



EXECUTIVE SUMMARY

WP 4.2 and WP 4.3 as initially described in the proposal, are very narrowly interlinked. To avoid repetition and to generate a more comprehensive study and text, WP 4.2 and WP 4.3 are regrouped together in this final text.

SECTION 1 presents the results of the European DigiPLACE survey, that forms the basis for further investigations and discussions. SECTION 2 summarizes the handicaps of the traditional construction industry in comparison to the “manufacturing industry”¹. SECTION 3 studies how these handicaps can be addressed by the opportunities of “CONSTRUCTION 4.0”. In SECTION 4 “best BIM practices” are summarized. SECTION 5 treats the topics of datalinking with the building product and elements manufacturing industry as well as the related topics of modeling conventions and LOIN (Level of Information Need), which are essential aspects in sharing data. SECTION 6 shows the first interesting examples of non-commercial collaborative platforms with a focus on SME’s.

The overall slow innovation receptivity of the sector can be partially explained by the peculiarities and factors exposed in chapter 1. Starting from these general considerations, the main focus of this WP is to thoroughly assess the main barriers that the construction sector encounters for increasing its productivity through digitalization. The analysis for tasks 4.2 and 4.3 included, among others, a survey on the digital status – partially focusing on SMEs – and the different figures showed a good representation of both SME’s and larger companies. When analyzing the “digital status” of the companies and sectors, the survey sometimes shows a limited to medium degree of digitalization, but altogether, an important percentage of the companies is using to some degree newer tools like chat systems (40 %), filesharing platforms (40 %) etc. When looking more in detail for the variation of the sectoral groups, some important differences can be found, especially for the more advanced tools. For instance, only 5 % of the contractors indicate a regular use of collaboration tools, compared to 30 or 40 % for engineering or software development. Overall, project development, contracting and facility management seem to show a lower use of professional ICT tools, and this difference compared to sectoral groups increases for newer or more advanced tools.

When detailing the use of ICT related to specific internal processes, we see an important use for the quoting and invoicing phase: 80 % of the replies confirm the use of software for this phase. For all other phases, the software use is lower, with more than 50 % use for general accounting, work order, calculation and recalculation of costs and preparation/planning of works. It is also worth highlighting that 5 % of respondents state that they do not use any software tools. When plotting per sectoral group,

¹ The manufacturing industry is that part of the industry that processes materials into new products. Sometimes referred to as discrete industry or discrete manufacturing, this branch is distinct from the process industry. The manufacturing industry includes the mechanical engineering, metal products, transport equipment, electronics, plastics processing and textiles sectors. However, sometimes the term manufacturing industry is used much more broadly, for example as “the production of generally physical products and includes the industries extraction of minerals, industry, and the production and distribution of electricity, natural gas, power and water”



for most of the tools, a positive correlation between company size and percentage of software use can be established. Software for calculation or recalculation of costs is for all sectoral groups the most important tool, except for large contractors. Although large companies use much more software tools, for some construction phases they indicate only about 50 to 60 % software use regarding stock management, purchasing materials, time recordings on site and customer orders.

BIM use seems to be low to moderate – 17 % in a modelling environment and 10 % in a viewing environment, but this is in line with expectations at European level. When asking for (future) applications regarding technology, most options – ranging from drones, augmented reality (AR), virtual reality (VR), scanning, data management and more – score between 25 % and 50 %. The highest score for data management may be surprising, but it concerns probably the most common and general challenge for all companies, occurring in nearly each software or digitized process they implement.

The use of digital tools seems to be encouraged mainly by market forces: mostly clients, project partners and competition (each time indicated as “somehow agree” or “fully agree” by about 60 % of the replies), while the “public forces” such as government push/encouragements or public procurement score significantly lower. On the other hand, 50 to 60 % ticked ‘agree’ for public or private initiatives that might encourage or support the companies in sharing digital information with construction partners.

As a self-indicated conclusion, companies were asked to give their own digital score, and the global average score for all respondents is 5.9 (on a scale from 0 to 10), with a rather limited dispersion. The average company score increases with company size, with the lowest scores of about 5 for micro-enterprises and self-employed persons, and nearly 7 for large enterprises. Most companies indicate investment, e.g. in technology and software, as well as the undergoing of training as possible measures to increase the score.

