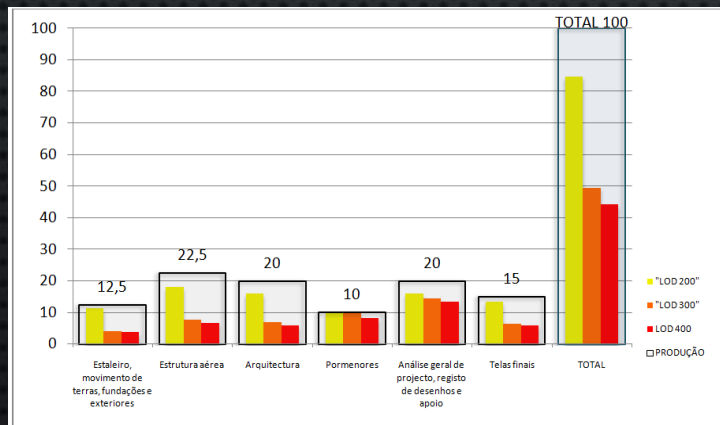
THE 7 BENEFITS

THE 7 BENEFITS

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(2) OPTIMIZED CREWS

- Our internal studies show that with a BIM Process we can have smaller teams in charge of the site;
- **This can represent a saving of 1 to 2% of the costs on the project.**

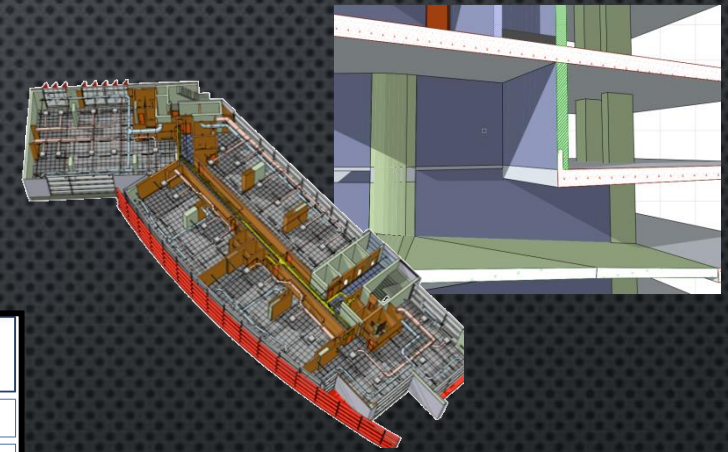


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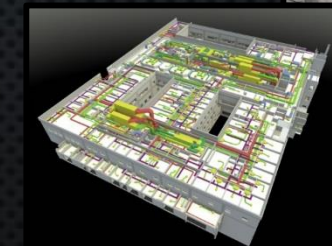
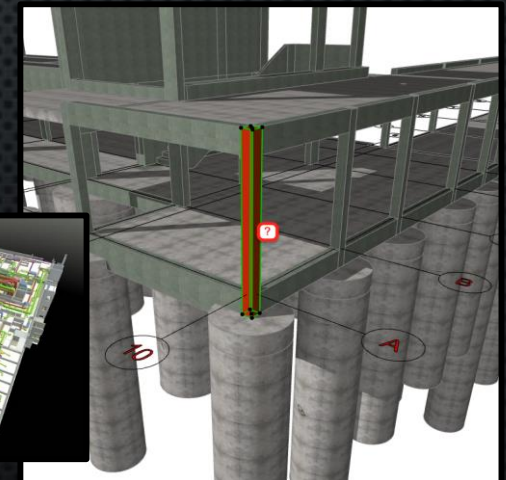
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(3) PROBLEM IDENTIFICATION AND RESOLUTION

- Because of the deficient quality of the projects, there are always lots of problems.
- The ability to detect them beforehand has proven to be invaluable.
- **Aim to have a 80% rework economy.**



ID	Specialties	Floor	Axes	2D Drawings	Who find it?	Who should resolve it?	Severity	Resolved?
12	ARQ/ STR	-2	09-D	Cx.Esc.02	JM	ARQ		
Descrição A PORTA DE ACESSO A ÁREA TÉCNICA POR BAIXO DA ESCADA ESTÁ DESIGNADA NA PLANTA DE ARQUITETURA COMO VIP.01, CONTUDO QUER EM LARGURA COMO EM ALTURA PARECE INCOERENTE COM O EXISTENTE.								
Intervenção NÃO SE PROCEDEU A QUALQUER ALTERAÇÃO. AGUARDA-SE PARECER DO PROJETISTA.								
								



Resolução de Incompatibilidades



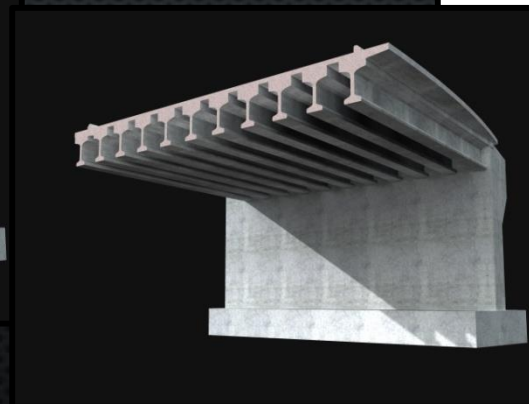
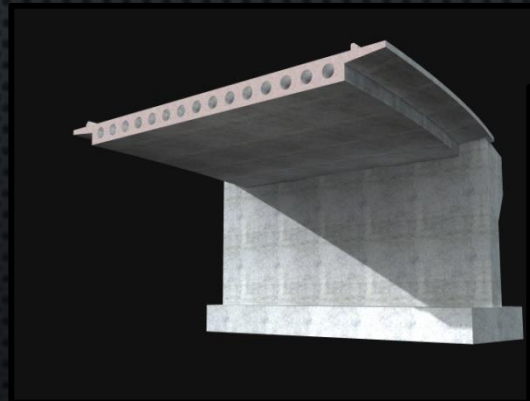
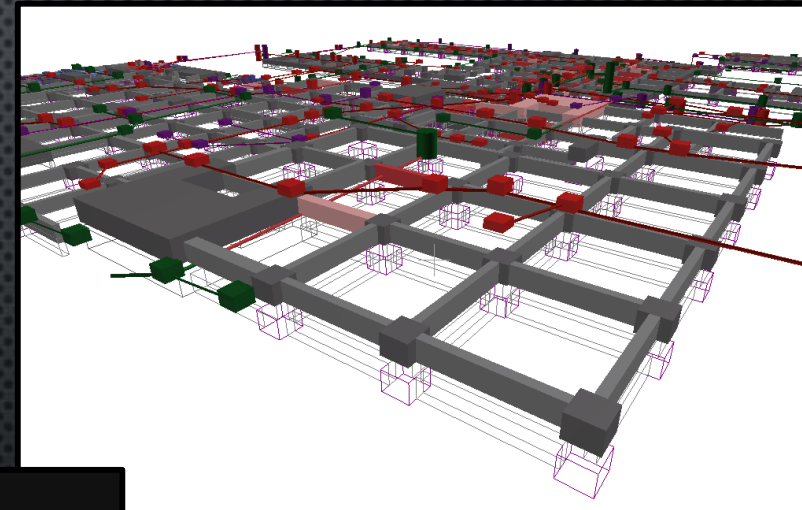
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(4) DESIGN OPTIMIZATION

- *Internationally there is a long standing tradition of GC presenting project alternatives to the client.*
- *The model clarifies the intentions.*
- **Our goal is to increase builders margin at least in 1%.**

