Digital Innovation in the Construction of Buildings

Thomas Messervey
CEO/Founder – R2M

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PROMPT

How will the world of construction will look like in 10 years from now, from the construction and operational phases?

- Not so much different
- More digital technologies and digital tools
- Buildings that have more requirements (NZEB / Circular)
- Larger gap between have and have not companies
- Increased risk to a major market disruption where many won’t survive (analogous to Amazon vs. shopping malls or Uber to Taxis or big utilities vs. smart grid)
- Opportunities for companies that innovate
Block I: R2M

A bit about R2M and where we fit in digitalization and construction

• Who we are
• How we fit into digitalization and construction
• Sustainability certification as a market point of entry
• Sustainability certifications in the digital age
• What drives us
R2M Solution

R2M IN BRIEF

R2M was founded 7 June 2012 in Milan and has its main office in the city of Pavia, Italy.

R2M Solution has offices in Italy, France, Spain and the UK with a team of approximately 50 persons who offer integrated and multidisciplinary consulting services with the objective of closing the gap between research and market implementation of innovative technologies developed in the framework of European Research.

15 persons are dedicated to dynamic energy modelling, LEED, BREEAM, Energy Audits, Commissioning, Indoor Air Quality, and digitalization of construction and retrofitting processes.

In 2018, R2M Energy, an ESCO targeting innovative NZEB interventions, was founded.

OUR LOCATIONS

Italy
R2M Solution S.r.l.
Via F.lli Cuzio 42
27100 Pavia, Italy
P.IVA: IT04998380879

France
R2M Solution SAS
Les Galeries de Beaumon
06330 Roquefort-les-Pins, France
VAT: FR11828579367

Spain
R2M Solution Spain, S.L.
Calle Villablanca 85
28032 Madrid, España
VAT N° ES B87348470

United Kingdom
R2M Solution S.r.l.
Via F.lli Cuzio 42
27100 Pavia, Italy
P.IVA: IT04998380879
What we do

Innovation

• Participation and support to national and European projects.
• Technology scouting and technology transfer.
• Software and services dedicated to management and financial accountability of R&D projects also leveraging tax incentives on R&D.

Sustainability

• Dynamic energy modelling
• Sustainability certifications (LEED, BREEAM, WELL)
• Commissioning
• Due diligence

Engineering

• Worksite measurements (blower door test, thermography, IAQ)
• Drone overflights, video & 3D model construction, point clouds
• Matterport scanning with navigable models, tags, point clouds, BIM
• Structural Health Monitoring

ICT

• Robotics software, training & applications
• Data Mining and sentiment analysis
• Customization of ERP Solutions (enterprise resource planning)

Innovative Products

• Zutec: BIM-enabled Construction Management Platform
• IES: Dynamic Environmental and Energy Simulation Environment
• Onyx Solar: Photovoltaic Glass (BIPV)

R2M Energy

• Demand Response & Energy Management
• NZEB design & implementation
• Deep Retrofit (Conto Termico 2.0)
• Energy Diagnosis and ESCO Projects
R2M Solution

360 degree integrated solutions across all phases of construction (and linking them). From design, to construction, operation, maintenance and end of life, the development and implementation of new technologies and tools for the monitoring and use of data to improve processes and performance.
Onyx Solar – Photovoltaic Glass
Milan area study by CBRE
- Rents 7-14% higher
- After 6 months on market, 80% of certified building rented vs. 21% non-certified

Building Certification is a good market point of entry because:
- You engage decision makers
- They are looking for innovation and are typically open minded (e.g. early adopters)
- They are investing in sustainability
Sustainability Certifications – Today & Tomorrow

**LEED Credit Categories**
- Sustainable Sites
- Water Efficiency
- Energy & Atmosphere
- Materials & Resources
- Indoor Environmental Quality
- Innovation in Operations & Regional Priority

**Today**
- **Design Based Certification**

**Tomorrow**
- **Data Based Certification**
Digitization and main objectives of sustainability certification protocols

Sustainability Protocol
Credits vs ENERGY and DECARBONIZATION

- optimize commissioning operations
- easy sharing of commissioning results
Digitization and main objectives of sustainability certification protocols

