Recognised Micro-Learnings To Support The Digital Journey In The Construction Industry

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Abstract

The aim of this paper is to demonstrate how the human-capital basis of the construction sector can be enriched using Building Information Modelling (BIM) and digital tools to improve the sustainable building environment. The research within the BIMzeED project (www.bimzeed.eu), conducted across 4 EU countries, identified a number of gaps between the skills and needs of industry and the current availability of training. The gaps identified thus informed the development of 12 innovative and multidisciplinary Learning Units (LUs) addressing nearly zero energy buildings (NZEB), circular economy and compliance. The mutually recognised micro LUs delivered as blended, in-class/on-site or on-line training, are designed to be flexible as stand-alone units, combined as a group of LUs or integrated into existing curricula. Training the workers and staff in small to medium enterprises (SMEs) will improve their competitiveness by ensuring SMEs can keep pace with this fast developing industry, and integrating the LUs into existing curricula will ensure that the training available at higher and vocational levels meet the demands and needs of the industry. The LUs, as they are designed to be flexible and accessible, will enable SMEs in particular within the construction sector, to start the digitisation and transformation journey within their organisations.

Keywords – Micro-learning, Mutually Recognised, Active learning, Digital tools, Sustainable built environment, SME competitiveness

I. INTRODUCTION

There is a major opportunity for the construction sector to not only reduce energy demand, but also to improve process efficiency and reduce carbon emissions; however the industry is traditionally highly fragmented and is often portrayed as involving a culture of "adversarial relationships", "risk avoidance", exacerbated by a "linear workflow", which often leads to low efficiency, delays and construction waste [I]. Construction is a complex sector that includes a wide range of economic activities: extraction of raw materials, manufacturing and distribution of construction products, design and construction of buildings and infrastructures, maintenance, renovation and demolition, waste recycling, etc. It is also characterised by being a highly SME-based sector, where small and medium-sized enterprises (SMEs) and micro-enterprises make up the majority of the construction value chain and according to EUROSTAT, 94% of the construction companies engage less than 9 employees [II]. The image of the construction sector is widely perceived as a "low-tech trade" sector, but the construction industry is experiencing its digital revolution, with an intensification of digital support in all stages of building design and construction.

Recent policies in Europe require significant changes to how the industry moves forward. "A Europe fit for the digital age" is one of main priorities set by the 2019-2024 Commission, together with the European Green Deal [III], the new Circular Economy Action Plan [1V] and the Industrial Strategy [V], as well as a dedicated Commission Communication expressing the importance of supporting SMEs in construction and other sectors, in order to achieve a sustainable and digital Europe [VI].

To align with these orientations, the digitalisation of construction SMEs has to accelerate, not only within the existing workforce, but also to accommodate new jobs emerging from the gaps and needs in the industry. These changes have

established the critical need to improve specialised training and skills with active uptake of new technologies and digital tools. At the same time, construction workers are asked to continuously demonstrate new abilities related to digitalisation, circular economy, energy efficiency and improved occupational health and safety regulations [VII]. While some of these skills are being addressed through public policies, further work is needed to encourage upskilling, and reskilling for the entire construction sector. Additionally, the construction sector suffers from a shortage of qualified labour and a lack of interest from young people, it is essential to make the sector more attractive to young workers and women and provide appropriate awareness and training to encourage entry.

This paper will discuss skills needs and how mutually recognised micro-learnings can support the Digital Journey of the construction sector to improve the sustainable built environment, modernise the industry and encourage young workers and women into the sector.

II CURRENT UPSKILLING CHALLENGES IN THE EU CONSTRUCTION MARKET

BIMzeED (Erasmus+) project intends to improve the human-capital basis of the construction sector, which is identified as a strategic initiative by the European Commission, acting on Higher Education Institutions (HEIs) and Vocational Education and Training (VET) systems in Europe. This project supports the construction industry, through education and training using technical innovation and digitalisation. Not only is digital training an important focus for the progression of the construction sector, but providing a low carbon efficient economy requires the integration of BIM with NZEB design and development approaches.