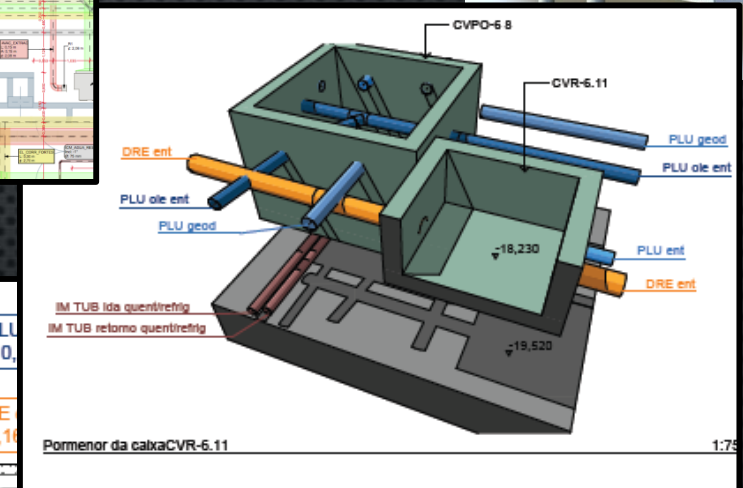
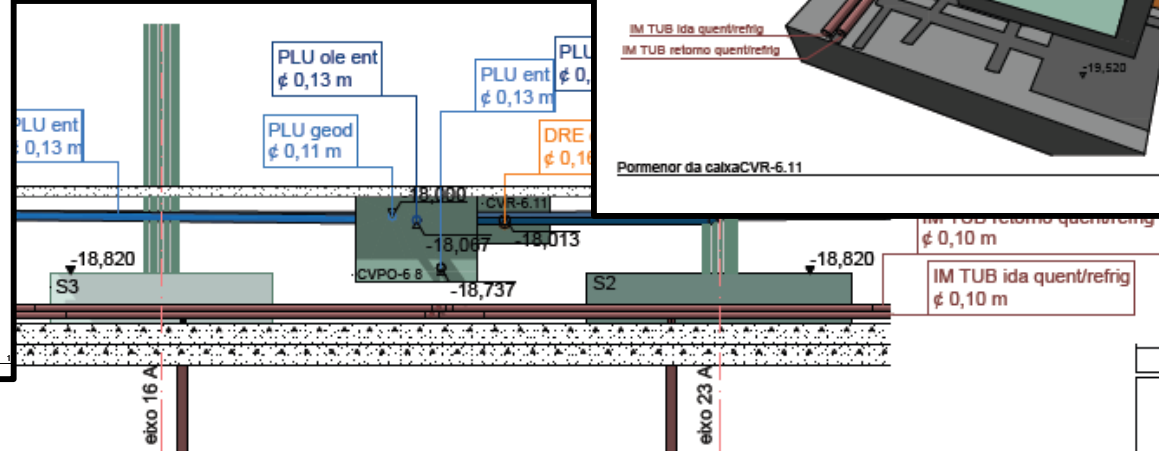
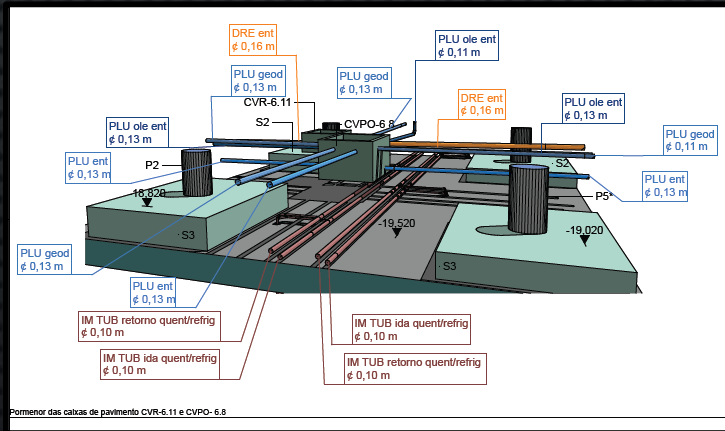
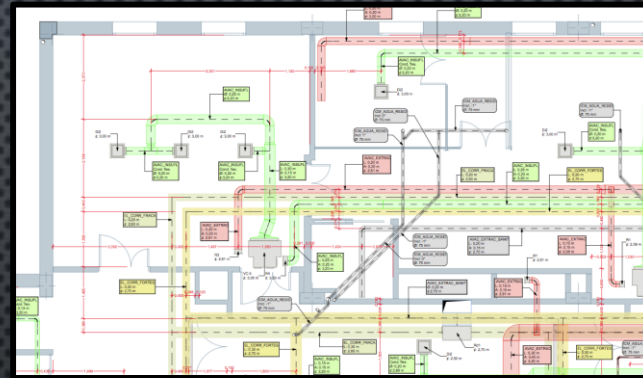
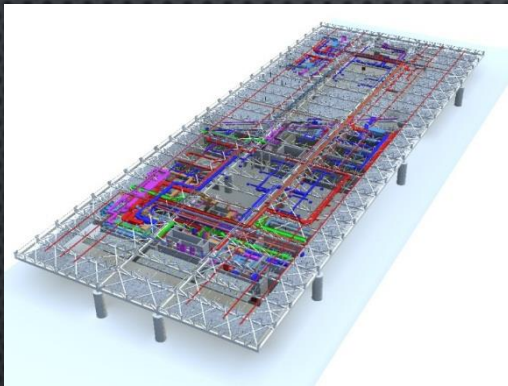


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(5) SHOP DRAWINGS

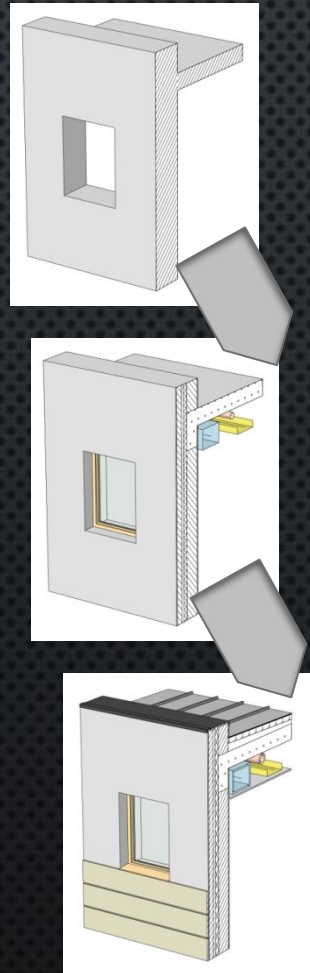
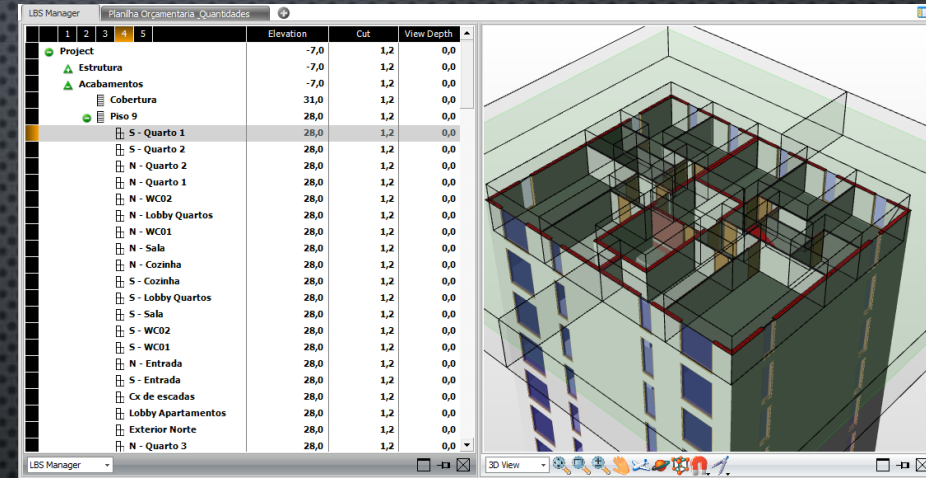


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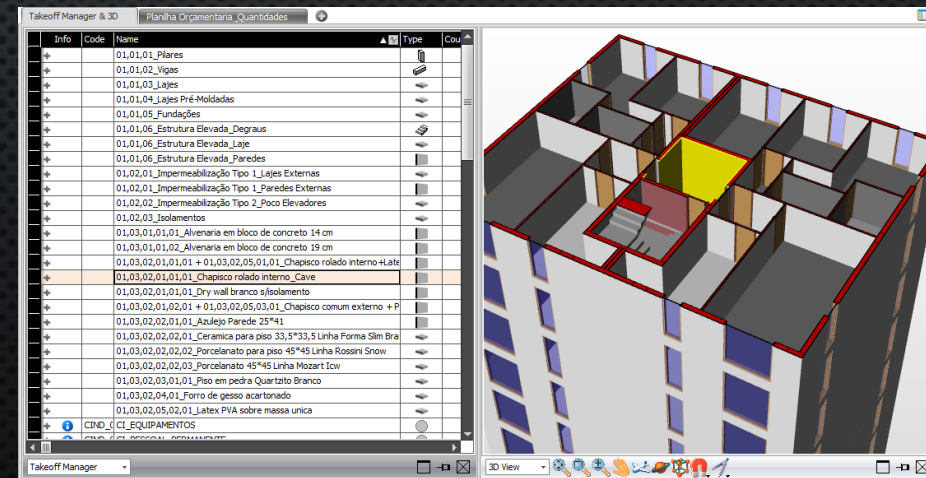
(6) QUANTITY EXTRACTION AND COST ESTIMATION

- Quantity Extraction acquires an enormous importance for Cost Estimation;
- Possibility to **measure more in less time;**
- The model based process is **more reliable and error proof than the traditional method;**
- Better Cost Estimates and **Risk Mitigation.**



The screenshot shows a software interface with a detailed cost estimation table. The table has columns for Item, Description, Unit, Quantity, Price, and Total. It lists various construction items and their associated costs.