Sustainability Protocol 
Credits vs ENERGY and DECARBONIZATION

- integration and sharing of the results of dynamic simulations
Digitization and main objectives of sustainability certification protocols

Sustainability Protocol Credits vs ENERGY and DECARBONIZATION

- user involvement in optimizing energy performance
- careful check after construction and during operation
Digitization and main objectives of sustainability certification protocols

Sustainability Protocol Credits vs CIRCULAR ECONOMY

- easy LCA comparison for different solutions
Digitization and main objectives of sustainability certification protocols

Sustainability Protocol
Credits vs COMFORT and HEALTHINESS

- indoor air quality improvement related with natural ventilation strategies
- improvement of thermal comfort
Digitization and main objectives of sustainability certification protocols

Sustainability Protocol
Credits vs COMFORT and HEALTHINESS

- interior lighting and daylighting integration
- interior lighting optimization
Digitization and main objectives of sustainability certification protocols

Sustainability Protocol
Credits vs COMFORT and HEALTHINESS

- easy custom setting of the parameters of environmental comfort
BIM is the platform for digitization integration of all the building life

- **all digital technologies** that support the achievement of sustainability credits **can be integrated into a BIM platform**
- a process managed with the BIM can **instantly provide the level of sustainability** related to varying scenarios digitally simulated.
One example of digitalization – combining BIM/real time operational data.
A result coming out of the H2020 project Hit2Gap
Motivation: Buildings, Energy & Population

Making Europe's BUILDINGS energy-efficient attractive sustainable

Devastating UN Report: CO2 Emissions Must Go to Zero By 2050 to Avoid Worst Effects of Climate Change

The IPCC’s ‘1.5 Degree Report’ paints a dire picture that suggests we must fundamentally change the nature of society in the next decade.

At 1.5 degrees of warming compared to 2 degrees of warming, 90 percent of coral reefs will bleach, as opposed to 98 percent. Sea levels will rise by 40 centimeters, as opposed to 50...
Impacts of climate change

Humans Are Speeding Extinction and Altering the Natural World at an ‘Unprecedented’ Pace

Climate and Environment

One million species face extinction, U.N. report says. And humans will suffer as a result.
1. Market landscape: digitalize or die
2. The productivity and business opportunity of digitalization
3. Upskilling companies and the labor force
4. Intelligent digital mesh
FROM MODERNIZE OR DIE TO DIGITALIZE OR DIE

The patient (construction) is sick, perhaps even dying.

SYMPTOMS

The critical symptoms of failure and poor performance have been identified in this review as:

- Low Productivity
- Low Predictability
- Structural Fragmentation
- Leadership Fragmentation
- Low Margins, Adversarial Pricing Models & Financial Fragility
- A Dysfunctional Training, Funding & Delivery Model
- Workforce Size & Demographics
- Lack of Collaboration & Improvement Culture
- Lack of R&D & Investment in Innovation
- Poor Industry Image

DIAGNOSIS

Sitting behind these ten features and characteristics are three identified root causes that explain not only why we see these issues in the industry but also confirm why things may not change without strategic intervention:

One

The industry has evolved a ‘survivalist’ shape, structure and set of commercial behaviours in reaction to the environment in which it operates. That environment is fundamentally characterised by low capital reserves and high demand cyclicality.

Two

The industry and its clients usually have non-aligned interests reinforced by traditional procurement protocols and a deep-seated cultural resistance to change pervading across both parties.

Three

There is no strategic incentive or implementation framework in place to overcome the issues above and initiate large-scale transformational change. The issues of variable demand, resistance to change and lack of alignment / integration with clients have become de facto accepted norms for the industry.
FROM MODERNIZE OR DIE TO DIGITALIZE OR DIE

Productivity has declined and is not keeping up with other sectors

Figure 2: OECD Productivity and ULC by main economic activity (ISIC Rev.4) data, 2015
FROM MODERNIZE OR DIE TO DIGITALIZE OR DIE

Labor force: most self-employed, most SMEs, nearly least trained

Is this the kind of opportunity we want to offer to our students, children or the next generation?