However, the European construction sector is one of the least digitalised sectors, whose productivity rate increased by only 1% [VIII] during the last 20 years, SME growth is also constrained by the lack of skilled workers and site or project managers, as well as those with digital and smart technology skills. An overview of the digitalisation process shows that the digital technologies are not understood in the construction sector. However, the industry is facing major challenges in achieving energy efficiency targets, in particular for nearly zero energy building, but they are also experiencing a digital revolution, with Building Information Modelling, digital cloud based management tools and other digital tools such as Augmented Reality, drones, 3D printing and smart controls.

Transferring knowledge in relation to BIM is currently highly fragmented and particularly weak at manager, craft and operative levels, so solutions to improve employability and cost effectiveness for SMEs is paramount. Over the last years, a number of relevant European projects have addressed various challenges in a comprehensive way, both in developing technological solutions and BIM adoption, addressing and solving market barriers and developing strategies for involving all construction workers and users to stimulating demand and uptake training. These main challenges related to the uptake of digital training include:

1. Lack of motivation and time

Flexibility in delivery and scheduling is required using blended or online approaches. The traditional “death by PowerPoint” delivery requires alternatives such as micro-learnings using digital (field apps, BIM, AR) and practical hands-on upskilling on-line, in-house or on-site.

2. Stimulate Awareness of digital tools

Increasing the demand for a quality workforce involves digital skills training with collaboration between educational and industry organisations and promoting champion case studies. Understanding the benefits and principles of digitalisation and the benefits of hiring skilled workers/professionals (quality compliance, competency) or upskilling staff is paramount

3. Lack of skills and expertise in SMEs

This is associated with the lack of participation of SMEs in upskilling their workers/managers in energy and digital skills. Adoption of a training plan to upskill the team with in-house and online training and hire specific expertise will empower a stronger united workforce.

4. Fragmented availability of training

Preparing the foundations for a one-stop-shop training platform or mobile app are proposed in two projects DASBE [IX] and BUSLeague [X]. It is essential to make it easier for the workforce to find suitable training nationally and locally with support and direction for a training progression pathway

5. New societal and technological career opportunities

The number of young adults and women taking up employment in the construction sector is decreasing, the workforce is severely affected by labour skill shortages and there is a misalignment between VET/apprenticeship training. The motivation of young people for climate protection, digital and IT jobs are an important step towards securing the availability of skilled personnel. Therefore, it is crucial to modernise the image of the industry and build the connection between young people and environmental innovative professional roles.

6. Mutual Recognition of Skills

The successful BuildUp Skills EU Exchange [11] and EU funded projects (NewCom, BUSLeague) place importance on the need for workers to be

recognised for their new acquired skills. A skills register and/or passport will stimulate the demand for skills and enable the companies to promote their competence and skillset

As the construction industry incorporates greater digital innovation and embraces modern design processes, the need for specialist workers is set to rise, but a lack of investment in new technologies, a lack of knowledge on how to undertake the digital transition, and a lack of the skills required to implement that digital transition are the main barriers facing construction sector SMEs.

With the industry now fully reopened after COVID-19, there is a fresh enthusiasm in the air to explore, and a change in attitude towards digital tools forcing companies across the industry to invest in new technologies and to employ new practices in order to meet new challenges. Like many other industries, it is almost inconceivable that construction will return to its old way of operating. Everything from business processes, design, drawing up contracts, material supplies to activity on site has been impacted. Not only will technology and BIM learning, play a crucial role for the industry in the post-pandemic recovery era, its use in tackling the ongoing sector challenges and capitalising on the emerging opportunities must also be analysed and acted upon.

