TRAINEE TowaRd market-based skills for sustAINable Energy Efficient construction

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 785005

Acronym: TRAINEE

Grant Agreement Number 785005

HORIZON 2020

TRAINING PROGRAMME BIM

-FINAL-

Deliverable 3.6

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DISCLAIMER

ACKNOWLEDGEMENT

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Related task	Task 3.4 Piloting BIM software through case study to assess the energy performance gap
Lead beneficiary	BIM Academy
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CONTENT

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1. Introduction

1.1. Project description

The project "TowaRd market-based skills for sustAINable Energy Efficient construction" is EU funded project under HORIZON 2020 programme, topic: Construction skills, Type of action: CSA Coordination and support action.

Overall objective is to increase the number of skilled building professionals according to recommendations from National qualification roadmap (http://buildupskills.mk/images/Publikacii/Roadmap/EN_Roadmap_BUS-MK.pdf) concerning two priorities, training of 4.500 building professionals and blue collar workers and overcoming barriers for implementation of EE measures in operation and maintenance.

Three specific objectives are set up as:

(1) Upgrading two qualification schemes for technicians, building managers and engineers and development of large scale of training schemes for 5 blue collar qualifications and two RES occupations (designers and installers) by establishing the Knowledge Centre for support in development of sustainable EE market-based construction skills with annual capacity to replicate it to 10 training providers and 600 qualified construction workers (200 through training and 400 through recognition of previous learning);

(2) Increasing awareness of building professionals for use of Building Information Modelling (BIM) tools, in order to achieve the desired multidisciplinary approach in construction that should result with reduction in the gap between designed and actual energy performance through improved quality of construction in specific projects and to achieve measurable energy savings and improved quality of indoor environment;

(3) Improved market recognition of skills in the building sector and enhancing collaboration across different professional groups and introducing methodology for mutual recognition of skills with three EU countries (Greece, Slovenia and Croatia).

The TRAINEE consortium consists of 6 partners, 5 from Macedonia: ECM-Economic Chamber of Macedonia; ZBK Kreacija-Association of business and consultancy; UKIM Ss Cyril and Methodius University, with the Faculty of Electrical Engineering and Information Technologies; EIM-Engineering institution of Macedonia; AEC-Adult Education Centre; and 1 partner from Spain: BIM Academy-WITS Institute from Barcelona.

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The project is organized in six working packages that will produce 34 deliverables (products) with intended impact on two areas: (a) enabling policy and (b) building capacity and skills for energy efficiency measures. The project intends to have impact on 270 building professionals, 440 blue color workers, 230 construction companies and 32 relevant market actors (6 public authorities; 6 national professional associations 1- educational and training institutions and 10 investors).

1.2. Purpose of the document

This document is Deliverable # 3.6, which results out of Task 3.4: Organizing training for BIM professionals by internationally accredited provider.

The purpose of the Training Programme is to identify the appropriate training strategies and activities required to achieve the desired learning outcome during the implementation of Building Information Modeling (BIM) based on Project TowaRd market-based skills for sustAINableEnergy Efficient construction.

The Training Programe provides a clear understanding of what must happen to meet the training requirements that have been defined, thus, end-users receive training in the knowledge, skills, and/or abilities required to support the new roles, business processes and/or technology.

Creating and modifying BIM models and objects in 3D parametric BIM environment is a highly professional activity that requires not only special knowledge in the field of construction but also the skills to use specialized software allowing BIM utilization. Properly created object is important prerequisite for further use of information derived from BIM model and to fully explore the potential of BIM. Therefore, it is essential that practitioners learn not only BIM theory, but it is essential to learn how to work with specialized software to guarantee the accuracy and completeness of all available information about the object.

The project will enable training for 50 BIM professionals. The trainings will be governed and organised by BIMAcademy as experienced institution for BIM trainings. The trainings will be organised for different profiles,in order to cover the whole life cycle of the construction process (designers, developers, technicians, engineers, ownersand public administration).

Four different training programmes will be developed:

1. BIM for practitioners: engineers, architects and technicians (40 training hours onsite);

2. BIM for decision makers, market, owners -shorter training (15 training hours online);

3. BIM for builders and contractors (40 training hours onsite);

4. BIM for industry and manufacturers (15 training hours online)

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For the BIM trainings, training material will be developed for onsite and online formats. It will be available as e-learning material too.