How can we attract or keep top-talent into the construction sector?
The productivity opportunity in construction

Construction matters for the world economy ... but has a long record of poor productivity

Construction-related spending accounts for 13% of the world’s GDP ... but the sector’s annual productivity growth has only increased 1% over the past 20 years

$1.6 trillion of additional value added could be created through higher productivity, meeting half the world’s infrastructure need
CONSTRUCTION MATTERS

Construction is a sector of two halves
Fragmented specialized trades drag down the productivity of the sector as a whole

Construction productivity by subsector:
Value added per employee, indexed total sector = 100, 2013
% of construction value added

Total 100, Building 104, Civil 119, Industrial 124, Specialized 79

Action in seven areas can boost sector productivity by 50–60%
- Reshape regulation
- Rewire contracts
- Rethink design
- Improve procurement and supply chain
- Improve on-site execution
- Infuse technology and innovation
- Reskill workers

5–10x productivity boost possible for some parts of the industry by moving to a manufacturing-style production system

Business opportunity in unlocking this value proposition

- Engineering Firms
- Builders
Definition:
“Digitization is about businesses encountering connected systems at every link in the value chain. It is about working with tools and practices based on information and communication technology”

- Roland Berger

“Construction needs to catch up.”

Photo credits: vitranc, peshkov, iStockphoto
Product suppliers are educating but is the sector responding / buying in?
CONSTRUCTION ROLES THAT DON’T EXIST YET FROM THE B1M

Drone Wrangler – Robot Commander – Ocean Architect

https://www.theb1m.com/video/3-construction-jobs-that-dont-exist-yet

There will be change and new opportunities (skills needed)
HOW ARE WE DOING USING AVAILABLE TECHNOLOGIES?

Accessibility & Planned Use
Basic technologies

In surveys of 177 construction firms of various sizes:

- In over half of construction firms, greater than 60% of employees have access to PCs and internet but there is still a large percent (29%) where access is limited to 20-40% of the staff and in 12% of firms, access is less.

- Smartphones are less implemented and despite the standard stock photographs of construction workers with tablets, in over half of construction firms, less than 20% of the staff have access.
Accessibility & Planned Use
Basic technologies

2015 Study of Construction Planning Methods (approx 300 respondents):

- Only 29% of firms are using BIM (BIM3D).
- Only 6% of firms are using BIM that incorporate the element of time (BIM4D).
The Business Value of BIM in Europe

Getting Building Information Modeling to the Bottom Line in the United Kingdom, France and Germany

BIM Benefits Contributing the Most Value


- Improved collective understanding of design intent: 69%
- Improved overall project quality: 62%
- Reduced conflicts during construction: 59%
- Reduced changes during construction: 56%
- Fast Client Approval Cycles: 44%
- Better cost control/predictability: 43%
- Reduced number of RFIs (Requests for Information): 43%
A first important step is to make better use of the technologies we have available today.
BUT THERE’S A PROBLEM

“When you’re a small organization, everyone has to chip in and just get it done. You are focused on tactical execution.” (and not on innovation)
- Jeff Weiner CEO LinkedIn

Source: European Builders Confederation

94.1% Microenterprises
less than 10 employees

80% Produce 80% of the construction industry’s OUTPUT

83% Employ 83% of the total WORKFORCE of the sector

What is the social impact of an EU construction workforce that doesn’t upskill fast enough?
IMPLEMENTING CHANGE

Associations as gateways to industrials and professionals for both implementation and training
DIGITALIZATION AND ESPECIALLY ITS RESEARCH, DEVELOPMENT AND INNOVATION IS NOT (ONLY) ABOUT PCS / SMARTPHONES & TABLETS

“The intelligent digital mesh is a foundation for future digital business and its ecosystems. To create competitive advantage, enterprise architecture and technology innovation leaders must evaluate these top trends to identify opportunities that their organizations can exploit.”