To stimulate market demand, appropriate measures are required to ensure quality of training, in order to build trust in the market. The question is to what extent these learnings will be adopted in the long-term? The industry has changed significantly to embrace energy efficiency, circular economy, sustainability and digitalisation, the traditional belief that the construction industry is for the "craft orientated" is no longer accepted. The construction sector has a wider audience which includes new emerging employment opportunities and positions for technical/BIM managers, on-site digital experts, technical operators to utilise AR, drones, robotics, communication experts to ensure knowledge transfer and retain communication strategies to improve cost and time management, energy experts and waste management/lean experts and the list goes on. One of the concerns raised in the sector is the availability, at scale, of the necessary skills to accommodate these skills gaps. To satisfy these gaps, would require significant upskilling of those already working in the industry and recruiting a substantial number of young people into the industry, to ensure they have the right skills and knowledge.

Table 2: Percentage of the Construction Sector by Age

Age Group	Percentage of Sector
15-24 year olds	7.7%
25-49 year olds	60.8%
50-64 year olds	31.5%

However, current figures for employment in the construction sector in EU in 2019 demonstrate that young people are not entering the aging construction industry. Not only does IT/digitalisation and new technologies motivate young people, but climate protection jobs are an important step towards securing the availability of skilled personnel [XII]. Technological and climate solutions will only have maximum impact if the skills exist within the workforce, the investment happens along the supply chain, and procurement acts as a driver for investment. We need to stimulate ways for the young and women to enter the construction sector and digitalisation is one approach, but the existing workforce also needs clear direction in digitalising the industry.

In this context, it is evident that building information modelling (BIM) integrated with energy performance compliance (NZEB) will facilitate the improvement of energy performance in a more effective and efficient manner. Computer generated BIM models using the cloud systems enables the planning, design, construction and operational phases of a NZEB Project to be simulated, in order to reduce so called energy performance gap and to improve the quality and understanding of NZEBs.

II. NEW APPROACHES TO EDUCATION AND UPSKILLING

It is important to consider and evaluate the overall approach and perspective on learning and teaching at higher educational, vocational level and interactive online training, specifically for the construction industry. At EU level, it is still a challenge to introduce relevant standardised environmental and energy efficient learning topics into mainstream training and degree courses at HEIs & VETs (European Commission, 2013) and encourage the construction industry (especially SMEs) to take up these programmes. An important outcome from the Build Up Skills EU Exchanges states "the need to provide flexible routes for career progression". SMEs consist of 95% of the construction sector, so it is important to consider their needs. A collaborative approach in developing the training materials with SMEs and industry is needed.

Educational theories in the past have been systematic with emphasis on classroom learning, however this model has been turned upside down especially with the advent of COVID-19 and

opportunities to access vast numbers of open educational resources online. The classroom is rapidly transitioning from a teaching-centred to a learning-centred environment as a result of a recognition for the positive active-learning. While definitions of active learning vary, they share two common priorities. (1) Students are doing more than just simply listening, it is important to strengthen skills-development rather than just conveying information, and students have the tendency to engage in activities (e.g. debate, discussion, polls, forums) which promote higher-order thinking (such as critical thinking, analysis etc) [XIII]. Active Learning engages students in the process of learning through activities and/or discussion in class, as opposed to passively listening to an expert or trainer (Traditional Learning). It emphasises higher-order thinking and often involves group work. Active Learning can be enabled in face to face, blended and/or online environments.

One of the approaches to freeing up class time for active-learning is the "flipped classroom". In the flipped classroom approach, the "learning unit" is moved out of the classroom in the form of an audio-video or reading e-learning resources for students to study before coming to class. The classroom time can then be effectively dedicated to carefully design hands-on activities that strengthen the concepts and provide opportunities to enhance critical thinking skills. Students have demonstrated that the teaching method flipped classroom promotes stronger student engagement, flexibility and a more active approach to learning, as it provides the opportunity to study at their own pace with accessibility to video lectures and resources [XIV].