The traditional ways of working in construction have some serious handicaps and challenges compared to the manufacturing industry. The digital transformation has the potential to solve most of these handicaps with the possibilities to increase productivity, quality and offer new solutions for challenges such as the reduction of construction waste, circular economy, resource efficiency, climate change, optimizing construction solutions etc. It transforms or generates new business models such as working in construction teams, the use of BIM-management and its new accompanying professions, a shift towards industrial construction with qualitative and robotized off-site manufacturing reducing largely the construction activities to assembling and further automation on the construction side. A wide spectrum of technological evolutions in software (e.g. AI, ERP) and equipment (scanning, drones, robots, 3D-printing, etc.) are stimulating these evolutions. The data linking with the supply chain of building product/element manufacturers is an evolution that has only just started, offering new possibilities for manufacturers (marketing, client contact) and the construction industry that may use the data in all kind of applications. Investing in the digital transformation of companies thus seems an excellent idea. Not investing in it might be of economic disadvantage, e.g. due to the competitive advantage of digitalized companies (profit, building cost).

The survey showed the reactions of companies and especially SMEs towards this necessary evolution. The inertia fear for the complexity and cost or even disbelief is hindering the massive adoption



of the new technologies by the AEC-industry². So, what are the good practices that could stimulate the transformation of the sector?

First, the digital transformation is an on-going evolution which still has a lot of problems and unrealized goals. The document further focusses upon the adoption of BIM and data exchange. The UTOPIA is a fully integrated ecosystem or environment as a Swiss pocketknife or a PDA full of apps, which are easy to use (plug-and-play), affordable and allow to concentrate all data and treat these to optimize building design and construction activities.

Vendors of commercial modelers often offer services (templates, libraries, tools, ...) to user groups (client binding) to approach this utopia (except maybe for the aspect “affordable” for very small SME’s) and combine these with trainings and helpdesks. As they work within the same group, in the same region, based upon the same software, it is easier to make conventions and agreements. The approach is fully appreciated and a good way to start with the adoption of BIM (first good practice). However, when a collaboration is needed with companies belonging to another “user group” of a different vendor or even different modelling software, all the benefits crumble down. To approach this utopia independent of the “user community”, a lot of conventions, agreements and semantics need to be agreed upon. This could be done per project or per region or even per country, but fixing the basics in international standardisation is probably the best way forward.

Through a series of interviews with stakeholders, contacts in standardisation and BIM-associations, reactions, examples and good practices were inventorised and documented in “inserts” about topics such as:

(1) Working together requires a lot of conventions and agreements. This can be done on a project basis, but to have a large part of these conventions, agreements and good practices valid for all projects, is a major help. This can be realised by international standardisation. Obviously, this work has a major impact, getting knowhow about on-going work and realised standards is crucial for good practice.

(2) Construction traditions and responsibilities differ in European countries. Good practice requires to adapt some aspects of international standardisation (e.g. EN ISO 19650 -1/2) to pragmatic, local applications (BIM protocols, BIM execution plans, ...) taking in account local building practices.

(3) Clustering sectoral and intersectoral companies (architects, contractors, engineers, software, manufacturers, facility managers, ...) to stimulate the use of BIM, to solve common BIM-problems, to inform, to network and to create new opportunities has large benefits. What are the good practices and initiatives?

(4) Even if the utopia of the fully integrated approach does not exist yet, a lot of tools exist that can be very helpful. The AEC industry should not wait to adopt the existing solutions.

² AEC = Architecture, Engineering and Construction Industry



(5) Investments for micro and very small SMEs can be low and still allow working in BIM with partners. For some companies, working with viewers is enough and the best solution. Best practices?

(6) Education, training and retraining are major challenges that should be considered and applied. A newly trained workforce is one of the most powerful ways to guide the AEC industry through this digital transformation. What are good practices? What new jobs and competences should be considered?

(7) It is good practice that modelers do not only consider their goals, but also the needs “downstream” the construction process (modelling conventions/Level of Information Need). Are there good practices within companies, regions, countries and international work?

(8) Building research delivers innovative knowhow. This can be in the form of building solutions, calculation tools, alphanumeric data etc. If somehow this knowledge can be made available while working in a BIM-modeler or -viewer environment, this can be of utmost help for the different stakeholders in the design and building process and create extreme added-value for the BIM-technology and as such promote the technology. The disposition of such plugins will equally allow for the faster introduction of new knowhow and innovations in the construction sector.

(9) Create digital platforms that consider the financial and technical possibilities of SME's and their wishes. Two examples were given with the Kroqi- and BIMio-projects.

(10) Open BIM: a good and noble idea of interoperability, long time saving of data and communication with authorities.

(11) Manufacturers should make the link with the supply chain of building product/element manufacturers possible (data dictionaries). This will be of utmost importance for the AEC industry as well as for the manufacturers.

(12) National or Regional authorities can stimulate the BIM-adoption and be an example for project owners. What government initiatives are happening? What are the good practices?