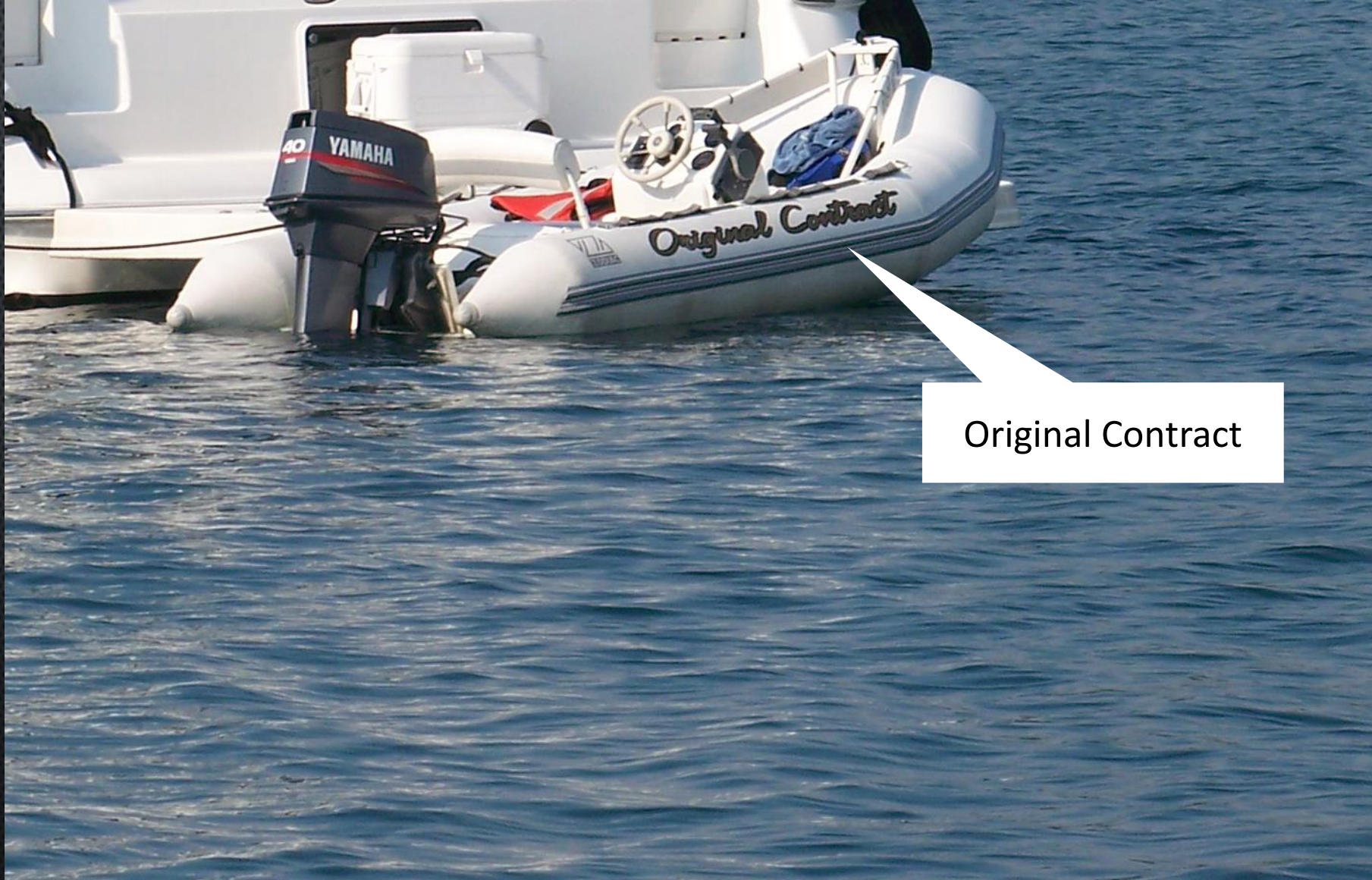
Item	Description	Unit	Quantity	Price	Total
4.11	Fundamentação e montagem de todos os tipos em obra	m3	1018,26	25,50	25.965,63
4.12	Montagem e montagem de todos os tipos em obra	m3	1018,26	25,50	25.965,63
4.13	Montagem e montagem de todos os tipos em obra	m3	1018,26	25,50	25.965,63
4.14	Montagem e montagem de todos os tipos em obra	m3	1018,26	25,50	25.965,63
4.15	Montagem e montagem de todos os tipos em obra	m3	1018,26	25,50	25.965,63
4.16	Montagem e montagem de todos os tipos em obra	m3	1018,26	25,50	25.965,63
4.17	Montagem e montagem de todos os tipos em obra	m3	1018,26	25,50	25.965,63
4.18	Montagem e montagem de todos os tipos em obra	m3	1018,26	25,50	25.965,63
4.19	Montagem e montagem de todos os tipos em obra	m3	1018,26	25,50	25.965,63
4.20	Montagem e montagem de todos os tipos em obra	m3	1018,26	25,50	25.965,63



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Original Contract

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Change Order

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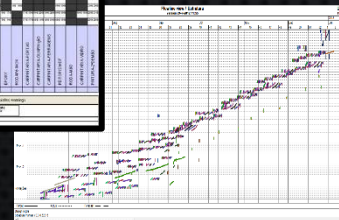
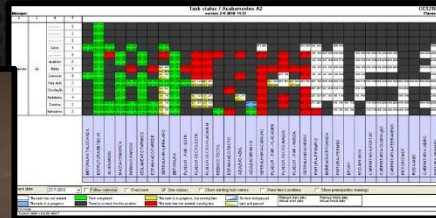
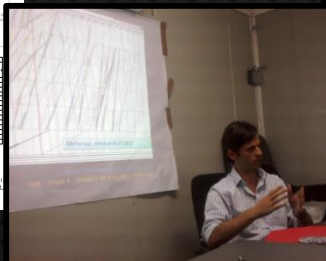
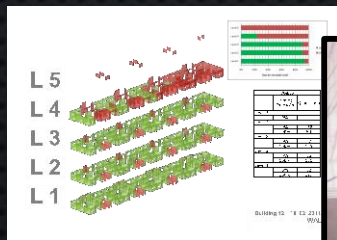
(7) BETTER SCHEDULING

- Pilots have shown us that there can be a 20% gain in the total duration of the construction with a proportional saving on the site:

Example:

Construction site cost can represent 10% or more of construction costs, so for a 10M€ site it can represent a savings of 200.000€.

- Line of Balance based discussion clarifies problems and options, promoting trust between partners.