The New Skills Agenda for Europe, Skills Guarantee recognised that the non-formal education is key to life-long learning (LLL) and the European Association for the Education of Adults (EAEA) agrees with several key points in the New Skills Agenda, such as the necessity to increase participation in lifelong learning and to ensure that everyone has the opportunity to find pathways for upskilling via a "Skills Guarantee". The necessity to have skills recognised, especially for people who have acquired these through informal ways is also becoming more important within the construction industry. Ensuring continuous skills development of the workforce is necessary to allow people to develop their career pathways and to ensure that they have the right skills for future jobs [XV]. This has recently been acknowledged in the Sustainable Development Goals (SDG) 4: Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all [XVI].

Such development together with the life-long learning requirements have seen the approach to a new learning style. Micro-learning aims to effectively streamline the learners' fragmented time by carrying out personalized learning activities through online open educational resources (OER). The main workflow of a micro learning system can be separated into three processing stages: micro learning material generation, learning materials annotation and personalised learning materials delivery.

The reports on future skills needs at the European Vocational Skills, based on initial experiences in using micro-learnings to upskill SMEs in the construction sector is positive. Additionally, the recommendations from a high number of BuildUp Skills and other EU funded projects (QualiBuild, TrainSustain, BIMCert, BIMplement, ICARO, BIMzeED, Construction Blueprint etc.) also reported that micro learnings should be considered in order to optimise the transfer of knowledge to the overall construction workforce. The use of micro-learning units or short modules has been widely received as the future in learning in the construction industry. To encourage uptake of micro-learnings, it is also necessary to provide mutually recognised micro-credentials. This system is already available in the form of continuous professional development (CPD), however a more robust system is required to ensure sustainability and acceptable by the industry.

The benefits to the industry for a European approach to micro-credentials will:

- widen learning opportunities and further shape the lifelong learning in all education, as it can offer more flexible, learner-centred forms of education and training
- a larger take-up of micro-credentials will serve social, economic and pedagogical innovation
- scale up flexible, modular learning in a mutually comparable manner throughout Europe, whilst ensuring agreed quality standards. As a result, it will be easier for learners to get these types of course recognised.

As one of the fast-growing niches in the construction industry is in the field of energy efficiency, NZEB and digitalisation. It is evident that the skills required to implement these, might best suit a life-long-learning approach, to be integrated into progressive career pathways. This is true for those workers who have already acquired basic competences in NZEB or BIM, however, the lack of LLL courses in many EU countries represents a significant gap which needs to be addressed. It is essential to promote informal education at HEIs and VETs, as well as lifelong learning (EQF level 6 & 7) in the field of NZEBs and renovation of existing buildings to provide the necessary technical knowledge to public authorities, designers, technical supervisors, and site managers, and other experts [XV11].

There is also still a large knowledge gap around BIM processes and digital data and its importance to the future of the construction industry. Research can address potential BIM related skills shortage; support companies to put BIM processes in place, thus alleviating some of the costs linked to BIM implementation; and help shift the construction mind-set towards innovation adoption. It was shown in some countries that industry's initiatives play an important role in the BIM implementation process, providing construction companies (from project's owners to architects, engineers and constructors) with relevant support and incentives. By helping the industry build BIM capacities through courses and trainings; knowledge and experience sharing; and workshops, industry initiatives must offset some of the costs relating to BIM implementation. Education, not exclusively through HEI and academia, is a key component and actors of the BIM ecosystem. BIM education is not only a technical issue: it is not only about training workers to use BIM software, but also significantly changing the working methods and process in a company for the future.

It is important to strike a balance between theory and practice when developing training and all players need to know not only the 'how', but also the 'why' and the 'what if'. The BIMzeED project establishes this balance and utilises a number of important models by incorporating a varied use of active micro-learning and innovative approaches to enhance learning, as well as providing flexible deliveries in blended or face to face and online versions to SMEs to complete in a self-directed format.

