



## D6. REPORT COMPETENCE MAP CONSTRUCTION SECTOR

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## 1. EXECUTIVE SUMMARY

The purpose of the WP2 is in one hand to identify the main trends and innovations the construction sector is facing or will be facing in the coming years and in the other hand to identify the impacts of these evolutions on the occupations and the training needs of the construction sector. This WP2 is divided into three main tasks which are the study of the economic-business framework of the sector through secondary sources (desk research), the identification of prospecting trends in the sector (interviews) and the competence reality study of the sector (Delphi Panel).

Through WP2 it appears that the construction sector is facing multiple challenges as demographical, structural, and technical. Four main evolutions are operating their impacts on the occupations and training needs are expected to strengthen in the coming years. Those four trends are the digitalisation of the sector through the development of new technologies in the production process but also for instance through the use of social media in marketing techniques; the greening of the sector with the rise of the circular economy by the adoption of waste minimising approach beginning in the production process or even the re-use of materials thanks to the concept of deconstruction; the standardisation, automation and prefabrication is the third trend and is closely related to the two first trend, it includes flexible assembling methods or the lean management for instance; the last trend is health and safety and will impact the sector by the new approach of individual and collective risks minimising which can also be improved with the development of the three other trends. In other words, each trend is evolving and impacting the other trends allowing their development even more. Therefore, the construction sector will not see these trends evolve in a specific domain, they will have consequences on each other creating, in a way, a new industry.

Regarding the impacts on the occupations, the loss of occupations was not identified but the job content (skills and knowledge) will change as workers will face the use of new technologies, new materials, etc. The adaptation of the skills and knowledge of the construction sector companies is therefore the key to stay competitive. However, the experts from the training companies showed a heavy focus on management training. Our discussions did highlight the craft training was only a small part of their portfolio. Hence it is highly important to develop training schemes adapted to the organisation's needs, adapting the working culture should also be a priority to facilitate the change. The workers will then need to know more about the how and why in order to arouse the eagerness to learn new skills and knowledges but also because the trends will impact to their relationship with clients. The construction sector's workers will face higher expectations from the client, and it will demand more knowledge on the bigger picture from the workers (technical details, recycling methods, etc.).

During the last stage of the study, the comments of these experts allowed us to confirm the main results and feed them with one new skill which is the cooperation skill. Initial interviews with internationally expert expressed the significant need for this type of research but the difficulties they had encountered when attempting research in this area. Many of the interviewee expressed the absolute need for this type of research. They had themselves reviewed this area on craftsman, trades, and blue-collar worker but on review had maintained their research focus on white collar grades.

The research held for the creation of a formative map showed that there are key challenges in relation to quality in vocational education and training within the European construction sector and on how the EQAVET Recommendation can support the development and improvement of national education and training systems in relation to the construction sector.

According to integrating ECVET, we suggest an overall learning time of hours of learning could be established, including direct contact hours, hands-on practice, self-study and assessment hours. The allocation of ECVET points should be based on using a convention according to which 60 points are allocated to the learning outcomes expected to be achieved in one year of formal full time VET. It is up to the competent institutions in charge of designing qualifications to decide which specific programme will be chosen as a point of reference. The duration of the selected reference programme, together with the ECVET convention on ECVET points (60 points for 1 year), will give the number of ECVET points allocated to the qualification. The learning outcomes, according to the EQF framework, are to be found in a synoptic table and consider especially the levels of EQF, in the trades of the construction sector.

An important issue is that generic skills such as problem orientation, problem solving, communication, design and entrepreneurial skills – which are critical for cross-occupational collaboration in work teams and for exploiting value-added creativity at the enterprise level- need to form part of education and training programmes within the construction sector, as 21<sup>st</sup> century jobs and occupations require the development of these new skills within the sector, such as green and tech skills.

An occupational skills map was elaborated in order to identify the skills and knowledge that are already essential and optional today as well as the skills and knowledge that are anticipated. As understood during the first step of the diagnosis of the construction sector, the major impact of those four trends is the creation of new skills for most of the occupations in the sector. These new skills are translated in this skills map into anticipated skills for each occupation. Therefore, the skills map has identified 39 anticipated skills (AS) and 16 anticipated knowledge (AK) for 68 occupations in the construction sector (according to the ESCO classification). A category has been assigned to each AS and AK in order to relate these AS and AK to a trend identified above. From these categories we understand that most of the AS are related to the trend of digitalisation, as it was confirmed by the Delphi Panel. Also, a majority of the AK are related to another category of knowledge, the reason being that they are transversal knowledge that can be used for every trend. This was also confirmed by the Delphi Panel (showing knowledge as project management, engineering, communication).

This skills map has the advantage to provide information on the occupation categories and the occupations that will face new skills and knowledge. This is a great advantage when the research had not been able to provide a concrete list because of the lack of study at a European level. During the desk research phase, there had only been found short list or general information without any detailed description of the occupations or the skills concerned by the changes anticipated in the coming years.

## 2. INTRODUCTION

The purpose of this report is to give an insight into the main trends and innovations the construction sector is facing or will be facing in the coming years in order to identify the impacts of these evolutions on both the sector's occupations and training needs. Therefore, this report is divided into two specific reports one focusing on the occupational map, carried out by Constructiv, and the other one, carried out by the University of Limerick, focusing on the formative map of the construction sector. Both reports hold the same structure as both organisations used the same methodology. The diagnosis will first be elaborated by collecting the prospective point of view of different areas to understand the construction sector. These areas are: the economic-business area, the occupational and competence area, the training fields. Then, the analysis of the construction sector will help design the skills and formative maps of the sector, as it will also allow the correlation and correspondence between professional competences and related training actions.

## 3. OBJECTIVES OF WP2

The aim of the work package 2 was the prospective diagnosis of the construction sector. To do so, the diagnosis will first be elaborated by collecting the prospective point of view of different areas to understand the construction sector. These areas are:

- the economic-business area,
- the occupational and competence area,
- the training fields.

Then, the analysis of the construction sector will help design the skills and formative maps of the sector, as it will also allow the correlation and correspondence between professional competences and related training actions.

The specific tasks to collect the information necessary to the development of both maps are:

- the study of the economic-business framework of the sector through secondary sources,
- the identification of prospecting trends in the sector: changes and difficulties with interviews with experts,
- the competence reality study of the sector: skills panorama, ESCO, EUROSTAT, etc. Experts Delphi Panel.

## 4. DIAGNOSIS OF THE CONSTRUCTION SECTOR

To collect the perspectives of the different areas, the understanding of the construction sector has been divided into three main steps (see above). UFEMAT as leader organisation of this WP has designated Constructiv to realise those tasks in collaboration with the University of Limerick.

### 4.1 STEP 1: The Desk Research

The first step to diagnose the construction sector was the study of the most recent secondary sources that describe and characterize the construction sector at European level. The methodology followed in this analysis was the pre-analysis, the coding, the categorization and the interpretation of these sources. The coding and categorization methods respected the tables provided by FORTEC (see table).

The desk research was divided into two stages, on one hand the compilation of statistics through a data inventory based on available European and national data and on the other hand the compilation of publications, articles, reports. The final version of this inventory gathered quantitative data identified in reports but also indicators:

- Eurostat indicators inventory
- Skills panorama indicators inventory
- List of public employment services across Europe
- Surveys: Construction Europe Barometer, ...
- Publication/articles: European Builders Confederation, ...
- List of occupations in shortage extracted from the Trends Identification Report

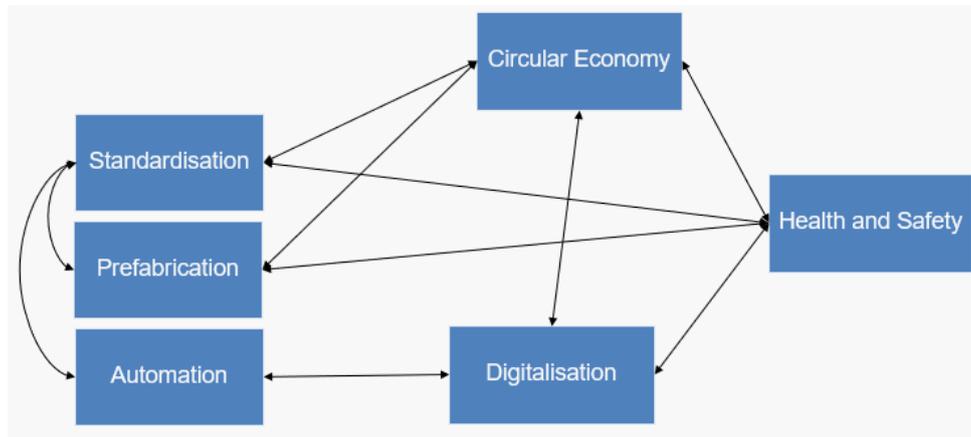
A final report (annex 1) was also elaborated to organize and summarize the different information collected. In total, 36 reports, articles and projects were analysed and codified from 29 different sources such as ECSO, BUS, OECD, ... This research allowed us to identify the prospective trends of the construction sector as well as some occupation needs, and skills needs sometimes at a European level but mainly at a national scale. These trends can be categorized as followed:

- Digitalisation,
- Circular Economy,
- Standardization, Automation and Prefabrication (S.AP.),
- Health and Safety.

Digitalisation	Circular Economy	S.A.P.	Health and Safety
Administrative management	Waste minimising	Flexible assembling methods	Equipment
E-marketing use	Materials passports & Materials selection	Stratification of buildings	Individual risks reduction
Production	Urban mining	Lean management	Collective risks reduction

More than that, the desk research allowed us to understand that those four trends were linked to each other, each one impacting/allowing the other to evolve. This means that the evolutions the construction sector is experiencing are connected and the developing of one trend will not happen without the development of the other trends. Plus, as these trends are evolving simultaneously, it will impact the construction sector from the production process to the relationship client/salesmen.

REPORTS AND STUDIES:			
URL	•		
URL information	•		
Typology	Statistics		
	Bibliographic		
	Statement		
Resume			
ANALYSIS OF RELEVANCE OF THE SOURCE			
INCLUSION CRITERIA	INDICATOR OF RELEVANCE	% value	% value (maximum)
Accessibility	Degree of openness	0	10%
	Localisation	0	10%
Percentage of Accessibility		0	20%
Frequency and update	Frequency	0	10%
	Updating	0	15%
Percentage of frequency and update		0	25%
Rigour	Origin and impact	0	10%
	Systematisation	0	10%
Percentage of rigour		0	20%
Completeness	Totality, credibility and representativeness	0	15%
Percentage of completeness		0	15%
Adequacy	Typology of source	0	20%
Percentage of adequacy		0	20%
Total		0	100%



#### 4.2 STEP 2: The Experts Survey

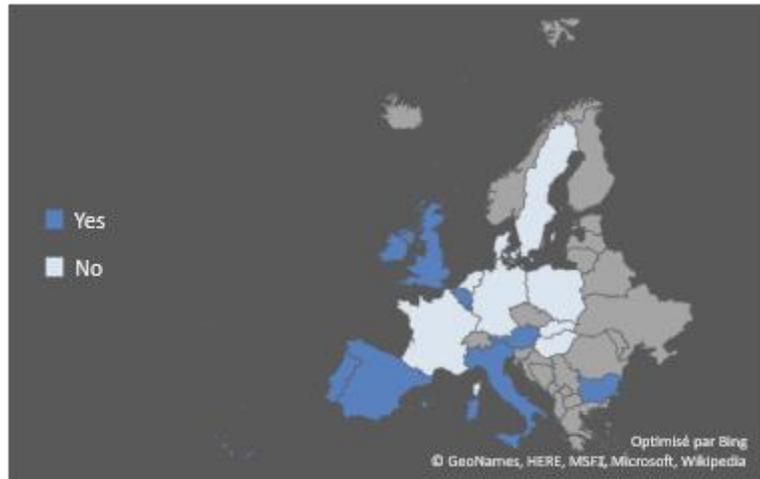
The second phase consisted in interviewing experts from organisations. In total, Constructiv achieved to interview 19 different organisations to collect their broad vision of the changes that are affecting the sector and their impacts on the occupations.

An online survey was developed, inspired by the information gathered during the desk research. Questions were asked to understand if those four trends are having or will have impacts on occupations, skills and knowledges in the construction sector, but also to know if the organisations have already implemented actions to adapt to these changes, as well as has it been implemented by the organisation as a self-initiative or were they forced by a legal framework.

The survey was sent to the UFEMAT network members by email as well as the FIEC network members. The DETECTA project was first presented at a UFEMAT meeting in Lisbon gathering European members where topics as digitalisation were talked. It was next presented to the annual board meeting of UFEMAT in Zellik. There, the results of the desk research were presented and the UFEMAT members were informed of the creation of an online survey. The leader of UFEMAT made a personal statement encouraging the organisations to participate in the survey and to explain the benefits of the project.

In both meetings, the topics at the agenda were directly linked to the trends identified in the desk research. Therefore, we can easily state that all UFEMAT members present at the meeting agreed with these trends. Plus, a UFEMAT member also member of the Tiles and Bricks Europe Executive Committee showed great interests in the project and suggested we sent the survey to TBE's Members. The report of the last meeting in Zellik shows an agenda including topics as digitalisation, circular economy (packaging) as it also shows that topics as digitalisation, circular economy and the creation of a digital builders' merchant site will be discussed at the next meeting. This emphasizes the importance of these trends and the great impacts they are having and will have on the construction sector.

In total, 19 interviews (interview script in annex 2 and list of interviewees in annex 3) were undertaken. The response rate to the online survey (January – March 2019) was not sufficient for the projects initial objectives. Constructiv used the invitation to a symposium to increase the number of interviewees. The event was organised by the ProBE Centre for the Study of the Built Environment and the agenda was about “Transforming construction into a Green industry”.



## SOME RESULTS

The 19 responses came from 9 different countries being Austria, Belgium, Bulgaria, Ireland, Italy, Luxembourg, Portugal, Spain and the United Kingdom. This means that we reached 75% of the 12 Erasmus+ programme countries identified in the project (see map).

In the survey, the construction organisations were asked 4 main questions related to the 4 main trends identified in the desk research. The aim was to know if these trends were already impacting the construction sector or if these trends will have an impact in the coming years. Also, it tried to identify the impacts it is having/will have on the occupations, skills and knowledge of the sector. These two concepts were explained<sup>1</sup> through the survey to make sure the distinction was clear. The last questions were interested in knowing what have those organisations implemented to cope with the impacts as well as if there were a legal framework leading them to taking action.

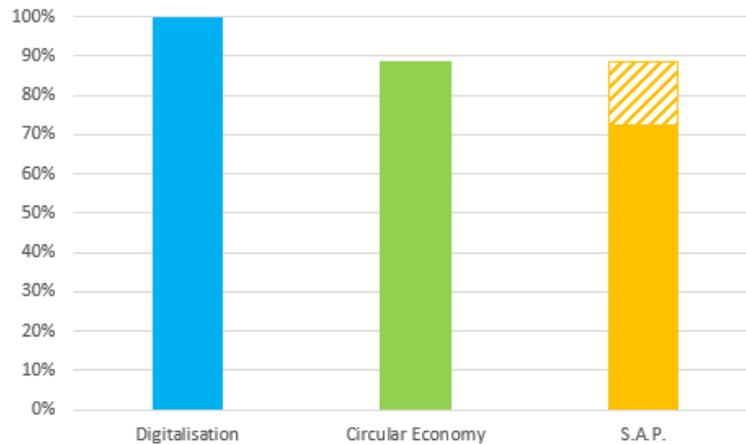
### Trends impacting the sector:

From the graph below, we can say that:

- all the organisations say that digitalisation is already having an impact on the construction sector,
- 89% of the organisations say that Circular Economy is having impacts on the construction sector,
- 89% of the organisations say that standardization, automation and prefabrication is impacting the construction sector: 72% of them say that it is already impacting the sector now and 17% of them say that it will impact the sector in the coming years.

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<sup>1</sup> A skill is the ability to do something while a knowledge is the theoretical and/or practical understanding (information) needed to do something.



The tables below summarize the impacts of the four trends identified on the construction sector according to the responses of the experts' survey.

Digitalisation
Impacts on occupations
<ul style="list-style-type: none"> <li>• The relationship with the customer is changing because digitalisation also changes the customer's role in purchasing information and the product, the workers need to give digital services to the customers too.</li> <li>• The way they manage the suppliers' relationship, the pricing and the commercial approach is changing.</li> <li>• Workers and new workers must show interests in digitalisation as the use of digital devices/software is inevitable as well as the social media or even new online marketing platforms.</li> <li>• Digitalisation is revolutionising the traditional work's organisation, lessening the burden of administrative tasks and counting on the self-reliance of individual workers.</li> <li>• All workers need to adapt to the fast evolution of the systems/programs and production processes (automation of most processes, automatic data gathering, production control system), this means that they need to learn fast because of the fast evolution of digital tools.</li> </ul>
Impacts on skills
<ul style="list-style-type: none"> <li>• IT skills (administrative management, e-marketing and production)</li> <li>• Communication skills</li> <li>• Project management skills</li> <li>• Marketing and selling skills</li> </ul>
Impacts on knowledge
<ul style="list-style-type: none"> <li>• IT knowledge to use digital tools (software and hardware devices) for administration management (e.g. e-mail, MS Office, ERP system), production (e.g. BIM models), e-marketing (e.g. internet, social media)</li> <li>• More technical knowledge of the products</li> <li>• Online communication with the customers (e.g. social media, e-mails)</li> <li>• Digital marketing techniques (use of 3D visualisation system, e-marketing)</li> <li>• Management</li> <li>• Accountability</li> <li>• Engineering</li> </ul>

The organisations have also implemented actions to face the impacts of digitalisation: organising trainings for the workers, digitalising the infrastructure, digitalising the processes and creating information campaigns. They see the new European General Data Protection Regulation as the main legal framework related to the digitalisation.

Circular Economy
<b>Impacts on occupations</b>
<ul style="list-style-type: none"> <li>• The relationship with the customers is evolving because of their growing interest in Circular Economy, they are more curious, and the construction workers need to be able to answer their questions.</li> <li>• Circular Economy is impacting the production chain and logistics, especially the packaging, (new) workers need to adapt to new production processes.</li> <li>• The life-cycle of the materials is evolving, and the construction workers need both to know more about it and to adapt to new procedures.</li> <li>• Workers need to enlarge their knowledge related to the Circular Economy of the products as well as the normative regulations they are confronted to. Workers need to be informed about what to do and why it is important.</li> </ul>
<b>Impacts on skills</b>
<ul style="list-style-type: none"> <li>• Construction and demolition waste management skills</li> </ul>
<b>Impacts on knowledge</b>
<ul style="list-style-type: none"> <li>• Recognising different types of packaging waste</li> <li>• Recycling / reuse / life-cycle of materials/products</li> <li>• European/national/local regulations</li> </ul>

The organisations have implemented actions mainly regarding waste management with trainings but also with infrastructure organisation and processes adaptation. There is no majority through the organisation mentioning the presence of a structured legal framework.

S.A.P.
<b>Impacts on occupations</b>
<ul style="list-style-type: none"> <li>• All S.A.P. aspects are already impacting the work chain in depth: production, logistics, process of design and construction, monitoring after completion of building (regarding energy &amp; water consumption, sustainability) and recycling after demolition.</li> <li>• The use of the BIM model will impact the occupations.</li> <li>• S.A.P. can impact the speed of construction work as well as it can impact the demand's growth and therefore impact on the occupation's demand.</li> <li>• The focus on prefabrication solution will induce a work sphere less dependent on the workers.</li> </ul>
<b>Impacts on skills</b>
<ul style="list-style-type: none"> <li>• Digital skills</li> <li>• Project management</li> <li>• Prefabricated construction skills</li> </ul>
<b>Impacts on knowledge</b>
<ul style="list-style-type: none"> <li>• Robotics and smart technologies</li> <li>• IT programs/software and hardware</li> <li>• Project management</li> <li>• Health &amp; Safety regulations related to the use of new technologies</li> </ul>

- Use of prefabricated products and techniques (concrete beams and vaults, steel construction, wooden roof and wall elements for timber frame construction)

The organisations have already implemented actions related to S.A.P., being trainings (and adapting the recruitment procedure) and investing in Research & Development as well as participating in pilot projects involved in standardisation, automation and prefabrication. Except for the health & safety regulations, no special legal framework internal nor external has been implemented. However, the development of S.A.P. is closely linked to the digitalisation regulation (GDPR).

Health and Safety
Measures implemented
<ul style="list-style-type: none"> <li>• Implementation of an internal legal framework to be compliant for employees and construction sites including medical checks, safety clothes/equipment, external safety coordinator, elaboration of safety plans with risk analysis, ...</li> <li>• H&amp;S trainings with ISOH certification and bonus scheme for the trainings followed</li> <li>• Offering H&amp;S management services to members: H&amp;S guides/advisors</li> <li>• Production of H&amp;S business guides</li> </ul>

In conclusion, the responses collected in this survey confirm the four trends identified in the desk research. Most of the participants have identified these trends as impacting the construction sector (some already and others in the coming years). The most common adaptation the organisations have implemented is the training of their workers to these evolutions, both internal and external. Plus, connections between the four trends are underlined, as it was understood in the desk research. For example, the development of S.A.P. is closely linked to the implementation of Health & Safety measures. In fact, the arrival of new procedures using new devices also introduces the arrival of new risks.

#### 4.3 STEP 3: The Delphi Panel

The third phase consisted in the realisation of a Delphi panel with experts in the occupational area (Delphi Panel Script in annex 4, Delphi Panel Results in annex 5 and List of occupational experts in annex 6). The technique of the Delphi Panel is configured as a method of structuring a group communication process that is effective in allowing a group of individuals to deal with a complex problem, in this case the determination and structuring of professional competences corresponding to the impacts of the four trends identified on the occupations/skills/knowledge in the construction sector.

Eight experts were appealed to participate in the Delphi Panel. The Delphi was structured in two steps. First, the experts were asked to evaluate each statement collected from the organisation's interviews on a scale between 1 and 10. Taking their expertise into account, they could confirm (or not) each statement and comment their answers. When they had all answered to the first evaluation, Constructiv calculated the mean for each statement, accepting each mean equal or above 5 as a confirmation of the statement. Second, a report was created gathering the main results of the first sending of the Delphi Panel and this report was sent to the experts. They could then validate the results and still express their opinion regarding those results.

The table below shows that each topic received a mean score superior to 7/10. Therefore, we can say that the topics were confirmed by the experts of the Delphi Panel. Plus, each statement received a score equal or above 6 out of 10 (minimum mean 6.0 and maximum mean 8.6). We can then conclude that all the statements were confirmed by the experts appealed to participate to this Delphi Panel. 37.5% of the statements received a mean score equal or superior to 8 and 42.5% received a mean score between 7.0 and 7.9 (included). This means that the statements that scored the lowest represent only 20% of the statements.

TOPIC	MEAN
DIGITALISATION - OCCUPATIONS	7.2
DIGITALISATION - SKILLS	7.5
DITIALISATION - KNOWLEDGE	7.3
CIRCULAR ECONOMY - OCCUPATIONS	7.7
CIRCULAR ECONOMY - SKILLS	8.0
CIRCULAR ECONOMY - KNOWLEDGE	7.6
S.A.P. - OCCUPATIONS	7.4
S.A.P. - SKILLS	8.2
S.A.P. - KNOWLEDGE	7.7
HEALTH & SAFETY	8.1

From the four statements that received the poorest mean-scores (6.0 and 6.3), 3 of them are related to the marketing competences of the construction workers. This can be explained by the nature of the organisations that responded to the survey, were also included in the respondent merchant organisations. However, the experts appealed to participate in the Delphi Panel were experts of the construction sector in general and may have identified the marketing competences as a minor impact for the construction sector.

From the comments collected in the Delphi Panel, only one suggested that we add one skill related to the digitalisation being cooperation skills. The other comments were just confirming what had already been said in the statements. The second sending allowed each expert to be informed of the comments made by the other experts appealed to the Delphi Panel and allowed us to confirm all the statements collected in the organisations interviews that were based on the desk research.

#### 4.4 SKILLS MAP

An occupational skills map (Some tables are available in annex 7, skills map in annex 8) was elaborated in order to identify the skills and knowledge that are already essential and optional today as well as the skills and knowledge that are anticipated. This skills map was created from data extracted from the interviews, the Delphi Panel, the ESCO database and Constructiv database. As understood during the first step of the diagnosis of the construction sector, the major impact of those four trends is the creation of new skills for most of the occupations in the sector. These new skills are translated in this skills map into anticipated skills for each occupation. Therefore, the skills map has identified 39 anticipated skills (AS) and 16 anticipated knowledge (AK) for 68 occupations in the construction sector (according to the ESCO classification).

The skills map was realised in a excel document and the analysis below will briefly try to interpret the results. A category has been assigned to each AS and AK in order to relate these AS and AK to a trend identified above. From these categories (table 1) we understand that most of the AS are related to the trend of digitalisation, as it was confirmed by the Delphi Panel. Also, a majority of the AK are related to another category of knowledge, the reason being that they are transversal knowledge that can be used for every trend. This was also confirmed by the Delphi Panel (showing knowledge as project management, engineering, communication) when the AK in the “other” category shows knowledge as maths and mechanical tools.

The occupation categories that will be affected by the highest number of different AS are shown in the table 2. The top three of them are also the occupation categories that will face the highest number of different AK. The results change a little when we don’t take the difference between the AS into account. In fact, the table 3 shows that the occupation categories that will face the highest number of AS almost exactly the same one to experience the highest number of AK. However, these results are mainly driven by the number of occupations per category. When we take the mean number of AS per occupation into account (table 4) the



top 5 list of occupation category varies again. But, there is one occupation category that is always present in these 4 different tables and it is the “Carpenters and Joiners”.

Amongst all the anticipated skills, the top 5 AS are shown on table 5. Four of these five AS are skills related to digitalisation as the skill “sorts waste for recycling / re-use” is related to Circular Economy. The skill the most anticipated is the skill “use digital tools to optimise the exchange of information”. It is anticipated for 97% of the occupations in the construction sector. The two occupations where there is no anticipation for this skill are “Construction Scaffolder” and “Demolition Worker”. Amongst those 5 most AS, 4 of them will be most anticipated by the occupation category “Plumbers and Pipe Fitters”. However, amongst the 2 occupations that will face the highest number of AS are: “Kitchen Unit Installer” (5 AS) and “Staircase Installer” (6 AS), both from the category “Carpenters and Joiners”.

This skills map has the advantage to provide information on the occupation categories and the occupations that will face new skills and knowledge. This is a great advantage when the research had not been able to provide a concrete list because of the lack of study at a European level. During the desk research phase, there had only been found short list or general information without any detailed description of the occupations or the skills concerned by the changes anticipated in the coming years. After the study of this work package 2 in the scope of the DETECTA project, the tables below try to handle this task.

## 5. CONCLUSIONS

This report aims at identifying the occupational and training landscape for the construction sector in the scope of the Work Package 2 of the DETECTA project. It aims to realise the identification of the prospective trends that are/will be impacting the sector in terms of occupations/skills/knowledge and the diagnosis of the construction sector needs. Whilst identifying the training landscape and methods utilised to achieve the future, training of blue-collar construction trades.

This WP2 was divided in three main tasks, a study of the formative educational offering of training in the EU construction sector through secondary sources (desk research), the identification of prospecting trends in the sector (interviews) and the competence reality study of the sector (Delphi Panel).

During the desk research, numerous articles and projects were analysed and lead the study to identify the significant challenges affecting the composition of the workforce, job content and how workers experience their working lives (Eurofound, 2017). The principal challenges that the sector will face over the medium term all point towards skill needs being high and dynamic as the skill content of jobs is likely to change (UK Commission for Employment and Skills, Sector Skills Insights: Construction, 2012). The study led us to identify four main evolutions impacting the occupational and formative landscapes in the construction sector. These four trends are the digitalisation of the sector through the development of new technologies in the production process but also for instance through the use of social media in marketing techniques; the greening of the sector with the rise of the circular economy by the adoption of waste minimising approach beginning in the production process or even the re-use of materials thanks to the concept of deconstruction; the standardisation, automation and prefabrication is the third trend and is closely related to the two first trend, it includes flexible assembling methods or the lean management for instance; the last trend is health and safety and will impact the sector by the new approach of individual and collective risks minimising which can also be improved with the development of the three other trends. In other words, each trend is evolving and impacting the other trends allowing their development even more. Therefore, the construction sector will not see these trends evolve in a specific domain, they will have consequences on each other creating, in a way, a new industry.

The experts in the second phase of WP2 underline that workers and construction companies face challenges in matching the right skills and professional qualifications with the needs of the companies. Hence it is highly important to develop training schemes adapted to the organisation's needs, but more than that, the working culture should also be adapted to facilitate the change. The workers will then need to know more about the how and why of their job content in order to arouse the eagerness to learn new skills and knowledges. Also, because the trends will impact to their relationship with the clients. The construction sector's workers will face higher expectations coming from the clients and it will demand more knowledge on the bigger picture from the workers (technical details, life cycle of the products, etc.).

The Delphi Panel allowed us to confirm what has already been said and feed the study with the importance of the cooperation skill. A better cooperation through a better communication is the key. Initial interviews with internationally expert expressed the significant need for this type of research but the difficulties they had encountered when attempting research in this area. Many of the interviewee expressed the absolute need for this type of research. They had themselves reviewed this area on craftsman, trades, and blue-collar worker but on review had maintained their research focus on white collar grades.



The future competitiveness of the construction sector is critical not just for the different subsectors, but for the European economy as a whole. First, improving the performance of the construction sector will likely improve the performance of most other economic sectors as well as increase the quality of life for Europeans. Secondly, it would likely also contribute to reducing the challenges relating to environment and climate issues.

There is a need to invest in developing further quality assurance in the Construction sector, both for ensuring that students are provided with training of high standard as well as for ensuring that sector workers possess the necessary skills

## 6. ANNEX 1 – FINAL REPORT DESK RESEARCH

### Construction sector

#### CONSTRUCTION SECTOR DESCRIPTION

The construction sector profile<sup>2</sup> (2014) written by the European Foundation for the Improvement of Living and Working Conditions is one in a series and gives an overview of structural characteristics, work organisation practices, human resources management, employee participation and social dialogue in the construction sector compared to the EU28. It is based on the third European Company Survey (2013) and uses the construction sector terminology including all activities related to construction.