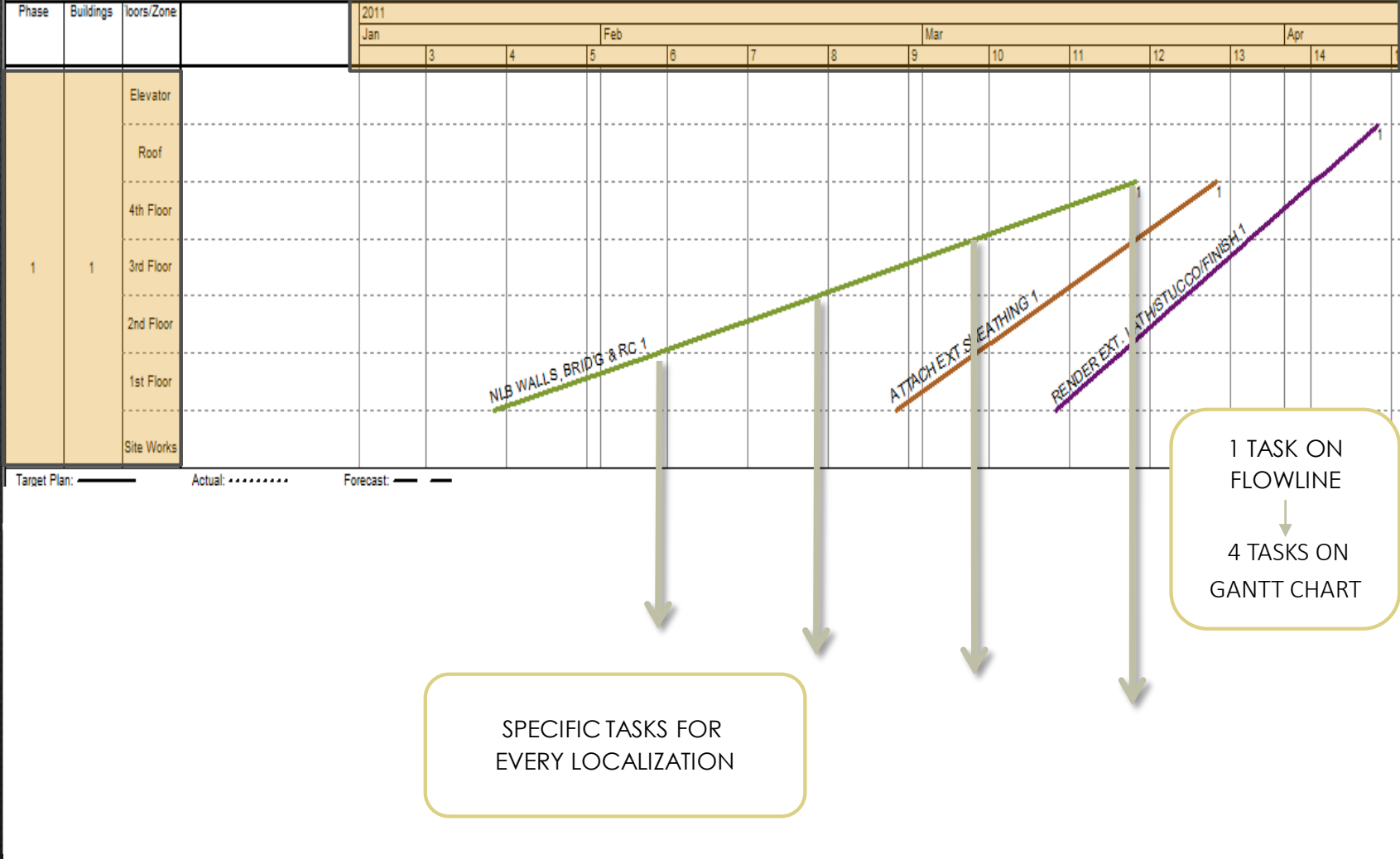


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LOCATIONS

TIME

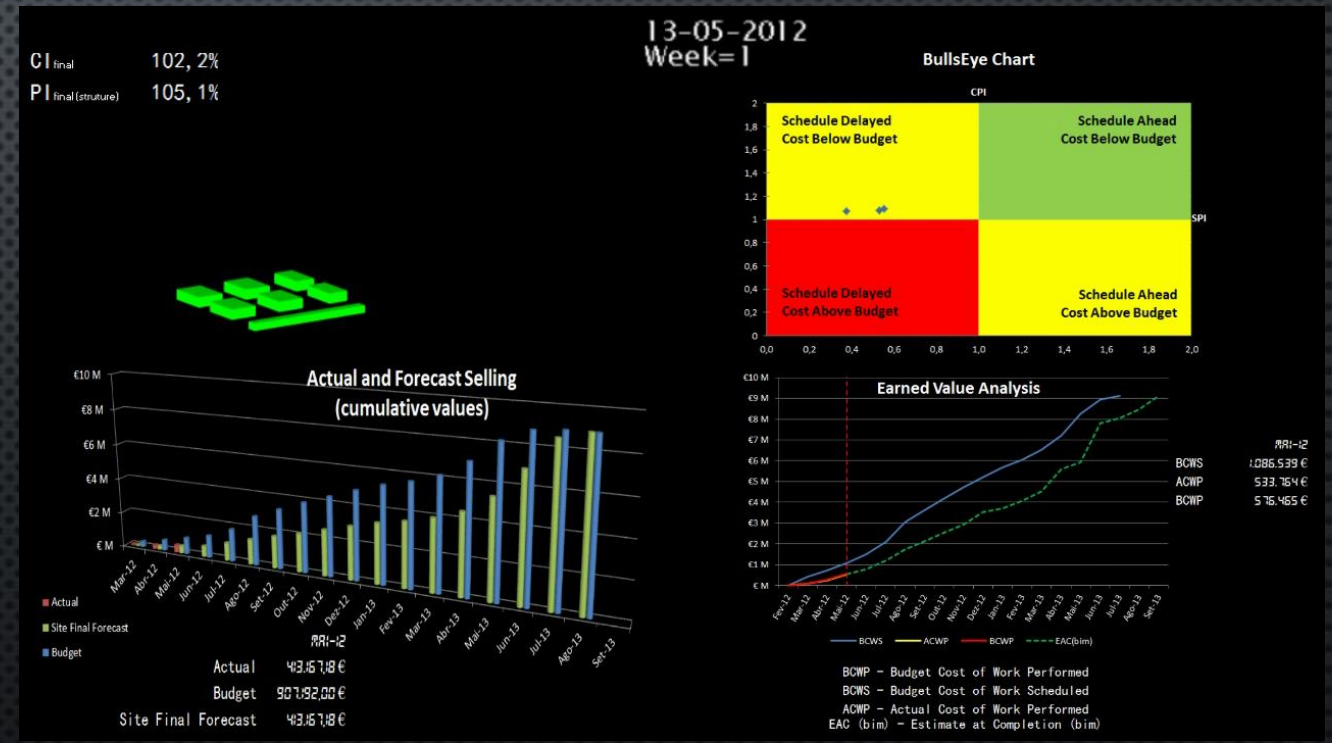
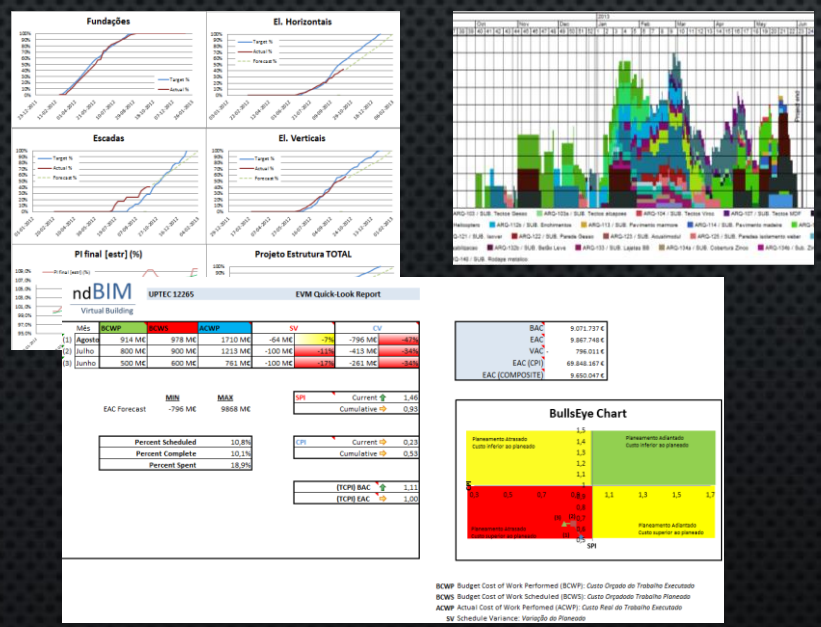


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CONCLUDING: MORE DATA TO DECIDE!

- S-Curves
- Earned Value Analysis
- Resources Histogram
- Etc.



THE TRUE 5D BIM!

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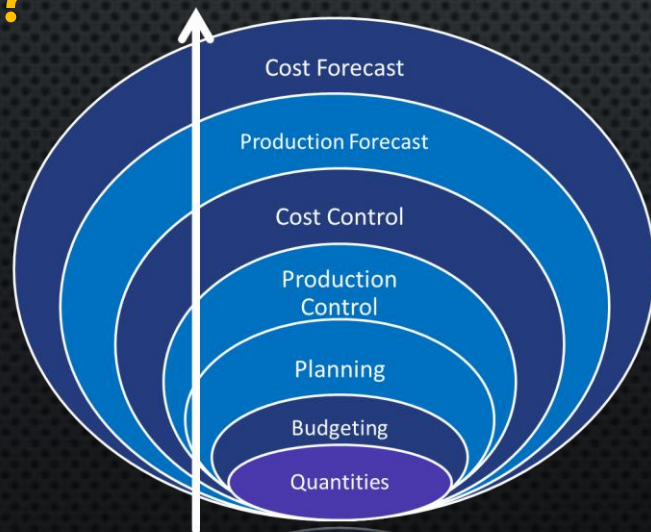
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Say NO to Hollywood BIM!!

This is the path to True BIM!

1) At what point are you?

2) And how far do you want to go?



**Absolutely, we use
BIM all the time!**



**Well, at least we
bought the software...**

THE 6D BIM! THE NEXT STEP!