Training for the developed programmes will be addressed as follows:

1. For program No1. – 20 trainees
2. For program No2. – 10 trainees (on-line training)
3. For program No3. – 10 trainees
4. For program No4. – 10 trainees (on-line training)

The initiation of design of BIM courses in higher education system is also target activity, especially in terms ofsustainability and replication.

The Knowledge Centre will offer environment for establishing regular workshops for promotion and for trainings by creation of environment for collaborative industry-wide training and/or up-skilling scheme that would pool scarceresources, control duplication of effort and ensure consistency in the quality of training.

Transposing the developed training scheme to the Knowledge centre will ensure sustainability after project end.

It is envisioned that trained BIM professionals will pilot their skills for using BIM in calculation of energy gaps inselected case studies.

1.3. Audience

This document is intended for use by:

- TRAINEE project consortium
- Project Manager of the Training, Knowledge and Skills Management Center
- Training Lead

2. Training scope

2.1. Training Objectives

The Training Programme is designed to provide Architects and Civil engineers with the skills and technical knowledge requested both by investors and EU energy policy to reduce the gap between designed and actual energy performance and measurable energy savings through introducing BIM (Building Information Modeling). The curriculum of the program focuses on the development of fundamental BIM skills and problem-solving strategies.

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Another objective is to link education with activities of New Knowledge and Skills management Center in Skopje.

- Ensure that all impacted stakeholders understand the role of using BIM as an open tool,
- Ensure receive relevant training to prepare stakeholders for new working practices and workflow,
- Ensure appropriate level of knowledge is delivered as a base for model-oriented training,
- Ensure appropriate level of skill is reached in order to perform roles.

The following bullets describe what is "in scope" for the project:

- Employees and managers who will need training on in order to understand BIM processes will be included "in scope" for the purposes of training development

The following bullets describe what is "out of scope" for the project:

- The training of wide spectrum of software and adaptation of any training-related documents to individual teams/companies will be "out of scope" and will be the responsibility of the individual companies. Although Knowledge and Skills management Centre may provide paid form of services to meet this requirement.

2.2. Assumptions

The following assumptions apply to the Training Programme:

- The Training Programme will be based on the training requirements gathered through meetings and workshops
- Consideration will be given to the use of on-site and/or remote resources for the development of training materials

2.3. Dependencies

Successful training is dependent on the availability of:

- Access to resources for input and review of the course outlines
- Access to resources for input and review of the training materials
- Availability of training facilities including rooms, hardware, software, flip charts, whiteboards, etc.

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2.4. Risks

The following risks apply to the training for the project:

- End users want more training than required/feasible
- Changes to project occur during development and delivery of training
- Low interest due to lack of time of employed professionals

2.5. Training needs assessment

The Training Needs Assessment identifies gaps in the knowledge, skills or abilities of impacted stakeholders compared to levels required to support and sustain the changes implemented.

First action is to identify end-user groups and objectives/priorities in order to develop appropriate training activities. **It is** defined during BIM promo Workshops and Consortium meetings, and according to the assessment the training content is developed.

3. Training approach

3.1. Training Methods

This section describes the training methods selected based on the options available and recommended for use by the project:

- Hybrid Training Approach: To help retention of learning, a hybrid training delivery method is proposed, we assume it will meet the needs of our project the best.
- Training including:
  - Instructor-Led Presentation, Theory of BIM (possible utilization of e-learning)
  - Instructor-Led Training, Practical examples - Hands on Training using selected software
  - Exercises, remote consultations and support

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3.2. Training roles & responsibilities

Use the table below to profile the key roles that will be part of the Training team. Individuals may have more than one role.