The report shows figures related to the European sector and allows us to emphasise some trends but no linked are made to employment needs, evolutions in the sector, differences between countries and subsectors, etc. The main trends were in 2013:

- most establishments (87%) in the construction sector are single establishments;
- a slightly higher than average proportion of establishments in the construction sector (70%) has been in operation from 10 to 49 years;
- regarding the sector's population variety (education, woman rate, innovation),
  - o less than 20% of workers have a degree in 78% of construction establishments, compared to 58% in the EU28 overall,
  - o in 75% of construction establishments, less than 20% of the workforce is female,
  - o the construction sector is less innovative than the EU28 average;
- there are large differences regarding innovative activities in terms of size;
- work is more likely to be organised in teams in the construction sector than on average. In 42% of establishments, most employees work in a single team, compared to 32% in the EU28;
- as compared to the EU28 average, the planning and execution of daily tasks in the construction sector is more frequently decided by managers or supervisors (70% compared to 54% for the EU28);
- in 30% of construction firms, the number of employees decreased between 2010 and 2013, compared to 24% in EU28 establishments. The group is characterised by an extremely high proportion of establishments that had difficulties in finding skilled employees (88%);
- in the construction sector, 75% of establishments offer time off for training – at least to some of their employees (EU28 71%);
- flexibility in starting and finishing time is not offered in 44% of establishments, compared to 35% across the EU;
- differences between the sector and the EU overall average are marginal about variable pay schemes;
- an official structure of employee representation is present in 29% of establishments in the construction sector, a little lower than in the EU28.

#### EUROPEAN STRATEGY FOR A SUSTAINABLE COMPETITIVENESS

According to the European Union<sup>3</sup>, the construction industry plays a key role in the European economy, in numbers and in impacts on the life of the EU-citizens. Therefore, the competitiveness of the enterprises is an important issue. The construction sector plays an important role in the delivery of the Europe 2020 Strategy on smart, sustainable and inclusive growth: renovation of the buildings and infrastructure. Furthermore, higher energy efficiency in new and existing buildings is key for the transformation of the EU's energy system.

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2 Establishment characteristics and work practices: Construction sector  
<https://www.eurofound.europa.eu/nl/publications/information-sheet/2016/working-conditions-industrial-relations/establishment-characteristics-and-work-practices-construction-sector>

3 Strategy for the sustainable competitiveness of the construction sector and its enterprises  
<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2012:0433:FIN>

### Construction market diagnosis

The markets of the EU construction sector and the sector itself are highly fragmented, with many micro-enterprises, large differences between Member States in the performance of the sector and considerable difficulty in spreading good practices. Better value-chain integration would significantly increase the scope for spill-over innovation effects from collaboration.

### Main challenges to 2020

The sector faces today and up to 2020 many challenges in terms of investment, human capital, environmental requirements, regulation and access to markets. The main challenges are:

- the shortfall of skilled workers,
- the low attractiveness to young people,
- the limited capacity for innovation,
- the undeclared work,
- the recovery from the hard hit by the financial and economic crisis,
- the increased competition from non-European operators inside and outside the EU-borders,
- the achieving the EU's climate, energy and environmental objectives.

It will require significant changes that will be difficult for the sector to tackle without appropriate policy support.

### *Sustainability*

As announced in the recast of the Energy Performance of Buildings Directive, the introduction of Nearly Zero Energy Buildings (NZEB) is going to be a major challenge for the construction sector. The transition to a resource-efficient and low-carbon economy will also bring important structural changes in the construction sector, which will have to adapt and anticipate the needs for skills and competences in these areas.

### *Circular economy*

The industry is developing more and more materials that are easier to collect and reuse and systems or 'building solutions' that facilitate the 'deconstruction' of the works and the re-use of materials.

It is necessary to better anticipate future skills and qualification needs, to attract a sufficient number of students to relevant construction professions and to create the conditions for a better working environment and career management, for a greater mobility of construction workers and for wider provision of cross-border services.

### European Strategy

As Europe shapes the future of the European construction sector in terms of circular economy, zero emission houses, investment in infrastructure, lack of low skilled workers and anticipation in trainings, this strategy focuses on five key objectives:

- (a) stimulating favourable investment conditions;
- (b) improving the human-capital basis of the construction sector;
- (c) improving resource efficiency, environmental performance and business opportunities;
- (d) strengthening the Internal Market for construction;
- (e) fostering the global competitive position of EU construction enterprises.

## INNOVATION IN BELGIAN COMPANIES

A study of Belgian construction companies<sup>4</sup> focuses on innovating in the construction sector and the consequences for the employee's occupations.

The expected transformations of the construction sector are that the number of white-collar workers is rising rapidly, while the number of workers is constantly falling. This has consequences for the provision of additional training courses. The main evolutions of the sector in Belgium are:

- an increase in involved actors,
- stricter (legal) requirements,
- changing financing models,
- shrinking margins,
- demanding customers,
- stricter technical standards.

### Technology

The evolution of the sector will require more cooperation between all building partners (architects, engineers, building companies, project leaders, blue and white-collar workers, ...) and technology is the great facilitator by digitisation and ICT evolutions (e.g. Building Information Modelling (BIM) and lean building). Through technology it becomes possible to produce much more accurately and efficiently and this is no longer at the expense of customisation. Robots, drones or 3D printers are highly flexible devices that can be used in the construction industry but there is no guarantee of success. Technological innovation requires social innovation.

Safety, weight, strength and functionality are important factors in the development of new products. However, the main role is reserved for the sustainability of materials and techniques.

### Employment

It is very likely that the standardisation of processes and products will continue in the future. But also, in terms of organisation, a certain degree of standardisation in the processes can be realised through sustainable partnerships.

The number of purely executive employees will steadily decline as technology becomes smarter and faster. This is compensated by an increase in the number of employees in the construction sector due to an increasing need for management, maintenance and control functions. But there is a threat of creating a dual labour market with, on the one hand, the well-paid and highly trained coordinators and managers, and on the other hand, the – often foreign – executive and low-paid staff, who are also getting more and more competition from technological alternatives.

The construction sector is extremely fragmented and is involved in a tough competition. The availability of cheap, foreign workers is another brake on innovation: if the costs for labour remain so low, companies have little pressure to innovate.

The sector has a role to play in the economic, socio-cultural, political and technological evolutions that take place. In fact, the construction sector is socialising more and more. The added value is to be found in the way one produces, the customer focus, the speed of building, the materials used to build, or the technologies

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4 Trends en innovatie in bouwsector  
<https://www.cevora.be/Portals/0/Documents/Sectoren/Studie%20-%20Trends%20en%20innovaties%20in%20de%20bouwsector.pdf>

used. Too many suppliers of production capacity are with a one-sided focus on cost reduction and this prevents innovation.

To conclude, the transition that the construction sector will undergo can best be described as the evolution from a fragmented production market to a process-based, integrated services market in function of social added value. However, interviews and literature all point in the direction of chain cooperation as process innovation, but it is now still in the start-up phase. Under the influence of lean (where executive personnel have more autonomy), BIM and standardisation (offsite prefabrication instead of onsite), many functions in the construction sector will change, disappear or see the light. In terms of health and safety this has positive consequences, but in terms of employment and autonomy, the expectations are unclear.

## Digital trends in Europe

### WORLD'S TOP CONTRACTORS AND TECHNOLOGIES

According to Ernst & Young<sup>5</sup>, all the top 30 contractors from a technology perspective have been quite actively deploying technologies, such as green concrete, lean construction, BIM and drones, to increase operational efficiency and cost effectiveness. However, perhaps owing to the already thin margins in the construction industry, technology investments remain well below 1% of total revenues. In fact, the review of the top 30 global contractors shows that US and European contractors spend close to 0.1%, in contrast to Asian contractors, which spend well above 1%.

Employee productivity also remained low compared with other sectors, confirming that the engineering and construction sector still lags on productivity. The construction sector does not invest largely in technology. Yet the world's biggest contractors do invest (green concrete, lean construction, BIM and drones) to increase productivity. Compared to other sectors the productivity remains low in the construction sector.

### DIGITAL TECHNOLOGIES IN EUROPEAN COUNTRIES

#### BIM

A report from the Build Up portal<sup>6</sup> shows that in Europe, the construction sector labour-productivity growth doesn't match the labour productivity growth achieved in the overall economy. However, the World Economic Forum described the digital tool BIM as one of the 10 most promising technologies that can act as a force for lowering the barriers for change and reversing this trend.

BIM is much more than a digital technology and should be considered as a strategic and complete methodology to increase construction productivity by delivering cost savings, improved construction and exploitation management, better environmental performance and quality, enhanced transparency and collaboration across the industry.

According to the CSTC<sup>7</sup> (Scientific and Technical Centre in Construction, in Belgium), the BIM is one of the main innovations in digitalisation. It plays an important role in the conception of smart cities and smart buildings by the conception of a digital twin. The use of the BIM is a strategic priority as the Belgian

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5 How the world's top contractors are preparing for a new era of growth (EY)  
[https://www.ey.com/en\\_gl/real-estate-hospitality-construction/how-the-world-s-top-contractors-are-preparing-for-a-new-era-of-g](https://www.ey.com/en_gl/real-estate-hospitality-construction/how-the-world-s-top-contractors-are-preparing-for-a-new-era-of-g)

6 Benefits of BIM and its Level of Adaptation in European Countries  
<http://www.buildup.eu/es/node/56441>

7 Confédération construction – La construction numérique. Balises pour une transition réussie  
[https://www.confederatiebouw.be/Portals/0/documenten/documenten%20-%20enkel%20leden/jaarverslag/Rapport%20Annuel\\_Confederation%20Construction\\_2016\\_2017\\_FR\\_WEB-190617.pdf](https://www.confederatiebouw.be/Portals/0/documenten/documenten%20-%20enkel%20leden/jaarverslag/Rapport%20Annuel_Confederation%20Construction_2016_2017_FR_WEB-190617.pdf)



governments do not apply a top-down strategy compared to other European countries where government invest millions in digitalisation of the sector.

However, BIM is still distant from reaching its potential in Europe; and, is progressing at different speeds in European countries.

Several studies have underlined the main barriers for BIM adoption: low demand, absence of national standards, initial investment or lack of knowledge and experience of stakeholders involved in the AEC industry.

#### European digitalisation<sup>8</sup>

An overview of the digitalisation process in Western Europe (France, The Netherlands with a detailed analysis of Belgium) shows that the digital technologies are not very known in the construction sector. The main obstacles are that these technologies are identified as useless (41,1%), are not essential (33,5%), too expensive (10,5%), demand too much time and qualified workforce (4,6% and 3,2%), etc. However, a large list of different digital tools already exists. An index has been established as the Digital Economy and Society Index (DESI) using indicators like connectivity, human capital, internet use, digital technology integration and digital public services.

#### *In the United Kingdom*

The United Kingdom is since 2011 engaged in a deep modernisation of its construction sector through digitalisation. The purpose is reducing by 20% the construction costs, the timing and the heritage management costs.

#### *In the Netherlands*

The Netherlands (and other countries like Finland) have already made the BIM utilisation mandatory since 2011. It is estimated that almost 20% of the partners are already using BIM.

Public forces have started integrating the BIM since 2011, they made the e-invoice compulsory since 2017. Bouwend Nederland (Dutch Construction Enterprises Federation) plays a key role in the transition. BN says that the digital transition is already happening in the Netherlands: robotization, 3D-printing, drones, e-tools. According to BN, 20% of Dutch enterprises use the BIM in 2017. They created a survey on BIM use and it showed that the BIM barriers are: lack of knowledge about the BIM utilisation, existence, lack of standardisation in information exchange procedures, lack of demand from the workers.

#### *In France*

France has been developing a digitalisation transition plan for more than two years. The government is willing to help enterprises to achieve the digitalisation transition.

PNTB (Digital Transition Plan in Construction) is financed by the government and aims at accelerating the digital transition in France by convincing the enterprises, allowing trainings, good communication strategy.

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8 Confédération construction – La construction numérique. Balises pour une transition réussie  
<https://www.confederatiebouw.be/Portals/0/documenten/documenten%20-%20enkel%20leden/jaarverslag/Rapport%20Annuel%20Confederation%20Construction%202016%202017%20FR%20WEB-190617.pdf>



### *In Belgium*

Belgium is located quite behind in the line of digitalisation transition. The Confederation Construction Report shows that more than 15% of Belgian enterprises already know how to use the numeric tools in administrative management but very few of them know or use the BIM.

### *In Sweden*

Skanska<sup>9</sup> is working on many opportunities including drones, robotics and 3D printing. By using new technology, they can deliver projects faster, safer, at lower costs and using fewer resources. These are positive impacts on both productivity and the environment.

#### Drones

Instead of contracting a pilot to do a photo shoot of a jobsite, drones, or Unmanned Aerial Systems (UASs), are being piloted by certified employees at Skanska to monitor site progress and to complete aerial survey photography. The drones provide detailed information, are quicker and often less expensive. For inspections, drones are used in place of sending workers to hard-to-reach locations or other hazardous areas. This promotes worker safety and mitigating jobsite risks. Other benefits of drones/UAS in construction includes smarter planning and construction delivery.

#### Robotics

- Automated construction

Together with industry and academia partners, Skanska has established a new industrial research school in Sweden called Automation Region Research Academy (ARRAY), exclusively focusing on future technologies in automation and automated construction. ARRAY has been jointly founded by Skanska, ABB, Volvo CE, Sandvik and Robotdalen, among others.

- Rebar robotics

Robots will be a part of the future building process. Together with ABB and Robotdalen, they have developed an automated rebar robot that can manufacture steel reinforcement cages onsite. Through working smarter with the digital input solution, they can speed up the production process, eliminate cumbersome work and reduce transport emissions.

- 3D printing

3D printing has huge potential for the construction industry creating substantial sustainability and productivity gains. They are already using it on the 6 Bevis Market in London where the roof's supporting structure was formed using 3D material. The printing technique provided a considerable cost and time saving alternative to a traditional method using case steel nodes.

#### [Exoskeletons for Industrial Application](#)<sup>10</sup>

An exoskeleton can be defined as a wearable, external mechanical structure that enhances the power of a person. Exoskeletons can be classified as 'active' or 'passive'. The main application area of exoskeletons has been for medical /rehabilitation purposes, but also for military applications. There is still a need to further develop lightweight exoskeletons compatible with operators.

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9 Skanska is one of the world's leading construction and project development companies, focused on selected home markets in the Nordic region, Europe and USA.

<https://group.skanska.com/about-us/research-and-innovation/innovation-projects/>

10 Exoskeletons for Industrial Application and their Potential Effects on Physical Work Load

[https://pdfs.semanticscholar.org/b38c/5795d943ae8d36f0c1296d63c5f7e7822bf7.pdf?\\_ga=2.63511919.1313414861.1542096524-514920681.1542096524](https://pdfs.semanticscholar.org/b38c/5795d943ae8d36f0c1296d63c5f7e7822bf7.pdf?_ga=2.63511919.1313414861.1542096524-514920681.1542096524)



The industrial use of passive and active exoskeletons requires consideration of several specific safety issues. Varying risk scenarios can be defined for the worker wearing an actuated exoskeleton in the occupational field, for example on the shop floors in production industry, in warehouses, in hospitals, or outdoors in agriculture or construction.

*Health and safety*

Exoskeleton could be a solution for the aging of the population, facilitating physical work in the construction sector. Some have specifically been developed for industrial purposes and to assess the potential effect of these exoskeletons on reduction of physical loading on the body. The main use is in the medical sector, or even in the military. As the structure has been tested, it is still a project for industrial uses.

All passive exoskeletons retrieved were aimed to support the low back. A reduction of 10 to 40% in back muscle activity during dynamic lifting and static holding has been reported. Both lower body, trunk and upper body regions could benefit from active exoskeletons. Muscle activity reductions up to 80% have been reported with an effect of active exoskeletons. Exoskeletons have the potential to considerably reduce the underlying factors associated with work-related musculoskeletal injury.

*Barriers*

Specific issues include discomfort (for passive and active exoskeletons), weight of device, alignment with human anatomy and kinematics, and detection of human intention to enable smooth movement (for active exoskeletons). Many workers are still exposed to physical workloads due to material handling (over 30 % of the work population in the EU), repetitive movements (63%), and awkward body postures (46 %). In the European Union, yearly more than 40 % of the workers suffer from low back pain or neck and shoulder pain.

Full-automation could be a solution to these issues. Plus, there is a growing movement in modern industry towards human robot collaboration to improve use of robotics while retaining the flexibility of humans. The main benefit is that, specifically in dynamic environments, one will fully profit from the human’s creativity and flexibility, while he is the one in charge, and there is thus no need for robot programming or teaching of robots.

Digital Tools Identification in the Construction Sector		
Administrative management	E-marketing use	Production
<ul style="list-style-type: none"> <li>• e-mail</li> <li>• Electronic archiving</li> <li>• Excel sheet</li> <li>• Accounting programs</li> <li>• Electronic invoice</li> <li>• Track and trace (GPS)</li> <li>• ERP (Enterprise Resource Planning)</li> <li>• Documents management</li> <li>• Cloud computing (access to apps, data and material through the internet)</li> <li>• Notifications (presence checklist, ONSS e-box, work declaration, subcontractor control, social risks declaration)</li> </ul>	<ul style="list-style-type: none"> <li>• Website</li> <li>• Social networks (e-reputation)</li> <li>• E-procurement</li> </ul>	<ul style="list-style-type: none"> <li>• Project portal (online workspace for info sharing)</li> <li>• Virtual reality casks</li> <li>• BIM</li> <li>• Drones</li> <li>• 3D pilotage (GPS pilotage)</li> <li>• 3D scan and print</li> <li>• Robots</li> <li>• E-objects</li> <li>• Exoskeletons</li> </ul>

## Circular economy trends in Europe

### CIRCULAR ECONOMY AND CONSTRUCTION INDUSTRY

The CSTC<sup>11</sup> produced a document explaining the concept of circular economy and gives examples of its application through Europe.

#### Challenges in the construction sector

The construction sector plays a key role in the resources management as resources consumer and waste producer.

According to the European Commission, the construction and buildings exploitation in the European Union represent half of the material extraction and a third of water consumption. Even if huge progress has been made in energy saving measures, the construction sector stays a big energy consumer: 40% of the demand in Europe and produces 36% of its CO<sub>2</sub> emissions.

#### 5 principles in European circular economy

The circular economy is based on 3 pillars which are conception and construction, new economic models and urban mining (considering buildings as the source of materials); and has 5 principles: adaptability, stratification, environmental friendly materials, assembling methods and waste management. Here are some examples of each principle in Europe

##### *Adaptability in the Netherlands*

Buildings adaptation is important to convert them to other uses or functions in the future as also to adapt them to the evolution of the user's needs. The Martini Hospital in the Netherlands is one example. The building structure is entirely modulable, flexible and can be dismantled to transform it into an office building or even in housings. However, this process has a cost and the inconveniences for the users are multiple.

##### *Stratification of buildings in Germany*

The different stratum in a same building have sometimes different lifetimes. Building in stratum allows then to transform a stratum without modifying the others. An example of this stratification process is the Smart Price House in Germany. The supporting structure, the vertical circulation and the technical connexions are furnished during the initial phase of the building process and are provided to the future users of the building, so they can modulate it according to their needs.

##### *Material selection in Denmark*

This principle focuses on the selection of environmental friendly materials as recycled materials or reused materials. In Denmark, the Biological House has been built with the use of agroindustry wastes (grass, seaweed, straw, etc.). Materials considered as waste are here transformed to become building materials.

##### *Flexible assembling methods in Germany*

To reuse construction materials without ruining it, it is important to adapt the assembling methods. In Germany, the F87 (Efficiency House Plus) project is the construction of an emission free building that does not produce nor consume energy and should be entirely re(up)cyclable. But the building has not been dismantled yet, so it is still too soon to know if the assembling method worked.

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11 Vers une économie circulaire dans la construction. Introduction aux principes de l'économie circulaire dans le secteur de la construction. [https://www.cstc.be/homepage/download.cfm?lang=fr&dtype=publ&doc=Vers\\_une\\_economie\\_circulaire\\_dans\\_la\\_construction.pdf](https://www.cstc.be/homepage/download.cfm?lang=fr&dtype=publ&doc=Vers_une_economie_circulaire_dans_la_construction.pdf)



### *Waste minimising in Belgium*

Prevent, minimise and manage construction wastes are more and more important in a circular economy model. In Belgium, a construction site guardian position has been created. These guardians are accountable for the waste management and the construction site cleanliness prevention.

### Developing circular solutions

#### *Standardisation*

Standardisation of products and process in construction is one of the strategies minimising waste. Standardisation is negatively seen but it is important to realise that the construction industry has already largely been standardised.

#### *Lean management*

The lean management consists in creating sustainable value for clients suppressing waste costs in the company's process and avoiding everything that does not create added value for the client (this means reducing the costs and optimise the flows). The lean process leads to reduce delivery costs and time and improves quality and security.

#### *Materials passports*

The building can be imagined as the first second-hand material storage this could reduce the importation of new materials (and therefore reduce the carbon emissions). Some tools can facilitate the quantification and qualification of these resources as the BIM and passports for materials. Indeed, materials must be documented and identified in the building to proceed to the operational recuperation. These documents would follow the materials during their lifetime and would reflect the degradation conditions of the materials.

#### *Urban mining*

The urban mining process sees the city as the main furnisher of construction materials. The process starts by defining strategies to preserve the existing and create an inventory of "pre-deconstruction". Then starts the selective deconstruction (for a better waste selection on construction site and for the reuse from deconstruction), the remanufacturing phase, the reuse and the preparation for the reuse and finally comes the recycling.

### Circular economy and employment

If the reuse of construction materials will generate employment needing a high rate of low qualified workers for the deconstruction phase, other occupations will be created with medium qualifications profiles for the manutention, storage, documentation, etc. As the selling of reused materials implies an increase in the workforce demand including a wide range of profiles as logistics, technical, commercial, etc. The circular economy generates employment in a product-service economy.

## CIRCULAR ECONOMY IN EUROPE

Regarding the political framework, a paper produced by the University of Gloucestershire<sup>12</sup> states that the circular economy has been encouraged by the European Commission since 2015. The circular economy in Europe grows in an environmentally challenged context and exists through different circular business models that can be used at different stages of the lifecycle of an asset. An analysis of the circular economy by the

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12 The Construction Industry and the Circular Economy.  
<http://eprints.glos.ac.uk/5562/1/5562%20Jones%20%282018%29%20The%20construction%20industry%20and%20the%20circular%20economy.pdf>



University of Gloucestershire in the European construction industry provides examples from the UK, the Netherlands, Sweden, Spain, France, Ireland and Germany.

#### In the Netherlands

In the Netherlands, the Bam group employed circular design while building a new town hall extension for the municipality of Brummen. Here the local authority commissioned a 20-year lifetime building therefore Bam designed a building for disassembly. The extension's modular design will not only enable easy disassembly and some 90% of the materials in the newly added space can be dismantled and reused at the end of the extension's service life.

#### In Spain

Ferrovial, the Spanish based construction company, for example, created a circular economy working group in 2016 'to identify and promote opportunities for transforming waste produced and managed' by its two divisions 'into raw materials or secondary fuels, which can subsequently be used in other works and infrastructures designed, built and operated by Ferrovial'.

#### In the United Kingdom

The Construction Products Association (2016) has identified several mechanisms by which construction products and materials can be reused.

Salvo, for example, trades in France, Germany, Netherlands, Ireland and the UK, and offers a reclamation service for architectural antiques, doors, fireplaces, ironwork, lighting, radiators, windows and stained glass.

Toyne (2016) has provided some illustrations of how Balfour Beatty employed a circular design approach in using King Sheet Piling on the M25 widening project and the A421 improvement project in the UK and claimed significant savings in the steel used and reductions in carbon dioxide emissions.

#### In Sweden

Skanska<sup>13</sup> recognised that significant opportunities exist in construction to prevent waste from occurring' and reported that they 'operate in line with the waste hierarchy and are working on several initiatives which aim to eliminate waste to landfill and promote the circular economy.

Skanska developed a Deep Green Cooling Solution, which uses ground boreholes to cool buildings, has near-zero impact on the environment – far beyond compliance with existing codes, standards and voluntary certification schemes. It has been used throughout Skanska projects since 2013.

BoKlok, the affordable housing concept owned by Skanska and IKEA, is the first residential developer in Sweden to commit to equipping all apartment buildings with photovoltaic solar panels. Beginning in 2019, BoKlok will equip all apartment buildings it builds in Sweden with photovoltaic solar panels on the roofs. That's about 1,000 homes annually

### Occupation needs in Europe

#### **BOTTLENECK VACANCIES IN EU LABOUR MARKETS**

The European Commission published a study<sup>14</sup> identifying the top-20 bottleneck occupations on the EU labour markets (in all Member States and including Iceland, Norway and Liechtenstein). Bottleneck

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13 The Swedish based multinational construction company.  
<https://group.skanska.com/about-us/research-and-innovation/innovation-projects/>

14 Mapping and Analysis of the Bottleneck Vacancies in EU Labour Markets  
<https://ec.europa.eu/eures/downloadSectionFile.do?fileId=8010>

occupations should in this context be understood as occupations where there is evidence of recruitment difficulties, i.e. employers have problems finding and hiring staff to meet their needs.

### Results

- Building and related trades workers, excluding electricians, are the second biggest group of skilled manual occupations, where bottlenecks have been identified.
- All in all, 41 bottlenecks exist in 18 of the 29 studied countries in this report.
- The division between the specific occupations is rather clear-cut (see table 25 of the report): in particular “carpenters and joiners” (11 bottlenecks) and “plumbers and pipe fitters” (8 bottlenecks) are in high demand, whereas one or two bottlenecks exist for most of the other specific occupations within this occupational group.
- Top 20 bottleneck vacancies at ISCO 4-digit level European level (per occupation): #10 carpenters and joiners (in 11 countries), #17 Plumbers and pipe fitters (in 8 countries), #19 Building and related electricians (in 6 countries)
- Top 20 bottleneck vacancies at ISCO 2-digit level European level (per sector): #5 Building and related trades workers, excluding electricians (18 countries reporting 41 bottleneck vacancies)

The table below shows the bottleneck occupations in the construction sector for the countries implied in the Detecta Desk Research. The rank of the specific occupation among the top-20 bottleneck occupations in the country in question is indicated in parentheses behind each occupation. The national ranking per each occupation is included only when available. If further specification of the 3- or 4- digit level occupational category was provided in the national ranking, this is included in parentheses, specifying its rank.

Country	Bottleneck vacancies
<b>Austria</b>	<ul style="list-style-type: none"> <li>○ Carpenters and joiners (specifically: Carpenter (7); Joiner (13); Construction- and furniture joiner (16))</li> <li>○ Roofers (4)</li> <li>○ Plumbers and pipe fitters (12)</li> </ul>
<b>Croatia</b>	<ul style="list-style-type: none"> <li>○ Bricklayers and related workers (13)</li> <li>○ Carpenters and joiners (14)</li> <li>○ Plumbers and pipe fitters (15)</li> </ul>
<b>Denmark</b>	<ul style="list-style-type: none"> <li>○ Carpenters and joiners (specifically: Carpenter (7); Joiner (13); Construction- and furniture joiner (16))</li> </ul>
<b>France</b>	<ul style="list-style-type: none"> <li>○ Roofers (6)</li> <li>○ Plumbers and pipe fitters (specifically: Pipe fitters (20))</li> </ul>
<b>Italy</b>	<ul style="list-style-type: none"> <li>○ Plumbers and pipe fitters (specifically: Plumbers (5))</li> <li>○ Air conditioning and refrigeration mechanics (specifically: Heating system mechanic (2))</li> </ul>
<b>Poland</b>	<ul style="list-style-type: none"> <li>○ Building and related trades workers, excluding electricians (1)</li> </ul> <p>Meaning almost all job vacancies in the sector (it includes building and related trades workers, excluding electricians; building finishers and related trades workers; and painters, building structure cleaners and related trades workers)</p>
<b>Portugal</b>	<ul style="list-style-type: none"> <li>○ Building frame and related trades workers not elsewhere classified (2)</li> <li>○ Painters and related workers (20)</li> </ul>

Building and related trades workers, excluding electricians, are mainly needed in the European construction industry, where almost all bottlenecks within this occupation group were identified. More specifically, construction of buildings and specialised construction activities need qualified employees representing this occupational group. In the construction sector the lack of labour force is in many countries related to labour mobility. The main reasons for bottleneck problems are one of the two reasons below, or both:

- the lack of applicants meeting the skills requirements for the job,
- the applicants with necessary skills are available, but not willing to take the job due to different reasons.

This can be explained by several reasons:

- an overall unfavourable perception of manual construction work persists;
- few young people are interested in the occupations;
- the pay is considered low in some countries;
- the status of the occupations is low;
- workers mobility as part of the workforce leaves the country results in both a labour and a skills shortage, as those remaining lack adequate qualifications.

In Austria, the lack is also attributed to a decrease in the training offer.

### Solutions

In this context, awareness-raising campaigns to attract employees to building and related trades workers and to the industry in general, can be considered a viable strategy to alleviate the lack of interest towards those professions. Labour mobility is also to be mentioned as causing bottlenecks in some of the European countries, where qualified workers left to work in the construction sector in other European countries. The economic crisis, however, has partly diminished the needs in the construction sectors of some of the receiving countries, as for instance Spain, making return schemes relevant.

## EVOLUTIONS IN FRANCE

France Strategy and the Researches, Studies and Statistics Management (DARES)<sup>15</sup> identify the changes in manpower and labour per occupation in France. The main evolution of employment in the construction sector by 2022 is that employment will increase. However, it results that this increase will be a consequence of a high retirement rate among workers leaving the sector “at the end of their career”.