Asset Planning
Area management

Asset management

Tenant management

Maintenance

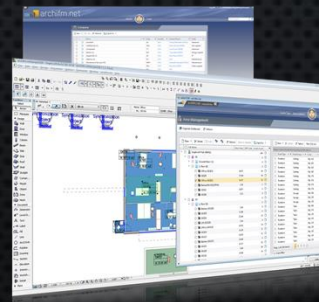
Planned maintenance

Breakdown maintenance

Facility management

Reporting

Analysis



Seven Steps:

1. Benchmarking
2. Strategy Plan and Goals
3. People and culture/change
4. Process Definition
5. Software Choice
6. Training
7. Pilots and Evaluation

Key findings

BIM IMPLEMENTATION STRATEGY

1. BENCHMARKING

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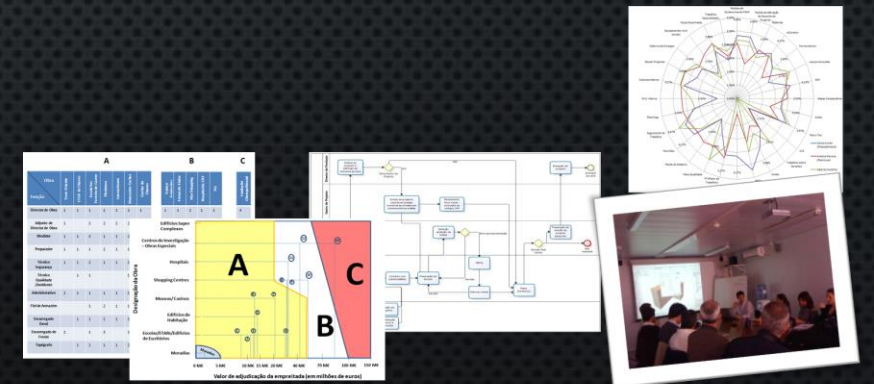
External Benchmarking

- analyzed hundreds of scientific articles, books and market studies published between 2008 and 2012;
- visited more than 15 international “BIM companies” (USA, Hungary, Finland, Sweden).



Internal Benchmarking

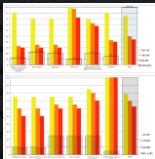
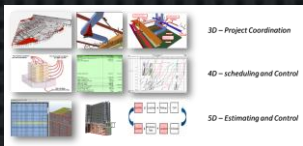
- Process mapping methodology through Swim Lanes
- Statistical research on optimal size of work teams
- Study on time spent on work activities



2. STRATEGY PLAN AND GOALS

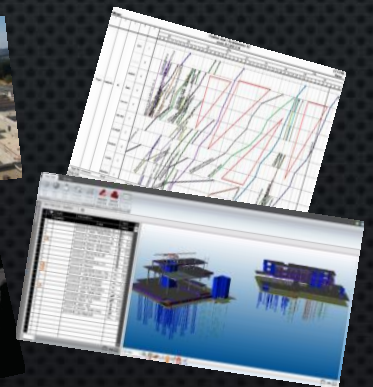
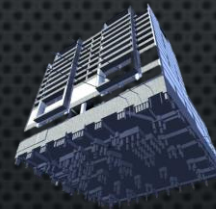
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A MASTER PLAN



	All Is	To Be	Short term	Medium term	Long term
Progress					
Best Practices					
Economic Indicators					
CO2 Indicators					

normaBIM			
Mota-Engil			
Fluxos e Responsabilidades	Nível de Detalhe	Armazen Virtual	Boas Práticas
	LOD 100 LOD 200 LOD 300 LOD 400 LOD 500		
RFI (Request for Information)	Pedido de Informação	Constructability Report	



3. PEOPLE AND CULTURE/CHANGE

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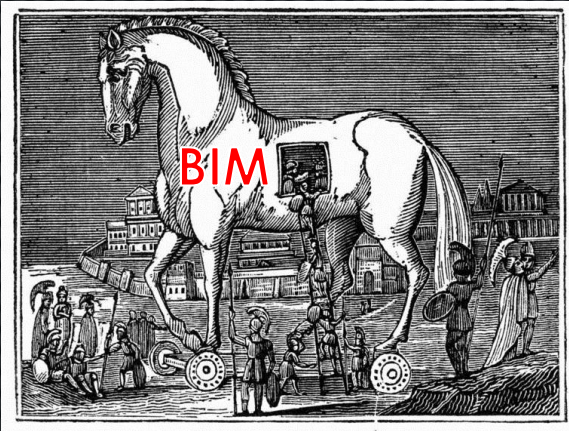
- The need for a **good evangelist that keeps motivation** when facing difficulties;
- The **culture and values of the organization must be aligned with the new approaches** [empowerment, sharing, teamwork, etc.];
- The fact that **not all want to enter** on these concepts:
 - **Fear of being overtaken by the colleagues;**
 - Information overload;
 - **Lack of time;**
 - **Lack of motivation;**
 - Palatability and ease of using these "tools"
- The importance of the **usefulness of the results** that you can extract from the "BIM";
- The importance of **managing the expectations** of those who collaborate;

3. PEOPLE AND CULTURE/CHANGE

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Diferent implementation strategies according to the corporate culture.

Trojan Horse



Profile 1:

- Large companies;
- High resistance to change;
- High inertia.

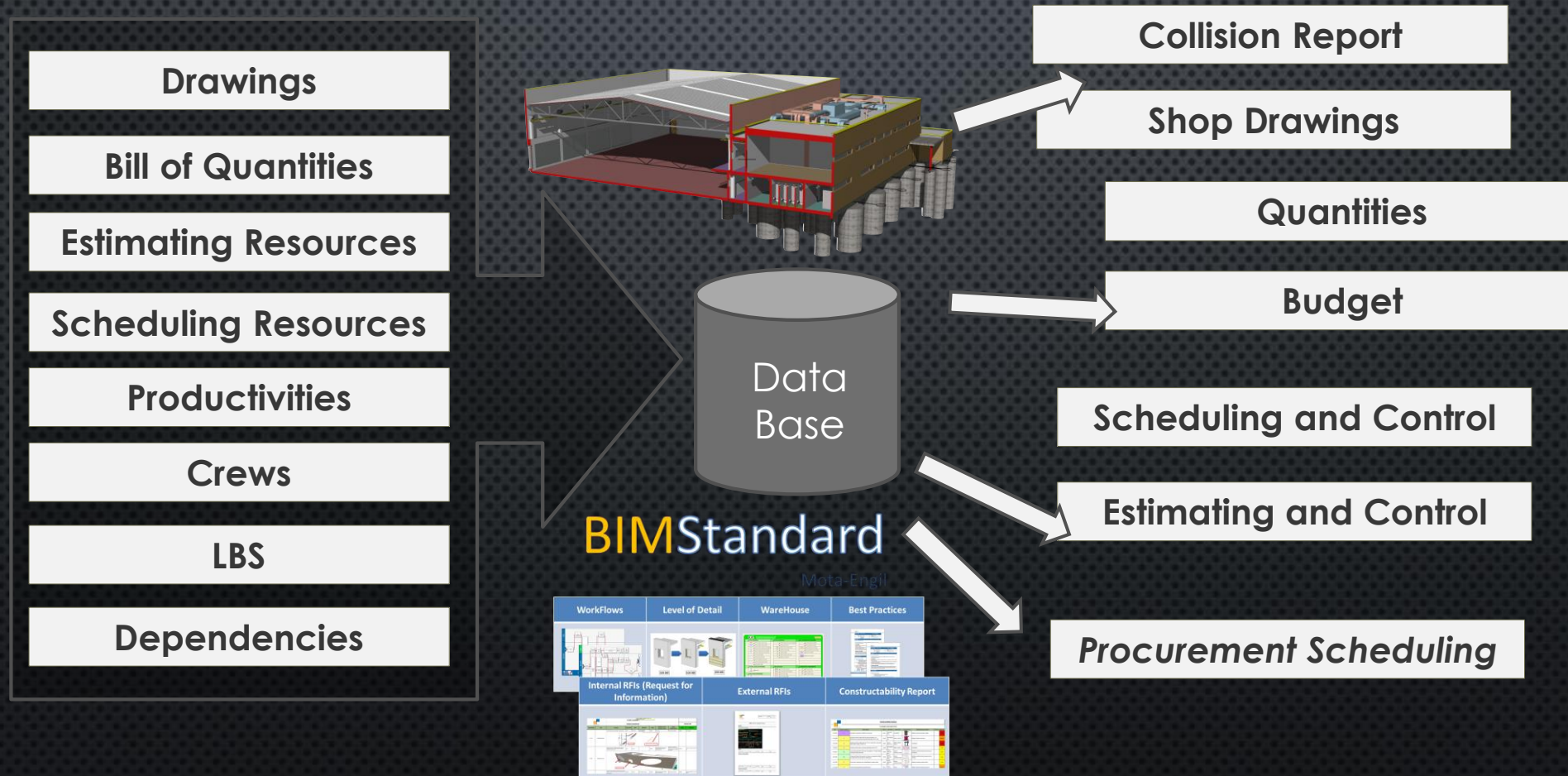


Profile 2:

- Small to medium sized companies;
- Less resistance to change and available for new methodologies;
- Reduced inertia.