Table 1 – Training Team Profile

Role	Profile	Skills / Considerations
Training Lead	Responsible for completing and managing the training program, including the development of instructional materials and training delivery Develop the training strategy	It is recommended that there be one Training lead from the project team Project management skills Educational skills
Lecturer	Responsible for development of individual topic of theoretical training	BIM theory background Experience with lecturing of various BIM topics
Training Expert	Responsible for development of BIM model-based sample project	Experienced in BIM modeling and data exchange

3.3. Training infrastructure

3.3.1. Training Facilities

The following is a list of the equipment and facilities preparation that will be required for classroom training sessions:

- An instructor computer, attached to a projector
- A projection screen
- One computer for each trainee (for hands-on training)
- Computer equipped with necessary software

3.3.2. Training Environments

The following section describes the distinct training environments:

- Training Development Environment. Will be used for creating training materials; this environment is for the exclusive use of the project team
- Training Production Environment - Knowledge and Skills management Centre. Will be used to deliver Instructor-Led Classroom Training
- Training Practice Environment. Will be used by end-users to practice in the new system; concurrently with the deployment of e-learning

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4. Training Programme

4.1. Training curriculum

The curriculum defines the training courses that will be developed and delivered, including the associated learning objectives, sourcing options, delivery methods and course owners. Use the table below to help plan and manage your training curriculum.

The training consists of two parts - theoretical preparation in the form of a lecture and practical preparation where the participants actively work on the BIM model under the guidance of Experts.

For training purposes, the suggested curriculum comprise of:

Table 2 – Training Curriculum

Curriculum Name	Learning Objectives	Duration (classes)	Delivery Method
Theory of BIM	Provide basic concept and comprehensive overview of principles of Building Information Modelling (BIM) as a cooperative working method that captures and administers information that is relevant for the life-cycle of a building and allows the transparent communication and information transfer between all persons involved in the process.	8	Presentation / e-Learning
Development of skills	Provide the hands-on training for trainees aimed for model-based cooperation with focus on integrated project delivery and open BIM approach.	12	Hands-on training / In class
Energy performance	Provide the concept of using BIM to reduce the gap between designed and actual energy performance and measurable energy savings. Trainees learn to use specialized open BIM software through intensive hands-on training.	8	Presentation / e-Learning / Hands-on training / In class

4.1.1. Theory of BIM

Specialized classes are aimed at acquiring and acquiring basic knowledge and skills for teamwork within virtual projects.

The course module is intended for individuals from all participants in the building process and throughout the life cycle of the building. A prerequisite for successfully completing training courses is the ability to adopt a new concept of work focused on object collaboration and effective exchange of information.

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Table 3– Training Curriculum - Theory

Curriculum Name	Module Name	Learning Objectives	Duration (hrs.)	Delivery Method
Theory of BIM	Introduction to the BIM	a. Basic concepts and principles b. The current situation in member country and abroad c. Development of design methods d. Building lifecycle and project development over time	1	Presentation / e-Learning
Theory of BIM	Technology and interoperability	a. Parametric modelling b. Sharing the model and exchanging information c. BIM maturity in the lifecycle d. Level of detail / Level of information	2	Presentation / e-Learning
Theory of BIM	The role of the stakeholders	a. BIM from a designer perspective - model development b. BIM from the perspective of the contractor - 4D, 5D c. BIM for Facility Management d. BIM for geodesy and transportation, Laser scanning utilization e. Project Team Composition, Coordination and role of BIM Manager	2	Presentation / e-Learning
Theory of BIM	Information technology and system requirements	a. File types b. Structure and development of the IFC c. Model Federation and Conflict Detection d. Fundamentals of contractual relationships in BIM	1	Presentation / e-Learning
Theory of BIM	BIM Contracts	a.Types of construction procurement b. 19650 series of EU standards c. BIM execution Plan	2	Presentation / e-Learning / Exercise

4.1.2. Development of skills

Successful graduates are prepared to work in accordance with the BIM principles and further develop their skills following the use of specialized software tools. The participants are divided on the basis of the profession in which they operate and assigned to the individual coaches who provide them with support during training. Together they work on the BIM model and simulate real-world practice as instructed by the coaches. This form of collaboration meets the requirements for model-based collaboration where all information is transmitted directly through the BIM model.