Top Strategic Technology Trends for 2018
DIGITALIZATION AND ESPECIALLY ITS RESEARCH, DEVELOPMENT AND INNOVATION IS NOT (ONLY) ABOUT PCS / SMARTPHONES & TABLETS
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Digital Twins

Cloud and Edge Computing

Source: Gartner (October 2017)

CAD = computer-aided design; FEA = finite element analysis; ML = machine learning

Source: Gartner (October 2017)
DIGITALIZATION AND ESPECIALLY ITS RESEARCH, DEVELOPMENT AND INNOVATION IS NOT (ONLY) ABOUT PCS / SMARTPHONES & TABLETS

Platforms of Services & Multi-Sided Business Models

Intelligent Digital Mesh

Source: Gartner (October 2017)
DIGITALIZATION AND ESPECIALLY ITS RESEARCH, DEVELOPMENT AND INNOVATION IS NOT (ONLY) ABOUT PCS / SMARTPHONES & TABLETS

https://www.iesve.com/icl

Digital Twins – beyond building and toward urban spaces / smart cities
AS WE APPLY THESE CONCEPTS TO THE CONSTRUCTION SECTOR – WHAT TYPES OF BUILDINGS AND INFRASTRUCTURE ARE WE TRYING TO DELIVER AND WHAT NEW SERVICES ARE UNLOCKED?
ARE WE BUILDING FOR TOMORROW?

Revisit value proposition design for.....

2070-2120

and make sure we’re preparing to build the buildings people want coupled to the appropriate infrastructure .

Can business stay as usual?  
Any risk to market disruption?
Voice has emerged as a delightful technology in the home, and there are now more than 20,000 Alexa-compatible smart home devices from 3,500 different brands.

Amazon makes first investment in a homebuilder, backing start-up focused on prefabricated houses.

- Amazon said it's funding homebuilding start-up Plant Prefab, marking its first investment in the space.
- Plant Prefab builds prefabricated, custom single- and multifamily homes.
- The investment follows Amazon's launch of more than a dozen new smart home devices powered by Alexa.
BUT OUR EUROPEAN FUTURE IS NOT IN THE HANDS OF AMAZON OR ANYONE ELSE (UNLESS WE PUT IT THERE)

https://www.egreenideas.com/resources/blog/well/
EVOLUTION OF CERTIFICATION PROTOCOLS – TOWARD CIRCULARITY

Not futuristic concepts...

Prefabricated / Modular NZEB
Smart Grid
Wellness
Circularity
Block III: H2020 Examples

Examples of European Research on Digitalization in the Construction Sector to help mitigate climate change, upskill construction workers and increase sector productivity
The gap between actual energy performance and design energy performance can arise from:
- Design Errors
- Construction errors
- Commissioning errors
- the way buildings are actually operated and used
Some highlights

- BIM based knowledge management platform
- Use of scanners, drones, 3D reconstruction and Augmented Reality on site
- AIR Pulse - Innovative air tightness measurement for envelope commissioning
- BIM for renovation and open source software as a way to stay at the cutting edge
AIR Pulse

QUALITY ASSURANCE TESTING
- Track changes in airtightness throughout the build process, bringing contractor accountability
- Reduce the risk of non-compliance, defects and the cost of remedy
- Give indication of build quality
3D SCANNING at R2M

OUTDOOR reconstruction

3D Point Cloud from Drone
3D Point Cloud from GoPro
3D Point Cloud from 3D scanner or Matterport

INDOOR reconstruction

3D Point Cloud from Google Tango
3D Point Cloud from HoloLens
3D Point Cloud from 3D scanner or Matterport
3D SCANNING – CASO STUDIO DI SAN SALVO

HoloLens in action (video)

Video removed for file size – feel free to contact us
Quick 3D scanning and models

Video removed for file size – feel free to contact us
Assess progress and quality
Identify differences in time and with BIM

Video removed for file size – feel free to contact us
Live difference with Augmented reality
Assess progress and quality for outdoor with drone
Assess progress and quality for outdoor with drone

Video removed for file size – feel free to contact us
BIM based knowledge management platform

Architects  Engineers  Contractors  Owners
Building Life Cycle approach

Design
- Design specification archived in the BIM or the Asset register

Build
- History of all submission and approval loops for each asset

Operate
- Management of site minutes, action lists and non-compliance and delivery cycles