4. PROCESS DEFINITION




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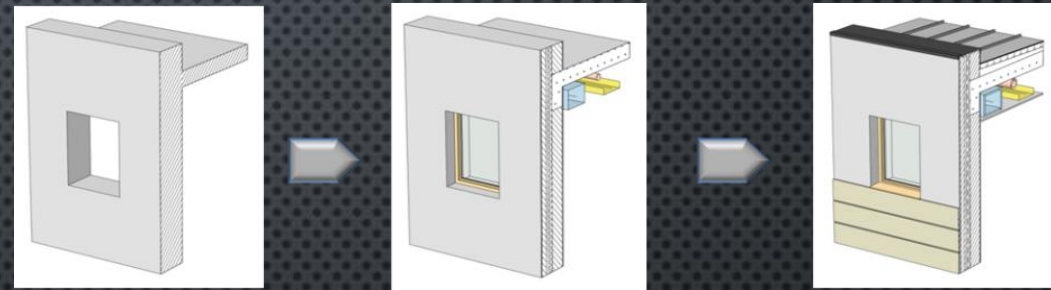
4. PROCESS DEFINITION

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GOALS (FOR WHAT?)

		
<p><i>Standard 3D Services</i> <u>Constructibility</u></p> <p>3D Model + Constructability Analysis + Renderings and visitable virtual models</p>	<p><i>Standard 4D Services</i> <u>Simulation</u></p> <p>3D Model + Constructability Analysis + Renderings and visitable virtual models + Scheduling</p>	<p><i>Standard 5D Services</i> <u>Virtual Construction</u></p> <p>3D Model + Constructability Analysis + Renderings and visitable virtual models + List of Quantities for Cost Bid + Scheduling and Optimization</p>

LEVEL OF DETAIL (HOW?)



MODEL PROGRESSION SPECIFICATION (WHEN?)

		LEVEL OF DETAIL (CUMULATIVE)		ARCHITECTURE													STRUCTURE				MEP														
		1	2	DEMOLITIONS / EXISTING BUILDINGS	MASONRY	ROOFING AND BALCONIES	CEILING FINISHES	WALL FINISHES	PAVEMENT FINISHES	STONEWORK	METAL WORK	CARPENTRY	GLASS	PAINTINGS	MISCELLANEOUS	SANITARY EQUIPMENT	OTHER EQUIPMENT	EXTERIOR WORKS	EARTH MOVEMENTS	PERIPHERAL TEMPORARY CONTENTION	CONCRETE	METALIC	WATERPROOFING	OTHERS	I&E HYDRAULIC	I&E GAS	I&E VENTILATION	CENTRALIZED TECHNICAL MANAGEMENT	I&E ELECTRIC AND SECURITY	ELEVATORS	I&E TELECOMMUNICATIONS	WASTE	FIRE SAFETY		
I	Bidding Phase	NA																			NA	NA	NA	NA											
II	Site Construction Phase	NA																			NA	NA	NA	NA											
III	Foundations Phase	01-05-2012	1	1	2																NA	NA	2	NA	NA										
IV	Structural Phase	01-06-2012	1	1	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	NA	NA	3	1	NA	NA	1	1							
V	Architectural Phase I	01-09-2012	1	1	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	NA	NA	3	1	NA	NA	1	1			1				
VII	MEP Phase I	01-09-2012	1	1	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	NA	NA	3	1	NA	NA	1	1			1				
VI	Architectural Phase II	15-10-2012	1	1	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	NA	NA	3	1	NA	NA	3	3	3	3	3	3	3	3	3
VIII	MEP Phase II	15-10-2012	1	1	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	NA	NA	3	1	NA	NA	3	3	3	3	3	3	3	3	3
IX	Exterior works Phase	03-08-2012	1	1	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	NA	NA	3	1	NA	NA	3	3	3	3	3	3	3	3	3

4. PROCESS DEFINITION

Necessity is the mother of BIM

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*There are numerous cases of unsuccessful implementations because companies do not know what to ask when ordering BIM Models!
And worse is that they believe that making models is to have BIM !!*