### Three scenarios

Three scenarios are established to shape the evolution of the skills in France: the central tends to be neutral about the unexpected behaviours of the economy, the target scenario is ambitious, and the crisis scenario is the most pessimist.

- The central scenario takes in account two facts: first, the recovery capacities of the economy of the different sectors and second, the structural modifications already engaged influencing the productivity and the employment evolution.
- The crisis scenario imagines a lower economic growth due to irrecoverable loss because of the crisis (investment, innovation, human capital) and a decrease in the global demand.
- The target scenario imagines a productivity rebound of the French economy based on a strategy of investment and innovation within a normative and fiscal context that facilitates the outbreak of new activities linked to environment and the articulation of services and industry.

### Employment evolution

The need of qualified labourers in the construction sector (in the three scenarios) would continue increasing and this would be the result of the population growth in the country, of the refurbishment of buildings and adaptation of building lots to an aging population and to dependency, of the development of regulatory and environmental norms. However, the job creation would be lower than the last decade. The qualified

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15 Les métiers en 2022.

[https://www.strategie.gouv.fr/sites/strategie.gouv.fr/files/atoms/files/fs\\_rapport\\_metiers\\_en\\_2022\\_27042015\\_final.pdf](https://www.strategie.gouv.fr/sites/strategie.gouv.fr/files/atoms/files/fs_rapport_metiers_en_2022_27042015_final.pdf)

labourers in the “second structural work” (electricians, painters, plumbers, carpenters...) would relatively be affected by the retirement of workers (mainly self-employed) creating needs for the coming years.

#### *Employment need*

According to the central scenario, the creation of employment would mainly affect the technicians, supervisors and managers. Also, the low-qualified labourers but they could represent a high entry potential for higher occupations through training. In the “second structural work” field, one out of four low-qualified workers is a trainee. If the employment creation varies according to the three different scenarios, it shows positive rates in all three cases.

#### *Retirements*

Regarding the leaves “at the end of career”, they will be higher among qualified labourers (40% of self-employed) than among the low-qualified labourers where there is a turn-over phenomenon. However, we can see in all professional fields in the construction sector that workers stop early their career as a “at the end of career” leave due to uncomfortable working conditions, physical conditions, higher risks, etc.

#### *Turn-over effect*

The turn-over effect will play a key role in the employment creation when the leave of workers is linked to hard working conditions and to the transition of workers to a more qualified occupation. The employment creation would affect mostly low-qualified workers and especially workers in structural work, public works and concrete.

#### Qualifications needs

The evolution of the sector will need a higher qualification from workless labourers due to environmental laws, the increasing use of ICT and the adaptation of the relational competencies. The qualifications at the beginning of the employment will increase and underlies a big challenge in training opportunities for the next decade. Plus, the workers profile in the sector remains mainly men-only. Even though there is an increase in the female rate in the very qualified occupations such as architects and managers, they remain very few among the labourers. The rates of foreign manpower working in the construction sector is still very high being three times higher than in the total employed population.

## EVOLUTIONS IN IRELAND

DKM Economic Consultants<sup>16</sup> reports on the evolution of the demand for skills in construction to 2020 in Ireland. It gives a review and prospects on the Irish economy and focuses on the construction industry. It establishes medium-term prospects for construction, the situation of the public sector then leads to overall construction prospects to 2020. It follows with the key risks, the implications for construction enterprises and skills and finishes with recommendations – enhancing skills capacity.

#### Perspectives to 2020

What comes out of the implications for construction enterprises and skills is that:

- the industry will remain a fragmented sector with a large majority of self-employed firms and among the employing enterprises 98% will be less than 10 employees’ enterprises;
- direct employment in construction is expected to increase;

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16 Demand for Skills in Construction to 2020.

[https://www.ey.com/Publication/vwLUAssets/ey-demand-for-skills-in-construction-to-2020/\\$FILE/ey-demand-for-skills-in-construction-to-2020.pdf](https://www.ey.com/Publication/vwLUAssets/ey-demand-for-skills-in-construction-to-2020/$FILE/ey-demand-for-skills-in-construction-to-2020.pdf)

- there will be significant replacement demand for workers required to do the jobs of individuals who leave the labour market because of illness, retirement or death;
- a strong skills shortage could be a threat to the aging of the workers, the need of new entrants with required skills and experience will be significant. The analysis gives some numbers in needed manpower prospecting and insist on implementing a strong apprentice training system to form new entrants that could replace the leaves expected in 2020.

There is a particularly pressing issue with specialised tradespersons and the availability of apprenticeships. The combination of technical education and practical experience obtained via the apprenticeship system leaves apprentices well placed to contribute the knowledge, skills and competencies needed to work as a craftsperson in the workplace.

#### Recommendations to enhance skills capacity

These recommendations are by means of a collaboration between the Irish Government and industry to:

- establish a Construction Skills Forum that would report annually to work as a feedback mechanism between industry and the education and training system allowing issues to be resolved in partnership;
- use the report as a benchmark to constantly monitor progress and year-on-year changes, to ensure the education and training system;
- improve the image of the industry by inspiring young people through extensive communications;
- deliver an international recruitment drive to target the Irish diaspora, to attract skilled construction personnel back to Ireland;
- refine apprenticeships and seek to introduce innovative methods of apprenticeship delivery
- engage with Solas and the Education and Training Board (ETB) network to deliver skills courses nationally;
- adapt initiatives such as “Leadership for Growth” and deliver to a wider cadre of management functions within construction companies in all size cohorts of the sector;
- refocuses CIF Training and its Construction SME Skillnet on driving new skills around modern building techniques, green construction and professionalism across the industry.

#### EVOLUTIONS IN THE UNITED KINGDOM

The UK Commission for Employment and Skills<sup>17</sup> is a social partnership led by Commissioners from large and small employers, trade unions and the voluntary sector. The study is the most detailed and comprehensive set of UK labour market forecasts available (released in April 2016) and is part of a series of studies *Working Futures* (2003-2004, 2004-2014, 2007-2017, 2010-2020, 2012-2022, 2014-2024). The results provide a picture of employment prospects by industry, occupation, qualification level, gender and employment status for the UK and for nations and English regions up to 2024.

Construction is expected to see the fastest rate of growth of the sixth sectors, in both output and employment terms, resulting from an anticipated increase in public and private investment. To 2024 an employment growth is expected as the productivity growth will show positive rates.

#### Key factors

The key factors influencing the sector are:

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17 Working Futures 2014-2024

[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/513801/Working\\_Futures\\_final\\_evidence\\_report.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/513801/Working_Futures_final_evidence_report.pdf)

- construction growth will depend on the recovery of lending to the private sector and public infrastructure spending
- rising population levels in the UK are expected to increase demand for construction of housing and infrastructure

Long-term, major public infrastructure projects

- overall, regulatory policies are likely to encourage construction growth particularly as firms seek innovative processes and technologies to adapt to environmental concerns
- new types of demand will encourage technological innovations and stimulate growth

### Occupational profile

Occupational profile in construction and building trades to 2024 are mainly skilled trades employment including: steel erectors, bricklayers and masons, roofers, roof tilers and slaters, plumbers and heating and ventilating engineers, carpenters and joiners, glaziers, window fabricators and fitters.

All these occupations imply a high level of physical duties that normally require a degree of initiative, manual dexterity and other practical skills. This underlines the importance of traineeship. Also, this occupational group will see changes in task and skill requirements, resulting from technological innovation and new business and delivery models.

### **Build Up Skills Projects in Europe (2012)**

The Build Up Skills Projects<sup>18</sup> were aimed at European countries to identify the training needs of craftsmen and other on-site construction workers and systems installers in the building sector. Its final aim is to increase the number of qualified workers across Europe to deliver building renovations which offer high-energy performance as well as new, nearly zero-energy buildings. The initiative addresses skills in relation to energy efficiency and renewable energy systems and measures in buildings.

### **IN BELGIUM**

The analysis of the National Status Quo (NSQ) shows that an overwhelming majority of the annual intake of construction workers consists of young people without formal qualifications. This means in other words that there is a substantial intake of unqualified personnel. Consequently, raising the competency level of the workforce up to standard will constitute a challenge for the current workers.

The analysis features the construction sector, the national policy and strategies to contribute to the EU 2020 energy targets in buildings, the statistics on buildings and energy sectors, the existing vocational education and training (VET) facilities, the gap between the current situation and the needs for 2020 in terms of skills and its barriers.

### Vocational competences

The vocational competencies relating to renewable energy and energy efficiency were also updated. Reworked vocational profiles were validated in 2012 for the following occupations:

- Roofer
- Weatherproofing roofer
- Plumbing installer
- CH fitter

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18 Build Up Skills Projects  
<http://www.buildup.eu/en/skills/about-build-skills>

- Ventilation systems installer

Other occupations will be updated at a subsequent stage. Work is currently in progress on the following occupations:

- Roofing carpenter
- Timber frame construction
- Exterior joinery worker
- Interior joinery worker
- Interior fitter

Different barriers that impede the expansion of the technical collaborators' skills in the working field have been mapped:

- a shortage of qualified workers (irrespective of training);
- a shortage of trained workers;
- a high-quality execution of contracts does not offer any economic added value;
- the existing training courses are too theoretical;
- the existing manpower allocation does not offer any opportunity to enter into any results or performance commitments;
- technical progress is not being followed up on soon enough;
- the way in which the work is organised does not allow workers to be sent for training;
- the cost of training is too high to send workers for training;
- there are no results or performance commitments included in the scope of contract execution.

## IN DENMARK

The NSQ concluded that there would be a shortfall of up to 13,100 skilled construction craftsmen if the sector is to meet its share of the 2020 goals. The current competence level is thus insufficient and is a barrier to meeting these goals. The roadmap presents concrete initiatives aimed at overcoming this barrier. There are several approaches to this: the workforce supply can be increased; the current workforce can have its skills in energy efficiency and the use of renewable energy upgraded through continuing and further education and training; and the loss of skilled workforce to other sectors can be minimised.

The construction sector has shown an almost continuous negative trend since 2000, which makes labour productivity one of the sector's major challenges. At the same time, there has been a growth in labour productivity in manufacturing, which could indicate the need for increased industrialisation in construction processes. Two scenarios are identified to predict the sector evolution in the coming years:

Scenario A	Scenario B
The optimistic, which includes positive factors Energy consumption for heating is reduced by 0.5% per year from 2011 – 2014	The conservative, which includes negative factors Unchanged energy consumption for heating from 2011 – 2015
Around 10% of the overall energy savings is attributed to "do-it-yourself" work	The effect of "do-it-yourself" work is not included
Energy consumption for heating is reduced by 80 GWh/year	Unchanged conditions corresponding to the historical development
Other initiatives account for 10% of the total energy savings	Other initiatives are not included
The effect of energy saving initiatives is not reduced (temperature)	The effect of energy saving initiatives is reduced by 10% (1 °C higher indoor)

### Shortage in occupations

Skilled construction sector craftsmen needed for the energy saving initiatives from 2015 to 2020:

- bricklaying,
- carpenter/joiner,
- plumbing/heating/air conditioning (VVS),
- electrical installations.

### Barriers

Barriers for reaching the 2020 goals have been identified at a workshop held by the consortium with the participation of representatives from the stakeholder group. The lack of interdisciplinarity in the construction sector is seen as the greatest challenge, presenting itself in several ways:

- there is a general lack of interdisciplinary insight and understanding between craftsmen's trades;
- the construction workforce most often does not have the necessary competences to be able to conceive of a building holistically, and is too narrowly focused on own areas of expertise;
- there is a lack of understanding between consultants and craftsmen, and there are often communication breakdowns that can hinder energy savings.

There are also specific fields within the vocational education programmes that need to be strengthened, for example competences relevant to new renewable energy sources such as solar panels and heat pumps, and greater insight in sealing and the proper positioning of vapour barriers.

### Other barriers

The identified barriers indicate that there is currently a range of additional gaps that are not directly related to education content, but which are structural or more overarching, such as:

- there will be a lack of well-educated manpower to carry out energy improvement initiatives if demand increases in the future.
- there are several barriers in the current vocational and continuing education systems for skilled workers. Some are structural, some are economic, and some are based on familiarity and image.
- many members of the construction workforce are semi-skilled<sub>1</sub> and need their skills upgraded.
- there is a lack of an incentive structure that can stimulate interest in continuing education and training.

## IN ITALY

The green economy has led to the creation of specific jobs such as installers of photovoltaic panels and other clean technologies. These new jobs, according to the research by Ires Cgil, require new skills to be developed through training and the adoption of training programmes.

The study has identified 16 new professions for thermal and photovoltaic solar energy; 14 new professions for wind energy; 13 new professions for biomass sources and 11 general figures.

The new employment would be distributed in the following sectors: electric (19%), metal products (4%), building (8%), wholesale trade (4%), professional activities (18%) and other activities (47%).

The main occupations identified with a shortage are:

- Masons,
- Carpenters,

- Workers installing insulation, windows and fittings,
- Painters,
- Other building workers,
- Floor layers, layers of lining and plasterers,
- Electricians,
- Plumbers and heating experts,
- Others.

### ECSCO Country Profiles

The country profiles emitted by the European Construction Sector Observatory (ECSCO)<sup>19</sup> provide information of the construction sector for the 28 countries of the European Union on its economic-business framework, the skills shortage, the regulation on construction and demolition (C&D) waste management but as well on the vocational education and training system. It is a three-year action (2015-2017) and ECSCO is also identifying and analysing specific policy measures that are being implemented in each member state to stimulate construction sector employment, growth and opportunities, and to help overcome societal challenges.

### SKILLS SHORTAGE

The Country profile of six countries were analysed to identify the skills shortage in those countries. The table below shows the mains occupations where skills shortage was identified:

Country	Skills shortage
Poland	<ul style="list-style-type: none"> <li>○ Bricklayers</li> <li>○ Plasterers</li> <li>○ All building and related trades occupations (excluding electricians)</li> </ul>
France <sup>20</sup>	<i>Risks linked to new skills required by the evolving needs (energy efficient renovation and digital construction)</i>
Germany	<ul style="list-style-type: none"> <li>○ Plumbers</li> <li>○ Heating and air-conditioning technology occupations</li> <li>○ Finishing trades occupations</li> </ul>
Austria	<ul style="list-style-type: none"> <li>○ Roofers and master roofers</li> <li>○ Tinsmiths</li> <li>○ Construction site workers</li> <li>○ Plumbers</li> <li>○ Installation technicians</li> </ul>
Sweden	<ul style="list-style-type: none"> <li>○ Bricklayers</li> <li>○ Roofers</li> <li>○ Floorers</li> <li>○ Scaffolders</li> <li>○ Painters</li> <li>○ Concrete workers</li> </ul>
Luxembourg	<ul style="list-style-type: none"> <li>○ Mason</li> <li>○ Bricklayers</li> <li>○ Façade specialists</li> </ul>

19 European Construction Sector Observatory  
[http://ec.europa.eu/growth/sectors/construction/observatory/index\\_en.htm](http://ec.europa.eu/growth/sectors/construction/observatory/index_en.htm)

20 Bottleneck vacancies in Poland (2013)  
<http://ec.europa.eu/social/BlobServlet?docId=12666&langId=en>

## IN POLAND

### Context

The main reasons explaining this shortage are:

- significant migration of young construction professionals to Northern and Western EU countries, mostly the United Kingdom and Germany;
- life-long learning is still undeveloped, with adult participation in education and training standing only at 2.9%.

The Polish context justifies the need for a formal and pan-European certification of the qualifications relevant to the construction industry related to two trends:

- 1) Polish migrant workers are mostly educated at the vocational level (60% of employees in the sector display medium-level skills) but the Polish system is not recognised abroad forcing migrants to work below their qualifications (it is the same as migrants acquire new skills abroad and come back to Poland);
- 2) Polish construction sector is dominated by small companies and self-employed people (there is a high competition and a certification of certain services would enhance the credibility of such companies).

### Polish VET system

Polish VET suffers from low quality and limited alignment of curricula with labour market needs, which in turn leads to low levels of participation and lack of needed skills, however the participation proportion of students increased in 2016. The employment rate of VET graduates stood at EU average. Even though skills mismatch is high in the construction sector, there is currently no dedicated policy measure for vocational education in construction

### Waste management

Poland has no specific legal provisions dedicated to construction & demolition waste. Instead, the Act on Waste adopted in 2012 implements the EU Waste Framework Directive as well as other EU legislation related to waste management. The Act stipulates that plans should be implemented at national and regional level to meet the objectives. Currently all C&D waste is managed individually by Municipalities and City Councils.

## IN FRANCE

### Skills shortage

Adult participation in education and training in the construction sub-sector doubled in 2014 compared to 2010. Despite this, the skills shortage in French construction sector is important considering the rapid evolution to energy efficient renovation and digital construction. A further study shows that skills shortage is identified as a barrier to hiring. As there is a need for training the workers to update their skills, it is also needed to form trainers.

### French VET system

The employment rate of VET graduates in France was in 2016 well below the EU average, while participation of upper secondary students in VET was also below the EU average. Moreover, access to continuous VET is difficult for the unemployed and lower skilled, as well as for employees of small companies.

### Waste management

The Energy Transition Law sets a recycling target of 70% for C&D waste by 2020. Moreover, it stipulates that, as of January 2017, distributors of construction materials, products and equipment shall take back the waste arising from the same type of materials, products and equipment they sell.

## IN GERMANY

### Context

The amount of foreign workforce has increased due to the lack of skilled professionals. Foreign (non-EU) workers with relevant recognised vocational qualifications have been allowed. Migrants often lack necessary language skills and need to be provided with the necessary education before being employable.

### Waste management

The recovery rate of C&D waste in 2015 was well above the target for 2020. However, some regions are experiencing a shortage of landfill capacity for contaminated C&D waste which cannot be recycled. This process may take up to 10 years and there are considerable variations among Germany's 16 regions.

## IN AUSTRIA

### Austria VET system

Austria is enhancing the green skills of its workforce through the klima:aktiv initiative which focuses, among others, on providing advanced vocational training in the fields of renewables, energy efficiency and mobility.

### Skills shortages

Austria lacks high-skilled labour and faces difficulties in attracting young people to work in the construction sector, mostly due to a poor image of the sector. Adult participation in education and training in the broad construction sector has been fluctuating since 2010. The good quality of the VET system is a key contributor to low levels of unemployment for recent upper secondary graduates. The share of young people (15-29) not in education, employment or training is one of the lowest. It focuses on integrating also young refugees (high immigration rate).

### Waste management

Austria is already a leader among European countries in terms of the management of construction and demolition waste (CDW). Austria is considered a leader in ecological construction and particularly with respect to passive house building.

## IN SWEDEN

### Skills shortage

Sweden is experiencing a slight skills shortage in the narrow construction sector. The skills shortage is expected to increase in the coming years, due to growing investments in construction, coupled with high retirement rates in the sector. The ID06 Skills Database (Kompetensdatabasen) is an electronic card that stores and centralises all the professional qualifications of workers on the building site, enabling the site manager to quickly check that all employees have the necessary skills to perform their respective tasks. This system constitutes a means to limit undeclared illegal work, to ensure the appropriate level of skills and consequently to enhance the safety of the workplace and the quality of the construction output.

### Swedish VET system

The employment rate of VET graduates is high compared to the EU average. Nevertheless, participation of upper secondary students in VET is decreasing, and the transition between the different training pathways remains challenging. The Swedish VET system is well developed, with dual education programmes combining practical work experience with theoretical teaching having been introduced and boasting good participation among employers.



### Waste management

The Waste management plan for 2012-2017 published by the Swedish Environmental Protection Agency emphasises the need for improved waste statistics and improved Construction and Demolition waste management, namely recycling.

## IN LUXEMBOURG

### Luxembourgish VET system

Adult participation in education and training in the construction sub-sector increased between 2010 and 2016 above the EU average. Despite high enrolment rates, completion rates of VET education are below average. Furthermore, the Luxembourgish system offers training paths based on the dual principle, but also ones that are mostly school-based, thus lacking consistency in its VET approach. To improve the VET system, a reform process was initiated in 2015 aimed at increasing the overall matching of skills with labour market needs. Plus, LuxBuild 2020 is website that focuses on the centralisation of all the information on the trainings offered. several trainings and certifications are available on the market, offered by the public sector or trades association.

### Waste management

In terms of legal framework for the management of C&D waste, two main pieces of legislation are applicable in Luxembourg, namely the Law of 21 March 2012 on management of waste and the Grand-Ducal Regulation of 24 February 2003 on landfilling of waste, as amended. In addition, Luxembourg introduced a General Waste Management Plan in 2010, which also covers C&D waste.

## Skills needs in the construction sector

### ESCO SKILLS MAPPING PILOT

The ESCO skills mapping pilot<sup>21</sup> tried to test the ESCO classification comparing the skills classifications of curriculum vitae (CV) and job vacancies (JV) from Austria and Sweden to the ESCO skills classifications to check the relevance of its classifications. They used both blue- and white-collar profiles (but not from the construction sector).

It results that the Public Employment Services of the European countries should detail as much as it can the different skills both in CVs and in JVs. The more listed skills there are easier is the matching with the ESCO skills. Sweden shows a 60% accuracy rate due to the lack of detailed skills when Austria shows a 77% accuracy rate.

The importance of “Noise” is underlined. “Noise” are skills which are introduced during the transformation but are not part of the correct skills in the target system. The noise represents more than 80% of the skills which means that only one/two out of every ten skills represented are correctly transferred skill. These can be useful for a career guidance meaning that the jobseeker sees a wider list of job opportunities.

## SKILLS, KNOWLEDGE AND ABILITIES SHORTAGE AND SURPLUS ACROSS EUROPE

The OECD report<sup>22</sup> published in 2017 identifies the skills that are in shortage or surplus in European economies. The main goal is to furnish a database for every country willing to identify the skills needs and

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21 Final report of the ESCO skills mapping pilot  
[https://ec.europa.eu/esco/resources/escopedia/20181010\\_150824/657260c3-3f9d-4b0a-b093-bb3589808676Skills\\_mapping\\_pilot\\_report.pdf](https://ec.europa.eu/esco/resources/escopedia/20181010_150824/657260c3-3f9d-4b0a-b093-bb3589808676Skills_mapping_pilot_report.pdf)

22 Getting Skills Right: Skills for Jobs Indicators  
[https://read.oecd-ilibrary.org/employment/getting-skills-right-skills-for-jobs-indicators\\_9789264277878-en#page1](https://read.oecd-ilibrary.org/employment/getting-skills-right-skills-for-jobs-indicators_9789264277878-en#page1)

therefore the training priorities. Many factors are expected to challenge the European economies such as the new technologies, the ageing population and the increase of female workers in the labour market. This analysis can help restructure the economy to ease the transition of workers showing skills in surplus through a field showing a skill shortage.

### Shortage and surplus in construction

The average age of the employed population is rising and with them the number of workers with low cognitive skills. Countries in which the skills gap between older and younger workers is the biggest have stronger shortages of key information-processing skills. The main trends showed in the OECD report are that:

- the skills shortage (all sectors) are most pronounced in Luxembourg, the Netherlands, Spain or Germany but less pronounced in Hungary;
- the probability of being mismatched is strongly influenced by socio-economic characteristics but also by job characteristics (e.g. working hours);
- there is a high need of adaptability for teaching professionals;
- adult training and lifelong learning are fundamental.

	Shortage	Surplus
<b>Skills</b>	<ul style="list-style-type: none"> <li>• Content skills (reading comprehension, writing, speaking and active listening)</li> <li>• Process skills (critical thinking and active learning)</li> <li>• Complex problem-solving skills and social skills (instructing, social perceptiveness)</li> </ul> <p><b>More pronounced in Finland, Luxembourg, the Netherlands, Spain and Germany.</b></p>	<ul style="list-style-type: none"> <li>• Content skills (reading comprehension, writing, speaking and active listening)</li> <li>• Process skills (critical thinking and active learning)</li> <li>• Complex problem-solving skills and social skills (instructing, social perceptiveness)</li> </ul> <p><b>More pronounced in Switzerland, Hungary, Cyprus and South Africa.</b></p>
<b>Knowledges</b>	<ul style="list-style-type: none"> <li>• Computers and electronics</li> <li>• Education and training</li> <li>• Mathematics and science fields</li> <li>• Healthcare field</li> </ul> <p><b>More pronounced in Finland, the Netherlands, Ireland and Belgium.</b></p>	<ul style="list-style-type: none"> <li>• Transportation, manufacturing and production</li> <li>• Building and construction</li> </ul> <p><b>More pronounced in Estonia, Bulgaria, Romania, the Netherlands, Ireland and Belgium.</b></p>
<b>Abilities</b>	<ul style="list-style-type: none"> <li>• Verbal and reasoning abilities</li> <li>• Perceptual and quantitative abilities</li> </ul> <p><b>More pronounced in Finland and Iceland.</b></p>	<ul style="list-style-type: none"> <li>• Manual and routine abilities: physical strength, flexibility, balance and co-ordination, endurance or control movement and fine manipulative abilities</li> </ul> <p><b>More pronounced in Finland, Luxembourg, Ireland and Estonia.</b></p>

### Sector transition

Construction and building shows a surplus in the knowledge domain across most countries and particularly in Bulgaria, the Netherlands, Ireland and Belgium. It also shows a surplus in manual and routine abilities such as physical strength, flexibility, balance and co-ordination, endurance or control movement and fine manipulative abilities.

Results show that for the average country, “building and related trades workers” are in surplus, but have a very similar skills profile to “metal, machinery and related trades workers” which are in shortage. The two occupations differ, however, in that workers in the latter occupation have more technical skills than those in the former. Additional training designed to reinforce specific technical skills of building and related trades

workers could be useful for them to move into metal and machinery trades jobs that have better labour market outcomes.

### New technologies

There are substantial shortages in a variety of cognitive skills. It is likely related to the automation processes that are making routine skills redundant and cognitive ones increasingly more important. Results confirms the existence of surplus in routine manual and physical skills and abilities. Control precision abilities (e.g. the ability to quickly and repeatedly adjust the controls of a machine or a vehicle to exact positions) are shown to be in considerable surplus in many of the countries examined. Similarly, evidence shows a negative correlation between the increase in robots per hours and the shortages of control precision abilities and physical strength needs across countries.

### Organisational restructuring

The transition to the digital economy implies an organisational restructuring in the workplace as they cannot replace soft skills. There will then be a rise of soft skill needs as well as skills such as co-ordination with others and ability to lead others. Results show that countries that underwent substantial restructuring in the workplace (Sweden, Denmark) are also showing stronger shortages in administration and management knowledge as well as in other key skill dimensions requiring workers to develop autonomy in making decisions and independence in the organisation of tasks.

## SKILLS NEEDS IN MENTORING OCCUPATIONS

This study<sup>23</sup> identifies the evolution of competences needs per framing occupation (works conductor, construction site manager, team manager) in France. It underlines the creation of new occupations in the sector implying new qualification needs. This will lead to the emergence of new competences for developing tasks: technical, organisational, social and relational, adaptation competences. The report gives a descriptive analysis of the trainings for framing occupations (continuous vocational education and training (CVET), initial vocational education and training (IVET) and skills and competences).

### Adaptation of CVET and IVET

The table below resumes the adaptation of the competences needed for CVET and IVET for each framing occupation (team manager, construction site manager, works conductor) and transversal trainings.

The technical competences	The relational and social competences
<ul style="list-style-type: none"> <li>• Identifying technical and financial options</li> <li>• Anticipation and planification of construction site steps respecting budget and norms</li> <li>• Anticipation and analysis of inherent risks in each construction site step</li> <li>• Securing the construction site</li> <li>• Mastering informatic tools</li> <li>• ...</li> </ul>	<ul style="list-style-type: none"> <li>• Negotiations including technical aspects on construction site</li> <li>• Oral and written expression</li> <li>• Commandment capacity</li> <li>• Team animator capacity</li> <li>• Adaptability to different communication modes depending on context and interlocutor</li> <li>• ...</li> </ul>
The adaptation competences	The organisational competences
<ul style="list-style-type: none"> <li>• Capacity to transfer know-how to team members</li> </ul>	<ul style="list-style-type: none"> <li>• Works and subcontractors' coordination</li> <li>• Contractual management</li> </ul>

23 Étude sur les fonctions d'encadrement de chantier du BTP  
[https://www.metiers-btp.fr/images/documents/publications-et-etudes/encadrement\\_de\\_chantier/exe\\_etude\\_encadrement\\_chantier\\_HD.pdf](https://www.metiers-btp.fr/images/documents/publications-et-etudes/encadrement_de_chantier/exe_etude_encadrement_chantier_HD.pdf)

<ul style="list-style-type: none"> <li>• Capacity to adapt the offer depending on the clients demands</li> <li>• Polyvalence</li> <li>• Mobility to supervise and move to geographically distant construction site</li> </ul>	<ul style="list-style-type: none"> <li>• Waste management</li> <li>• Financial reporting</li> <li>• Priorities and emergencies management</li> <li>• ...</li> </ul>
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## IN SPAIN

A new reform in Spain<sup>24</sup> on the setting up of a Professional Training System for the Employment aims to overcome some needs and priorities of both companies and workers in a competitive context with increased needs of qualifications. These needs are due to the aging of the active population, the coexistence of high rates of unemployment and the lack of qualified labour supply in some sectors or in emerging occupations demanding high innovative skills, and the increase of long-term collective unemployment. According to the report, the reform should be able to improve the companies competitiveness, the workers employment and to treat efficiently the incompatibility between qualified supply and work demand. As it has four strategic goals:

- the guarantee that the workers (employed and unemployed) keep their right to access these trainings,
- the effective contribution of the trainings to the companies competitiveness,
- the collective negotiation enforcement with a qualified labour supply consistent with the productive system requirements and
- the transparency and efficiency in managing public finances.

### Spanish economic-business framework

In 2016 in Spain there has been an increase in employment (compared to 2015) showing a consecutive period of increase for the last four years since 2006. The construction sector is one of the four sectors showing this increase and includes the bricklayers as one of the occupations with the most recruitments rates. Therefore, the construction sector in Spain shows the best rate of negative interannual variation of unemployment in 2016. However, the construction sector has not yet recovered from the pre-crisis situation, last sector showing recruitment rate lower than those in 2009.