Transact
- Definition of a maintenance plan already scheduled in the delivery phase and ticketing for reactive maintenance
- Document and administrative compliance supporting the purchase of the property
Seamless integration

Direct bi-directional connection between:
- Platform
- BIM
- 3D scan model
- Reality (QR codes)

Project data available in IFC format
- Approval history
- Data sheets
- PM inspections results
- Testing documents
- Warranty documents
- Commissioning documents
- Scheduled maintenance plan
- Management of events of responsive maintenance
Variety of customizable outputs
MOBILE PRODUCTS

Onsite
- Defect Management
- QA/QC
- Progress Management
  For Field Teams

Elevation
- 2D Drawings
  For Field Teams

Dimensions
- 3D Interface
  For Field Teams
  For Office Teams
ONSITE

Key Features

- Reviews
- Forms
- Offline
- Google Maps
- Mark up
- Pin Locations
- Photos
- QR Codes / Barcodes
Use Cases

- Work Inspection Requests
- Defect Management
- Void Inspections
- Progress Monitoring
- Non Compliance Reports
- Commissioning Inspections
- Planned Maintenance

ONSITE

- Compliance
- H&S Audits
ONSITE - WORK INSPECTION REQUEST PROCESS
ONSITE - REPORTING

Reports

WIR Live Report
90% Time Saving
Report Adapter
Any BI Tool
JSON/HTML/.XLS
ONSITE – TASK MANAGEMENT

Task Management Workflow

Review Status:
- Select All
- Blank
- Consultant/Client
- Consultant/Client Only
- Consultant/Consultant

Task Type:
- Blanks
- Clean Up Multi
- Incomplete
- Incomplete/Work

Review Status:
- Select All
- Blank
- Consultant/Client
- Consultant/Consultant Only
- Consultant/Consultant

Action Required by:
- Select All
- Blank
- Consultant/Client
- Consultant/Consultant Only
- Consultant/Consultant

Level:
- Select All
- Blank
- Consultant/Client
- Consultant/Consultant Only
- Consultant/Consultant

19/04/2018
ELEVATION

Version Control
Collaboration
Speed
Ease of Use
Change Control
Audit Trail
ELEVATION

Mark up
Drop Pins
Share
Redline
Attach Photos
Open Source Software in the Operational Phase

https://www.bemserver.org/
BEMSServer: A new kind of energy management platform

Reducing the gap in energy performance between design, construction and use of buildings

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N° 680708.
The energy performance gap

The Actual energy consumption of buildings in Europe often exceeds design energy predictions by a significant margin!

This gap between actual energy performance and design energy performance can arise from:

- design constraints,
- construction errors,
- commissioning errors, and,
- the way buildings are actually used.
What is BEMserver?

BEMServer was established by the H2020 HIT2GAP project to develop an energy management platform which could eliminate this gap in existing buildings, by providing:

- a data platform – collection and storage of data
- modelling – e.g. energy predictions, benchmarks
- modules – calculations, statistics and visualisation
A quick illustration

**Core modules**
Data processing and visualisation

**Third party modules**
Data processing and visualisation

**Simulation services**
Forecasting energy requirements & benchmarking

**Information services**
SMS text, e-mail generation, mobile phone applications

**Perceptualisation services**
Simple and detailed energy information dashboards

**People**
Presence
Behaviour
Environment

**Energy**
HVAC
Power
ICT

**Environment**
Weather
Air quality
GIS
Core functionalities

- Management
- Connectivity
- Data processing & statistics
- Visualisation
Who can benefit from BEMServer?

Owners of buildings
- plus decision-makers, managers of buildings,
  energy-managers, estates managers, facility managers,

Users of buildings

ESCOs and financial institutions that promote a green economy where energy saving pays for investments

Providers of technology, providers of advice

Organisations concerned with climate change

Suppliers of energy........
Who can benefit from BEMServer?