III. IMPACT OF MICRO-LEARNING USING BIM TO ACHEIVE NZEB.

Not only is digitalisation trainings an important focus for the progression of the construction sector, but providing a low carbon efficient economy requires the integration of BIM with NZEB design and development approaches. The BIMzeED project utilises Active Learning using the flipped classroom approach enabling a highly engaged classroom to ensure collaboration of all SMEs in the learning process. The learning environment is one of interaction, collaboration and stimulation. To ensure that SMEs are motivated, easily engaged in the training course and expand their knowledge further, it is important to include a number of active learning methodologies such as individual-based, paired and group-based activities (collaborative discussions and active tasks). Additionally, active learning strategies including Problem Based Learning (PBL), case-studies and enquiry-based learning are also included. The training methodology proposes to categorise the learning content into specific micro-learning units to be presented as a number of short training modules with 8-10-hour contact and 12-20-hour self-study. Each learning unit is delivered over 4 sessions, covering a main topic in each session enabling flexibility for the students and SME workers during their working days. This enables the industry to streamline their learning strategy using a training pathway to build up their skills, which is further recognised through a collection of credits/badges. Completing the Learning Units and building up badges/credits will encourage further study and upskilling enabling SMEs (professionals and workers) to progress in their vocation and progress towards accredited trainings and courses. Furthermore, the upskilling content will be described according to a methodology which is compatible with developed qualification (compare description of competences/units of learning outcomes) and mutual recognition.

The BIMzeED project objectives is to develop and pilot 12 Learning Units with the aim to increasing the understandings and skills of Building Information Modelling (BIM) and other Digital tools to achieve NZEB. To ensure viability and relevance, a number of gaps between the skills and needs of industry and the existing availability of training were identified which informed the development of the 12 innovative and multidisciplinary Learning Units (LUs) addressing BIM, NZEB, circular economy and compliance. Further support and expertise were provided by other academics and educators, professionals, SMEs, Industry, product and technology providers, R&D and policy makers across Europe. By working with SMEs to tackle skills mismatches and promote excellence in skills development, BIMzeED is in line with "renewed EU agenda for higher education" (Education and Training 2020 strategy – ET2020) and also ensures that SMEs are not left behind in this fast developing industry as BIM and digital tools can assist with achieving cost effective NZEB construction.

It is recognised that BIM has a number of socio-technological advantages not only at the technological level, but also the process level, and can complement the way that architectural design artefacts are created, but also profoundly change the collaborative process associated with how the building is used and maintained. It is also clear that the design, installation, operational and maintenance processes with regards to NZEB needs to be a collaborative effort between all stakeholders. There is a substantial need for all relevant parties within the construction chain (clients, architects, engineers, specialist, site supervisors, sub-contractors, workers and facilities managers) as well as other stakeholders, to be specifically educated in an integrated design

and build approach and trained to work in cross-disciplinary teams using BIM and other collaborative digital tools. Moreover, it is essential that educational and training institutions nurture professionals and workers with such competences. New technologies require talent with substantially different skills, with experts in BIM and skills in artificial intelligence, data analysis and programming.

A number of gaps identified in the BIMzeED Roadmap [XVIII] were prioritised and integrated into the BIMzeED learning units. The Learning Outcome indicators from the BIMzeED literature review are as follows:

- Various studies and reports have revealed an actual lack of competences (knowledge, skills, responsibility) on the sustainability concept among practitioners in the construction industry
- Lack of knowledge, trust, and communication between various industry partners in the lifecycle stages of a building are identified as a main barrier
- Lack of specialised knowledge and collaboration (communication and trust) is one of the reasons for the under-performance of NZEB and sustainable building.
- Optimisation of building energy use requires an integrated design approach and cross-disciplinary teamwork, which leads to high quality indoor environments and satisfaction of the occupants' needs
- Better management of the information during the whole life cycle of the NZEB is necessary to avoid mistakes and establish trustworthy information at any time or when an intervention is necessary.
- Integrated design courses (especially those which include specific skills to manage NZEB challenges in cross-disciplinary teams) are scarce throughout EU educational institutions, and there are many experts having little or no knowledge on integrated design.
- BIM offers a foundation for comprehensive facilities management, especially in light of the trend toward "smart" buildings. Using detailed BIM models, owners can connect the building information with data from sensors and monitor its operations, thus optimising operations while meeting occupants' needs.
- In many EU countries, and among many stakeholders there is still a large knowledge gap around BIM processes and data and its importance to the future of the construction industry. This gap is not just isolated to certain areas of the industry; it pervades to the entire construction value chain.
  - Interoperability, is one of the most critical issues for advanced BIM users and needs to be addressed. Lack of automated processes (interoperability) for BIM (Building Information Modelling) to BEM (Building Energy Modelling) is one of the major gaps where technology needs to advance in the future.