The activity with the best behaviour is the specialised construction, mostly because of the renovation, even if the construction of buildings has been reactivated in some geographical areas with the increase of new buildings.

The sector is characterised by a high volume of workers as self-employed, mostly in the specialised construction even if the volume is decreasing. The self-employed workers in the construction of buildings represent almost a third of the professional workers in this activity and show a positive evolution.

### Skills shortage

The report gives an overview of the formative needs<sup>25</sup> in the construction sector (edification and civil works).

Technical professional skills	Transversal skills	General skills
<ul style="list-style-type: none"> <li>• Auxiliary techniques</li> <li>• Machinery</li> <li>• Structure</li> <li>• Brick layering</li> </ul>	<ul style="list-style-type: none"> <li>• Languages</li> <li>• IST and informatics</li> <li>• Knowledge in finance</li> </ul>	<ul style="list-style-type: none"> <li>• Soft skills</li> <li>• Team management</li> <li>• Literacy</li> <li>• Organisation and planification</li> </ul>

24 Detección de necesidades formativas

[https://www.sepe.es/contenidos/que\\_es\\_el\\_sepe/observatorio/pdf/DETECCION\\_NECESIDADES\\_FORMATIVAS\\_2017.pdf](https://www.sepe.es/contenidos/que_es_el_sepe/observatorio/pdf/DETECCION_NECESIDADES_FORMATIVAS_2017.pdf)

25 List of the formative needs in the construction sector pp. 68-72. Plus, an annex to the report gives the list of formative needs, the list of the most representative economic activities per occupation and gives information about the job market per occupation and its territorial distribution.

<ul style="list-style-type: none"> <li>• Finishing touch</li> <li>• Others</li> </ul>	<ul style="list-style-type: none"> <li>• Juridical and normative knowledge</li> <li>• Functioning of public administrations</li> </ul>	<ul style="list-style-type: none"> <li>• Social skills</li> </ul>
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### The future of the construction sector

What will help the rebound of the construction sector is the implementation of the technical code in the construction with criteria related to the environment, energetical efficiency, sustainable energies. Some experts state that the future of the construction sector is in prefabricated construction and engineering of buildings, this will create a need in trainings for skills linked to new materials or for safety as they will change the working organisation. The young workers play then a key role in the replacement of the workers close to retirement. The construction sector shows a high rate of workers aged more than 60 years old affiliated to a social security.

### IN GERMANY, HUNGARY AND SLOVENIA

According to the Skillco project reports<sup>26</sup> (based on an analysis of German, Hungary and Slovenian economies in the construction sector), the construction industry in Europe has suffered from the economic crisis explaining fewer investments in digital construction, which has been identified as the main trend for this geographical area. However, the construction industry is now recovering from the crisis and begins to adapt and invest in new technologies. The major goal underlined in Europe is the creation of new jobs such as in green energy and in smart infrastructure. This reinforces the need to invest in technologies and innovation and underlines the implementation's evolution of VET in Europe.

The evolution of the new technologies in the construction industry in Europe will lead to an increasing need in the workers skills related to energy efficiency and renewable energy by 2020. This shows the importance of developing a qualified workforce, the main challenge in Europe being digital construction.

### Skills shortage

The ESCO report identifies four skills categories (table below): green skills, occupational safety and health, literacy and numeracy to which it adds soft skills including: communication/vocabulary, time management, ability to lead others and written skills. It also identified two valuable vanishing skills as wooden construction (in Germany and Slovenia) and thatched construction (in Hungary). These skills are linked to the natural environment of the country.

Green skills	Health and safety	Literacy	Numeracy
<ul style="list-style-type: none"> <li>• reuse of industrial/construction waste material</li> <li>• recycling with the safe use of potentially harmful materials</li> </ul>	<ul style="list-style-type: none"> <li>• measures of prevention of musculoskeletal disorders and basics of ergonomics</li> </ul>	<ul style="list-style-type: none"> <li>• understanding of construction schedule and sequence of construction works</li> <li>• reading/understanding of project documentation</li> <li>• preparing time plans with the use of ICT on construction site/use of ICT technology for construction works</li> </ul>	<ul style="list-style-type: none"> <li>• cost calculation</li> <li>• expenditure forecasts in construction for group of work or small objects</li> </ul>

26 Status Report on Finding of Skill Gaps, Skillco WP2 General document of research results  
<https://www.skillco.eu/en/content/outputs/>

## INCLUSIVE VOCATIONAL EDUCATION AND TRAINING FOR LOW ENERGY CONSTRUCTION (VET4LEC)

The VET4LEC<sup>27</sup> project aims to identify the implementation of VET for low energy construction (LEC) in 10 European countries which are Belgium, Germany, Finland, Spain, Italy, Bulgaria, Hungary, Poland, Slovenia and Ireland.

The project contextualises the low energy concerns in the construction sector insisting on the need of a trained workforce, the different set of knowledge, skills and competences that it implies. As well as the interdisciplinarity that it requires through communications between all different actors implied in the process.

### Similarities between the different countries

The 10 countries can be grouped by traditional industrial relations:

- Germany and Belgium represent the Germanic system with strong social partnership and a strong dual system with common curricula;
- Italy, Spain and perhaps Slovenia represent a “Mediterranean” model with regional variation;
- Finland represents the Scandinavian school-based approach;
- Hungary and Poland represent an Eastern European model;
- Ireland belongs to the Anglo-Saxon liberal market economy model.

Other similarities can be observed between some countries:

- mainstreaming of VET for LEC: Belgium and Germany;
- concerted attempts to embrace nZEB and develop VET for LEC: Ireland and Finland;
- many regional and local initiatives in terms of CVET: Italy, Spain, Slovenia and Poland;
- more limited and sporadic efforts observable: Bulgaria and Hungary.

The report underlines the importance of the Build Up Skills projects to introduce LEC into VET. In fact, reforms have been implemented in the 7 countries implied in the BUS project which are:

- a review of the national qualifications framework to align it with EQF (Bulgaria, Hungary, Slovenia);
- the development of national (Italy) and sectoral (Poland) qualification frameworks;
- initiatives to strengthen work-based learning (Bulgaria, Hungary, Slovenia, Spain);
- the introduction of apprenticeships (Slovenia and Hungary);
- the introduction of mandatory work-placement schemes (Hungary);
- restructuring of the regulatory framework and governance arrangements (Ireland, Poland, Slovenia);
- increased autonomy for schools and teachers (Slovenia);
- the introduction of a competence-based system (Slovenia).

### Observations

The report gives an analysis of the implementation of VET in the 10 countries. This leads to the listing of challenges that were observed in the 10 countries. Those are:

- structural features
- unregulated and undeclared activity
- varying qualification levels
- workforce diversity or lack of it
- skill shortages
- rapid technological innovation

Some factors enabling and supporting effective training have been identified as follows:

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27 VET4LEC – Inclusive Vocational Education and Training for Low Energy Construction  
<http://www.fiec.eu/en/fiec/projects/current-5460/vet4lec.aspx>

- social partnership and consultative structures
- levy style funding arrangements for VET
- a relatively highly qualified workforce
- broadly based IVET
- the development of new qualifications and upgrading of existing ones
- the development of CVET for LEC

The experiences of these projects in the 10 countries allowed to underline some important trends: an increase in the number of profiles for new LEC related occupations, an increase in the number of existing profiles incorporate LEC elements, more awareness of relevant inter-occupational interfaces, more emphasis on transversal abilities and that CVET is critical to equip the existing workforce for LEC/NZEB.

The integration of LEC into Construction VET can be imagined by different models as a common syllabus, a common curriculum, a sector framework, etc.

What works best for IVET:	What works best for CVET
<ul style="list-style-type: none"> <li>– Knowledge, know-how and attitudes are spelled out in a way that can be used by curriculum designers.</li> <li>– Identify occupational overlaps and build them in where this is deemed to be desirable to achieve better inter-occupational co-ordination. Extending or updating the scope of existing occupations with SQF. For those countries that do not have centralised VET curricula, a more flexible approach is desirable.</li> <li>– The appropriate national, regional or sectoral bodies responsible for drawing up profiles use the Belgian profiles, the <i>Qualibuild</i> framework and the Leeds guidelines as a basis for reviewing existing profiles.</li> </ul>	<ul style="list-style-type: none"> <li>– LEC is concerned with innovation and the rationale for LEC CVET is to introduce construction workers to these innovations and incorporate them into their practice. APEL procedures on their own are unlikely to guarantee that candidates have acquired the latest knowledge and practices since they are unlikely to have encountered these in their work. APEL can at best only be a component of a LEC CVET qualification.</li> </ul>

## PUBLIC WORKS JOBS' GREENING

Constructys (the accredited collection organism for construction in France) published a study<sup>28</sup> in 2013 analysing the greening of Public Works occupations identifying some training needs to achieve the green objectives as the global performance of buildings.

Six main evolution in the integration of green economy in Public Works in France:

- Biodiversity preservation
- Construction site acceptability
- Waste management
- Primary materials saving and recycling
- Global performance of buildings
- Energy and SEG reduction saving

Training offer to eco-prestation address to execution workers

- Commercialisation of new offers: ecological alternatives, sustainable roads, canalisation renovation...
- Resources saving and recycled materials optimisation
- Developing intelligent networks and systems

Training offer to eco-responsibility

- Understanding and reducing buildings impact on biodiversity



- Construction site acceptability: organising concertation

#### Health and Safety

Construction sites are dynamic and complex environments which makes them difficult to control. Indeed, safety and performance efficiency are often inadequate. Construction industries are relying on new equipment and machinery to keep up with the dense and complex design projects. To cope with the development, new techniques and technologies are being adopted to deal with the rising safety risks.

### **IMPROVING CONSTRUCTION SAFETY USING BIM**

A paper written for the Second Congress of BIM<sup>29</sup> states that automated recognition of construction risks using BIM is being developed and looks promising to manage and minimise accidents.

Currently, BIM is just being introduced to be a part of safety and health planning in the construction industry. BIM is being used for visualisation and analysis procedures to improve health and safety programs during the project lifecycle. Prevention planning using BIM can be 4D visualisation and transferred to all project levels and stakeholders. In addition, to the work space conflicts could be analysed and prevented in earlier stages and avoid collisions according to construction schedules

#### Major areas where Safety and Health professionals can use BIM:

- Safety training,
- safety planning,
- pre-task planning,
- job hazard analysis,
- site equipment planning,
- design for safety and
- accident investigations.

Monitoring the site using sensors could decrease the manual monitoring, a centralised data base could be used to store data and retrieve them whenever needed, that will help to take necessary actions and planning.

#### BIM limitations:

- BIM being an immeasurable tool,
- benefits that are related to any phase other than the design phase are hard to assess,
- project managers also consider BIM as money and time.

#### BIM requirements:

- model familiarity and good modelling skills,
- understanding the model and relate schedules and components,
- the person developing the model should also be familiar with the safety regulations and requirements,
- the models need to be detailed and having all necessary safety information for safety planning and checking, lacking these details will prevent identifying risks,
- BIM is considered hard to use and for subcontractors, site workers and foremen they might be uncomfortable using it and they rather stick to the traditional 2D drawings instead,
- as for health and safety professionals, access to BIM models could be limited and the technical skills and tools to use the model are not yet in place. BIM is still not able to fully simulate the construction process, and still rely on manual assistance, as an example changes in the construction site were hazards arise might suddenly occur for workers, BIM do not simulate the rapid changes,
- some accidents are still not able to be fully covered with BIM, for example operating from heights, machinery operation, personnel safety management,

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29 Improving construction safety using BIM-based sensor technologies.  
<https://repositorio-aberto.up.pt/bitstream/10216/111987/2/266242.pdf>

- BIM technology requires a high level of inter-organisational coordination. This coordination must be flexible in technological structure, secure, easy system to use and cost-effective. This is more effective and beneficial if and only if both parties adopt 3D CAD system, also either they use the same software, or any software which follows same standards.

Assisting BIM system by sensing tools improved the safety status but still most of the location tracking system do not gather accurate indoor data. As well as some sensors loose connection in underground or tunnel works where Wi-Fi is not available. The sensing technologies still rely on heavy infrastructure. In addition, the implemented system creates additional efforts to safety manager such as attaching Tags, analysing data and training individuals. Results of the research also shows that sensor data may provoke false alarms and may cause inaccurate reading of sensing subsystem. Most of the sensing devices that relies on batteries have energy deficiency and cannot be continuously used for monitoring.

## GREEN JOBS AND OCCUPATIONAL SAFETY AND HEALTH

The 'Foresight of new and emerging risks to occupational safety and health associated with new technologies in green jobs by 2020'<sup>30</sup> summarises impacts that new technologies in green jobs would have on occupational health and safety by imagining three scenarios of greening.

Key technology innovations directly linked to construction are:

- green construction technologies with energy-efficiency measures (examples: new build and retrofit, renewable energy, new techniques, increasing use of ICT and robotics and automation);
- green manufacturing technologies and processes, including robotics and automation with advanced manufacturing techniques, distributed manufacture, lean methods, biotechnologies, green chemistry, nanomaterials;
- nanotechnologies and nanomaterials with a very wide range of potential applications including materials used in construction (for instance, pavements/bricks/asphalts 'capturing' environmental pollutants, nanocoating/nanopaint transforming solar energy into electricity, 'green' anti-fouling nanocoating).

The use of these rapidly evolving technologies reinforces the high need of training systems to work with qualified workers. The risk of skill shortages due to these rapid changes is high. In fact, the high demand in (qualified) workers will have two impacts which are the employment of unqualified workers unaware of the new risks and a greater polarisation of the workforce by a highly competitive highly qualified workforce leading low-skilled workers to work in poor working conditions. Plus, there is a high need of monitoring these new technologies over their lifecycle to understand and prevent unknown health and safety risks.

### Scenarios and workers' health and safety impacts

#### *Win-Win scenario*

The win-win scenario includes high economic growth, strong green values and high innovation in green technologies. In more details, this means that:

- new buildings are zero carbon and external insulation of existing buildings to reduce the carbon footprint,
- photovoltaics are integrated into buildings or painted
- hyper-insulating materials are in use,
- buildings can be disassembled and recycled,
- modular prefabricated buildings are the norm,

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30 Green jobs and occupational safety and health: Foresight on new and emerging risks associated with new technologies by 2020  
<https://osha.europa.eu/fr/tools-and-publications/publications/reports/summary-green-jobs-and-occupational-safety-and-health-foresight-on-new-and-emerging-risks-associated-with-new-technologies-by-2020/view>

- buildings interact amongst themselves and the smart grid.

According to these changes, the impacts on workers' health and safety are:

- exposition to hazards from old building demolition;
- + improved onsite safety by automated construction of modular buildings offsite;
- workers are exposed to novel substances increasingly used in construction material;
- issues linked to the mixing of automated activities with manual ones;
- risks during connection of services (water and electricity) with the pre-fabricated modules;
- electrical risks as old and new buildings must be integrated into the smart grid;
- increasing underground congestion with the increase of basements construction;
- new hazards and unexpected accidents linked to the use of new energy sources;
- risks of falls or exposure to lead and asbestos by the increasing roof work linked to old buildings retrofitting.

#### *Bonus world scenario*

The bonus world scenario includes high economic growth, weak green values and medium - innovation in green technologies. In more details, this means that:

- most new buildings are prefabricated modular designs with increased automation in assembling and retrofitting,
- most old buildings are demolished, and demolition waste are not recycled,
- high levels of insulation are the norm,
- photovoltaics are integrated into buildings,
- buildings are not designed for recycling,
- subcontracting is used to drive down costs.

According to these changes, the impacts on workers' health and safety are:

- exposition to hazards from old building demolition;
- + improved onsite safety by automated construction of modular buildings offsite;
- workers are exposed to novel substances increasingly used in construction material;
- increasing underground congestion with the increase of basements construction;
- risks of falls or exposure to lead and asbestos by the increasing roof work linked to old buildings retrofitting;
- attraction of unqualified workers for indoor ventilation as the demand in insulation retrofitting is high.

#### *Deep green scenario*

The deep green scenario includes low economic growth, strong green values and medium + innovation in green technologies. In more details, this means that:

- limited construction of new buildings and high proportion of recycled materials,
- retrofitting homes to new standards is the norm,
- governmental regulations and controls limit buildings' energy consumption.

According to these changes, the impacts on workers' health and safety are:

- exposition to hazards from old building refurbishment,
- height risks, electrical risks, dust and hazardous chemicals exposition linked to retrofitting of renewable energy technologies;
- attraction of unqualified workers for indoor ventilation as the demand in insulation retrofitting is high.

## INNOVATIVE SOLUTIONS IN THE CONSTRUCTION

The European Agency for Safety and Health at Work<sup>31</sup> identified in 2011 four risk categories at work. A report on innovative solutions identifies the main risk factors for each category in three sectors: construction, healthcare and HORECA. The table below summarises the identified main risk factors per category (psychosocial load, physical load, slips, trips and falls and dangerous substances) for the construction sector with their solutions.

Risk categories	Main risk factors	Solutions
<b>Physical load</b>	<ul style="list-style-type: none"> <li>Accidents</li> <li>Manual handling of (heavy) loads</li> <li>Work environment (e.g. not enough room, uneven or slippery floor, cold)</li> <li>Awkward postures (e.g. stretched arms, bent postures, kneeling and squatting)</li> <li>Working above shoulder/head level</li> <li>Repetitive work (e.g. hammering, drilling, driving screws, sawing, painting with brushes, plastering, cutting sheet metal with scissors, loading and unloading small pieces like tiles or bricks)</li> <li>High force applications</li> <li>Vibration</li> <li>Local compression of tools and surfaces</li> <li>Psychosocial factors</li> </ul>	<ul style="list-style-type: none"> <li>The risk management framework for work-related risks</li> <li>Increasing construction workers' use of hearing protection</li> <li>A job safety programme using tool box training and safety management techniques</li> <li>Improving lifestyle among male construction workers</li> <li>Reducing the level of sickness absence by organisational measures</li> <li>Working well together campaign to improve health and safety</li> <li>Worker engagement decision tool</li> <li>Achieving behavioural change by the TASK approach</li> <li>Better health under construction through a supervised work environment</li> <li>Organisational health management interventions</li> </ul>
<b>Slips, trips and falls*</b>	Falling from heights <ul style="list-style-type: none"> <li>Working on scaffold or platform without guard rails, or without a safety harness correctly attached</li> <li>Working on fragile roofs and ladders that are badly maintained, positioned and secured</li> </ul>	<ul style="list-style-type: none"> <li>Information for training/toolbox talks on the use of safety harness</li> </ul>
<b>Dangerous substances</b>	(varies with size, exposure) <ul style="list-style-type: none"> <li>Tunnel construction</li> <li>Demolition</li> <li>Renovation</li> </ul>	<ul style="list-style-type: none"> <li>Dibasic esters can replace dichloromethane in cleaning</li> <li>OSH preventing solutions for fire accidents</li> <li>OSH preventing solutions during the painting process</li> <li>OSH preventing solutions during the welding process</li> <li>OSH preventing solutions during work with sprays</li> <li>Dust-free construction materials reduce inhalation</li> <li>Dust free sanding of wood</li> <li>Innovative application solution to prevent skin irritation</li> <li>Use of warm mixed asphalt to reduce expositions</li> </ul>
<b>Psychosocial load</b>	<ul style="list-style-type: none"> <li>Time pressure and deadlines</li> <li>Undeclared work</li> <li>Low control</li> <li>High demands (physical workload)</li> <li>Training (or lack thereof)</li> <li>Job certainty</li> <li>Safety climate</li> <li>Skill under-utilisation</li> <li>Responsibility for safety of others</li> <li>Safety compliance</li> <li>Hours of exposure</li> <li>Tenure</li> <li>Harassment/discrimination</li> <li>Lack of communication</li> <li>Posture</li> <li>High turnover</li> <li>Unsafe work practices</li> </ul>	<ul style="list-style-type: none"> <li>Ergonomic interventions and mechanisation aids</li> <li>Implementation strategy and training on new work methods</li> <li>Use of a hydraulic ladder rack for all maintenance work</li> <li>Mechanical aids for plasterers</li> <li>Use of prefabricated steel and self-compacting concrete</li> <li>Mechanisation aids for road workers and floor workers</li> <li>Use of alternative methods for pile cropping</li> </ul> <p>*Tasks carried out in specific construction jobs: filling joints between bricks; screeders making floor (using pneumatic tools, manual spreading); scaffold erectors; tile installers; glaziers, manual handling, kit cutting, applying kit; insulation workers, when applying mineral wool; use of Computer Aided Design (CAD); paviours, concrete finishers, materials, and using vibrating equipment.</p>

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# Detecta Experts Survey UFEMAT

Welcome!

You are about to begin the Detecta Experts Survey. Your answers will be used in order to identify the occupations, skills and training needs that are and will be detected in the construction sector. It aims at defining the major trends for the future in order to anticipate the change and stay up to date.

*The survey's questions are written in English and we would prefer you to answer them in English. But we don't want the language to be a barrier for you, so feel free to answer in your own language if it is too difficult in English.*

## 1) Profile

- \* Organisation's name
- \* Field
- \* Country
- \* Name (interviewee)
- \* Function in the organisation (interviewee)

## 2) \* Is your organisation working at a larger scale than national?

- Yes
- No

## 3) \* In which countries is your organisation working?



In 2018, we observe in the construction sector a trend of growing digitalisation through the use of new technologies such as the BIM (Building Information Modelling), 3D scan and print but also the growing use of the computer for administrative tasks (e-mails, internet, programs and software).

**Regarding your area of expertise, how would you answer the following questions:**

**4) \* Do you perceive impacts of digitalisation in your sector?**

- Yes → GO to 5)
- No → GO to 12)

**5) \* What impacts of digitalisation do you perceive on the occupations?**

Which ones? How? Since when? Why? More occupations than others?

**Information:** Skills and knowledge are not the same!

A **skill** is the **ability** to do something while

a **knowledge** is the **theoretical and/or practical understanding** (information) needed to do something.

**6) \* What impacts of digitalisation do you perceive on the skills of the workers?**

Which ones? Are there new skills to be developed? Are some skills disappearing?

**7) \* What impacts of digitalisation do you perceive on the knowledge of the workers?**

Which ones? Are there new knowledge to be learned? Are some knowledge disappearing?

**8) \* Do you perceive other impacts of digitalisation than those commented above?**

Explain.



9) \* What has been implemented in your sector to adapt to these impacts?

Actions? Trainings? Other?

10) \* Has it been implemented by your organisation? Explain.

11) \* Is there a legal framework that has an impact on these adaptations?

Does it facilitate the adaptations or not?

→ GO to 18)

12) \* Do you think digitalisation will have an impact in your sector in the coming years?

- Yes → GO to 13)
- No → GO to 18)

*Information: Skills and knowledge are not the same!*

*A skill is the ability to do something while*

*a knowledge is the theoretical and/or practical understanding (information) needed to do something.*

13) \* What will these impacts be?

- Impacts on the occupations
- Impacts on the skills
- Impacts on the knowledge
- Other

14) \* How will digitalisation impact the occupations in the coming years?

Some more than others? Why? Give examples if you can.

*A skill is the ability to do something.*

15) \* How will digitalisation impact the skills of the workers in the coming years?



Some more than others? Why? Give examples if you can.

*A knowledge is the theoretical and/or practical understanding (information) needed to do something.*

**16) \* How will digitalisation impact on the knowledge of the workers in the coming years?**

Some more than others? Why? Give examples if you can.

**17) \* Can you explain the other impacts digitalisation will have in the coming years?**

Give examples if you can.

**→ GO to 18)**



In 2018, we identify the circular economy as a growing trend in the construction sector.

Here are some examples:

- the construction and demolition waste management,
- the reuse of construction materials,
- the choice of local suppliers,
- the corporate social responsibility,
- lean management,
- urban mining,
- ...

Regarding your area of expertise, how would you answer the following questions:

18) \* Do you perceive impacts of circular economy in your sector?

- Yes → GO to 19)
- No → GO to 26)

19) \* What impacts of circular economy do you perceive on the occupations?

Which ones? How? Since when? Why? More occupations than others?

*Information: Skills and knowledge are not the same!*

A **skill** is the **ability** to do something while

a **knowledge** is the **theoretical** and/or **practical understanding** (information) needed to do something.

20) \* What impacts of circular economy do you perceive on the skills of the workers?

Which ones? Are there new skills to be developed? Are some skills disappearing?

21) \* What impacts of circular economy do you perceive on the knowledge of the workers?

Which ones? Are there new knowledge to be learned? Are some knowledge disappearing?



22) \* Do you perceive other impacts of circular economy than those commented above?

Explain.

23) \* What has been implemented in your sector to adapt to these impacts?

Actions? Trainings? Other?

24) \* Has it been implemented by your organisation? Explain.

25) \* Is there a legal framework that has an impact on these adaptations?

Does it facilitate the adaptations or not?

→ GO to 32)

26) \* Do you think circular economy will have an impact in your sector in the coming years?

- Yes → GO to 27)
- No → GO to 32)

**Information:** Skills and knowledge are not the same!

A **skill** is the **ability** to do something while

a **knowledge** is the **theoretical** and/or **practical understanding** (information) needed to do something.

27) \* What will these impacts be?

- Impacts on the occupations
- Impacts on the skills
- Impacts on the knowledge
- Other

28) \* How will circular economy impact the occupations in the coming years?



Some more than others? Why? Give examples if you can.

*A **skill** is the **ability** to do something.*

**29) \* How will circular economy impact the skills of the workers in the coming years?**

Some more than others? Why? Give examples if you can.

*A **knowledge** is **the theoretical** **and/or** **practical** **understanding** (information) needed to do something.*

**30) \* How will circular economy impact on the knowledge of the workers in the coming years?**

Some more than others? Why? Give examples if you can.

**31) \* Can you explain the other impacts circular economy will have in the coming years?**

Give examples if you can.

**→ GO to 32)**



In 2018, we identify a trend for standardisation, automatization and prefabrication (S.A.P.) in the construction sector.

Regarding your area of expertise, how would you answer the following questions:

32) \* Do you perceive impacts of S.A.P. in your sector?

Yes → GO to 33)

No → GO to 40)

33) \* What impacts of S.A.P. do you perceive on the occupations?

Which ones? How? Since when? Why? Some occupations more than others?

*Information: Skills and knowledge are not the same!*

A **skill** is the **ability** to do something while

a **knowledge** is the **theoretical** and/or **practical understanding** (information) needed to do something.

34) \* What impacts of S.A.P. do you perceive on the skills of the workers?

Which ones? Are there new skills to be developed? Are some skills disappearing?

35) \* What impacts of S.A.P. do you perceive on the knowledge of the workers?

Which ones? Are there new knowledge to be learned? Are some knowledge disappearing?

36) \* Do you perceive other impacts of S.A.P. than those commented above?

Explain.

37) \* What has been implemented in your sector to adapt to these impacts?

Actions? Trainings? Other?

38) \* Has it been implemented by your organisation? Explain.

**39) \* Is there a legal framework that has an impact on your adaptations?**

Does it facilitate the adaptations or not?

**40) \* Do you think S.A.P. will have an impact in your sector in the coming years?**

- Yes → **GO to 41)**
- No → **GO to 46)**

*Information: Skills and knowledge are not the same!*

*A **skill** is the **ability** to do something while*

*a **knowledge** is the **theoretical** and/or **practical** **understanding** (information) needed to do something.*

**41) \* What will these impacts be?**

- Impacts on the occupations
- Impacts on the skills
- Impacts on the knowledge
- Other

**42) \* How will S.A.P. impact the occupations in the coming years?**

Some more than others? Why? Give examples if you can.

*A **skill** is the **ability** to do something.*

**43) \* How will S.A.P. impact the skills of the workers in the coming years?**

Some more than others? Why? Give examples if you can.

*A **knowledge** is the **theoretical** and/or **practical** **understanding** (information) needed to do something.*

**44) \* How will S.A.P. impact on the knowledge of the workers in the coming years?**

Some more than others? Why? Give examples if you can.



45) \* Can you explain the other impacts S.A.P. will have in the coming years?

Give examples if you can.

→ GO to 46)



In 2018, we identify a growing trend of health and safety measures in the construction sector.

Regarding your area of expertise, how would you answer the following questions:

**46) \* What measures related to health and safety are implemented in your sector?**

Explain. Give examples if you can.

**47) The questionnaire is now finished. Is there any comment you would like to share with us related to the questions and/or the answers you have given?**

[Send]

100 % completed



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### **List of the respondents to the organisation's interviews**

- Alexander Laquiere, Director Innovation and Digitalisation, Willemen (Belgium);
- Antonina Andreeva, Technical Director, Wienerberger EOOD (Bulgaria);
- Christophe Decker, Technical Director, Baucenter Decker-Ries (Luxembourg);
- Fran Bradshaw, Partner, Anne Thorne Architects (United Kingdom);
- Jill Aquilani, Sales Manager, Eco-Beton (Belgium);
- Kenneth Callens, Learning and Development Manager, DEME (Belgium);
- Keyvan LankarAni, Owner, K LANKARANI ARCHITECTURE + DESIGN (United Kingdom);
- Mario Verduci, General Director, Federcomated(Italy);
- Marnix Van Hoe, Administrator, Fema (Belgium);
- Martin Kasa, Director, Wienerberger (Austria);
- Melahat Sahin-Dikmen, Research Fellow, Centre for the Study of the Production of the Built Environmnet (ProBE) (United Kingdom);
- Michael Bennett, Owner, Michael Bennett and Sons Contractors (Ireland);
- Nikki Heyerick, Project Manager, Casadomus bvba (Belgium);
- Patricia Martinho, Formação, APCMC (Portugal);
- Richard Ellithorne, Director, Builders Merchants Federation (United Kingdom);
- Sebastian Molinero, Director, Andimac (Spain);
- Sergío Serrano, Manager, ANMOPYC (Spain);
- Sue Arundale, Director Technical Affairs, FIEC (Belgium based European organisation);
- Tom Vanwezer, Business Development, Valipac (Belgium).

# Delphi Panel Detecta

Welcome!