Companies working in the field of energy efficiency

Engineers: providers of BMS technology, ICT professionals, maintenance staff

Research communities and clusters,

Other H2020 projects – e.g. BUILT2SPEC, MOEEBIUS, QUANTUM, TOPAs

Regional politicians & citizens’ representation bodies

Standardisation bodies and certifiers of technology

General public and the media.
Visualisation

Visualisation is a key outcome:

Tools/modules to interrogate processed data - tailored for particular audiences: e.g.
- detailed information for energy managers, but
- a simpler but engaging presentation for public display.
Pilot Projects – proof of concept

- Establish reference energy performance, for a base year.
- Gather data from energy bills related to the base year.
- Compare the designed (i.e. simulated) and real energy performance of each pilot.
- Survey user’s preferences.
Pilot Project: Offices and laboratories, Nanogune

Offices & Laboratories, Nanogune, San Sebastian, Spain:

- PV panels
- BMS to control lighting and HVAC
Pilot Project: The Challenger Building

Challenger - Office building, France

- PV panels & dual solar panels
- Ground source heat pump
- BMS controls lighting, HVAC, hot & cold water & technical alarms
Pilot Project: The Challenger Building

Headquarters of Bouygues Construction, Guyancourt, Paris
Pilot Project: The Challenger Building

Challenger - Office building, France

- solar panels
- Ground source heat pump
- BMS controls lighting, HVAC, hot & cold water & technical alarms
Pilot Project: Town hall in Wilanów

Office building, Warsaw, Poland

- BMS controls lighting & HVAC
Pilot Project: Town hall in Wilanów

Ratusz w Wilanówie
Pilot Project: Town hall in Wilanów
Pilot Project: Alice Perry Engineering Building

- Teaching and research building, Ireland
- BMS controlling HVAC
- Lighting controls with lux adjustment
- Uses district heating network
Pilot Project: Alice Perry Engineering Building

Teaching and research building, Ireland

- District heating
- Combined Heat & Power
- Biomass pellet boiler
- Night purging
- Heat exchangers
Pilot Projects

The approach:
1. Establish an energy baseline by examining energy bills and information from the HVAC
2. Decide which parts of the building should have BEMServer sensors
3. Survey user preferences and conduct energy simulations
4. Evaluate the gap between actual and theoretical energy use
5. Decide which parts of the building are going to have BEMServer sensors
6. Implement a system of data collection
7. Evaluate the impact of the BEMServer system
A new kind of energy management platform
Modules store

HIT2GAP is an open platform allows third-party developers to:

- Create their own module
- Add a full compatibility of their existing modules with the HIT2GAP platform

The modules store will provide an easy access to those modules for the final users.

[Modules Store Image]

- ENERGY MANAGEMENT
  - Developed by ENEIT
  - More Details

- FAULT DETECTION AND DIAGNOSIS
  - Developed by FRAUNHOFER INSTITUT FÜR SOLARE ENERGISYSTEME IE / UNIVERSITAT DE GIRONA
  - More Details

- USER BEHAVIOUR
  - Developed by EGE UNIVERSITY / APIENET
  - More Details

- OCCUPANTS VISUALISATION
  - Developed by INOXIA
  - More Details

- RENEWABLE ENERGY SIMULATOR
  - Developed by CYRIC
  - More Details

- GAP REASONER
  - Developed by FRAUNHOFER INSTITUT FÜR SOLARE ENERGISYSTEME IE
  - More Details
Modules interaction through BEMServer API
John is a building manager working for the Challenger building.

He needs to check that the overall energy consumption of the building is compliant with expectations and that no deviation occurs. Where a deviation does occur, he needs to identify where the gap originates from.
“Energy Management Module” selection

Energy Management Module
#2

Selecting the building to be checked
Launching the “Energy performance” feature

Energy Management Module
Overall Energy Consumption verification

Energy Management Module
Choice of the EnPI to be checked
Energy Per Area Consumption verification

<table>
<thead>
<tr>
<th>Title:</th>
<th>Total Electricity per Area</th>
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</thead>
<tbody>
<tr>
<td>Reference:</td>
<td>EnPl-001-TN</td>
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<tr>
<td>Location:</td>
<td>North Triangle (TN)</td>
</tr>
<tr>
<td>Category:</td>
<td>Select an Option</td>
</tr>
</tbody>
</table>

EnPl: Total Electricity per Area (kWh/m²) - 2018

<table>
<thead>
<tr>
<th>Month</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
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<td>Baseline</td>
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<td>5.96</td>
<td>5.12</td>
<td>5.51</td>
<td>7.8</td>
<td>8.47</td>
</tr>
</tbody>
</table>
Checking current year energy distribution then changing the period.