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Trainers provide professional supervision and guidance in the following areas:

- Architecture and model development
- Statics and supporting structures
- MEP and HVAC profession
- Preparation and realization of buildings, Construction management
- Surveying

Table 4 – Training Curriculum - Development of skills

Curriculum Name	Module Name	Learning Objectives	Duration (hrs.)	Delivery Method
Development of skills	Introduction to Modelling	Creation of a parametric BIM model in accordance with the terms of interoperability, modification of the model, processing of the summaries, import and data export settings. Ensuring the process of coordinating feedback and model changes.	4	Hands-on training
Development of skills	Surveying	Basic settings of the coordinate system of the project and location of the building on a particular plot, working with cloud points in the context of targeting the current state of the buildings by means of terrestrial laser scanning.	2	Hands-on training
Development of skills	Project sample	Work on a prepared project - simulation of specific situations from practice that require a change in the proposed design solution of the project. Practical exercises include taking the design model and then incorporating comments into individual parts of the profession - modifying the model, its parts and subsequent export. Coordination of comments and incorporation of changes is ensured solely through the model. At this stage, trainees will identify spatial conflicts between individual professions (eg, missing transitions by supporting structures, placing two piping systems at one site)	4	Hands-on training

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Development of skills	Construction management	Practical exercise aimed at taking over the complete BIM model of the construction including all professions and processing the checklist area. At this stage, any time collisions in the implementation will be examined. Frequently on-the-job workflow simulation (4D) works and extends the model to the finance component (5D). The exercise is mainly focused on creating timetable links with the model and dynamically displaying the course of construction and the drawing of finances over time.	2	Hands-on training

4.1.3. Energy performance

Successful trainees will be prepared to use BIM models as a source of information for energy performance models and analysis. Trainees are able to transform model through inoperable format to specialized software in order to perform various forms of evaluation.

Table 5 – Training Curriculum - Energy performance

Curriculum Name	Module Name	Learning Objectives	Duration (hrs.)	Delivery Method
Energy performance	Theory of energyperformance	Provide information about the energy reduction related European framework of standards and regulations enriched with the practical information on using BIM to reduce the gap between designed and actual energy performance.	2	Presentation / e-Learning
Energy performance	Solar systems	Usingspecialized software fordesigningphotovoltaicsystemsbased on dataobtainefromBIM model. Modul includespracticalactivities and calculations.	3	Hands-on training / Exercise
Energy performance	Thermalbridges	Using specialized software to build upon parametric BIM model in order to calculatethermalbridges.Modul includespracticalactivities and calculations.	3	Hands-on training / Exercise

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4.2. Training formats

The training forms will be different depending on its format: onsite or online.

Onsite programmes have a duration of 40 hours (classes) and Online programmes have a duration of 15 hours (classes).

Onsite programmes are encompassed of 10% exam, 30% theoretical classes and 60% practical classes which will be organized in 5-days sessions from 10 to 17h, dedicating 1 hour for having lunch, between 13 to 14h. To complete the programme, 8 hours of homework are contemplated.

Online programmes are encompassed of 10% exam, 13% theoretical classes and 77% practical classes which will be organized in 6 videos with a duration of 20 minutes each-one (some will be divided in shorter videos that in total will be one module of 20 minutes long). They are complemented with readings, search and exercises covering 13 homework hours.

4.3. Training modules

The overall modules have these main objectives to achieve:

- To experience the changes proposed by the BIM as a work methodology.
- To make tangible the benefits that BIM supposes for a designer when being in an intermediate position between the design of a building and its later management like real estate asset.
- To help to know and select the necessary software and hardware tools for their development in a construction company.
- To have contact with new technologies that interacts or can interoperate with a digital BIM model.
- To maximize the constructability of a building project and improve its pre-construction.
- To introduce advanced 4D and 5D for cost analysis and planning and clash detection.
- To give shape to the BIM Coordinator profile for the improvement of internal design processes in an AECO company.

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This training programme is organized in complementary modules:

Table 6 – Training modules in the frame of BIM training, according to professional profiles

Professional profile			**Practitioners**		**Builders and contractors** (40 classes)	**Decision makers** (on-line, 15 classes)	**Industry and manufacturers** (on-line, 15 classes)
			Architects	Engineers			
			(40 classes)				
Number of classes (1 class = 45min)			40 classes onsite		40 classes onsite	15 classes online	15 classes online
	Module	Dates	Nov-Dec 2019		Nov-Dec 2019	Nov-Dec 2019	Nov-Dec 2019
Theory of BIM	**B**IM Basics and its 10D Dimensions	8	✓		✓	✓	✓
Development of skills	**I**nformation in a Life Cycle Model (design phase)	8	✓				
	Information in a Life Cycle Model (construction phase)	8		✓	✓		
	Information in a Life Cycle Model (maintenance and operations phase)	4	✓				
	How to implement BIM	4		✓	✓		
	Working on BIM model (decision makers)	4				✓	
	Working on BIM model (industry, manufacturers)	4					✓
Energy performance	**M**odelling Energy Efficiency in BIM	8	✓		✓		
	Exam	4 (on-site) 3 (on-line)	✓		✓	✓	✓