In the scope of the Detecta project, Constructiv conducted some interviews with construction companies related to the main evolutions the construction sector is facing. The four evolutions are digitalisation, Circular Economy, Standardisation Automation and Prefabrication (S.A.P.), and Health and Safety. The organisations indicated some impacts these trends are having on the occupations, skills and knowledge in the construction sector. Now we would like to confirm those trends to your expertise.

*The survey's questions are written in English and we would prefer you to answer them in English. But we don't want the language to be a barrier for you, so feel free to answer in your own language if it is too difficult in English.*

## 1) Profile

- \* Organisation's name
- \* Field
- \* Name (interviewee)
- \* Function in the organisation (interviewee)

How would you agree with these statements on a scale from 1 to 10 (1 = I completely disagree and 10 = I strongly agree).

Regarding the impacts of **DIGITALISATION** on the occupations:

**2) The relationship with the customer is changing because digitalisation also changes the customer's role in purchasing both information and the product, the workers need to give digital services to the customers too**

1  2  3  4  5  6  7  8  9  10

3) The way the construction workers manage the suppliers' relationship, the pricing and the commercial approach is changing.

1  2  3  4  5  6  7  8  9  10

4) Workers and new workers must show interests in digitalisation as the use of digital devices/software is inevitable as well as the social media or even new online marketing platforms.

1  2  3  4  5  6  7  8  9  10

5) Digitalisation is revolutionising the traditional work's organisation.

1  2  3  4  5  6  7  8  9  10

6) All workers need to adapt to the fast evolution of the systems/programs and production processes (automation of most processes, automatic data gathering, production control system), this means that they need to learn fast because of the fast evolution of digital tools.

1  2  3  4  5  6  7  8  9  10

7) Would you like to add other impacts on the occupations or to comment your answers?

How would you agree with these statements on a scale from 1 to 10 (1 = I completely disagree and 10 = I strongly agree).

Regarding the impacts of **DIGITALISATION** on the skills:

8) IT skills

1  2  3  4  5  6  7  8  9  10

9) Communication skills

1  2  3  4  5  6  7  8  9  10

10) Project management skills

1  2  3  4  5  6  7  8  9  10

11) Marketing and selling skills

1  2  3  4  5  6  7  8  9  10

12) Would you like to add other skills or to comment your answers?

How would you agree with these statements on a scale from 1 to 10 (1 = I completely disagree and 10 = I strongly agree).

Regarding the impacts of **DIGITALISATION** on the knowledges:

13) IT knowledge to use digital tools (i.e. BIM models), systems (i.e. ERP) and programs (i.e. MS Office) but also hardware devices

1  2  3  4  5  6  7  8  9  10

14) More specific/technical knowledge of the products

1  2  3  4  5  6  7  8  9  10

15) Online communication with the customers and the use of social media

1  2  3  4  5  6  7  8  9  10

16) Digital marketing techniques (use of 3D visualisation system, e-marketing)

1  2  3  4  5  6  7  8  9  10

17) Management

1  2  3  4  5  6  7  8  9  10

18) Accountability

1  2  3  4  5  6  7  8  9  10

19) Engineering

1  2  3  4  5  6  7  8  9  10

20) Would you like to add other knowledges or to comment your answers?

How would you agree with these statements on a scale from 1 to 10 (1 = I completely disagree and 10 = I strongly agree).

Regarding the impacts of **CIRCULAR ECONOMY** on the occupations:

21) The relationship with the customers is evolving because of their growing interest in Circular Economy, they are more curious, and the construction workers need to be able to answer their questions.

1  2  3  4  5  6  7  8  9  10

22) Circular Economy is impacting the production chain and logistics, especially the packaging, (new) workers need to adapt to new production processes.

1  2  3  4  5  6  7  8  9  10

23) The life-cycle of the materials is evolving, and the construction workers need both to know more about it and to adapt to new procedures.

1  2  3  4  5  6  7  8  9  10

24) Workers need to enlarge their knowledge related to the Circular Economy of the products as well as the normative regulations they are confronted to.

1  2  3  4  5  6  7  8  9  10

25) Would you like to add other impacts on the occupations or to comment your answers?

How would you agree with these statements on a scale from 1 to 10 (1 = I completely disagree and 10 = I strongly agree).

Regarding the impacts of **CIRCULAR ECONOMY** on the skills:

26) Waste management skills

1  2  3  4  5  6  7  8  9  10

27) Would you like to add other skills or to comment your answers?



How would you agree with these statements on a scale from 1 to 10 (1 = I completely disagree and 10 = I strongly agree).

Regarding the impacts of **CIRCULAR ECONOMY** on the knowledges:

28) Recognising different types of packaging waste

1  2  3  4  5  6  7  8  9  10

29) Recycling / reuse / life-cycle of materials/products

1  2  3  4  5  6  7  8  9  10

30) European/national/local regulations

1  2  3  4  5  6  7  8  9  10

31) Would you like to add other knowledges or to comment your answers?

How would you agree with these statements on a scale from 1 to 10 (1 = I completely disagree and 10 = I strongly agree).

Regarding the impacts of **STANDARDISATION, AUTOMATION AND PREFABRICATION (SAP)** on the occupations:

32) All S.A.P. aspects are already impacting the work chain in depth: production, logistics, process of design and construction, monitoring after completion of building (regarding energy & water consumption, sustainability) and recycling after demolition.

1  2  3  4  5  6  7  8  9  10

33) The use of the BIM model will impact the occupations.

1  2  3  4  5  6  7  8  9  10

34) S.A.P. can impact the speed of construction work as well as it can impact the demand's growth and therefore impact on the occupation's demand.

1  2  3  4  5  6  7  8  9  10

35) The focus on prefabrication solution will induce a work sphere less dependent on the workers.



1  2  3  4  5  6  7  8  9  10

**36) Would you like to add other impacts on the occupations or to comment your answers?**

How would you agree with these statements on a scale from 1 to 10 (1 = I completely disagree and 10 = I strongly agree).

Regarding the impacts of **SAP** on the skills:

**37) Digital skills**

1  2  3  4  5  6  7  8  9  10

**38) Project management skills**

1  2  3  4  5  6  7  8  9  10

**39) Would you like to add other skills or to comment your answers?**

How would you agree with these statements on a scale from 1 to 10 (1 = I completely disagree and 10 = I strongly agree).

Regarding the impacts of **SAP** on the knowledges:

**40) Robotics and smart technologies**

1  2  3  4  5  6  7  8  9  10

**41) IT programs/software and hardware devices**

1  2  3  4  5  6  7  8  9  10

**42) Project management**

1  2  3  4  5  6  7  8  9  10

**43) Health & safety regulations related to the use of new technologies**

1  2  3  4  5  6  7  8  9  10



44) Would you like to add other knowledges or to comment your answers?

How would you agree with these statements on a scale from 1 to 10 (1 = I completely disagree and 10 = I strongly agree).

Regarding the evolution of **HEALTH AND SAFETY** standards, the construction organisations are taking actions. With your expertise how would you agree with these:

45) Implementation of an internal legal framework for employees and construction sites including medical checks, safety clothes/equipment, ...

1  2  3  4  5  6  7  8  9  10

46) H&S trainings with ISOH certification and bonus scheme for the trainings followed

1  2  3  4  5  6  7  8  9  10

47) Offering H&S management services to members: H&S guides/advisors

1  2  3  4  5  6  7  8  9  10

48) Production of H&S business guides

1  2  3  4  5  6  7  8  9  10

49) The questionnaire is now finished. Is there any comment you would like to share with us related to the questions and/or the answers you have given?

[Send]

100 % completed

## 10. ANNEX 5 – DELPHI PANEL RESULTS (DOCUMENT USED FOR THE SECOND SENDING TO THE EXPERTS)

This document shows the main results regarding the Delphi Panel created in the scope of the DETECTA project. The organisations identified impacts of the four main evolutions of the construction sector on the occupations, skills and knowledge. These impacts were translated into statements and submitted to experts in order to confirm (or not) these impacts by evaluating the statement on a scale from 1 to 10. We can say that each statement that received a mean score equal or above 5 out of 10 is confirmed by the experts. From that we can see in the table below that each topic received a mean score superior to 7/10. Therefore, we can say that the topics were confirmed by the experts of the Delphi Panel.

THEME	MEAN
DIGITALISATION - OCCUPATIONS	7,2
DIGITALISATION - SKILLS	7,5
DITIALISATION - KNOWLEDGE	7,3
CIRCULAR ECONOMY - OCCUPATIONS	7,7
CIRCULAR ECONOMY - SKILLS	8,0
CIRCULAR ECONOMY - KNOWLEDGE	7,6
S.A.P. - OCCUPATIONS	7,4
S.A.P. - SKILLS	8,2
S.A.P. - KNOWLEDGE	7,7
HEALTH & SAFETY	8,1

The following information give the list of each statement and the mean score that it received. From those results, we can say that all statements obtained a mean score above 6/10. We can then conclude that all the statements were confirmed by the experts appealed to participate to this Delphi Panel.

From the four statements that received the poorest mean-scores, we see that 3 of them are related to the marketing competences of the construction workers. This can be explained by the nature of the organisations that responded to the survey, were also included in the respondents merchant organisations. However, the experts appealed to participate in the Delphi Panel were experts of the construction sector in general and may have identified the marketing competences as a minor impact for the construction sector.

DIGITALISATION - OCCUPATIONS	
The way the construction workers manage the suppliers' relationship, the pricing and the commercial approach is changing.	6,3
DIGITALISATION - SKILLS	
Marketing and selling skills	6,3
DITIALISATION - KNOWLEDGE	
Digital marketing techniques (use of 3D visualisation system, e-marketing)	6,0
S.A.P. - OCCUPATIONS	
The focus on prefabrication solution will induce a work sphere less dependent on the workers.	6,0

## 1 Digitalisation

### 1.1 OCCUPATIONS

- ✓ The relationship with the customer is changing because digitalisation also changes the customer's role in purchasing both information and the product, the workers need to give digital services to the customers too  
**Mean: 8,1**
- ✓ The way the construction workers manage the suppliers' relationship, the pricing and the commercial approach is changing.  
**Mean: 6,3**
- ✓ Workers and new workers must show interests in digitalisation as the use of digital devices/software is inevitable as well as the social media or even new online marketing platforms.  
**Mean: 7,7**
- ✓ Digitalisation is revolutionising the traditional work's organisation.  
**Mean: 7,3**
- ✓ All workers need to adapt to the fast evolution of the systems/programs and production processes (automation of most processes, automatic data gathering, production control system), this means that they need to learn fast because of the fast evolution of digital tools.  
**Mean: 6,6**
- ✓ Would you like to add other impacts on the occupations or to comment your answers?

The level of digital mastery depends on the profession, the size of the company and if specialization or polyvalence are requested.

Regarding the "revolutionizing" of the work organisation: We valued lower because we do not see a revolution but evolutions.

Differences between adaptation maturity will become critical bottlenecks. For example a construction company on BIM level 1 cannot comply to the needs of another company on BIM level 2

Only when organisations are on the same level, successful cooperation (without upskilling) is possible.

In the sector it is no problem if groups of organisations are operating on lower maturity levels. Then will earn their money in other ways

### 1.2 SKILLS

- ✓ IT skills (administrative management, e-marketing and production)  
**Mean: 7,9**
- ✓ Communication skills  
**Mean: 7,7**
- ✓ Project management skills  
**Mean: 8,1**
- ✓ Marketing and selling skills  
**Mean: 6,3**

- ✓ Would you like to add other skills or to comment your answers?

Cooperation skills: in the future you can no longer run a sustainable business if you do not cooperate with other disciplines.

### 1.3 KNOWLEDGE

- ✓ IT knowledge to use digital tools (software and hardware devices) for administration management (e.g. e-mail, MS Office, ERP system), production (e.g. BIM models), e-marketing (e.g. internet, social media)  
Mean: 8,4
- ✓ More specific/technical knowledge of the products  
Mean: 6,9
- ✓ Online communication with the customers (e.g. social media, e-mails)  
Mean: 7,0
- ✓ Digital marketing techniques (use of 3D visualisation system, e-marketing)  
Mean: 6,0
- ✓ Management  
Mean: 7,4
- ✓ Accountability  
Mean: 7,9
- ✓ Engineering  
Mean: 7,7

## 2 Circular Economy

### 2.1 OCCUPATIONS

- ✓ The relationship with the customers is evolving because of their growing interest in Circular Economy, they are more curious, and the construction workers need to be able to answer their questions.  
Mean: 7,3
- ✓ Circular Economy is impacting the production chain and logistics, especially the packaging, (new) workers need to adapt to new production processes.  
Mean: 7,4
- ✓ The life-cycle of the materials is evolving, and the construction workers need both to know more about it and to adapt to new procedures.  
Mean: 8,0
- ✓ Workers need to enlarge their knowledge related to the Circular Economy of the products as well as the normative regulations they are confronted to.  
Mean: 8,0

### 2.2 SKILLS

- ✓ Construction and demolition waste management skills  
Mean: 8,0



## 2.3 KNOWLEDGE

- ✓ Recognising different types of packaging waste  
Mean: 8,1
- ✓ Recycling / reuse / life-cycle of materials/products  
Mean: 7,9
- ✓ European/national/local regulations  
Mean: 6,7
- ✓ Would you like to add other knowledges or to comment your answers?

This is an exclusive competence of the construction site manager / works manager related to his involvement in waste management and the environment's protection. Workers are not aware that they cannot put all the waste together, but they are not familiar with waste sorting procedures.

## 3 Standardisation, Automation and Prefabrication (S.A.P.)

### 3.1 OCCUPATIONS

- ✓ All S.A.P. aspects are already impacting the work chain in depth: production, logistics, process of design and construction, monitoring after completion of building (regarding energy & water consumption, sustainability) and recycling after demolition.  
Mean: 7,4
- ✓ The use of the BIM model will impact the occupations.  
Mean: 7,9
- ✓ S.A.P. can impact the speed of construction work as well as it can impact the demand's growth and therefore impact on the occupation's demand.  
Mean: 8,3
- ✓ The focus on prefabrication solution will induce a work sphere less dependent on the workers.  
Mean: 6,0
- ✓ Would you like to add other impacts on the occupations or to comment your answers?

Again, it is the responsibility of the construction site manager (hierarchy) to know the standards to be applied and to apply them himself on the construction site.

European/national/local regulations especially a few white collars need to know. The rest will follow changed procedures.

### 3.2 SKILLS

- ✓ Digital skills  
Mean: 7,9
- ✓ Project management skills  
Mean: 8,4
- ✓ Prefabricated construction skills  
Mean: 8,3
- ✓ Would you like to add other skills or to comment your answers?

The focus on prefabrication solution will induce disappearance of skills and emergence of less qualified trades as assemblers



### 3.3 KNOWLEDGE

- ✓ Robotics and smart technologies  
Mean: 7,1
- ✓ IT programs/software and hardware devices  
Mean: 6,9
- ✓ Project management  
Mean: 8,1
- ✓ Health & safety regulations related to the use of new technologies  
Mean: 7,7
- ✓ Use of prefabricated products and techniques (concrete beams and vaults, steel construction, wooden roof and wall elements for timber frame construction)  
Mean: 8,6

### 4 Health & Safety

- ✓ Implementation of an internal legal framework for employees and construction sites including medical checks, safety clothes/equipment, external safety coordinator, elaboration of safety plans with risk analysis, ...  
Mean: 8,4
- ✓ H&S trainings with ISOH certification and bonus scheme for the trainings followed  
Mean: 7,7
- ✓ Offering H&S management services to members: H&S guides/advisors  
Mean: 8,4
- ✓ Production of H&S business guides  
Mean: 8,0

### **List of the experts appealed to the Delphi Panel**

Christine Dalla Valle, Analyst, Le Forem (Belgium) ;

Dieter Carre, Coordinator, Talentenwerf (Belgium);

Jan Cromwijk, Program Manager Transition and Sustainability, ISSO (Netherlands);

Kšištofas, Project Manager, CCBP (Lithuania);

Linda Clarke, Professor, University of Westminster (United Kingdom);

Rolf Gehring, Secretary Wood and OSH, EFBWW (Belgium based European Organisation);

Sergío Serrano, Manager, ANMOPYC (Spain);

Xavier Maes, Coordinator, Construcity (Belgium).

## 12. ANNEX 7 – TABLES EXTRACTED FROM THE SKILLS MAP

*Table 1 - AS and AK per trend-category*

TREND	ANTICIPATED SKILLS	ANTICIPATED KNOWLEDGE
Circular Economy	5	3
Digitalisation	19	4
Health & Safety	6	2
S.A.P.	4	2
Other	5	5
<b>Sum</b>	<b>39</b>	<b>16</b>

*Table 2 – Top 5 list of occupation categories according to the highest number of different AS*

OCCUPATION CATEGORY	AS	AK
Earthmoving and Related Plant Operators	12	6
Building Frame and Related Trades Workers Not Elsewhere Classified	9	6
Carpenters and Joiners	8	4
Plumbers and Pipe Fitters	6	2
Crane, Hoist and Related Plant Operators	6	3
Civil Engineering Labourers	5	1
Concrete Placers, Concrete Finishers and Related Workers	5	3

*Table 3 – Top 5 list of occupation categories according to the highest number of AS and the number of occupations and AK for each occupation category*

OCCUPATION CATEGORY	NUMBER OF OCCUPATIONS	Nbr AS	Nbr AK
Plumbers and Pipe Fitters	14	50	28
Earthmoving and Related Plant Operators	9	31	20
Carpenters and Joiners	5	22	14
Crane, Hoist and Related Plant Operators	5	17	9
Floor Layers and Tile Setters	4	16	8
Civil Engineering Labourers*	6	13	6

\*Building Structure Cleaners is the fifth occupation category to show the highest number of AK with 7 AK.

**Table 4 – Top 5 list of occupation category according to the mean AS per occupation**

OCCUPATION CATEGORY	MEAN
Carpenters and Joiners	4,4
Floor Layers and Tile Setters	4,0
Insulation Workers	4,0
Plumbers and Pipe Fitters	3,6
Concrete Placers, Concrete Finishers and Related Workers	3,5

**Table 5 – Top 5 list of AS according to the number of occupations that it will affect**

ANTICIPATED SKILLS	OCCUPATIONS
use digital tools to optimise the exchange of information	66
sorts waste for recycling / re-use	33
exchanges information correctly with internal and external stakeholders	22
consults digital plans to know the necessary information about certain items	13
use of 3D visualisation systems	10

**Table 6 – The AS of the 2 most affected occupation by the AS**

CATEGORY	ANTICIPATED SKILL	STAIRCASE INSTALLER	KITCHEN UNIT INSTALLER
Digitalisation	use digital tools to optimise the exchange of information	X	X
Digitalisation	exchanges information correctly with internal and external stakeholders	X	X
Digitalisation	use of 3D visualisation systems	X	X
Digitalisation	use software to calculate stairs	X	
Circular Economy	uses water for tasks and cleaning efficiently	X	X
Health & Safety	uses energy sustainably and reduces noise pollution	X	X

**Table 7 – Top 5 list of AK according to the highest number of occupations that it will affect**

ANTICIPATED KNOWLEDGE	OCCUPATIONS
Digital tools	65
Recycling / reuse / life-cycle of materials/products	35



Eco-driving	8
GPS Systems	5
3D Visualisation systems	4



### 13. ANNEX 8 – SKILLS MAP

#### **7111 House Builders**

House Builders

#### **7112 Bricklayers and Related Workers**

Bricklayer

#### **7113 Stonemasons, Stone cutters, Splitters and Carvers**

Stonemason

#### **7114 Concrete Placers, Concrete Finishers and Related Workers**

Concrete Finisher

Terrazzo Setter

#### **7115 Carpenters and Joiners**

Carpenter

Door Installer

Kitchen Unit Installer

Staircase Installer

Window Installer

#### **7119 Building Frame and Related Trades Workers Not Elsewhere Classified**

Construction Scaffolder

Demolition Worker

Manufactured Wooden Building Assembler

Steeplejack

#### **7121 Roofers**

Roofers

#### **7122 Floor Layers and Tile Setters**

Carpet Fitter

Hardwood Floor Layer

Resilient Floor Layer

Tile Fitter

#### **7123 Plasterers**

Ceiling Installer

Plasterer

#### **7124 Insulation Workers**

Insulation Workers

#### **7125 Glaziers**

Plate Glass Installer

#### **7126 Plumbers and Pipe Fitters**

Bathroom Fitter

Drain Technician

Gas Service Technician

Heating Engineer

Irrigation System Installer

Irrigation Technician

Pipeline Maintenance Worker

Plumber

Septic Tank Servicer

Sewer Construction Worker

Sewerage Network Operative

Sprinkler Fitter

Water Conservation Technician

Water Network Operative

#### **7127 Air Conditioning and Refrigeration Mechanics**

Heating, ventilation, air conditioning (and refrigeration) service engineer

#### **7131 Painters and Related Workers**

Construction Painter

Paperhanger

#### **7132 Spray Painters and Varnishers**

lacquer spray gun operator

surface treatment operator

transport equipment painter

#### **7133 Building Structure Cleaners**

Asbestos Abatement Worker

Building Exterior Cleaner

Chimney Sweep

Chimney Sweep Supervisor

Decontamination Worker

#### **8342 Earthmoving and Related Plant Operators**

Bulldozer Operator

Dredge Operator

Excavator Operator

Pile Driving Hammer Operator

Road Construction Worker

Road Roller Operator

Scraper Operator

Snow-Clearing Worker

Surface Mine Plant Operator

#### **8343 Crane, Hoist and Related Plant Operators**

Automated Cable Vehicle Controller

Container Crane Operator

Mobile Crane Operator

Production Plant Crane Operator

Tower Crane Operator

#### **9312 Civil engineering labourers**

Drainage Worker

Rail Layer



Road Maintenance Worker  
Road Marker

Road Sign Installer  
Waterway Construction Labourer

HOUSE BUILDER

Competences	Essential (current)	Optional (current)	Anticipated	Category
check compatibility of materials	X			
check construction compliance	X			
create floor plan template	X			
create smooth wood surface	X			
design floor	X			
follow health and safety procedures in construction	X			
follow safety procedures when working at heights	X			
inspect concrete structures	X			
inspect roofs	X			
install construction profiles	X			
install wood elements in structures	X			
maintain construction structures	X			
perform roof maintenance	X			
plan construction of houses	X			
prepare building site	X			
prepare surface for hardwood floor laying	X			
read standard blueprints	X			
seal flooring	X			
use safety equipment in construction	X			
work in a construction team	X			
apply roll roofing		X		
calculate needs for construction supplies		X		
construct wood roofs		X		



coordinate construction activities				X	
cut resilient flooring materials				X	
cut stair carriages				X	
ensure compliance with construction project deadline				X	
install gutters				X	
install in-floor and in-wall heating				X	
install laminate floor				X	
install metal roofing				X	
install roof flashing				X	
install structural glazing				X	
lay interlocking roof tiles				X	
lay non-interlocking roof tiles				X	
lay resilient flooring tiles				X	
order construction supplies				X	
prepare roofing materials				X	
prepare surface for painting				X	
process incoming construction supplies				X	
set up temporary construction site infrastructure				X	
use digital tools to optimise the exchange of information (BIM...)				X	Digitalisation
exchanges information correctly with internal and external stakeholders				X	Digitalisation
checks for the presence and use of PPE and CPE according to the specific regulations				X	Health and Safety
	<b>Knowledge</b>	<b>Essential (current)</b>	<b>Optional (current)</b>	<b>Anticipated</b>	<b>Category</b>
building codes		X			
building materials industry		X			
roofing techniques		X			



construction product regulation	X		
energy efficiency	X		
energy performance of buildings	X		
digital tools (BIM...)		X	Digitalisation
safety, health, hygiene and welfare regulations		X	Health and Safety
specific risks of asbestos, quartz and wood dusts and other dangerous products		X	Health and Safety

#### BRICKLAYER

Competences	Essential (current)	Optional (current)	Anticipated	Category
check straightness of brick	X			
finish mortar joints	X			
follow health and safety procedures in construction	X			
follow safety procedures when working at heights	X			
inspect construction supplies	X			
install construction profiles	X			
interpret 2D plans	X			
interpret 3D plans	X			
lay bricks	X			
mix construction grouts	X			
secure working area	X			
snap chalk line	X			
sort waste	X			
split bricks	X			
transport construction supplies	X			



use measurement instruments	X	
use safety equipment in construction	X	
work ergonomically	X	
apply finish to concrete		X
apply proofing membranes		X
apply restoration techniques		X
build scaffolding		X
calculate needs for construction supplies		X
document survey operations		X
estimate restoration costs		X
inspect supplied concrete		X
install falsework		X
install insulation material		X
keep personal administration		X
keep records of work progress		X
maintain equipment		X
maintain work area cleanliness		X
mix concrete		X
monitor stock level		X
operate masonry power saw		X
operate surveying instruments		X
order construction supplies		X
place concrete forms		X
pour concrete		X
process incoming construction supplies		X
reinforce concrete		X
remove concrete forms		X
rig loads		X



screed concrete			X	
set up temporary construction site infrastructure			X	
use squaring pole			X	
work in a construction team			X	
place prefabricated elements			X	S.A.P.
use digital tools to optimise the exchange of information (BIM...)			X	Digitalisation
<b>Knowledge</b>	<b>Essential (current)</b>	<b>Optional (current)</b>	<b>Anticipated</b>	<b>Category</b>
building codes		X		
building materials industry			X	/
roofing techniques			X	/
construction product regulation			X	/
energy efficiency			X	/
energy performance of buildings			X	/
digital tools (BIM...)			X	Digitalisation
safety, health, hygiene and welfare regulations			X	Health and Safety
specific risks of asbestos, quartz and wood dusts and other dangerous products			X	Health and Safety
prefabricated elements			X	S.A.P.