Energy Management Module
Comparison with last year’s usages
Displaying the meters consumption details
Raising an "Improvement Opportunity" against the energy use

Energy Management Module
#11

Creating the new “Improvement Opportunity”

Energy Management Module

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### Improvement Opportunity

**Title:** Investigate large Unaccounted electricity usage for the North Triangle building

**Basic Information**

- **Reference:** IO-0044
- **Location:** North Triangle (Th)
- **Sub-Location:**
- **Type:** Energy
- **Category:** Havekeeping Action
- **Sub-Category:** Energy Saving Promotion
- **Energy Use:** N/A
- **Detail:**
  1. Use basic awareness training/reminders to reduce general electricity usage
  2. Identify any unmetered areas of the building
  3. If un-metered area companies in usage to any of the existing SEUs’s, consider sub-metering to monitor usage

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### Estimated Savings & Payback

<table>
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<tr>
<th></th>
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<th>€</th>
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<td>Grid Electricity</td>
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<td>1234</td>
<td>8005</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>11400</td>
<td>1234</td>
<td>8005</td>
</tr>
</tbody>
</table>

**Comments:**

- Basic awareness is known to deliver 4% savings in Energy usage.

  Up to June 2018, unaccounted electricity is 142,488kWh.

  4% of that saved up to 1 year is 11,400kWh.
#12

Basic awareness

BEM Server

Energy Management Module

4% Save on energy usage
Raising the awareness of building occupants

Data visualisation module for building occupants
#14

Setting up the module

Data visualisation module for building occupants
User interface for each building occupants

Data visualisation module for building occupants
#16
Alerts / Tips submodule

Data visualisation module for building occupants
Getting involved

BEMServer website at [https://www.bemserver.org/](https://www.bemserver.org/)

[www.hit2gap.eu](http://www.hit2gap.eu) website has contact details and details of forthcoming conferences and events plus downloadable newsletters and flyers

A sister project, focusing on the design and construction phases, can be seen at [www.built2spec-project.eu](http://www.built2spec-project.eu)

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement Nº 680708.
Project Partners
INTRODUCTION

BIM4Ren

Easy-to-use BIM tools and workflows for collaborative and energy-efficient renovation of residential buildings

Coordinator: Nobatek/INEF4

Consortium: 23 partners from 10 European countries

Duration: 48 months

Start: 1st Oct 2018

Budget: 7M€
CONSTRUCTION SECTOR LANDSCAPE

Existing buildings are responsible for 40% of the total energy consumption and 38% of GHG emissions.

We need to increase the renovation level of the existing building stock from 1% to 3%!

The construction sector:
- Has a very low productivity
- Has a very low use of digital tools

99.9% of the sector is made up of SMEs with less than 10 employees.

60% of the sector production is done by SME (less than 50 employees) while employing 70% of the sector working population (Eurostat 2011).

Digital Transformation is not easily accessible to SMEs and handcrafters.

We need to put adapted tools in the hands of every kind of construction actor.
BIM AS A TRIGGER FOR THE DIGITAL REVOLUTION

BIM is both:

• A collaborative process involving the generation and management of a digital representation of a building

• A semantically enriched model to describe a building, covering its lifecycle.

It allows for a more efficient, collective and integrated design among all stakeholders.

The BIM revolution needs to be available for all the construction value-chain.

BIM has strong potential to improve information management during a renovation and help overcome process fragmentation and communication problems between stakeholders.
BIM4Ren 4 INNOVATION PILARS

01 Digital Driven Workflows
Development of BIM based workflows dedicated to the renovation of residential buildings adapted to the complexity of targets of construction sector and put into a systematic and integrated workflows.