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4.3.1. BIM basics

The first module covers the following areas:

- What would be our definition of BIM
- Definition of Lean
- Definition of IPD
- BIM only affects the building sector or infrastructures too?
- Where does BIM affect the most? Which stage?
- In which phase of the life cycle of a construction is BIM used?
- Which 3 countries in the world are the most advanced with BIM. Best practices
- The fact to make BIM mandatory
- Is the use of BIM mandatory in Macedonia?
- BIM as expense or as saving
- Can I recover theoretically and practically the investment when implanting it
- Benefits provided by the BIM
- What does LOD mean
- What does LoD mean
- What does LOI mean
- What does LOIN mean
- What does LOG mean
- The importance of classification, taxonomy and property sets
- Necessary knowledge to procure BIM in a public work
- Choosing BIM software
- BEP-BIM Execution Plan by the designer or the public administration/private owner
- BIM as agent-by-agent process
- BIM as collaborative process between agents
- .IFC format, the necessity of interoperability

This course will focus on the sector's ability to complete a design from site survey or existing asset to the assessment through design, construction drawings, operations & maintenance and into permitting and commissioning.

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It provides to any stakeholder of the life cycle of construction from an owner to a designer, from contractor to installer with a comprehensive understanding of BIM design. These skills are essential to transform the value chain agents to cancel the gap between simulation and reality. This one-day module will provide the basics of this methodology and best practices.

4.3.2. Information in a life cycle model (design phase)

The second module covers the following areas:

- Profile, roles and functions of the BIM Coordinator
- BIM Onsite, power of new instruments: GPS, Laser Scan, Thermographic Camera, Remote Acoustic Laboratory, Drones, 3D printing at constructive level
- BIM Offsite, to manufacture, to prefabricate. BIM to modular, industrialize
- Collaborative models of contracting for a Collaborative Construction. Towards the IPD-Integrated Project Delivery
- Practical Training Unit
- BIM models according to their use
- BIM interfaces and softwares
- Modeling the BIM structure
- Modeling the BIM architecture
    1. Architecture: Walls and floors
    2. Architecture: Roofs and roofs
    3. Creation and management of view templates
    4. Display order.
    5. Communication Elements: Vertical and horizontal communication elements
    6. Carpentry
    7. Architectural details
    8. Plans
- Export IFC and Software to search and identify collisions between structures and facilities: ACCA and Solibri Model Viewer
- Comparison of measurements between IFC viewers

This program is preferably aimed at staff of Design Studies or Technical Office, as well as people who are in the studio deciding on project planning and budget.

The program will work mainly with ACCA suite but there will have continuous references to complementary software solutions as Revit, Navisworks, Solibri Model

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Viewer, Tekla BIM Sight, TCQ2000 and Presto Cost-it giving brushstrokes on applications Allplan of Nemetschek and Aecosim of Bentley.

4.3.3. Information in a life cycle model (construction phase)

The third module covers the following areas:

- Processes and workflows
- Possibilities of BIM construction
- Temporalize games. 3D tracking. Coordination of models. IFC
- BIM Construction Manager
- BEP
- Collaborative IPD construction models
- 5D Measurements and budgets
- BIM softares for construction: Navisworks, Vico, ACCA...
- Lean Construction
- The keys to improve processes thanks to BIM
- BIM Bid, Efficiency and transparency. Change of business model
- 7D, Facility Management. COBIe
- Models for its management and exploitation
- Real As-built, importance of the LOD 500. Selection information within the As-built
- Industrialized construction MMC, Modern Methods of Construction. Case studies

This course generates the knowledge base and total capabilities so that any professional related to construction activities, its project and its management can develop its activity at a basic level.

The program bases its activity on learning according to the case method. The theory taught takes 10% of the time, while the rest is divided into functional skills (basic knowledge of software and hardware) by 25%, procedural skills (collaborative processes, workflows and hiring models) by 30% , ability to manage 3D digital models in the different dimensions of the BIM by 35%.