## STONEMASON

Competences	Essential (current)	Optional (current)	Anticipated	Category
create cutting plan	X			
follow health and safety procedures in construction	X			
inspect construction supplies	X			
inspect stone surface	X			



interpret 2D plans	X	
interpret 3D plans	X	
maintain work area cleanliness	X	
mark stone workpieces	X	
operate grinding hand tools	X	
polish stone by hand	X	
prepare stone for smoothing	X	
regulate cutting speed	X	
secure working area	X	
transport construction supplies	X	
use measurement instruments	X	
use safety equipment in construction	X	
use stonemason's chisel	X	
work ergonomically	X	
advise on construction materials		X
answer requests for quotation		X
apply restoration techniques		X
assess conservation needs		X
build scaffolding		X
calculate needs for construction supplies		X
estimate restoration costs		X
finish mortar joints		X
follow safety procedures when working at heights		X
keep personal administration		X
keep records of work progress		X
lay stones		X
maintain equipment		X
mix construction grouts		X



monitor stock level					X	
operate forklift					X	
order construction supplies					X	
pack stone products					X	
polish stone surfaces					X	
process incoming construction supplies					X	
program a CNC controller					X	
rig loads					X	
set up temporary construction site infrastructure					X	
sharpen edged tools					X	
sort waste					X	
tend stone splitting machine					X	
use pneumatic chisel					X	
use traditional stone splitting techniques					X	
work in a construction team					X	
creates CAD drawings						X Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category		
building codes	X					
types of stone for working	X					
digital tools (BIM...)				X		Digitalisation
safety, health, hygiene and welfare regulations				X		Health and Safety

#### DOOR INSTALLER

Competences	Essential (current)	Optional (current)	Anticipated	Category
-------------	---------------------	--------------------	-------------	----------



apply insulation strips	X	
apply proofing membranes	X	
apply spray foam insulation	X	
cut house wrap	X	
cut insulation material to size	X	
fit doors	X	
follow health and safety procedures in construction	X	
inspect construction supplies	X	
install locks	X	
manipulate glass	X	
use measurement instruments	X	
use safety equipment in construction	X	
use shims	X	
work ergonomically	X	
advise on construction materials		X
apply house wrap		X
create architectural sketches		X
inspect insulation		X
inspect quality of products		X
install automatically opening door		X
install construction profiles		X
install insulation material		X
interpret 2D plans		X
interpret 3D plans		X
keep personal administration		X
keep records of work progress		X
monitor stock level		X
order construction supplies		X



pack fragile items for transportation				X	
process incoming construction supplies				X	
use sander				X	
use squaring pole				X	
work in a construction team				X	
use digital tools to optimise the exchange of information (BIM...)					X Digitalisation
sorts waste for recycling / re-use					X Circular Economy
uses energy sustainably and reduces noise pollution					X Health and Safety
uses water for tasks and cleaning efficiently					X Circular Economy
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
types of insulation material		X			
digital tools (BIM...)			X		Digitalisation
recycling / reuse / life-cycle of materials/products			X		Circular Economy

#### CONCRETE FINISHER

Competences	Essential (current)	Optional (current)	Anticipated	Category
clean wood surface	X			
follow health and safety procedures in construction	X			
inspect concrete structures	X			
inspect supplied concrete	X			
mix concrete	X			
monitor concrete curing process	X			
place concrete forms	X			
pour concrete	X			



prevent damage to utility infrastructure	X	
react to events in time-critical environments	X	
recognise signs of corrosion	X	
remove concrete forms	X	
screed concrete	X	
transport construction supplies	X	
use measurement instruments	X	
use safety equipment in construction	X	
work ergonomically	X	
work in a construction team	X	
apply finish to concrete		X
apply proofing membranes		X
apply spray foam insulation		X
calculate needs for construction supplies		X
drive mobile heavy construction equipment		X
feed hoppers		X
follow safety procedures when working at heights		X
guide concrete hose		X
inspect construction supplies		X
install insulation blocks		X
interpret 2D plans		X
interpret 3D plans		X
keep heavy construction equipment in good condition		X
keep records of work progress		X
monitor stock level		X
operate concrete mixer truck		X
operate road roller		X
order construction supplies		X



plan surface slope				X	
process incoming construction supplies				X	
report defective manufacturing materials				X	
rig loads				X	
set up reinforcing steel				X	
set up temporary construction site infrastructure				X	
sort waste				X	
tie reinforcing steel				X	
use sander				X	
use digital tools to optimise the exchange of information (BIM...)					X Digitalisation
place prefabricated elements					X S.A.P.
uses water for tasks and cleaning efficiently					X Circular Economy
<b>Knowledge</b>	<b>Essential (current)</b>	<b>Optional (current)</b>	<b>Anticipated</b>	<b>Category</b>	
types of concrete forms		X			
types of concrete pumps		X			
re-use of aggregates for the production of new concrete				X	Circular Economy
digital tools (BIM...)				X	Digitalisation

#### TERRAZZO SETTER

Competences	Essential (current)	Optional (current)	Anticipated	Category
apply proofing membranes	X			
blast surface	X			
follow health and safety procedures in construction	X			
grind terrazzo	X			



grout terrazzo	X		
inspect construction supplies	X		
mix terrazzo material	X		
pour terrazzo	X		
prepare floor for terrazzo	X		
prevent premature drying	X		
screed concrete	X		
transport construction supplies	X		
use measurement instruments	X		
work ergonomically	X		
work safely with chemicals	X		
calculate needs for construction supplies		X	
design floor		X	
install insulation material		X	
keep personal administration		X	
keep records of work progress		X	
lay terrazzo divider strips		X	
maintain terrazzo		X	
mix construction grouts		X	
order construction supplies		X	
polish stone surfaces		X	
process incoming construction supplies		X	
use safety equipment in construction		X	
work in a construction team		X	
use digital tools to optimise the exchange of information (BIM...)		X	Digitalisation
sorts waste for recycling / re-use		X	Circular Economy
uses energy sustainably and reduces noise pollution		X	Health and Safety
uses water for tasks and cleaning efficiently		X	Circular Economy



Knowledge	Essential (current)	Optional (current)	Anticipated	Category
aesthetics		X		
digital tools (BIM...)			X	Digitalisation
recycling / reuse / life-cycle of materials/products			X	Circular Economy

#### CARPENTER

Competences	Essential (current)	Optional (current)	Anticipated	Category
apply wood finishes	X			
clean wood surface	X			
create smooth wood surface	X			
create wood joints	X			
follow health and safety procedures in construction	X			
identify wood warp	X			
inspect construction supplies	X			
install construction profiles	X			
install wood elements in structures	X			
install wood hardware	X			
interpret 2D plans	X			
interpret 3D plans	X			
join wood elements	X			
keep sawing equipment in good condition	X			
keep track of wooden elements	X			
snap chalk line	X			
sort waste	X			



transport construction supplies	X	
use measurement instruments	X	
use safety equipment in construction	X	
work ergonomically	X	
answer requests for quotation		X
apply restoration techniques		X
assess conservation needs		X
build scaffolding		X
calculate needs for construction supplies		X
construct wood roofs		X
create cutting plan		X
estimate restoration costs		X
follow safety procedures when working at heights		X
install insulation material		X
keep personal administration		X
keep records of work progress		X
maintain equipment		X
maintain work area cleanliness		X
monitor stock level		X
operate band saw		X
operate crosscut saw		X
operate table saw		X
operate wood router		X
order construction supplies		X
process incoming construction supplies		X
program a CNC controller		X
secure working area		X
set up temporary construction site infrastructure		X



use sander			X		
use squaring pole			X		
work in a construction team			X		
use digital tools to optimise the exchange of information (BIM...)				X	Digitalisation
uses energy sustainably and reduces noise pollution				X	Health and Safety
uses water for tasks and cleaning efficiently				X	Circular Economy
treats surfaces of wooden elements (preservation, protection...)				X	Circular Economy
<b>Knowledge</b>	<b>Essential (current)</b>	<b>Optional (current)</b>	<b>Anticipated</b>	<b>Category</b>	
types of wood	X				
wood cuts	X				
woodworking tools	X				
asbestos removal regulations			X		
energy performance of buildings			X		
loading charts for transportation of goods			X		
digital tools (BIM...)				X	Digitalisation
recycling / reuse / life-cycle of materials/products				X	Circular Economy

#### KITCHEN UNIT INSTALLER

<b>Competences</b>	<b>Essential (current)</b>	<b>Optional (current)</b>	<b>Anticipated</b>	<b>Category</b>
check water pressure	X			
follow health and safety procedures in construction	X			
inspect construction supplies	X			
install PVC piping	X			
install construction profiles	X			
install cooktops	X			
install metal gas piping	X			



install oven	X	
install wood hardware	X	
interpret 2D plans	X	
interpret 3D plans	X	
load cargo	X	
replace faucets	X	
snap chalk line	X	
unload cargo	X	
use measurement instruments	X	
use safety equipment in construction	X	
work ergonomically	X	
attach PEX pipe		X
cut wall chases		X
demonstrate products' features		X
dispose of non-hazardous waste		X
handle customer complaints		X
install electrical household appliances		X
install plumbing systems		X
keep personal administration		X
keep records of work progress		X
maintain work area cleanliness		X
operate GPS systems		X
operate grinding hand tools		X
operate hand drill		X
operate wood sawing equipment		X
pack goods		X
prepare copper pipes for use as gas lines		X
process customer orders		X



process incoming construction supplies				X	
protect surfaces during construction work				X	
sort waste				X	
take payments for bills				X	
use metal bending techniques				X	
use sander				X	
work in a construction team				X	
use digital tools to optimise the exchange of information (BIM...)					X Digitalisation
uses energy sustainably and reduces noise pollution					X Health and Safety
uses water for tasks and cleaning efficiently					X Circular Economy
exchanges information correctly with internal and external stakeholders					X Digitalisation
use of 3D visualisation systems					X Digitalisation
	<b>Knowledge</b>	<b>Essential (current)</b>	<b>Optional (current)</b>	<b>Anticipated</b>	<b>Category</b>
electricity		X			
plumbing tools		X			
types of piping		X			
manufacturer's instructions for electrical household appliances			X		
road transport legislation			X		
types of cooktops			X		
vehicle cargo capacity			X		
digital tools (BIM...)				X	Digitalisation
recycling / reuse / life-cycle of materials/products				X	Circular Economy
3D visualisation systems				X	Digitalisation



STARCASE INSTALLER

Competences	Essential (current)	Optional (current)	Anticipated	Category
apply wood finishes	X			
clean wood surface	X			
fasten treads and risers	X			
follow health and safety procedures in construction	X			
inspect construction supplies	X			
install handrail	X			
interpret 2D plans	X			
interpret 3D plans	X			
join wood elements	X			
position carriage	X			
snap chalk line	X			
transport construction supplies	X			
use measurement instruments	X			
use safety equipment in construction	X			
work ergonomically	X			
work in a construction team	X			
advise on construction materials		X		
answer requests for quotation		X		
apply restoration techniques		X		
calculate needs for construction supplies		X		
calculate stairs rise and run		X		
create architectural sketches		X		
create cutting plan		X		
create smooth wood surface		X		



cut stair carriages				X	
estimate restoration costs				X	
follow safety procedures when working at heights				X	
install newel posts				X	
install spindles				X	
keep personal administration				X	
keep records of work progress				X	
maintain work area cleanliness				X	
monitor stock level				X	
operate hand drill				X	
operate table saw				X	
operate wood router				X	
order construction supplies				X	
place carpet				X	
process incoming construction supplies				X	
protect surfaces during construction work				X	
select restoration activities				X	
set up temporary construction site infrastructure				X	
sort waste				X	
use CAD software				X	
use digital tools to optimise the exchange of information (BIM...)					X Digitalisation
uses energy sustainably and reduces noise pollution					X Health and Safety
uses water for tasks and cleaning efficiently					X Circular Economy
exchanges information correctly with internal and external stakeholders					X Digitalisation
use of 3D visualisation systems					X Digitalisation
use software to calculate stairs					X Digitalisation
<b>Knowledge</b>	<b>Essential (current)</b>	<b>Optional (current)</b>	<b>Anticipated</b>	<b>Category</b>	



woodworking tools	X		
types of carpet		X	
types of wood		X	
wood cuts		X	
digital tools (BIM...)		X	Digitalisation
recycling / reuse / life-cycle of materials/products		X	Circular Economy
3D visualisation systems		X	Digitalisation

#### WINDOW INSTALLER

Competences	Essential (current)	Optional (current)	Anticipated	Category
apply insulation strips	X			
apply proofing membranes	X			
apply spray foam insulation	X			
cut house wrap	X			
cut insulation material to size	X			
follow health and safety procedures in construction	X			
inspect construction supplies	X			
install sill pan	X			
manipulate glass	X			
set window	X			
transport construction supplies	X			
use measurement instruments	X			
use safety equipment in construction	X			
use shims	X			



work ergonomically	X		
advise on construction materials		X	
apply house wrap		X	
assemble insulating glazing units		X	
assemble windows		X	
create architectural sketches		X	
follow safety procedures when working at heights		X	
inspect insulation		X	
inspect quality of products		X	
install construction profiles		X	
install frameless glass		X	
install insulation material		X	
interpret 2D plans		X	
interpret 3D plans		X	
keep personal administration		X	
keep records of work progress		X	
maintain work area cleanliness		X	
monitor stock level		X	
order construction supplies		X	
pack fragile items for transportation		X	
process incoming construction supplies		X	
use sander		X	
use squaring pole		X	
work in a construction team		X	
use digital tools to optimise the exchange of information (BIM...)		X	Digitalisation
exchanges information correctly with internal and external stakeholders		X	Digitalisation
use of 3D visualisation systems		X	Digitalisation



Knowledge	Essential (current)	Optional (current)	Anticipated	Category
energy performance of buildings	X			
types of insulation material	X			
digital tools (BIM...)			X	Digitalisation
recycling / reuse / life-cycle of materials/products			X	Circular Economy
3D visualisation systems			X	Digitalisation
different materials such as synthetics, aluminium, metal and wood			X	/

#### CONSTRUCTION SCAFFOLDER

Competences	Essential (current)	Optional (current)	Anticipated	Category
build scaffolding	X			
construct working platform	X			
dismantle scaffolding	X			
follow health and safety procedures in construction	X			
follow safety procedures when working at heights	X			
inspect construction supplies	X			
interpret 2D plans	X			
interpret 3D plans	X			
position base plates	X			
position guardrails and toeboards	X			
position sole plates	X			
recognise signs of corrosion	X			
recognise signs of wood rot	X			
use measurement instruments	X			



use safety equipment in construction		X			
work ergonomically		X			
work in a construction team		X			
inspect scaffolding				X	
install scaffolding pump jacks				X	
keep personal administration				X	
keep records of work progress				X	
plan scaffolding				X	
position outriggers				X	
process incoming construction supplies				X	
rig loads				X	
set up temporary construction site infrastructure				X	
transport construction supplies				X	
work safely with machines				X	
performs an LMRA				X	Health and Safety
sets up a material list for a standard configuration scaffolding				X	S.A.P.
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
scaffolding components	X				
construction product regulation		X		S.A.P.	
mechanical tools		X		/	

#### DEMOLITION WORKER

Competences	Essential (current)	Optional (current)	Anticipated	Category
demolish structures	X			



dispose of non-hazardous waste	X	
drive mobile heavy construction equipment	X	
follow health and safety procedures in construction	X	
keep heavy construction equipment in good condition	X	
operate heavy construction machinery without supervision	X	
operate jackhammer	X	
prevent damage to utility infrastructure	X	
react to events in time-critical environments	X	
recognise the hazards of dangerous goods	X	
secure working area	X	
transport construction supplies	X	
use safety equipment in construction	X	
work ergonomically	X	
work in a construction team	X	
demolish selectively		X
dispose of hazardous waste		X
follow safety procedures when working at heights		X
guide operation of heavy construction equipment		X
keep personal administration		X



keep records of work progress	X				
operate excavator	X				
operate laser cutting equipment	X				
operate oxygen cutting torch	X				
operate plasma cutting torch	X				
operate wrecking ball	X				
rig loads	X				
secure heavy construction equipment	X				
set up temporary construction site infrastructure	X				
sort waste	X				
use dust control techniques		X		Health and Safety	
disassembles structures for re-use		X		Circular Economy	
locates the support points via digital blueprints		X		Digitalisation	
	<b>Knowledge</b>	<b>Essential (current)</b>	<b>Optional (current)</b>	<b>Anticipated</b>	<b>Category</b>
mechanical tools		X			
asbestos removal regulations			X		
decontamination techniques			X		
demolition techniques			X		
excavation techniques			X		
radiation protection			X		



specific risks of asbestos, quartz and wood dusts and other dangerous products	X	Health and Safety
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### MANUFACTURED WOODEN BUILDING ASSEMBLER

Competences	Essential (current)	Optional (current)	Anticipated Category
clean wood surface	X		
install insulation material	X		
install wood elements in structures	X		
install wood hardware	X		
join wood elements	X		
manipulate wood	X		
perform pre-assembly quality checks	X		
use technical documentation	X		
apply technical communication skills		X	
apply wood finishes		X	
check quality of raw materials		X	
construct wood roofs		X	
create wood joints		X	
develop assembly instructions		X	
dispose of cutting waste material		X	
inspect insulation		X	
inspect quality of products		X	
install plumbing systems		X	
keep records of work progress		X	
operate wood sawing equipment		X	
prepare production reports		X	



provide technical documentation				X	
read standard blueprints				X	
sand wood				X	
sharpen edged tools				X	
stain wood				X	
wear appropriate protective gear				X	
place prefabricated elements				X	S.A.P.
use digital tools to optimise the exchange of information (BIM...)				X	Digitalisation
use 3D visualisation systems				X	Digitalisation
sorts waste for recycling / re-use				X	Circular Economy
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
construction products	X				
quality standards	X				
types of wood	X				
wood products	X				
woodworking processes	X				
woodworking tools	X				
plumbing tools			X		
types of insulation material			X		
wood cuts			X		
digital tools (BIM...)				X	Digitalisation



recycling / reuse / life-cycle of materials/products	X	Circular Economy	
3D visualisation systems	X	Digitalisation	

### STEEPLEJACK

Competences	Essential (current)	Optional (current)	Anticipated	Category
build scaffolding	X			
construct working platform	X			
follow health and safety procedures in construction	X			
follow safety procedures when working at heights	X			
handle equipment while suspended	X			
inspect climbing equipment	X			
inspect construction supplies	X			
spot other climbers	X			
use safety equipment in construction	X			
work ergonomically	X			
work from suspended access cradle	X			
work in a construction team	X			
blast surface		X		
clean building facade		X		
clean glass surfaces		X		
inspect concrete structures		X		
inspect insulation		X		
inspect masonry work		X		
inspect paintwork		X		
inspect roofs		X		
inspect scaffolding		X		



inspect wind turbines				X	
install insulation material				X	
keep personal administration				X	
keep records of work progress				X	
lay bricks				X	
paint surfaces				X	
perform search and rescue missions				X	
prune hedges and trees				X	
set up temporary construction site infrastructure				X	
set window				X	
use digital tools to optimise the exchange of information (BIM...)					X Digitalisation
<b>Knowledge</b>	<b>Essential (current)</b>	<b>Optional (current)</b>	<b>Anticipated</b>		
climbing equipment	X				
risk assessment for window cleaning		X			

## ROOFER

Competences	Essential (current)	Optional (current)	Anticipated	Category
apply roll roofing	X			
construct wood roofs	X			
follow health and safety procedures in construction	X			
follow safety procedures when working at heights	X			
inspect construction supplies	X			
inspect roofs	X			
install gutters	X			
install insulation material	X			



install roof flashing	X	
interpret 2D plans	X	
interpret 3D plans	X	
lay interlocking roof tiles	X	
perform roof maintenance	X	
prepare roofing materials	X	
recognise signs of wood rot	X	
remove roofs	X	
secure working area	X	
sort waste	X	
transport construction supplies	X	
use measurement instruments	X	
use safety equipment in construction	X	
work ergonomically	X	
advise on construction materials		X
answer requests for quotation		X
apply proofing membranes		X
build scaffolding		X
calculate needs for construction supplies		X
establish green roof		X
install facade cladding		X
install lightning protection system		X
install metal roofing		X
install roof windows		X
keep personal administration		X
keep records of work progress		X
lay non-interlocking roof tiles		X
maintain work area cleanliness		X



monitor stock level			X		
operate forklift			X		
order construction supplies			X		
plan scaffolding			X		
process incoming construction supplies			X		
thatch roofs			X		
use sander			X		
work in a construction team			X		
prepares the roof for the installation of solar panels and collectors				X	/
use digital tools to optimise the exchange of information (BIM...)				X	Digitalisation
use drones to inspect roofs				X	Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
roofing techniques	X				
asbestos removal regulations		X			
building codes		X			
crane load charts		X			
energy efficiency		X			
energy performance of buildings		X			
roofing drones		X			
solar panel mounting systems		X			
digital tools (BIM...)				X	Digitalisation
recycling / reuse / life-cycle of materials/products				X	Circular Economy



CARPET FITTER

Competences	Essential (current)	Optional (current)	Anticipated	Category
apply floor adhesive	X			
cut carpet	X			
finish carpet edges	X			
fit carpet seams	X			
follow health and safety procedures in construction	X			
inspect construction supplies	X			
interpret 2D plans	X			
interpret 3D plans	X			
lay underlayment	X			
place carpet	X			
prepare floor for underlayment	X			
transport construction supplies	X			
use measurement instruments	X			
work ergonomically	X			
advise on construction materials		X		
answer requests for quotation		X		
apply proofing membranes		X		
calculate needs for construction supplies		X		
create floor plan template		X		
demonstrate products' features		X		
install carpet gripper adhesive		X		
install insulation material		X		
keep personal administration		X		
keep records of work progress		X		



monitor stock level					X	
order construction supplies					X	
plan carpet cutting					X	
process incoming construction supplies					X	
use safety equipment in construction					X	
use sander					X	
work in a construction team					X	
use digital tools to optimise the exchange of information (BIM...)					X	Digitalisation
sorts waste for recycling / re-use					X	Circular Economy
use visualisation systems (augmented reality...)					X	Digitalisation
exchanges information correctly with internal and external stakeholders					X	Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category		
types of carpet	X					
aesthetics		X				
digital tools (BIM...)				X		Digitalisation
recycling / reuse / life-cycle of materials/products				X		Circular Economy

#### HARDWOOD FLOOR LAYER

Competences	Essential (current)	Optional (current)	Anticipated	Category
clean wood surface	X			
create floor plan template	X			
create smooth wood surface	X			
fill nail holes in wood planks	X			



follow health and safety procedures in construction	X	
identify wood warp	X	
inspect construction supplies	X	
install wood elements in structures	X	
interpret 2D plans	X	
interpret 3D plans	X	
join wood elements	X	
lacquer wood surfaces	X	
lay underlayment	X	
monitor processing environment conditions	X	
pin parquet	X	
prepare surface for hardwood floor laying	X	
transport construction supplies	X	
use measurement instruments	X	
wax wood surfaces	X	
work ergonomically	X	
acclimatise timber		X
advise customers on maintenance of parquet floors		X
advise on construction materials		X
answer requests for quotation		X
apply restoration techniques		X
calculate needs for construction supplies		X
estimate restoration costs		X
keep personal administration		X
keep records of work progress		X
lay marquetry		X
monitor stock level		X
nail floor boards		X



order construction supplies				X	
process incoming construction supplies				X	
screw and plug parquet boards				X	
seal flooring				X	
tend CNC laser cutting machine				X	
use safety equipment in construction				X	
use sander				X	
work in a construction team				X	
use digital tools to optimise the exchange of information (BIM...)					X Digitalisation
sorts waste for recycling / re-use					X Circular Economy
exchanges information correctly with internal and external stakeholders					X Digitalisation
use visualisation systems (augmented reality...)					X Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
types of wood	X				
wood cuts	X				
aesthetics		X			
wood moisture content		X			
digital tools (BIM...)			X		Digitalisation
recycling / reuse / life-cycle of materials/products			X		Circular Economy

#### RESILIENT FLOOR LAYER

Competences	Essential (current)	Optional (current)	Anticipated	Category
apply floor adhesive	X			



create floor plan template	X	
cut resilient flooring materials	X	
follow health and safety procedures in construction	X	
inspect construction supplies	X	
install laminate floor	X	
interpret 2D plans	X	
interpret 3D plans	X	
lay resilient flooring tiles	X	
lay underlayment	X	
mix construction grouts	X	
prepare floor for underlayment	X	
transport construction supplies	X	
use measurement instruments	X	
work ergonomically	X	
advise on construction materials		X
answer requests for quotation		X
apply proofing membranes		X
calculate needs for construction supplies		X
demonstrate products' features		X
install construction profiles		X
install insulation material		X
keep personal administration		X
keep records of work progress		X
monitor stock level		X
operate wood sawing equipment		X
order construction supplies		X
process incoming construction supplies		X
seal flooring		X



use sander					X	
work in a construction team					X	
work safely with chemicals					X	
use digital tools to optimise the exchange of information (BIM...)					X	Digitalisation
sorts waste for recycling / re-use					X	Circular Economy
exchanges information correctly with internal and external stakeholders					X	Digitalisation
use visualisation systems (augmented reality...)					X	Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category		
digital tools (BIM...)			X	Digitalisation		
recycling / reuse / life-cycle of materials/products			X	Circular Economy		

#### TILE FITTER

Competences	Essential (current)	Optional (current)	Anticipated	Category
apply tile adhesive	X			
caulk expansion joints	X			
cut tiles	X			
fill tile joints	X			
follow health and safety procedures in construction	X			
inspect construction supplies	X			
lay tiles	X			
mix construction grouts	X			
plan tiling	X			
snap chalk line	X			
transport construction supplies	X			



types of tile	X		
use measurement instruments	X		
use safety equipment in construction	X		
work ergonomically	X		
advise on construction materials		X	
answer requests for quotation		X	
apply restoration techniques		X	
attach accessories to tile		X	
calculate needs for construction supplies		X	
drill holes in tile		X	
estimate restoration costs		X	
install insulation material		X	
interpret 2D plans		X	
interpret 3D plans		X	
keep personal administration		X	
keep records of work progress		X	
maintain tile flooring		X	
maintain work area cleanliness		X	
make mosaic		X	
monitor stock level		X	
operate mosaic tools		X	
order construction supplies		X	
plan surface slope		X	
process incoming construction supplies		X	
protect surfaces during construction work		X	
work in a construction team		X	
use digital tools to optimise the exchange of information (BIM...)			X Digitalisation



sorts waste for recycling / re-use				X	Circular Economy
exchanges information correctly with internal and external stakeholders				X	Digitalisation
use visualisation systems (augmented reality...)				X	Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
sanding techniques	X				
types of tile adhesive	X				
aesthetics		X			
art history		X			
digital tools (BIM...)				X	Digitalisation
recycling / reuse / life-cycle of materials/products				X	Circular Economy

#### CEILING INSTALLER

Competences	Essential (current)	Optional (current)	Anticipated	Category
clean painting equipment	X			
fit ceiling tiles	X			
follow health and safety procedures in construction	X			
inspect construction supplies	X			
install construction profiles	X			
install drop ceiling	X			
maintain work area cleanliness	X			
paint surfaces	X			
place drywall	X			



protect surfaces during construction work	X		
tape drywall	X		
transport construction supplies	X		
use measurement instruments	X		
use safety equipment in construction	X		
work ergonomically	X		
advise on construction materials		X	
answer requests for quotation		X	
calculate needs for construction supplies		X	
install coffered ceiling		X	
install insulation material		X	
install stretch ceiling		X	
install wood elements in structures		X	
join wood elements		X	
keep personal administration		X	
keep records of work progress		X	
mix paint		X	
monitor stock level		X	
order construction supplies		X	
process incoming construction supplies		X	
snap chalk line		X	
use T-brace		X	
use digital tools to optimise the exchange of information (BIM...)		X	Digitalisation
sorts waste for recycling / re-use		X	Circular Economy
exchanges information correctly with internal and external stakeholders		X	Digitalisation
use visualisation systems (augmented reality...)		X	Digitalisation



Knowledge	Essential (current)	Optional (current)	Anticipated	Category
types of ceiling		X		
digital tools (BIM...)			X	Digitalisation
recycling / reuse / life-cycle of materials/products			X	Circular Economy

#### PLASTERER

Competences	Essential (current)	Optional (current)	Anticipated	Category
apply adhesive wall coating	X			
apply proofing membranes	X			
cut wall chases	X			
follow health and safety procedures in construction	X			
follow safety procedures when working at heights	X			
inspect construction supplies	X			
install insulation material	X			
mix construction grouts	X			
place drywall	X			
plaster surfaces	X			
prepare surface for plastering	X			
transport construction supplies	X			
use measurement instruments	X			
work ergonomically	X			
work safely with chemicals	X			
answer requests for quotation			X	
apply restoration techniques			X	



build scaffolding				X	
calculate needs for construction supplies				X	
craft ornamental plastering				X	
estimate restoration costs				X	
install construction profiles				X	
interpret 2D plans				X	
interpret 3D plans				X	
keep personal administration				X	
keep records of work progress				X	
maintain work area cleanliness				X	
monitor stock level				X	
order construction supplies				X	
place gypsum blocks				X	
process incoming construction supplies				X	
protect surfaces during construction work				X	
select restoration activities				X	
set up temporary construction site infrastructure				X	
tape drywall				X	
use safety equipment in construction				X	
use sander				X	
work in a construction team				X	
use digital tools to optimise the exchange of information (BIM...)					X Digitalisation
sorts waste for recycling / re-use					X Circular Economy
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
types of plastering materials	X				
art history		X			



digital tools (BIM...)	X	Digitalisation	
recycling / reuse / life-cycle of materials/products	X	Circular Economy	

#### INSULATION WORKER

Competences	Essential (current)	Optional (current)	Anticipated	Category
apply adhesive wall coating	X			
apply house wrap	X			
apply insulation strips	X			
apply proofing membranes	X			
cut insulation material to size	X			
follow health and safety procedures in construction	X			
follow safety procedures when working at heights	X			
inspect construction supplies	X			
install construction profiles	X			
install insulation blocks	X			
install insulation material	X			
interpret 2D plans	X			
interpret 3D plans	X			
transport construction supplies	X			
use measurement instruments	X			
use safety equipment in construction	X			
work ergonomically	X			
advise on construction materials			X	
answer requests for quotation			X	
apply spray foam insulation			X	
build scaffolding			X	



calculate needs for construction supplies					X	
create infrared imagery					X	
inspect insulation					X	
install drop ceiling					X	
keep personal administration					X	
keep records of work progress					X	
maintain work area cleanliness					X	
monitor stock level					X	
order construction supplies					X	
process incoming construction supplies					X	
protect surfaces during construction work					X	
pump insulation beads into cavities					X	
set up temporary construction site infrastructure					X	
use sander					X	
use squaring pole					X	
work in a construction team					X	
use digital tools to optimise the exchange of information (BIM...)						X Digitalisation
sorts waste for recycling / re-use						X Circular Economy
uses standard thicknesses per insulation material in order to comply with the applicable standards						X S.A.P.
places air and vapour barriers						X /
Knowledge	Essential (current)	Optional (current)	Anticipated	Category		
types of insulation material	X					
energy efficiency		X				
energy performance of buildings		X				



digital tools (BIM...)	X	Digitalisation	
recycling / reuse / life-cycle of materials/products	X	Circular Economy	
different insulation and post-insulation techniques	X	/	

#### PLATE GLASS INSTALLER

Competences	Essential (current)	Optional (current)	Anticipated	Category
adjust glass sheets	X			
cut glass	X			
follow health and safety procedures in construction	X			
handle broken glass sheets	X			
inspect construction supplies	X			
inspect glass sheet	X			
install construction profiles	X			
install frameless glass	X			
install glass frames	X			
interpret 2D plans	X			
interpret 3D plans	X			
manipulate glass	X			
remove glass from windows	X			
rinse glass	X			
smooth glass edges	X			
smooth glass surface	X			
transport construction supplies	X			
use measurement instruments	X			



use safety equipment in construction	X	
use shims	X	
work ergonomically	X	
apply a protective layer		X
apply insulation strips		X
assemble insulating glazing units		X
assemble windows		X
build scaffolding		X
calculate needs for construction supplies		X
create architectural sketches		X
follow safety procedures when working at heights		X
install insulation material		X
install roof windows		X
install sill pan		X
install structural glazing		X
keep personal administration		X
keep records of work progress		X
maintain equipment		X
maintain work area cleanliness		X
manage waste		X
monitor stock level		X
order construction supplies		X
pack fragile items for transportation		X
process incoming construction supplies		X
rig loads		X
set up temporary construction site infrastructure		X
set window		X
use squaring pole		X



work in a construction team				X	
use digital tools to optimise the exchange of information (BIM...)					X Digitalisation
sorts waste for recycling / re-use					X Circular Economy
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
glass coatings		X			
types of glazing		X			
digital tools (BIM...)			X		Digitalisation

#### BATHROOM FITTER

Competences	Essential (current)	Optional (current)	Anticipated	Category
attach PEX pipe	X			
check compatibility of materials	X			
check water pressure	X			
follow health and safety procedures in construction	X			
inspect construction supplies	X			
install construction profiles	X			
interpret 2D plans	X			
interpret 3D plans	X			
load cargo	X			
place sanitary equipment	X			
plan surface slope	X			
replace faucets	X			
snap chalk line	X			
unload cargo	X			



use measurement instruments	X		
use safety equipment in construction	X		
use shims	X		
work ergonomically	X		
apply proofing membranes		X	
cut wall chases		X	
demonstrate products' features		X	
dispose of non-hazardous waste		X	
handle customer complaints		X	
install PVC piping		X	
install frameless glass		X	
keep personal administration		X	
keep records of work progress		X	
maintain work area cleanliness		X	
operate GPS systems		X	
pack goods		X	
place mirrors		X	
process customer orders		X	
process incoming construction supplies		X	
protect surfaces during construction work		X	
set up water filtration system		X	
sort waste		X	
take payments for bills		X	
use sander		X	
use squaring pole		X	
work in a construction team		X	
use digital tools to optimise the exchange of information (BIM...)			X Digitalisation



disassembles old bathrooms for circular economy					X	Circular Economy
exchanges information correctly with internal and external stakeholders					X	Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category		
plumbing tools	X					
types of bath tubs	X					
types of piping	X					
types of showers	X					
types of toilets	X					
aesthetics		X				
road transport legislation		X				
vehicle cargo capacity		X				
water pressure		X				
digital tools (BIM...)			X		Digitalisation	
recycling / reuse / life-cycle of materials/products			X		Circular Economy	