02 BIM4Ren Tools & Digital Environment
Workflows are backboned by a novel, state of the art, open and decentralized environment, and BIM solutions on data collection, data management and data driven design are integrated into it.

03 One Stop Access Platform
All the services are integrated altogether, accessible from a single entry point granting access to all end users offering the most adequate solutions to its needs and objectives.

04 Pilots as Living Labs
Project pilots are used as a user-centered, open-innovation ecosystem with co-creation, exploration, experimentation and evaluation of the deployed tools.
BIM4Ren CONCEPT

Data collection

WHAT IS THE EXISTING DATA?
- Year?
- Local regulation?
- Cost € ?
- Energy performance?
- Geometry?
- Stakeholders expectations?
- Type of occupants ?
- Renovation potential ?
- State of the existing infrastructure ?

Data Management

Data-driven design

Stakeholders involved in the renovation
**WHAT IS THE EXISTING DATA?**

1. To create the BIM model
2. To organize, consolidate, secure
3. To exploit the BIM model

**BIM4Ren CONCEPT**

Data collection

- Digital inputs
- Data Management

- Data-driven design

**Stakeholders involved in the renovation**
**BIM4Ren CONCEPT**

**Data collection**

**WHAT IS THE EXISTING DATA?**

1. To create the BIM model
2. To organize, consolidate, secure
3. To exploit the BIM model

**Data management**

**Digital inputs**

**Exploit BIM**

**Data-driven design**

**Stakeholders involved in the renovation**
BIM4Ren CONCEPT

Data collection

Data Management

Data-driven design

BIM4REN ONE STOP ACCESS PLATFORM

Stakeholders involved in the renovation
BIM4Ren TECHNICAL OBJECTIVES

TO BUILD:
- A digital ready renovation workflow based on stakeholders elicitations
- A novel, state of the art, open, decentralized environment

TO OFFER TOOLS:
- Articulated around Data collection / Data management / Data driven design
- Making the most of the potential of BIM
- Adapted to the size, to the capacity, to the ambition of the project

TO DEMONSTRATE AND IMPACT:
- Through pilots as living labs for user-centered, open innovation ecosystems
- To contribute to standardization bodies as BuildingSmart
- To train a new generation of workers to the use of BIM tools
## PILOTS AS LIVING LABS

<table>
<thead>
<tr>
<th>Country</th>
<th>Spain</th>
<th>France</th>
<th>Italy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use</td>
<td>Residential (private)</td>
<td>Residential (social housing)</td>
<td>Residential (student dormitory)</td>
</tr>
<tr>
<td>Dwellings area per building</td>
<td>20 – 400 m²</td>
<td>14 – 4000 m²</td>
<td>14. – 2000 m²</td>
</tr>
<tr>
<td>Building owner</td>
<td>Multi owner private property</td>
<td>LOG</td>
<td></td>
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<tr>
<td>Architect</td>
<td>Contractor</td>
<td>Contractor</td>
<td>ATI</td>
</tr>
<tr>
<td>General construction company</td>
<td>KURS</td>
<td>Contractor</td>
<td>CMB Carpi</td>
</tr>
<tr>
<td></td>
<td>SME</td>
<td></td>
<td>Large Enterprise</td>
</tr>
<tr>
<td>Technical support</td>
<td>TEC</td>
<td>NBK</td>
<td>R2M / GBC</td>
</tr>
<tr>
<td>Renovation work</td>
<td>Façade</td>
<td>Energy renovation</td>
<td>Full renovation</td>
</tr>
</tbody>
</table>
Sharing and exchanging complementary experiences, expertise and best practices can benefit the project and ensure that the technical developments will meet the needs of the sector.
Ongoing Activities

• To be detailed by the presenter
THANK YOU
RECAP

• A bit about R2M, where we fit in digitalization and construction, and how sustainability protocols and innovative products are our market point of entry.

• Construction today & tomorrow, productivity challenge and opportunity, use of digital technologies, upskilling building professionals, and requirements of future buildings and retrofits.

• Impressions from several EU projects where we are working on the energy performance gap, digitalization and construction site technologies across all phases of the building lifecycle.
Thank you

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