The 10 Dimensions of the BIM and the Lean Construction methodology will be widely orchestrated and worked to ensure the full insertion of the participant in the digital construction environment in any geographical culture.

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4.3.4. Information in a life cycle model (maintenance and operations phase)

The fourth module covers the following areas:

- The meaning of BIM when we talk about Facility Management
- Case study: Applying the BIM at PUIG headquarters
- BIM from the vision of Asset and Facility Management.
- The opportunity that we cannot lose. An advance on the BIM Guide for FM of the Comisiones BIM
- Owners and asset managers and their three communication standards between the AEC world and the operation world: IFC (Industry Foundation Classes) and ISO 16739: 2013 Industry Foundation Classes (IFC), BCF (BIM Collaboration Format) related to IFC 2x3 or IFC4 DTV and COBie (Construction Operations Building Information Exchange).
- ISO 19650: "Organization and digitization of information about buildings and civil engineering works, including building information modeling (BIM) - Information management using building information modeling"
- Concepts and principles. Important this standard is related to the ISO 55000 AM.
- Phase of delivery of the assets.
- Operation phase of the assets.
- Set of environmental properties: Pset_Environmental Impact Indicators, Pset_environmental impact values.
- Set of properties associated with condition and shelf life: Pset_condition, Pset_servicelife
- Set of properties associated with the product and its guarantee: Pset_manufactureroccurrence, Pset_manufacturertypeinformation, Pset_warranty.

To create a successful high-performance building, an interactive approach to the design process is also required. It means that all stakeholders - all people involved in the planning, design, use, construction, operation and maintenance of the facility - must fully understand the problems and concerns of all other parties and interact closely throughout all phases of the project.

Maintenance management, both public and private buildings and infrastructures, in the Anglo-Saxon area has become a key aspect of the construction cycle.

In other cultures, maintenance needs an important way to understand that there are some requirements of owners or managers perhaps more important than space and that will condition more time than the time spent in the planning, project or construction phase.

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Who needs to be at the table at the beginning of a project to ensure an integrated team process? Each project is unique and will require the team and experience to adapt to the project's objectives. The team may include but is not limited to: the Architect, Landscape Architect, Owner, Client, Tenants, Engineers, Programmers, Interior Designer, Contractor, Specialists (Security, Telecommunications, Acoustics, LEED AP), Community Members or Other Interested, Operations and Maintenance Personnel, and others such as a Real Estate Buyer. HOK Chief Executive Officer Patrick MacLeamy, FAIA[1], explains why the term "BIM" doesn't convey the real promise of building information modeling over time. In this video, MacLeamy breaks down the mega acronym "**BIM-BAM-BOOM!**" and addresses the real promise of this new approach across three basic phases of a building's life[2]. Patrick MacLeamy made clear that the Maintenance and Operation phase was the recipient of all the efforts that were made during its project and construction - he added that we should start think of "assembly" rather than "construction" to facilitate that maintenance[3]. The BIM-BAM-BOOM concept defined by MacLeamy was eloquent. It all begins with BIM; the architect uses 3-D modeling to investigate options and test building performance early on in order to optimize the building's design. The design is then handed off to the contractor who streamlines the building process with BAM (Building Assembly Modeling), which allows for a significant decrease in construction costs. Once complete, BAM is turned over the owner and becomes BOOM (building owner operator model). This allows the owner to manage the building over time and ensure optimized building performance throughout its entire life cycle.

The real promise of "BIM-BAM-BOOM!" is "better design, better construction, better operation".

4.3.5. How to implement BIM

The fifth module covers the following areas:

- 10 fundamental steps for the success of an implementation of a BIM environment in a construction company
- Practical case: simulation of the implantation in the participating construction companies
- Lean Construction and the challenges of the industrial sector in the Construction sector
- Possible needs at the Strategy level, at the Operation level
- Training in BIM for elaboration offers, for production of services
- Acquisition of licenses

[1] *"Executive Profile: Patrick MacLeamy, FAIA, LEED AP". Bloomberg Business.*

[2] *"Interoperability in the Construction Industry" (PDF). American Institute of Architects. McGraw-Hill Construction.*