The BIMzeED learning units were designed with the purpose to ensure a balance between theory and practice. In short, the construction industry needs to know not only the 'how', but also the 'why' and the 'what if'. Whilst the incorporation of practical training is important, it must not be introduced to the detriment of a poor theoretical basis. Trainers can implement a practical solution where possible, demonstrating the importance of doing, using full scale demo models and practical models, real equipment and practical walls, or visits to construction sites where NZEBs are under construction, are the most useful way of learning. This active learning method of doing can also be used in the online capacity, especially with the demonstration and practical sessions for BIM and other digital tools.

BIMzeED structured the training material and content using common learning units (LUs) with flexible standardised delivery (in class, on-line and on-site) suitable for HEI, VET and SME training. The initial training content includes NZEB related subjects with BIM maturity. The training content covers and delivered in a Blended Learning format supported by an e-Learning portal.

The following 12 mutually recognised BIMzeED Learning Units[19] are designed for relevant target groups with 2 LUs common units open for everyone.

LU1: Collaborative BIM to achieve NZEB (EQF 4-7) *COMMON UNIT*
Give all necessary tools and knowledge to all team members for BIM workflow generation and application and NZEB understanding.

LU2: BIM and nZEB for Workers EQF (4-5)
Inform workers on the BIM methodology used during NZEB project construction, and awareness to prevent and anticipate solutions.

LU3: NZEB Realization and Commissioning: Building Envelope and Air Tightness (EQF 6)
Understand the parameters affecting building envelope and air tightness, quality controls and create BIM objects suitable for nZEB design and the correct use within the BIM model.

LU4: NZEB Realization and Commissioning: Building Services & Smart Technologies (EQF 6)
Understand the parameters affecting building services and smart technologies, quality controls and create BIM objects suitable for nZEB design and the correct use within the BIM model.

LU5: NZEB Realization and Commissioning: Quality Assurance (EQF 4-7) *COMMON UNIT*
Focuses on quality assurance of the elements for nZEB qualification of the building, using BIM methodology and other digital tools as

communication tools.

LU6: BIM Model Uses during Construction (EQF 6)
Use of BIM models to provide optimization during construction and a digital twin design by anticipating and solving problems.

LU7: BIM Model Uses for specification and quantification (EQF 6)
Exploit model data through cost extraction, site planning and material listing, acquiring knowledge in the design of a construction model considering time (4D), cost (5D) and environmental aspects (6D).

LU8: BIM Model Standardization for nZEB Design (EQF 6)
Standardizing and validating the structure of the BIM model to achieve an nZEB design and optimize the workflow.

LU9: Building Energy Modelling (BEM) Design and Export (EQF 7)
Develop a BEM and understand how it affects the design of nZEB buildings and future needs.

LU10: Energy Simulation with BIM Tools (EQF 7)
Analysis and interpretation of a Building Energy Model (BEM) to guarantee economic viability and nZEB requirements.

LU11: Nearly Zero Energy Building Facilities Management (EQF 5-6)
Maintain efficiency during facility management by preventing and anticipating future problems and guarantee nZEB qualification during its use.

LU12: BIM in Facility Management Software (CMMS) (EQF 6-7)
Create a BIM model for facility management systems focussing using CMMS software and standards like COBie.