#### DRAIN TECHNICIAN

Competences	Essential (current)	Optional (current)	Anticipated	Category
adjust cylinder valves	X			
apply health and safety standards	X			
assemble manufactured pipeline parts	X			



detect flaws in pipeline infrastructure	X		
ensure regulatory compliance in pipeline infrastructures	X		
install drainage well systems	X		
install plumbing systems	X		
lay pipe installation	X		
liaise with engineers	X		
read standard blueprints	X		
test pipeline infrastructure operations	X		
advise on equipment maintenance		X	
carry out cleaning of road drains		X	
examine engineering principles		X	
inspect pipelines		X	
maintain industrial equipment		X	
maintain records of maintenance interventions		X	
maintain water distribution equipment		X	
maintain water storage equipment		X	
maintain water treatment equipment		X	
mitigate environmental impact of pipeline projects		X	
operate soldering equipment		X	
operate welding equipment		X	
perform follow-up on pipeline route services		X	
regulate the flow of substances in pipelines		X	
repair pipelines		X	
supervise sewerage systems construction		X	
use personal protection equipment		X	
use digital tools to optimise the exchange of information (BIM...)		X	Digitalisation
sorts waste for recycling / re-use		X	Circular Economy



exchanges information correctly with internal and external stakeholders				X	Digitalisation
consults digital plans to know the necessary information about certain items				X	Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
types of pipelines	X				
engineering principles		X			
digital tools (BIM...)			X		Digitalisation
recycling / reuse / life-cycle of materials/products			X		Circular Economy

#### GAS SERVICE TECHNICIAN

Competences	Essential (current)	Optional (current)	Anticipated	Category
ensure correct gas pressure	X			
inspect pipelines	X			
install metal gas piping	X			
interpret technical requirements	X			
operate boiler	X			
prepare copper pipes for use as gas lines	X			
repair heating equipment	X			
repair pipelines	X			
resolve equipment malfunctions	X			
answer requests for quotation		X		
anticipate installation maintenance		X		
consult technical resources		X		
cut metal products		X		
ensure equipment cooling		X		



install gas heaters					X	
install utility equipment					X	
keep records of work progress					X	
monitor utility equipment					X	
read gas meter					X	
use personal protection equipment					X	
use welding equipment					X	
use digital tools to optimise the exchange of information (BIM...)					X	Digitalisation
sorts waste for recycling / re-use					X	Circular Economy
exchanges information correctly with internal and external stakeholders					X	Digitalisation
consults digital plans to know the necessary information about certain items					X	Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category		
fuel gas	X					
natural gas	X					
types of pipelines	X					
energy performance of buildings		X				
digital tools (BIM...)			X			Digitalisation
recycling / reuse / life-cycle of materials/products			X			Circular Economy

#### HEATING ENGINEER

Competences	Essential (current)	Optional (current)	Anticipated	Category
conduct routine machinery checks	X			



consult technical resources	X	
install heating furnace	X	
install heating, ventilation, air conditioning and refrigeration ducts	X	
install radtors	X	
operate soldering equipment	X	
operate welding equipment	X	
perform maintenance on installed equipment	X	
perform test run	X	
read standard blueprints	X	
record test data	X	
resolve equipment malfunctions	X	
use measurement instruments	X	
use testing equipment	X	
advise on safety improvements		X
answer requests for quotation		X
apply technical communication skills		X
dispose of hazardous waste		X
ensure compliance with environmental legislation		X
estimate restoration costs		X
identify customer's needs		X
install gas heaters		X
install heat pump		X
install heating boiler		X
install in-floor and in-wall heating		X
install solar water heater		X
install wood heater		X
issue sales invoices		X
lay pipe installation		X



order supplies					X	
perform risk analysis					X	
prepare compliance documents					X	
provide customer information related to repairs					X	
provide technical documentation					X	
repair heating equipment					X	
repair ventilation equipment					X	
troubleshoot					X	
write records for repairs					X	
use digital tools to optimise the exchange of information (BIM...)					X	Digitalisation
sorts waste for recycling / re-use					X	Circular Economy
exchanges information correctly with internal and external stakeholders					X	Digitalisation
consults digital plans to know the necessary information about certain items					X	Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category		
fuel gas	X					
thermodynamics	X					
types of fuels	X					
metal thermal conductivity			X			
digital tools (BIM...)				X		Digitalisation
recycling / reuse / life-cycle of materials/products				X		Circular Economy



IRRIGATION SYSTEM INSTALLER

Competences	Essential (current)	Optional (current)	Anticipated	Category
apply proofing membranes	X			
check water pressure	X			
follow health and safety procedures in construction	X			
inspect construction supplies	X			
install stationary sprinkler system	X			
install water purity mechanism	X			
set up drip irrigation system	X			
set up water filtration system	X			
transport construction supplies	X			
use measurement instruments	X			
use safety equipment in construction	X			
work ergonomically	X			
answer requests for quotation		X		
apply arc welding techniques		X		
apply spot welding techniques		X		
calculate needs for construction supplies		X		
install SSTI system		X		
install water reservoir		X		
keep personal administration		X		
keep records of work progress		X		
maintain irrigation systems		X		
monitor stock level		X		
operate excavator		X		
operate soldering equipment		X		
order construction supplies		X		



process incoming construction supplies				X	
set up water pump				X	
work in a construction team				X	
use digital tools to optimise the exchange of information (BIM...)				X	Digitalisation
sorts waste for recycling / re-use				X	Circular Economy
exchanges information correctly with internal and external stakeholders				X	Digitalisation
consults digital plans to know the necessary information about certain items				X	Digitalisation

Knowledge	Essential (current)	Optional (current)	Anticipated	Category
mechanical systems	X			
mechanics	X			
types of piping	X			
fertigation		X		
sensors		X		
digital tools (BIM...)			X	Digitalisation
recycling / reuse / life-cycle of materials/products			X	Circular Economy

**IRRIGATION TECHNICIAN**

Competences	Essential (current)	Optional (current)	Anticipated	Category
compute irrigation pressure	X			
ensure compliance with environmental legislation	X			
install irrigation systems	X			
install sprinkler systems	X			
keep competences about irrigation systems up-to-date	X			



lay pipe installation			X		
maintain irrigation controllers			X		
maintain irrigation systems			X		
maintain sprinkler systems			X		
develop irrigation strategies				X	
follow water supply schedule				X	
inspect fire equipment				X	
measure water flow				X	
monitor water quality				X	
organise irrigation				X	
perform water testing procedures				X	
use digital tools to optimise the exchange of information (BIM...)				X	Digitalisation
sorts waste for recycling / re-use				X	Circular Economy
exchanges information correctly with internal and external stakeholders				X	Digitalisation
consults digital plans to know the necessary information about certain items				X	Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
irrigation systems	X				
types of sprinklers	X				
water pressure	X				
fire prevention procedures		X			
fire safety regulations		X			
water policies		X			
water reuse		X			



digital tools (BIM...)	X	Digitalisation	
recycling / reuse / life-cycle of materials/products	X	Circular Economy	

#### PIPELINE MAINTENANCE WORKER

Competences	Essential (current)	Optional (current)	Anticipated	Category
apply health and safety standards	X			
carry out measurements of parts	X			
ensure regulatory compliance in pipeline infrastructures	X			
follow verbal instructions	X			
follow written instructions	X			
handle chemicals	X			
inspect pipelines	X			
maintain equipment	X			
maintain pipeline coating properties	X			
maintain working relationships	X			
operate soldering equipment	X			
operate welding equipment	X			
prevent pipeline deterioration	X			
test pipeline infrastructure operations	X			
use personal protection equipment	X			
use rigging equipment	X			
assemble manufactured pipeline parts			X	
detect flaws in pipeline infrastructure			X	
follow up pipeline integrity management priorities			X	
monitor storage vessels used to transport goods via pipeline			X	



use digital tools to optimise the exchange of information (BIM...)				X	Digitalisation
sorts waste for recycling / re-use				X	Circular Economy
exchanges information correctly with internal and external stakeholders				X	Digitalisation
consults digital plans to know the necessary information about certain items				X	Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
pipeline coating properties	X				
pipeline transport regulations;		X			
security requirements of goods transported via pipelines		X			
types of pipelines		X			
digital tools (BIM...)			X		Digitalisation
recycling / reuse / life-cycle of materials/products			X		Circular Economy

## PLUMBER

Competences	Essential (current)	Optional (current)	Anticipated	Category
attach PEX pipe	X			
check water pressure	X			
clear out drains	X			
follow health and safety procedures in construction	X			
inspect construction supplies	X			
install PVC piping	X			
install metal gas piping	X			
install plumbing systems	X			
interpret 2D plans	X			



interpret 3D plans	X	
place sanitary equipment	X	
prepare copper pipes for use as gas lines	X	
replace faucets	X	
snap chalk line	X	
transport construction supplies	X	
use measurement instruments	X	
use safety equipment in construction	X	
use welding equipment	X	
work ergonomically	X	
answer requests for quotation		X
apply a protective layer		X
apply proofing membranes		X
calculate needs for construction supplies		X
consult technical resources		X
cut metal products		X
cut wall chases		X
install solar water heater		X
keep personal administration		X
keep records of work progress		X
maintain work area cleanliness		X
monitor stock level		X
order construction supplies		X
process incoming construction supplies		X
protect surfaces during construction work		X
set up temporary construction site infrastructure		X
set up water filtration system		X
use metal bending techniques		X



use sander					X	
work in a construction team					X	
use digital tools to optimise the exchange of information (BIM...)					X	Digitalisation
sorts waste for recycling / re-use					X	Circular Economy
exchanges information correctly with internal and external stakeholders					X	Digitalisation
consults digital plans to know the necessary information about certain items					X	Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category		
plumbing tools	X					
types of piping	X					
water pressure		X				
digital tools (BIM...)			X	Digitalisation		
recycling / reuse / life-cycle of materials/products			X	Circular Economy		

#### SEPTIC TANK SERVICER

Competences	Essential (current)	Optional (current)	Anticipated	Category
apply health and safety standards	X			
ensure compliance with environmental legislation	X			
ensure equipment maintenance	X			
maintain cleaning equipment	X			
maintain records of maintenance interventions	X			
maintain septic tanks	X			
operate pumps	X			
operate sumps	X			



perform cleaning activities in an environmentally friendly way	X				
perform cleaning activities in an outdoor environment	X				
advise on equipment maintenance				X	
agree on repair arrangements				X	
clean industrial containers				X	
detect flaws in pipeline infrastructure				X	
dispose waste				X	
drain hazardous liquids				X	
handle chemical cleaning agents				X	
inspect pipelines				X	
install septic systems				X	
operate drilling equipment				X	
operate gas extraction equipment				X	
perform demarcation				X	
prevent pipeline deterioration				X	
report pollution incidents				X	
test samples for pollutants				X	
use personal protection equipment				X	
use digital tools to optimise the exchange of information (BIM...)				X	Digitalisation
sorts waste for recycling / re-use				X	Circular Economy
exchanges information correctly with internal and external stakeholders				X	Digitalisation
consults digital plans to know the necessary information about certain items				X	Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
waste transport legislation	X				
pollution legislation		X			
pollution prevention		X			



types of pipelines	X		
digital tools (BIM...)		X	Digitalisation
recycling / reuse / life-cycle of materials/products		X	Circular Economy

#### SEWER CONSTRUCTION WORKER

Competences	Essential (current)	Optional (current)	Anticipated	Category
assemble manufactured pipeline parts	X			
detect flaws in pipeline infrastructure	X			
dig sewer trenches	X			
follow health and safety procedures in construction	X			
inspect construction sites	X			
inspect construction supplies	X			
lay sewer pipe	X			
level earth surface	X			
prevent damage to utility infrastructure	X			
prevent pipeline deterioration	X			
provide pipe bedding	X			
react to events in time-critical environments	X			
secure working area	X			
test pipeline infrastructure operations	X			
transport construction supplies	X			
transport pipes	X			
use measurement instruments	X			
use safety equipment in construction	X			
work ergonomically	X			



cut metal products				X	
dig soil mechanically				X	
drive mobile heavy construction equipment				X	
guide operation of heavy construction equipment				X	
install PVC piping				X	
interpret 2D plans				X	
interpret 3D plans				X	
keep heavy construction equipment in good condition				X	
keep personal administration				X	
keep records of work progress				X	
mix construction grouts				X	
operate GPS systems				X	
operate excavator				X	
operate grappler				X	
operate heavy construction machinery without supervision				X	
process incoming construction supplies				X	
repair pipelines				X	
rig loads				X	
set up temporary construction site infrastructure				X	
work in a construction team				X	
use digital tools to optimise the exchange of information (BIM...)					X Digitalisation
sorts waste for recycling / re-use					X Circular Economy
consults digital plans to know the necessary information about certain items					X Digitalisation
used GPS controlled machines					X Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
excavation techniques	X				



mechanical systems	X		
mechanics	X		
electricity		X	
machinery load capacity		X	
types of bedding materials		X	
digital tools (BIM...)		X	Digitalisation
recycling / reuse / life-cycle of materials/products		X	Circular Economy

#### SEWERAGE NETWORK OPERATIVE

Competences	Essential (current)	Optional (current)	Anticipated	Category
apply health and safety standards	X			
detect flaws in pipeline infrastructure	X			
ensure regulatory compliance in pipeline infrastructures	X			
inspect pipelines	X			
maintain records of maintenance interventions	X			
operate pumps	X			
operate sumps	X			
prevent pipeline deterioration	X			
read maps	X			
repair pipelines	X			
test pipeline infrastructure operations	X			
use personal protection equipment	X			
advise on equipment maintenance			X	



analyse experimental laboratory data					X	
assemble manufactured pipeline parts					X	
carry out cleaning of road drains					X	
clean industrial containers					X	
collect samples for analysis					X	
document analysis results					X	
lay pipe installation					X	
maintain pipeline coating properties					X	
maintain septic tanks					X	
mitigate environmental impact of pipeline projects					X	
operate drilling equipment					X	
operate hydraulic machinery controls					X	
perform demarcation					X	
perform laboratory tests					X	
regulate the flow of substances in pipelines					X	
test samples for pollutants					X	
use geographic information systems					X	
use digital tools to optimise the exchange of information (BIM...)						X Digitalisation
sorts waste for recycling / re-use						X Circular Economy
consults digital plans to know the necessary information about certain items						X Digitalisation
used GPS controlled machines						X Digitalisation
	<b>Knowledge</b>	<b>Essential (current)</b>	<b>Optional (current)</b>	<b>Anticipated</b>	<b>Category</b>	
types of pipelines		X				
geographic information systems			X			
laboratory techniques			X			



pipeline coating properties	X		
digital tools (BIM...)		X	Digitalisation
recycling / reuse / life-cycle of materials/products		X	Circular Economy

#### SPRINKLER FITTER

Competences	Essential (current)	Optional (current)	Anticipated	Category
check compatibility of materials	X			
check water pressure	X			
follow health and safety procedures in construction	X			
inspect construction supplies	X			
install fire sprinklers	X			
interpret 2D plans	X			
interpret 3D plans	X			
lay pipe installation	X			
set up water pump	X			
use measurement instruments	X			
work ergonomically	X			
attach PEX pipe			X	
calculate needs for construction supplies			X	
install PVC piping			X	
install construction profiles			X	
install insulation material			X	
keep personal administration			X	
keep records of work progress			X	
monitor stock level			X	



operate hand drill				X	
order construction supplies				X	
process incoming construction supplies				X	
test sensors				X	
use safety equipment in construction				X	
wire security sensors				X	
work in a construction team				X	
use digital tools to optimise the exchange of information (BIM...)					X Digitalisation
sorts waste for recycling / re-use					X Circular Economy
consults digital plans to know the necessary information about certain items					X Digitalisation

Knowledge	Essential (current)	Optional (current)	Anticipated	Category
automated sprinkler bulbs	X			
mechanical systems	X			
plumbing tools	X			
types of piping	X			
types of sprinklers	X			
security panels		X		
smoke sensors		X		
digital tools (BIM...)			X	Digitalisation
recycling / reuse / life-cycle of materials/products			X	Circular Economy

WATER CONSERVATION TECHNICIAN				
Competences	Essential (current)	Optional (current)	Anticipated	Category



apply arc welding techniques	X	
apply proofing membranes	X	
apply spot welding techniques	X	
follow health and safety procedures in construction	X	
inspect construction supplies	X	
install PVC piping	X	
install water reservoir	X	
interpret 2D plans	X	
interpret 3D plans	X	
operate excavator	X	
set up water filtration system	X	
transport construction supplies	X	
use measurement instruments	X	
use metal bending techniques	X	
use safety equipment in construction	X	
work ergonomically	X	
answer requests for quotation		X
calculate needs for construction supplies		X
check water pressure		X
clear out drains		X
inspect roof for source of rainwater contamination		X
install construction profiles		X
install water purity mechanism		X
keep personal administration		X
keep records of work progress		X
maintain work area cleanliness		X
monitor stock level		X
operate pumping equipment		X



order construction supplies				X	
process incoming construction supplies				X	
set up temporary construction site infrastructure				X	
set up water pump				X	
work in a construction team				X	
use digital tools to optimise the exchange of information (BIM...)					X Digitalisation
sorts waste for recycling / re-use					X Circular Economy
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
mechanics	X				
energy efficiency		X			
energy performance of buildings		X			
digital tools (BIM...)			X		Digitalisation
recycling / reuse / life-cycle of materials/products			X		Circular Economy

#### WATER NETWORK OPERATIVE

Competences	Essential (current)	Optional (current)	Anticipated	Category
apply health and safety standards	X			
assemble manufactured pipeline parts	X			
detect flaws in pipeline infrastructure	X			
inspect pipelines	X			
lay pipe installation	X			
maintain water treatment equipment	X			
operate drilling equipment	X			



operate pumps	X		
operate sumps	X		
prevent pipeline deterioration	X		
repair pipelines	X		
use personal protection equipment	X		
advise on equipment maintenance		X	
carry out cleaning of road drains		X	
collect samples for analysis		X	
consider the impact of material characteristics on pipeline flows		X	
document analysis results		X	
ensure regulatory compliance in pipeline infrastructures		X	
inspect drilling equipment		X	
interpret scientific data to assess water quality		X	
maintain drilling equipment		X	
maintain pipeline coating properties		X	
maintain septic tanks		X	
maintain water distribution equipment		X	
maintain water storage equipment		X	
measure water quality parameters		X	
mitigate environmental impact of pipeline projects		X	
monitor water quality		X	
operate hydraulic machinery controls		X	
perform demarcation		X	
perform water treatments		X	
regulate the flow of substances in pipelines		X	
test samples for pollutants		X	
use water disinfection equipment		X	
use digital tools to optimise the exchange of information (BIM...)			X Digitalisation



sorts waste for recycling / re-use				X	Circular Economy
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
types of pipelines	X				
pipeline coating properties		X			
digital tools (BIM...)			X	Digitalisation	
recycling / reuse / life-cycle of materials/products			X	Circular Economy	

#### HEATING, VENTILATION, AIR CONDITIONING (AND REFRIGERATION) SERVICE ENGINEER

Competences	Essential (current)	Optional (current)	Anticipated	Category
apply proofing membranes	X			
conduct routine machinery checks	X			
consult technical resources	X			
handle refrigerant transfer pumps	X			
install air conditioning device	X			
install electrical and electronic equipment	X			
install heating boiler	X			
install heating furnace	X			
install heating, ventilation, air conditioning and refrigeration ducts	X			
install ventilation equipment	X			
maintain electrical equipment	X			
maintain electronic equipment	X			
operate hand drill	X			



operate hot glue gun	X	
operate soldering equipment	X	
operate welding equipment	X	
perform maintenance on installed equipment	X	
perform test run	X	
record test data	X	
resolve equipment malfunctions	X	
use measurement instruments	X	
use testing equipment	X	
work ergonomically	X	
analyse the need for technical resources		X
answer requests for quotation		X
apply technical communication skills		X
cut wall chases		X
demonstrate products' features		X
dispose of hazardous waste		X
ensure compliance with environmental legislation		X
estimate restoration costs		X
follow safety procedures when working at heights		X
install gas heaters		X
install heat pump		X
install in-floor and in-wall heating		X
install metal gas piping		X
install solar water heater		X
install wood heater		X
issue sales invoices		X
keep personal administration		X
lay pipe installation		X



lead a team	X		
order supplies	X		
perform ICT troubleshooting	X		
prepare compliance documents	X		
prepare copper pipes for use as gas lines	X		
provide customer information related to repairs	X		
provide technical documentation	X		
train employees	X		
use a computer	X		
use safety equipment in construction	X		
write records for repairs	X		
use digital tools to optimise the exchange of information (BIM...)		X	Digitalisation
sorts waste for recycling / re-use		X	Circular Economy
exchanges information correctly with internal and external stakeholders		X	Digitalisation

Knowledge	Essential (current)	Optional (current)	Anticipated	Category
electrical wiring plans	X			
electricity	X			
fluid mechanics	X			
heating, ventilation, air conditioning and refrigeration parts	X			
hydraulics	X			
mechanics	X			
refrigerants	X			



thermodynamics	X		
electronics		X	
digital tools (BIM...)			X Digitalisation
recycling / reuse / life-cycle of materials/products			X Circular Economy

### CONSTRUCTION PAINTER

Competences	Essential (current)	Optional (current)	Anticipated	Category
clean painting equipment	X			
dispose of hazardous waste	X			
dispose of non-hazardous waste	X			
follow health and safety procedures in construction	X			
follow safety procedures when working at heights	X			
inspect construction supplies	X			
inspect paintwork	X			
interpret 2D plans	X			
interpret 3D plans	X			
paint surfaces	X			
prepare surface for painting	X			
protect surfaces during construction work	X			
remove paint	X			
sand between coats	X			
snap chalk line	X			
transport construction supplies	X			
use measurement instruments	X			
use safety equipment in construction	X			



work ergonomically	X				
work safely with chemicals	X				
advise on construction materials				X	
answer requests for quotation				X	
blast surface				X	
build scaffolding				X	
calculate needs for construction supplies				X	
install construction profiles				X	
keep personal administration				X	
keep records of work progress				X	
maintain equipment				X	
maintain work area cleanliness				X	
mix paint				X	
monitor stock level				X	
operate rust proofing spray gun				X	
order construction supplies				X	
paint with a paint gun				X	
process incoming construction supplies				X	
recognise signs of corrosion				X	
set up temporary construction site infrastructure				X	
use sander				X	
work in a construction team				X	
use digital tools to optimise the exchange of information				X	Digitalisation
sorts waste for recycling / re-use				X	Circular Economy
	<b>Knowledge</b>	<b>Essential (current)</b>	<b>Optional (current)</b>	<b>Anticipated</b>	<b>Category</b>
types of paint		X			



digital tools	X	Digitalisation	
recycling / reuse / life-cycle of materials/products	X	Circular Economy	

## PAPERHANGER

Competences	Essential (current)	Optional (current)	Anticipated	Category
apply wallpaper paste	X			
cut wallpaper to size	X			
follow health and safety procedures in construction	X			
hang wallpaper	X			
inspect construction supplies	X			
mix wallpaper paste	X			
prepare wall for wallpaper	X			
protect surfaces during construction work	X			
remove wallpaper	X			
snap chalk line	X			
transport construction supplies	X			
use measurement instruments	X			
work ergonomically	X			
advise on construction materials		X		
answer requests for quotation		X		
calculate needs for construction supplies		X		
clean painting equipment		X		
demonstrate products' features		X		
follow safety procedures when working at heights		X		
keep personal administration		X		
keep records of work progress		X		



maintain work area cleanliness	X		
mix paint	X		
monitor stock level	X		
order construction supplies	X		
paint surfaces	X		
process incoming construction supplies	X		
tape drywall	X		
use safety equipment in construction	X		
use sander	X		
work in a construction team	X		
work safely with chemicals	X		
use digital tools to optimise the exchange of information			X Digitalisation
sorts waste for recycling / re-use			X Circular Economy

Knowledge	Essential (current)	Optional (current)	Anticipated	Category
art history	X			
types of paint	X			
types of wallpaper	X			
digital tools			X	Digitalisation
recycling / reuse / life-cycle of materials/products			X	Circular Economy

#### LACQUER SPRAY GUN OPERATOR

Competences	Essential (current)	Optional (current)	Anticipated	Category
apply spraying techniques	X			



ensure equipment availability	X			
operate lacquer spray gun	X			
remove inadequate workpieces	X			
remove processed workpiece	X			
sand between coats	X			
select spraying pressure	X			
troubleshoot	X			
wear appropriate protective gear	X			
apply precision metalworking techniques			X	
apply preliminary treatment to workpieces			X	
choose proper primer coat			X	
consult technical resources			X	
dispose of hazardous waste			X	
inspect quality of products			X	
keep records of work progress			X	
maintain mechanical equipment			X	
operate metal polishing equipment			X	
perform test run			X	
remove coating			X	
spot metal imperfections			X	
work ergonomically			X	
use digital tools to optimise the exchange of information				X Digitalisation
sorts waste for recycling / re-use				X Circular Economy
Knowledge	Essential (current)	Optional (current)	Anticipated	Category
health and safety in the workplace	X			
lacquer paint applications	X			



lacquer spray gun parts	X		
quality standards	X		
ferrous metal processing		X	
industrial paint		X	
manufacturing of cutlery		X	
manufacturing of door furniture from metal		X	
manufacturing of light metal packaging		X	
manufacturing of metal household articles		X	
manufacturing of weapons and ammunition		X	
metal coating technologies		X	
non-ferrous metal processing		X	
sanding techniques		X	
types of metal		X	
types of metal manufacturing processes		X	
types of plastic		X	
types of wood		X	
digital tools		X	Digitalisation
recycling / reuse / life-cycle of materials/products		X	Circular Economy

**SURFACE TREATMENT OPERATOR**

Competences	Essential (current)	Optional (current)	Anticipated	Category
apply health and safety standards	X			
read engineering drawings	X			
read standard blueprints	X			
wear appropriate protective gear	X			
work with chemicals	X			
maintain equipment		X		
mix chemicals		X		
monitor painting operations		X		
tend anodising machine		X		
tend dip tank		X		
tend electroplating machine		X		
tend surface grinding machine		X		
use digital tools to optimise the exchange of information			X	Digitalisation
sorts waste for recycling / re-use			X	Circular Economy
Knowledge	Essential (current)	Optional (current)	Anticipated	Category
corrosion types	X			
material mechanics	X			
quality standards	X			
anodising process		X		
dip-coating process		X		
electroplating		X		



industrial paint	X		
digital tools		X	Digitalisation
recycling / reuse / life-cycle of materials/products		X	Circular Economy

#### TRANSPORT EQUIPMENT PAINTER

Competences	Essential (current)	Optional (current)	Anticipated	Category
analyse the need for technical resources	X			
apply colour coats	X			
apply health and safety standards	X			
apply preliminary treatment to workpieces	X			
check paint consistency	X			
clean painting equipment	X			
dispose of hazardous waste	X			
ensure equipment availability	X			
fix minor vehicle scratches	X			
follow control of substances hazardous to health procedures	X			
handle chemical cleaning agents	X			
inspect paint quality	X			
keep records of work progress	X			
maintain work area cleanliness	X			
mix paints for vehicles	X			
monitor painting operations	X			
paint with a paint gun	X			
prepare vehicles for application of paint	X			
protect workpiece components from processing	X			



troubleshoot	X	
use colour matching techniques	X	
use drying equipment for vehicles	X	
use paint safety equipment	X	
use painting equipment	X	
use power tools	X	
use technical documentation	X	
add paint hardeners		X
add paint thinners		X
apply a protective layer		X
apply decorative design to vehicles		X
buff finished paintwork		X
carry out repair of vehicles		X
clean vehicle exterior		X
determine colour shades		X
ensure customer focus		X
ensure maintenance of railway machinery		X
follow safety procedures when working at heights		X
identify customer's needs		X
inspect aircraft's body		X
manage consumables stock		X
mix paint		X
operate rust proofing spray gun		X
perform general maintenance on ship exteriors		X
perform maintenance on locomotives		X
perform manual work autonomously		X
perform minor vehicle repairs		X
recognise signs of corrosion		X



remove paint				X	
remove rust from motor vehicles				X	
repair aircraft's body				X	
sand between coats				X	
set up automotive robot				X	
tend dip tank				X	
use digital tools to optimise the exchange of information					X Digitalisation
sorts waste for recycling / re-use					X Circular Economy
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
industrial paint	X				
lacquer paint applications	X				
paint spraying techniques	X				
quality standards	X				
types of paint	X				
dip-coating process		X			
fibreglass laminating		X			
mechanical tools		X			
mechanics		X			
sanding techniques		X			
teamwork principles		X			
digital tools				X	Digitalisation



recycling / reuse / life-cycle of materials/products	X	Circular Economy
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#### ASBESTOS ABATEMENT WORKER

Competences	Essential (current)	Optional (current)	Anticipated	Category
assess contamination	X			
avoid contamination	X			
disinfect surfaces	X			
investigate contamination	X			
remove contaminants	X			
remove contaminated materials	X			
store contaminated materials	X			
use personal protection equipment	X			
assess waste type		X		
assist people in contaminated areas		X		
dispose of hazardous waste		X		
ensure compliance with waste legislative regulations		X		
ensure operability of protective equipment		X		
follow safety procedures when working at heights		X		
handle chemical cleaning agents		X		
identify damage to buildings		X		
operate pressure washer		X		
perform demarcation		X		
report on building damage		X		
secure working area		X		
use solvents		X		
use digital tools to optimise the exchange of information			X	Digitalisation



Knowledge	Essential (current)	Optional (current)	Anticipated	Category
asbestos removal regulations	X			
contamination exposure regulations	X			
health, safety and hygiene legislation	X			
hazardous materials transportation		X		
hazardous waste storage		X		
hazardous waste treatment		X		
digital tools			X	Digitalisation