[3] *"The MacLeamy Curve - Real World BIM and IPD". IDEAbuilder.*

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- Procedures for type services in BIM
- BIM Legal Aspects
- Use of BIM models for communication / marketing
- Definition of BIM profiles for personnel incorporation
- BIM Implantation through 9 phases:
  - PHASE 1: Analysis of the organization
  - PHASE 2: Selection and prioritization of services
  - PHASE 3: Planning of the BIM implementation
  - PHASE 4: Implementation of the BIM
  - PHASE 5: Writing of other plans (acquisitions, HR, training, communication...
  - PHASE 6: Selecting licenses and training
  - PHASE 7: Maturing Departments, units of products, services
  - PHASE 8: Recruitment of new profiles
  - PHASE 9: Communication of the implementation

A methodology is presented: part of a prior knowledge of the organization reflected in a BIM Current Status Report in the company if it really exists. The case for adoption will be set out in greater detail. Notwithstanding the case for and against BIM implementation, were Government to decide to do nothing the technology and processes would be used in any case such is its traction at this stage. The strategy will be primarily concerned with managing its adoption rather than case making.

BIM programmes are essentially change management initiatives that require goals, resources, projects, momentum, successes and time. Its widespread adoption will have a disruptive impact akin to that experienced across the various sectors that have embraced digital technology over the past 20 years. The lessons learned from these experiences would suggest that Government and companies should take a lead in setting out measures to manage its adoption. In this way businesses can plan for the change rather than realise too late that they no longer have the capacity to contribute to the industry and to earn a living.

The module is based in a Project Management System based on ISO21500-PMBOK.

4.3.6. Working on BIM model (decision makers)

The sixth module covers the following areas:

- What would be our definition of BIM
- Definition of Lean
- Definition of IPD
- Sustainability
- Industrialisation

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- Scoring your performance in BIM
- Business value throughout the life cycle of capital assets
- Decision Sequence & Influence Diagram
- Software Tools, Functional Specifications, Evaluation Form
- Advancing Interoperability for the Capital Projects Industry

Imagine a highly automated project and facility management environment integrated across all phases of the facility life cycle. This is the vision of this module.

The future environment is one where information is available on demand, wherever and whenever it is needed to all interested stakeholders. Such an integrated environment could enable all project partners and project functions to interconnect—instantly and securely—all operations and systems.

This will drastically reduce the time and cost of planning, design, and construction. Scenario-based planning systems and modelling tools will enable rapid, accurate evaluation of all options, resulting in the best balance of capability and cost-effectiveness.

New materials and modern methods of construction will reduce the time and cost of construction and greatly extend facility performance, functionality, aesthetics, affordability, sustainability, and responsiveness to changing business demands.

The module is addressed to managers or executives on whom the technical and economic innovation of a real estate promotion or asset depends, whether in its conception, project, construction, management, operation or exploitation along a private or public promotion, building or infrastructural. As the module is also addressed to decision makers it will also provide guidance on how to use BIM in public tenders and what are the legal requirements for using electronic tools in procurement procedures, according to EU Directive 2014/24 EU[4].

4.3.7. Working on BIM model (industry and manufacturers)

The seventh module covers the following areas:

- Exploring Advanced Architecture and Construction 4.0. BIM as a solution
- What would be our definition of BIM
- Definition of Lean
- Definition of IPD
- Why builders and industrialists need BIM?

[4] Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement and repealing Directive 2004/18/EC Text with EEA relevance, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32014L0024

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- Scanning application cases using 3D laser technology in industrial environments
- The BIM Field Trip
- ... and after the BIM what? Maintenance management
- The entrance in BIM for the manufacturers of products. Standardization of object libraries and investment optimization and eCOB standard

The building and civil engineering sector is witnessing major changes and all agents of the AECO sector must migrate towards BIM processes and standards to maintain their competitiveness in local and international markets.

The bids for public building work must incorporate BIM requirements and on the other hand, owners and private promoters -especially those linked to important national and foreign projects- and the future operators of large buildings (hospitals, hotels, sports halls ...) and infrastructures (highways, ports, airports, railway lines ...) are introducing and demanding the use of BIM methodology in their projects.

The objective of the module Is to present what BIM is, how to implement it, what tools are necessary (hardware, software and systems) and how this new methodology will contribute to transforming the way of projecting, building and maintaining buildings and infrastructures.

It is addressed to industrial manufacturers of construction equipment and materials and wants to market them in public projects tendered according to BIM requirements, to developers and private builders, or through prescribers who work with BIM (architects, engineers, interior designers, urban planners...).