**MODELING
LEVEL OF
DETAIL**



**MODELING
COST**



5. SOFTWARE CHOICE

Necessity is the mother of BIM



+

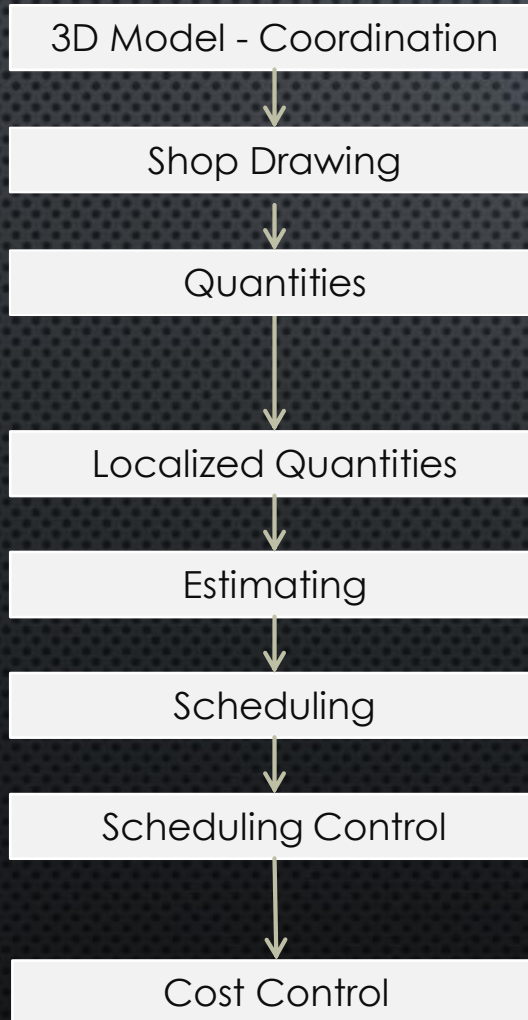


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Advanced Content Plan



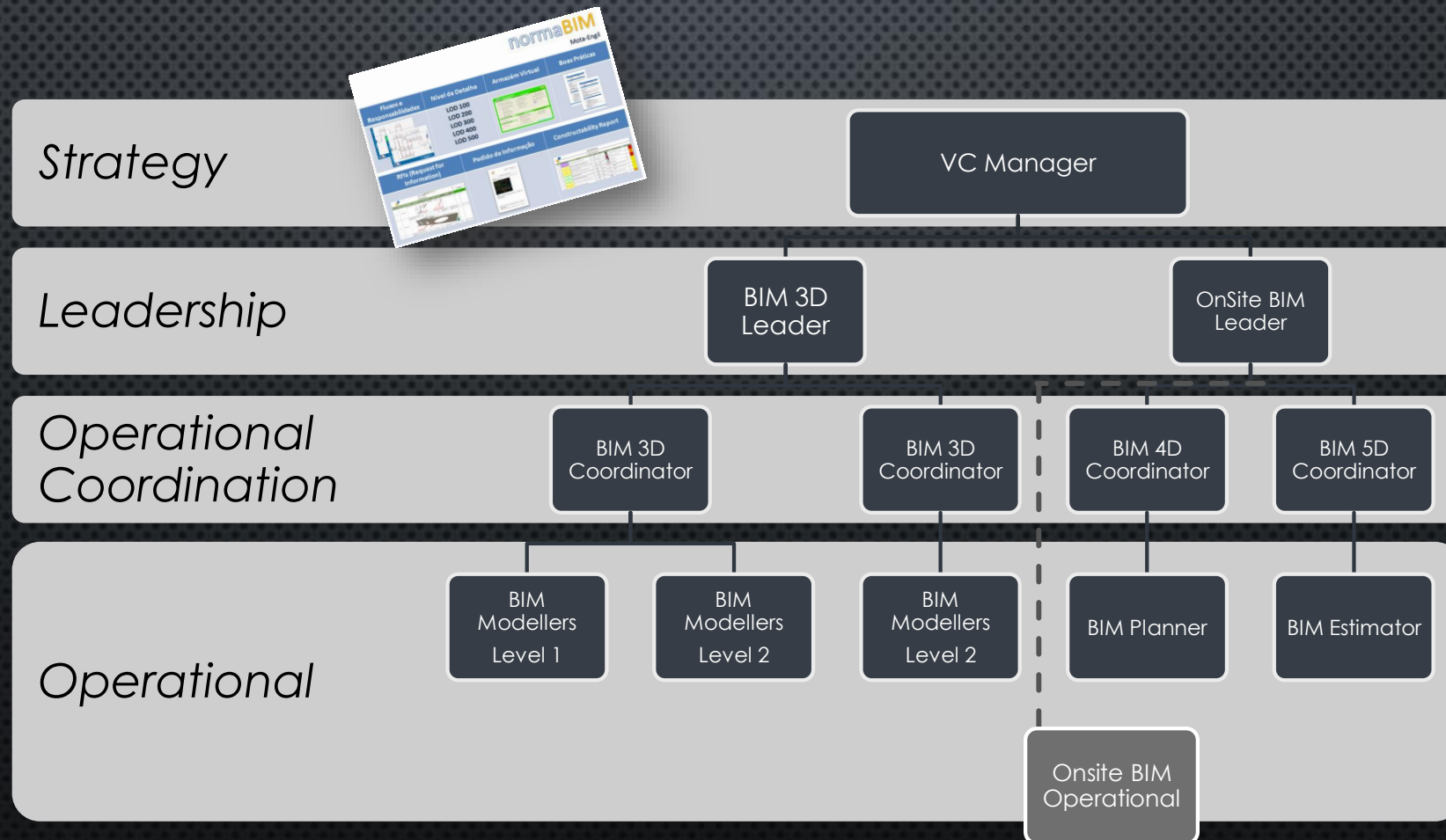
Economic Control



6. TRAINING

Necessity is the mother of BIM

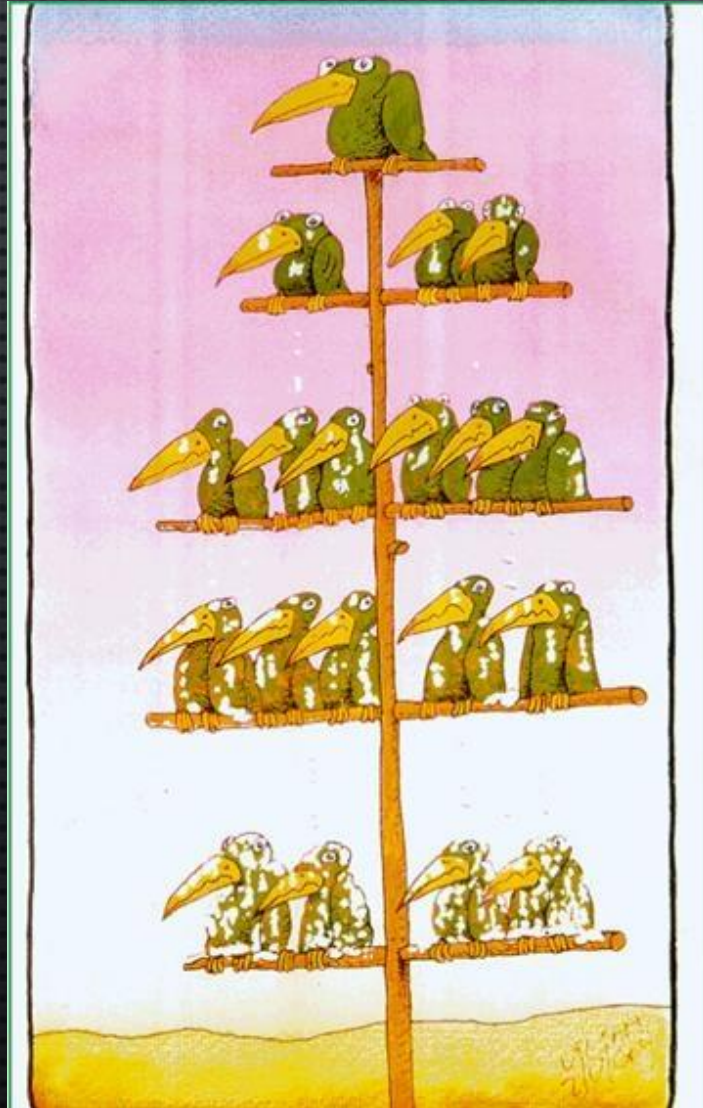
A FUNCTIONAL STRUCTURE... EVEN THAT THE COMPANY HAS A RIGID HIERARCHICAL COMMAND



6. TRAINING

Necessity is the mother of BIM

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THE PROBLEMS OF HIERARCHY

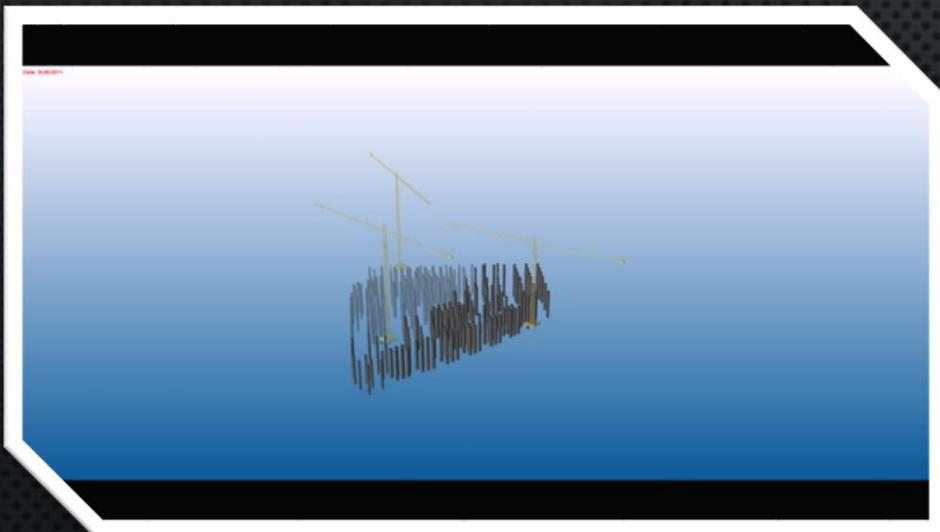
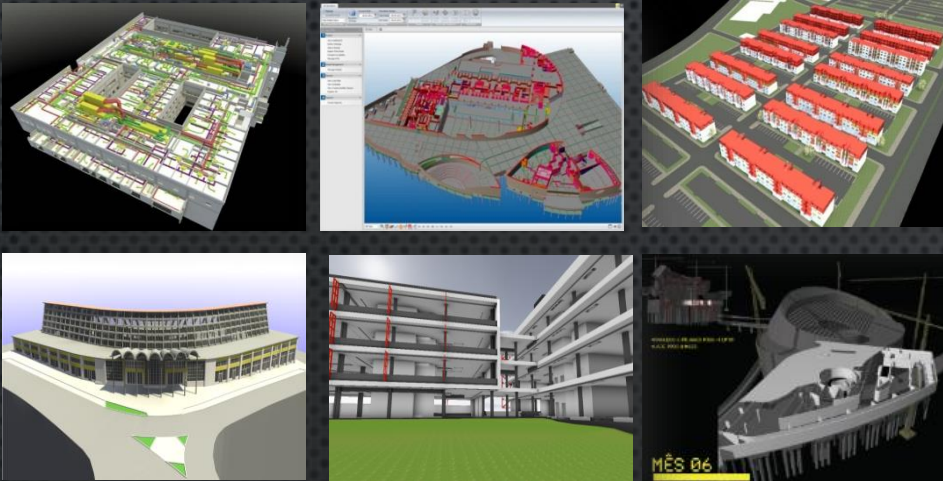
(“WITHIN” AND “BETWEEN” COMPANIES)

- Passage of Risk through the chain;
- Lack of Sharing;
- Does not favor Collaboration.

7. PILOTS PROJECTS AND EVALUATION

Necessity is the mother of BIM

IMPLEMENTATIONS.... STEP BY STEP



	3D	4D	5D
Lapa Residential Building (10.000 m ²)	✓	✓	✓
Champalimaud R&D Center (75.000 m ²)	✓		
Huambo Residential Building (15.000 m ²)	✓		
Planinova Office Building (15.000 m ²)	✓	✓	✓
Terceira Island Hospital (70.000 m ²)	✓		✓
Maputo Towers (50.000m ²)	✓		
3 Lisbon Schools (10.000 m ² each)	✓		
Ferreira de Castro School (10.000 m ²)		✓	
Olympic Village in Maputo, Mozambique (900 apartments)	✓	✓	
Leixoes Cruise Terminal (15.000m ²)	✓	✓	✓
Mercado Bom Sucesso Hotel (10.000 m ²)	✓	✓	✓
Coches Museum (15.000m ²)	✓		
EDP HeadQuarter (60.000m ²)	✓		
UPTEC Office Building (15.000m ²)	✓	✓	✓

8. KEY FINDINGS

Necessity is the mother of BIM

BIM Evangelist

- Conquer your Board and different departments!

BIM Strategy Group

- Study the potential return on investment
- Define the main targets

BIM Roadmap

- **What** is the goal?
- **Who** will be involved?
- **When** they will be involved?
- **Where** we will implement this?

BIM Task Group

- **Select the right people**
- **Avoid the barriers**
- **Develop internal BIM Standards**

Training & Pilot Project

- **Start with a small project**
- **Put the same stress as in a real project**

Project
Evaluation

One step at a time!