#### BUILDING EXTERIOR CLEANER

Competences	Essential (current)	Optional (current)	Anticipated	Category
apply spraying techniques	X			
assess contamination	X			
avoid contamination	X			
clean building facade	X			
clean building floors	X			
identify damage to buildings	X			
operate pressure washer	X			
remove contaminants	X			
secure working area	X			
use personal protection equipment	X			
assess waste type			X	
build scaffolding			X	



carry out pressure washing activities				X	
clean glass surfaces				X	
clean wood surface				X	
disinfect surfaces				X	
dispose waste				X	
follow safety procedures when working at heights				X	
handle chemical cleaning agents				X	
identify damage to public space				X	
maintain cleaning equipment				X	
perform cleaning activities in an outdoor environment				X	
perform demarcation				X	
report on building damage				X	
sort waste				X	
use solvents				X	
use digital tools to optimise the exchange of information					X Digitalisation
sandblasting façades					X /
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
cleaning industry health and safety measures	X				
cleaning techniques	X				
graffiti removal techniques		X			
microbiology-bacteriology		X			
waste management		X			
digital tools				X	Digitalisation



CHIMNEY SWEEP

Competences	Essential (current)	Optional (current)	Anticipated	Category
advise on potential safety hazards concerning heating systems	X			
carry out chimney pressure testing	X			
check chimney's conditions	X			
clean chimney	X			
clean ventilation system	X			
dispose soot from the sweeping process	X			
examine ventilation system	X			
maintain customer service	X			
measure pollution	X			
protect surrounding area during chimney sweeping process	X			
report chimney defects	X			
use chimney sweeping equipment	X			
use personal protection equipment	X			
advise on heating systems energy efficiency			X	
advise on pollution prevention			X	
analyse energy consumption			X	
create chimney inspection reports			X	
drive vehicles			X	
follow safety procedures when working at heights			X	
inform customers environmental protection			X	
keep personal administration			X	
maintain relationship with customers			X	
manage a small-to-medium business			X	
provide customer follow-up services			X	
work ergonomically			X	



work in outdoor conditions					X	
use digital tools to optimise the exchange of information						X Digitalisation
exchanges information correctly with internal and external stakeholders						X Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category		
domestic heating systems	X					
fire safety regulations	X					
personal protective equipment	X					
pollution prevention	X					
ventilation systems	X					
energy		X				
energy performance of buildings		X				
environmental engineering		X				
environmental policy		X				
eco-driving			X	Circular Economy		
digital tools			X	Digitalisation		

**CHIMNEY SWEEP SUPERVISOR**

Competences	Essential (current)	Optional (current)	Anticipated	Category
coordinate the activities of chimney sweeps	X			
enforce chimney sweeping quality standards	X			
enforce safety procedures when working at heights	X			



examine ventilation system	X				
handle customer complaints	X				
maintain customer service	X				
maintain relationship with customers	X				
perform resource planning	X				
report chimney defects	X				
train chimney sweeps	X				
advise on heating systems energy efficiency				X	
advise on pollution prevention				X	
advise on potential safety hazards concerning heating systems				X	
analyse energy consumption				X	
clean chimney				X	
clean ventilation system				X	
create chimney inspection reports				X	
drive vehicles				X	
ensure compliance with environmental legislation				X	
ensure compliance with waste legislative regulations				X	
inform customers environmental protection				X	
manage a small-to-medium business				X	
measure pollution				X	
use digital tools to optimise the exchange of information				X	Digitalisation
exchanges information correctly with internal and external stakeholders				X	Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
domestic heating systems	X				
fire prevention procedures	X				
fire safety regulations	X				



personal protective equipment	X		
ventilation systems	X		
construction product regulation		X	
energy		X	
energy performance of buildings		X	
environmental policy		X	
eco-driving		X	Circular Economy
digital tools		X	Digitalisation

#### DECONTAMINATION WORKER

Competences	Essential (current)	Optional (current)	Anticipated	Category
assess contamination	X			
avoid contamination	X			
disinfect surfaces	X			
investigate contamination	X			
remove contaminants	X			
remove contaminated materials	X			
store contaminated materials	X			
wear appropriate protective gear	X			
advise on soil and water protection		X		
assist people in contaminated areas		X		
dispose of hazardous waste		X		
document analysis results		X		



ensure compliance with waste legislative regulations				X	
ensure operability of protective equipment				X	
follow safety procedures when working at heights				X	
handle chemical cleaning agents				X	
identify damage to buildings				X	
perform demarcation				X	
report on building damage				X	
secure working area				X	
test samples for pollutants				X	
apply health and safety standards				X	Health and Safety
use digital tools to optimise the exchange of information				X	Digitalisation
exchanges information correctly with internal and external stakeholders				X	Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated		Category
cleaning industry health and safety measures	X				
contamination exposure regulations	X				
decontamination techniques	X				
hazardous waste treatment	X				
health, safety and hygiene legislation	X				
radiation protection	X				
radioactive contamination	X				
hazardous materials transportation		X			
hazardous waste storage		X			
digital tools				X	Digitalisation



**BULLDOZER OPERATOR**

Competences	Essential (current)	Optional (current)	Anticipated	Category
dig soil mechanically	X			
drive mobile heavy construction equipment	X			
follow health and safety procedures in construction	X			
inspect construction sites	X			
keep heavy construction equipment in good condition	X			
move soil	X			
operate GPS systems	X			
operate bulldozer	X			
prevent damage to utility infrastructure	X			
react to events in time-critical environments	X			
recognise the hazards of dangerous goods	X			
use safety equipment in construction	X			
work ergonomically	X			
work in a construction team	X			
follow safety procedures when working at heights			X	
keep personal administration			X	
keep records of work progress			X	
monitor stock level			X	
operate construction scraper			X	
operate excavator			X	
operate grader			X	
operate heavy construction machinery without supervision			X	
operate road roller			X	
perform minor repairs to equipment			X	



secure heavy construction equipment				X	
set up temporary construction site infrastructure				X	
sort waste				X	
supply machine with appropriate tools				X	
test soil load bearing capacity				X	
transport construction supplies				X	
levels with a GPS-controlled system				X	Digitalisation
carries out earthmoving on the basis of digital plans in the on-board computer				X	Digitalisation
use digital tools to optimise the exchange of information				X	Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
excavation techniques	X				
mechanical systems	X				
mechanical tools	X				
electricity		X			
digital tools			X		Digitalisation

#### DREDGE OPERATOR

Competences	Essential (current)	Optional (current)	Anticipated	Category
collect samples	X			
follow health and safety procedures in construction	X			
maintain dredging equipment	X			
measure water depth	X			
position dredger	X			



prevent damage to utility infrastructure				X	
use rigging tools				X	
use safety equipment in construction				X	
work ergonomically				X	
clear pipelines					X
control cutterheads					X
control suction booms					X
guide placement of anchors					X
keep personal administration					X
keep records of work progress					X
operate GPS systems					X
operate bucket wheel excavator					X
operate excavator					X
perform minor repairs to equipment					X
position anchor poles					X
replace cutterhead teeth					X
secure heavy construction equipment					X
use a computer					X
calculates the quantity to be dredged					X /
use digital tools to optimise the exchange of information					X Digitalisation
performs measurements with underwater controlled equipment					X Digitalisation
<b>Knowledge</b>	<b>Essential (current)</b>	<b>Optional (current)</b>	<b>Anticipated</b>	<b>Category</b>	
dredging consoles	X				
mechanical systems	X				
excavation techniques			X		



machinery load capacity	X		
soil mechanics	X		
digital tools		X	Digitalisation
maths		X	/

#### EXCAVATOR OPERATOR

Competences	Essential (current)	Optional (current)	Anticipated	Category
dig sewer trenches	X			
dig soil mechanically	X			
drive mobile heavy construction equipment	X			
follow health and safety procedures in construction	X			
inspect construction sites	X			
keep heavy construction equipment in good condition	X			
level earth surface	X			
operate GPS systems	X			
operate excavator	X			
prevent damage to utility infrastructure	X			
react to events in time-critical environments	X			
recognise the hazards of dangerous goods	X			
supply machine with appropriate tools	X			
use safety equipment in construction	X			
work ergonomically	X			
follow safety procedures when working at heights			X	
interpret 2D plans			X	
interpret 3D plans			X	



keep personal administration				X	
keep records of work progress				X	
monitor stock level				X	
operate bulldozer				X	
operate construction scraper				X	
operate grader				X	
operate heavy construction machinery without supervision				X	
operate road roller				X	
perform minor repairs to equipment				X	
secure heavy construction equipment				X	
set up temporary construction site infrastructure				X	
sort waste				X	
test soil load bearing capacity				X	
transport construction supplies				X	
work in a construction team				X	
levels with a GPS-controlled system				X	Digitalisation
carries out earthmoving on the basis of digital plans in the on-board computer				X	Digitalisation
use digital tools to optimise the exchange of information				X	Digitalisation
carries out excavation using predetermined methods				X	/
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
excavation techniques	X				
mechanical systems	X				
mechanical tools	X				
electricity		X			
machinery load capacity		X			



digital tools	X	Digitalisation	
excavation methods	X	/	

#### PILE DRIVING HAMMER OPERATOR

Competences	Essential (current)	Optional (current)	Anticipated	Category
drive concrete piles	X			
drive steel piles	X			
follow health and safety procedures in construction	X			
inspect construction sites	X			
keep heavy construction equipment in good condition	X			
operate pile driver hammer	X			
prevent damage to utility infrastructure	X			
react to events in time-critical environments	X			
secure heavy construction equipment	X			
set up pile helmets or sleeves	X			
use safety equipment in construction	X			
work ergonomically	X			
attach protective attachments to timber piles		X		
drive metal sheet piles		X		
drive mobile heavy construction equipment		X		
drive timber piles		X		
guide operation of heavy construction equipment		X		
keep personal administration		X		
keep records of work progress		X		
operate heavy construction machinery without supervision		X		
operate press-in pile driver		X		



operate vibratory pile hammer				X	
perform minor repairs to equipment				X	
set up temporary construction site infrastructure				X	
test soil load bearing capacity				X	
transport construction supplies				X	
use remote control equipment				X	
work in a construction team				X	
limited noise pollution					X Health and Safety
use digital tools to optimise the exchange of information					X Digitalisation
determines the location of the stand with the help of GPS					X Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
crane load charts	X				
mechanical systems	X				
mechanical tools	X				
digital tools				X	Digitalisation
GPS				X	Digitalisation

#### ROAD CONSTRUCTION WORKER

Competences	Essential (current)	Optional (current)	Anticipated	Category
follow health and safety procedures in construction	X			
inspect construction supplies	X			
install frost protection materials	X			
lay base courses	X			



level earth surface	X	
pave asphalt layers	X	
perform drainage work	X	
plan surface slope	X	
prepare subgrade for road pavement	X	
prevent damage to utility infrastructure	X	
transport construction supplies	X	
use safety equipment in construction	X	
work ergonomically	X	
work safely with chemicals	X	
work safely with hot materials	X	
apply proofing membranes		X
drive mobile heavy construction equipment		X
guide operation of heavy construction equipment		X
inspect asphalt		X
install kerbstones		X
keep personal administration		X
keep records of work progress		X
lay concrete slabs		X
manoeuvre heavy trucks		X
monitor heavy machinery		X
operate bulldozer		X
operate excavator		X
operate mobile crane		X
operate road roller		X
place temporary road signage		X
process incoming construction supplies		X
remove road surface		X



set up temporary construction site infrastructure				X	
work in a construction team				X	
levels with a GPS-controlled system					X Digitalisation
use digital tools to optimise the exchange of information					X Digitalisation
rides with machines based on GPS					X Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
mechanical tools		X			
types of asphalt coverings		X			
digital tools			X		Digitalisation
GPS			X		Digitalisation

#### ROAD ROLLER OPERATOR

Competences	Essential (current)	Optional (current)	Anticipated	Category
drive mobile heavy construction equipment	X			
follow health and safety procedures in construction	X			
inspect construction sites	X			
keep heavy construction equipment in good condition	X			
operate GPS systems	X			
operate road roller	X			
prevent damage to utility infrastructure	X			
react to events in time-critical environments	X			
recognise the hazards of dangerous goods	X			
use safety equipment in construction	X			
work ergonomically	X			



work in a construction team			X		
follow safety procedures when working at heights				X	
inspect construction supplies				X	
interpret 2D plans				X	
interpret 3D plans				X	
keep personal administration				X	
keep records of work progress				X	
monitor stock level				X	
operate bulldozer				X	
operate construction scraper				X	
operate excavator				X	
operate grader				X	
operate heavy construction machinery without supervision				X	
perform minor repairs to equipment				X	
plan surface slope				X	
secure heavy construction equipment				X	
set up temporary construction site infrastructure				X	
sort waste				X	
test soil load bearing capacity				X	
transport construction supplies				X	
levels with a GPS-controlled system				X	Digitalisation
carries out assignments on the basis of digital plans in the on-board computer				X	Digitalisation
use digital tools to optimise the exchange of information				X	Digitalisation
carries out excavation using predetermined methods				X	/
	<b>Knowledge</b>	<b>Essential (current)</b>	<b>Optional (current)</b>	<b>Anticipated</b>	<b>Category</b>
compaction techniques		X			



mechanical systems	X		
mechanical tools	X		
electricity		X	
digital tools		X	Digitalisation
GPS systems		X	Digitalisation

#### SCRAPER OPERATOR

Competences	Essential (current)	Optional (current)	Anticipated	Category
dig soil mechanically	X			
drive mobile heavy construction equipment	X			
follow health and safety procedures in construction	X			
inspect construction sites	X			
keep heavy construction equipment in good condition	X			
move soil	X			
operate GPS systems	X			
operate construction scraper	X			
prevent damage to utility infrastructure	X			
react to events in time-critical environments	X			
recognise the hazards of dangerous goods	X			
use safety equipment in construction	X			
work ergonomically	X			
work in a construction team	X			
follow safety procedures when working at heights			X	
interpret 2D plans			X	



interpret 3D plans					X	
keep personal administration					X	
keep records of work progress					X	
monitor stock level					X	
operate bulldozer					X	
operate excavator					X	
operate grader					X	
operate heavy construction machinery without supervision					X	
operate road roller					X	
perform minor repairs to equipment					X	
secure heavy construction equipment					X	
set up temporary construction site infrastructure					X	
sort waste					X	
test soil load bearing capacity					X	
transport construction supplies					X	
levels with a GPS-controlled system						X Digitalisation
carries out assignments on the basis of digital plans in the on-board computer						X Digitalisation
use digital tools to optimise the exchange of information						X Digitalisation
carries out excavation using predetermined methods						X /
Knowledge	Essential (current)	Optional (current)	Anticipated	Category		
mechanical systems	X					
mechanical tools	X					
electricity		X				
machinery load capacity		X				
digital tools				X		Digitalisation



GPS systems	X	Digitalisation
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### SNOW-CLEARING WORKER

Competences	Essential (current)	Optional (current)	Anticipated	Category
adapt to different weather conditions	X			
apply measures to prevent snow removal safety hazards	X			
carry out de-icing activities	X			
complete report sheets of activity	X			
drive heavy duty trucks for snow removal	X			
follow organisational guidelines in the cleaning industry	X			
perform cleaning activities in an outdoor environment	X			
remove snow	X			
use personal protection equipment	X			
use snow-removal equipment	X			
liaise with local authorities		X		
maintain snow removal equipment		X		
operate aerial work platforms		X		
perform cleaning activities in an environmentally friendly way		X		
perform emergency street clean ups		X		
regulate traffic		X		
select hazard control		X		
drives ecologically			X	Circular Economy
rides on the basis of GPS			X	Digitalisation
use digital tools to optimise the exchange of information			X	Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category



snow removal safety hazards	X		
mechanics		X	
road traffic laws		X	
eco-driving		X	Circular Economy
digital tools		X	Digitalisation
GPS systems		X	Digitalisation

#### SURFACE MINE PLANT OPERATOR

Competences	Essential (current)	Optional (current)	Anticipated	Category
address problems critically	X			
communicate mine equipment information	X			
conduct inter-shift communication	X			
deal with pressure from unexpected circumstances	X			
inspect heavy surface mining equipment	X			
make independent operating decisions	X			
operate mining tools	X			
perform minor repairs to equipment	X			
react to events in time-critical environments	X			
troubleshoot	X			
drive vehicles		X		
ensure compliance with safety legislation		X		
operate bucket wheel excavator		X		
operate bulldozer		X		
operate dragline		X		



operate dump truck				X	
operate excavator				X	
operate front loader				X	
operate shotcreter				X	
operate spreader				X	
operate tractor				X	
drives ecologically				X	Circular Economy
rides on the basis of GPS				X	Digitalisation
use digital tools to optimise the exchange of information				X	Digitalisation
carries out assignments on the basis of digital plans in the on-board computer				X	Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
excavation techniques	X				
impact of geological factors on mining operations	X				
mechanics	X				
eco-driving			X		Circular Economy
digital tools			X		Digitalisation
GPS systems			X		Digitalisation

#### AUTOMATED CABLE VEHICLE CONTROL

Competences	Essential (current)	Optional (current)	Anticipated	Category
adhere to transpiration work schedule	X			
communicate verbal instructions	X			
follow signalling instructions	X			



inspect crane equipment	X			
stay alert	X			
analyse reports provided by passengers			X	
ensure passenger comfort			X	
operate bottom supported cable-propelled vehicles			X	
operate railway control panels			X	
operate top supported cable-propelled vehicles			X	
restrict passenger access to specific areas on board			X	
use digital tools to optimise the exchange of information				X Digitalisation
<b>Knowledge</b>	<b>Essential (current)</b>	<b>Optional (current)</b>	<b>Anticipated</b>	
cable-propelled transit	X			
health and safety measures in transportation	X			
on board hazards	X			
passenger transport regulations		X		

#### CONTAINER CRANE OPERATOR

Competences	Essential (current)	Optional (current)	Anticipated	Category
assist in the movement of heavy loads	X			
check quality of products on the production line	X			
conduct routine machinery checks	X			
inspect crane equipment	X			
load cargo onto ships	X			
maintain crane equipment	X			
operate cranes	X			



operate railway lever frames				X		
organise weight of loads according to lifting equipment capacity				X		
perform high risk work				X		
set up crane				X		
stay alert				X		
use rigging tools				X		
act reliably					X	
follow verbal instructions					X	
have computer literacy					X	
have spatial awareness					X	
perform services in a flexible manner					X	
show confidence					X	
use different communication channels					X	
work in a logistics team					X	
operate cranes ecologically					X	Circular Economy
use digital tools to optimise the exchange of information					X	Digitalisation
carries out assignments on the basis of digital plans in the on-board computer					X	Digitalisation
use remote control equipment					X	Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category		
loading charts for transportation of goods	X					
eco-driving				X		Circular Economy
digital tools				X		Digitalisation



MOBILE CRANE OPERATOR

Competences	Essential (current)	Optional (current)	Anticipated	0
drive mobile heavy construction equipment	X			
follow health and safety procedures in construction	X			
inspect construction sites	X			
interpret 2D plans	X			
interpret 3D plans	X			
keep heavy construction equipment in good condition	X			
operate GPS systems	X			
operate mobile crane	X			
react to events in time-critical environments	X			
rig loads	X			
secure heavy construction equipment	X			
set up crane	X			
use safety equipment in construction	X			
work ergonomically	X			
follow safety procedures when working at heights		X		
guide operation of heavy construction equipment		X		
keep personal administration		X		
keep records of work progress		X		
operate heavy construction machinery without supervision		X		
perform minor repairs to equipment		X		
process incoming construction supplies		X		
set up temporary construction site infrastructure		X		
set up tower crane		X		
test soil load bearing capacity		X		
transport construction supplies		X		



use remote control equipment				X	
work in a construction team				X	
drives ecologically				X	Circular Economy
rides on the basis of GPS				X	Digitalisation
use digital tools to optimise the exchange of information				X	Digitalisation
carries out assignments on the basis of digital plans in the on-board computer				X	Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
crane load charts	X				
mechanical systems	X				
mechanics	X				
electricity		X			
eco-driving			X		Circular Economy
digital tools			X		Digitalisation
GPS systems			X		Digitalisation

#### PRODUCTION PLANT CRANE OPERATOR

Competences	Essential (current)	Optional (current)	Anticipated	Category
apply various lifting techniques	X			
determine crane load	X			
determine the load's centre of gravity	X			
follow safety procedures when working at heights	X			
handle cargo	X			
liaise with the transported goods' workers	X			



operate cranes			X		
operate lifting equipment			X		
operate railway lever frames			X		
communicate using non-verbal language				X	
follow manufacturing work schedule				X	
guide cranes				X	
maintain crane equipment				X	
maximise efficiency of crane operations				X	
operate mobile crane				X	
perform high risk work				X	
perform minor repairs to equipment				X	
provide advice to technicians				X	
set up crane				X	
operate cranes ecologically				X	Circular Economy
use digital tools to optimise the exchange of information				X	Digitalisation
carries out assignments on the basis of digital plans in the on-board computer				X	Digitalisation
use remote control equipment				X	Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
crane load charts		X			
ferrous metal processing		X			
non-ferrous metal processing		X			
eco-driving			X		Circular Economy
digital tools			X		Digitalisation



TOWER CRANE OPERATOR

Competences	Essential (current)	Optional (current)	Anticipated	Category
follow health and safety procedures in construction	X			
follow safety procedures when working at heights	X			
inspect construction sites	X			
interpret 2D plans	X			
interpret 3D plans	X			
keep heavy construction equipment in good condition	X			
operate tower crane	X			
react to events in time-critical environments	X			
secure heavy construction equipment	X			
use safety equipment in construction	X			
work ergonomically	X			
work in a construction team	X			
guide operation of heavy construction equipment		X		
keep personal administration		X		
keep records of work progress		X		
operate heavy construction machinery without supervision		X		
perform minor repairs to equipment		X		
rig loads		X		
set up temporary construction site infrastructure		X		
set up tower crane		X		
test soil load bearing capacity		X		
transport construction supplies		X		
use remote control equipment		X		
operate cranes ecologically			X	Circular Economy
use digital tools to optimise the exchange of information			X	Digitalisation



carries out assignments on the basis of digital plans in the on-board computer					X	Digitalisation
use remote control equipment					X	Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category		
crane load charts	X					
mechanical systems	X					
mechanical tools	X					
electricity		X				
eco-driving			X	Circular Economy		
digital tools			X	Digitalisation		

#### DRAINAGE WORKER

Competences	Essential (current)	Optional (current)	Anticipated	Category
assemble manufactured pipeline parts	X			
clear pipelines	X			
create open drainage systems	X			
detect flaws in pipeline infrastructure	X			
follow health and safety procedures in construction	X			
inspect construction supplies	X			
inspect drainage channels	X			
inspect pipelines	X			
inspect sewers	X			
keep airport drainage systems functional	X			
manage sumps	X			



operate sumps	X				
perform drainage work	X				
prevent pipeline deterioration	X				
provide pipe bedding	X				
use safety equipment in construction	X				
analyse various types of water				X	
design drainage well systems				X	
dig soil mechanically				X	
ensure regulatory compliance in pipeline infrastructures				X	
inspect construction sites				X	
install PVC piping				X	
install drainage well systems				X	
operate GPS systems				X	
operate excavator				X	
operate pumps				X	
operate vacuum dewatering system				X	
repair pipelines				X	
set up temporary construction site infrastructure				X	
test pipeline infrastructure operations				X	
transport pipes				X	
use measurement instruments				X	
work in a construction team				X	
use digital tools to optimise the exchange of information (BIM...)					X Digitalisation
sorts waste for recycling / re-use					X Circular Economy
consults digital plans to know the necessary information about certain items					X Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
mechanical systems	X				



mechanics	X			
types of pipelines	X			
excavation techniques		X		
health and safety hazards underground		X		
types of bedding materials		X		
digital tools			X	Digitalisation

#### RAIL LAYER

Competences	Essential (current)	Optional (current)	Anticipated	Category
apply arc welding techniques	X			
apply spot welding techniques	X			
apply thermite welding techniques	X			
follow health and safety procedures in construction	X			
inspect construction supplies	X			
keep heavy construction equipment in good condition	X			
react to events in time-critical environments	X			
recognise signs of corrosion	X			
secure working area	X			
transport construction supplies	X			
use measurement instruments	X			
use safety equipment in construction	X			
work ergonomically	X			
work in a construction team	X			
coordinate construction activities			X	



drive mobile heavy construction equipment	X		
ensure rail tracks remain clear	X		
inspect railways visually	X		
install railway detectors	X		
keep personal administration	X		
keep records of work progress	X		
maintain rail infrastructure	X		
monitor ballast regulator	X		
monitor rail laying machine	X		
monitor rail pickup machine	X		
monitor tamping car	X		
operate grappler	X		
operate rail grinder	X		
operate sleeper clipping unit	X		
pave asphalt layers	X		
perform drainage work	X		
pour concrete	X		
process incoming construction supplies	X		
rig loads	X		
screed concrete	X		
set up temporary construction site infrastructure	X		
use digital tools to optimise the exchange of information			X Digitalisation
sorts waste for recycling / re-use			X Circular Economy
use visualisation systems (augmented reality...)			X Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated Category
mechanical systems	X		



mechanics	X		
rail infrastructure	X		
work trains	X		
health and safety hazards underground		X	
machinery load capacity		X	
digital tools			X Digitalisation

#### ROAD MAINTENANCE WORKER

Competences	Essential (current)	Optional (current)	Anticipated	Category
follow health and safety procedures in construction	X			
guide operation of heavy construction equipment	X			
inspect asphalt	X			
inspect construction supplies	X			
inspect road signs	X			
pave asphalt layers	X			
perform traffic sign maintenance	X			
remove road surface	X			
transport construction supplies	X			
use safety equipment in construction	X			
work ergonomically	X			
work safely with hot materials	X			
apply proofing membranes		X		
carry out de-icing activities		X		
clear accident site		X		



inspect drainage channels				X	
keep personal administration				X	
keep records of work progress				X	
lay base courses				X	
lay concrete slabs				X	
maintain equipment				X	
maintain landscape site				X	
paint with a paint gun				X	
perform minor repairs to equipment				X	
place temporary road signage				X	
provide first aid				X	
use gardening equipment				X	
work in a construction team				X	
use digital tools to optimise the exchange of information					X Digitalisation
drives a measurement vehicle					X Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
asphalt mixes	X				
mechanical tools	X				
types of asphalt coverings	X				
road signage standards		X			
digital tools			X		Digitalisation

**ROAD MARKER**

Competences	Essential (current)	Optional (current)	Anticipated	Category
dispose of hazardous waste	X			
dispose of non-hazardous waste	X			
follow health and safety procedures in construction	X			
inspect asphalt	X			
inspect construction supplies	X			
inspect paintwork	X			
operate road marking machine	X			
paint with a paint gun	X			
place temporary road signage	X			
use safety equipment in construction	X			
work ergonomically	X			
work safely with chemicals	X			
carry out pressure washing activities		X		
drive mobile heavy construction equipment		X		
guide operation of heavy construction equipment		X		
interpret 2D plans		X		
interpret 3D plans		X		
keep personal administration		X		
keep records of work progress		X		
mix paint		X		
operate motorised street sweeping machine		X		
process incoming construction supplies		X		
set up temporary construction site infrastructure		X		
work in a construction team		X		
use digital tools to optimise the exchange of information			X	Digitalisation



Knowledge	Essential (current)	Optional (current)	Anticipated	Category
road traffic laws	X			
types of paint	X			
road signage standards		X		
types of asphalt coverings		X		
digital tools			X	Digitalisation

#### ROAD SIGN INSTALLER

Competences	Essential (current)	Optional (current)	Anticipated	Category
follow health and safety procedures in construction	X			
inspect construction sites	X			
inspect construction supplies	X			
interpret 2D plans	X			
interpret 3D plans	X			
interpret traffic signals	X			
operate GPS systems	X			
operate hand drill	X			
place temporary road signage	X			
use safety equipment in construction	X			
work ergonomically	X			
handle fragile items			X	
inspect road signs			X	
keep personal administration			X	



keep records of work progress				X	
mix concrete				X	
operate mobile crane				X	
operate vibratory pile hammer				X	
pour concrete				X	
process incoming construction supplies				X	
remove road surface				X	
use measurement instruments				X	
work in a construction team				X	
use digital tools to optimise the exchange of information					X Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
road signage standards	X				
road traffic laws	X				
digital tools			X		Digitalisation

#### WATERWAY CONSTRUCTION LABOURER

Competences	Essential (current)	Optional (current)	Anticipated	Category
construct canal locks	X			
construct dams	X			
dig soil mechanically	X			
follow health and safety procedures in construction	X			
identify defects in concrete	X			
inspect concrete structures	X			



inspect construction sites	X	
install tunnel segments	X	
maintain dredging equipment	X	
manage sumps	X	
measure water depth	X	
operate pumps	X	
operate sumps	X	
perform drainage work	X	
plan surface slope	X	
use rigging equipment	X	
work in a construction team	X	
check borehole depth		X
conduct erosion control		X
conduct sediment control		X
design dams		X
develop flood remediation strategies		X
identify risk of flooding		X
insert charges into drill holes		X
inspect drainage channels		X
inspect pipelines		X
mix construction grouts		X
operate cranes		X
operate drilling equipment		X
operate vacuum dewatering system		X
perform underwater bridge inspection		X
position dredger		X
pour concrete underwater		X
read standard blueprints		X



set up temporary construction site infrastructure				X	
use digital tools to optimise the exchange of information (BIM...)				X	Digitalisation
sorts waste for recycling / re-use				X	Circular Economy
consults digital plans to know the necessary information about certain items				X	Digitalisation
Knowledge	Essential (current)	Optional (current)	Anticipated	Category	
dredging consoles	X				
excavation techniques	X				
national waterways	X				
types of waterways	X				
water policies	X				
water pressure	X				
demolition techniques		X			
European classification of inland waterways		X			
flood remediation equipment		X			
international waterways		X			
quality assurance procedures		X			
water reuse		X			
digital tools			X		Digitalisation