4.3.8. Modelling energy efficiency in BIM

The eight module aims to enabling energy efficiency measures to be fully implemented in each of the main phases of construction: design phase, planning, contracting civil works and construction. This module will be included in the training programmes both for practitioners (architects and engineers) and builders and contractors. The module covers the following areas:

- Visualization and Monitoring: Managers and end users
- BIM model environmental data
- How to check comfort parameters and increase energy efficiency
- Temperature and consumed energy simulations
- How BIM Managers can simulate, exploiting real weather data, the temperature profiles in the rooms of the building or the consumed energy in a certain period.
- To check the overall efficiency of the building
- Through user-awareness applications, how to be notified on bad behaviors

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- Load scheduling simulations: exploit this simulation to evaluate if a change in the heating cycle schedules will provide the same comfort level
- Real-time data provided by the IoT sensors
- Refurbishment modelling: run simulations to assess refurbishment actions.
- Building Efficiency Comparison
- Non intrusive load monitoring: exploit advanced Non-Intrusive Appliances Load Monitoring(NIALM) techniques to extract from the electricity
- Building energy modelling and monitoring by integration of IoT devices and Building Information Models

BIM has entered fully into the world of Industrial Engineering. If it was first conceived as an architectural design program, BIM has quickly demonstrated its vouchers in the field of installations.

The installation consultant has the ability to calculate and measure services in BIM and this added value converts Building Information Modelling into a generator of a new market.

The objective of this module is to introduce to the industrial, civil, electrical engineers the meaning and potential of the BIM environments.

Later, through three case studies, will see how it is implanted and used in three very different projects: a block of houses, an industrial plant and an analysis of how BIM environments can be programmed and parameterized to generate automation.

This module is focused at the sector comprised of industrial, mechanical, electrical, plumbing, MEP, facility consultants and installation technicians.

4.4. Training roadmap

A preliminary training schedule consists of the key training program activities. The training schedule will continue to evolve as the project progresses and additional details become available. The Training Needs Assessment, Training Curriculum, and Content Development Tracker will be critical inputs to the creation of the detailed training schedule.

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Table 7 – Training Roadmap

Activities	Description	Responsible	Target Date
Training Needs Assessment	Assessment of the need and interest of target groups during BIM promo events	Kreacija and BIM Academy	During sep – nov 2019
Training Plan	Develop high-level training schedule	Kreacija	December 2019
Training Materials	Develop course outlines	Kreacija and BIM Academy	31 December 2019
Training delivery	Organisation of 2 onsite and 2 online pilot trainings in BIM	BIM Academy	February 2020

4.5. Training evaluation

In evaluating the effectiveness of training delivery, information will be sourced from the following areas:

- The outcomes of competency tests completed by trainees at the end of each module
- Feedback from trainees on confidence level at the end of each module
- Feedback from trainers on training problems or individuals with who have experienced learning difficulties
- To support the evaluation process, trainees will be provided with survey link to complete an evaluation survey. This will be used to measure the reaction of trainees post-training.

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ANNEX 1: Training material for

Building Information Modeling - BIM for practitioners: engineers, architects and technicians

(Cover page only, the entire training material will be available at

http://trainee-mk.eu/images/TRAINEE/Publications/P_Building_Information_Modeling_BIM_for_practitioners:_engineers,_architects_and_technicians.pdf)

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ANNEX 2: Training material for

Building Information Modeling - BIM for decision makers, market and owners

(Cover page only, the entire training material will be available at

http://trainee-mk.eu/images/TRAINEE/Publications/P_Building_Information_Modeling_BIM_for_decision_makers,_market_and_owners.pdf)

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ANNEX 3: Training material for

Building Information Modeling - BIM for builders and contractors

(Cover page only, the entire training material will be available at

http://trainee-mk.eu/images/TRAINEE/Publications/P_Building_Information_Modeling_BIM_for_builders_and_contractors.pdf)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 785005

ANNEX 4: Training material for

Building Information Modeling - BIM for industry and manufacturers

(Cover page only, the entire training material will be available at

http://trainee-mk.eu/images/TRAINEE/Publications/P_Building_Information_Modeling_BIM_for_industry_and_manufacturers.pdf)