The BIMzeED project aims to train and upskill 120 educators at European HEIs and VETs by piloting the new learning resources and training materials, which will be made available as transferrable Learning Units. Additionally, 500 students from higher and vocational education levels, SME and individuals from the construction industry will also be trained in an online or blended delivery format. The mutually recognised LUs delivered as blended, in-class/on-site or on-line training, are designed to be flexible as stand-alone units, combined as a group of LUs or integrated into existing curricula.

The stand-alone learning units enable SMEs to choose a short online training programme, where a qualified BIMzeED trainer directs and facilitates discussion between groups of industry members from a mix of backgrounds. It is important to enable group discussions which supports the method of active learning, strengthening the understanding of SMEs through role play, case studies and industry experiences. The flipped classroom practice also enables the SME participant to review the content in advance and most importantly review in their own time to prepare for the online class, so discussions and demonstrations can be maximised and thus reducing PowerPoint feeds.

The approved stand-alone LUs will become available as self-directed training enabling the industry to pick and choose which LUs they wish to complete and build up badges demonstrating their skills to improving their employability and support a profitable and low carbon future.

Grouping learning units allows the vocational and higher educational bodies to establish a new course for the SMEs and students. In the case of learning units 1, 2 and 5, it was anticipated that these skills were particularly required at vocational level and permits a VET programme to be established at EQF level 4-5. Additionally, at higher education levels, all the LUs can be grouped together in a systematic approach to create a new accredited programme relevant to the skills needs of the industry. Alternatively the LUs can be integrated into existing accredited programmes to support and enable updating and improving the existing curricula. It has been recognised that many of the courses available at higher and vocational levels have not been modernised or updated in the last few years mainly due to burden of work of the educators and trainers, but also due to the restrictions and delays of the legal and administrative accreditation process.

Initial results from All the LUs are tested within the industry and at higher or vocational organisations to determine quality and relevance. The final results will consider the type of delivery, content of the LUs, accessibility, flexibility, quality and relevance.

IV. CONCLUSIONS

New employment profiles and sought-after skills could encourage more women and young people (new talents) to join the industry and to close the talent gap. In some countries (i.e. Ireland) new occupations are emerging within the NZEB areas. BIMzeED analysed the current situation in the Construction industry in several EU countries and reviewed a number of EU projects and provides in part a solution for the training and upskilling challenges in the field of NZEB and BIM. The analysis of current formal and informal educational programs in the construction industry revealed that topics related to the NZEB and BIM are not adequately covered, or not covered at all, resulting with a lack of qualified workers and professionals. A number of gaps have been quantified in BIMzeED and it is equally important to predict the future roles for the construction industry to determine the skills

needs. The gaps and needs identified have been set out in 12 Learning Units as groups of competences required by the construction industry to understand and implement skills in the field of NZEBs and BIM. Competences have been prepared in a generic mode and also as specific actions within the Learning Unit. These Learning Units focus on the importance of drawing cogent conclusions on the type, level and mode of training relevant to SME employees working in an active construction industry.

Training the workers and staff in SMEs will improve their competitiveness by ensuring SMEs can keep pace with this fast developing industry and integrating the LUs into existing curricula will ensure that the training available at higher and vocational levels meet the demands of the industry. The LUs, as they are designed to be accessible, will enable SMEs in particular within the construction sector to begin the digitisation and transformation journey within their organisations.

It was always expected to provide flexible micro-learning with a variety of delivery methods and mode of training for SMEs to enable faster progression and also enable a flexible training pathway for the construction workers by building up credits in the form of mutually recognised badges
The expected benefits of digitalisation Skills for construction SMEs are diverse – including e.g.: increased efficiency and competitiveness; improved collaborative work across the construction value chain and during different stages of the construction lifecycle; better control and management of material resources, waste reduction and improved energy and environmental performance; resilient and greener buildings and infrastructures, etc.).

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