If...

...You involve **“true”** BIM experts on your implementation,

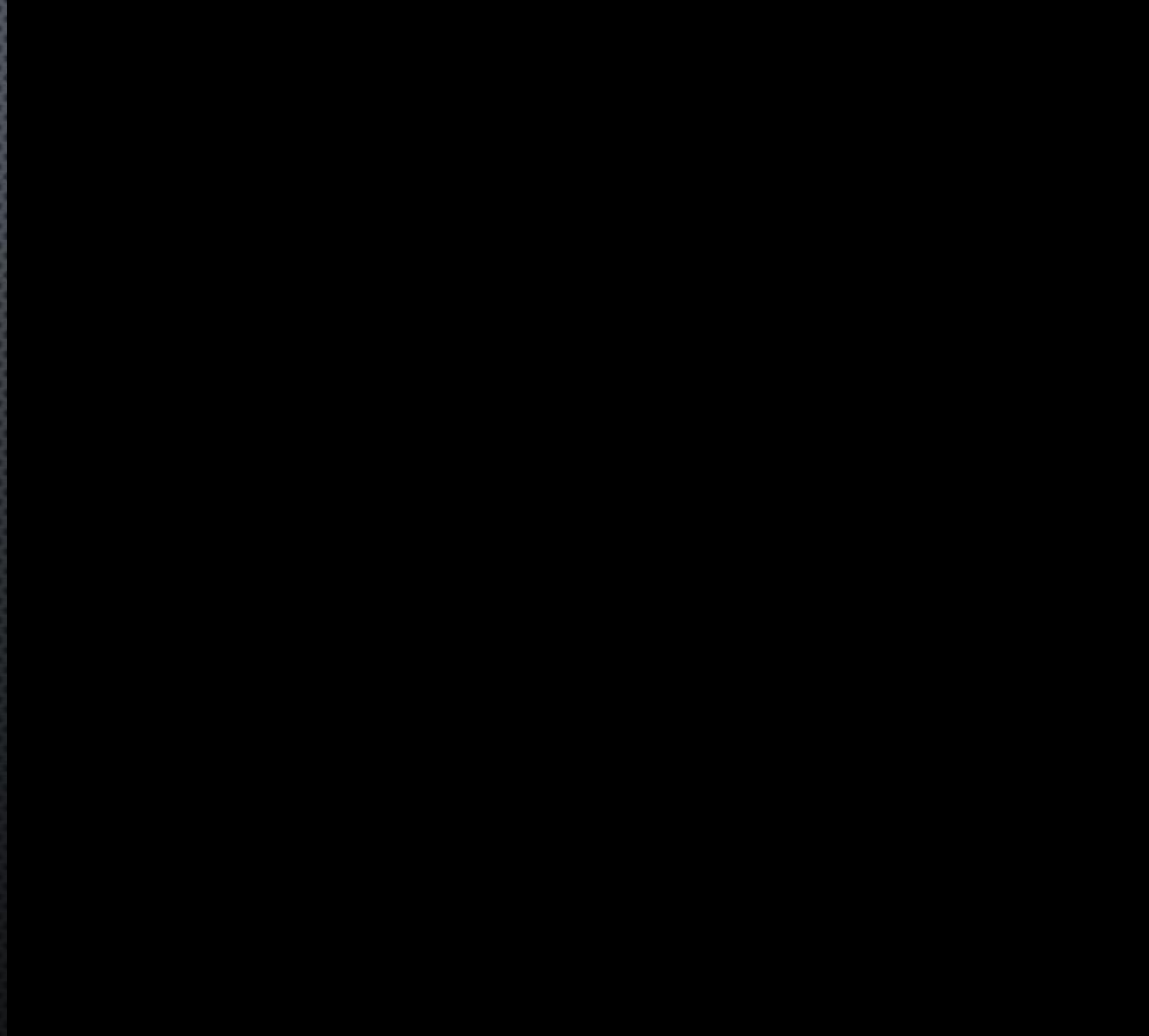
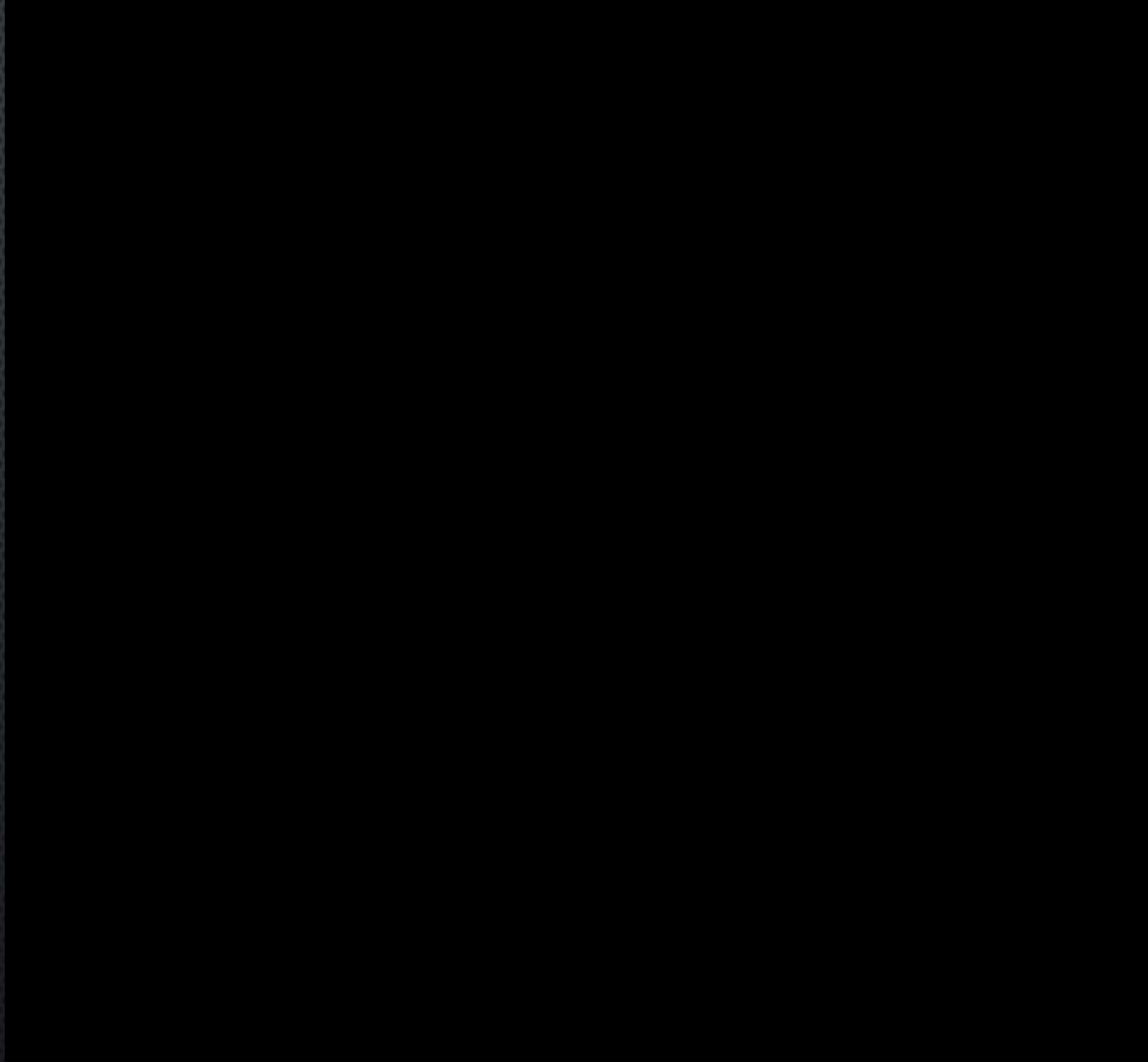
you will implement everything **faster and with less risk.**

Try to avoid reinventing the wheel!

TO WORK BETTER AND WITH PLEASURE. **BIM IS FUN!!!**

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Necessity is the mother of BIM



I invite you to join us on the BIC2014 in Lisbon on October 9 and 10

More information

<http://bimforum.com.pt>

Conference Dinner on October 9



Closing Party (including dinner) on October 10



BIM FORUM Portugal



"We at buildingSMART are pleased to see the effort being put into promoting the adoption of open BIM in the Portuguese construction industry. We look forward to welcoming Portugal back into the buildingSMART family," Christopher Groome, Buildingsmart International Limited.

BIC2014

Conference Program

Social Program

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Registration

Past Events

About us

We've done it in the past
BIM Implementation is a small challenge
when compared to the ones faced in past

BIM INTERNATIONAL CONFERENCE 2014

Challenges to Overcome

October 9 and 10, 2014 | Lisbon, Portugal

BIM FORUM Portugal

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