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Implications of the climate transition on employment, skills, and training in Belgium

FINAL REPORT

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TOWARDS A CLIMATE NEUTRAL SOCIETY

Colophon

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EXECUTIVE SUMMARY

In the face of climate change and the urgency to address it, countries worldwide pledged to reduce greenhouse gas emissions. The objective of the European Union and Belgium's federal government is to reach climate neutrality by 2050.

The climate-neutral transition is a paradigm shift that requires the implementation of numerous transformative measures to reduce greenhouse gas emissions in all sectors.

Such significant transformations have considerable impacts on the various components of the economy, including employment and training. The profound changes in the Belgian economy generate different types of labour market impacts such as the creation of new jobs, the redefinition or transformation of existing jobs, and the disappearance of jobs that have become obsolete.

Certain groups of workers are more vulnerable to these labour market developments. To achieve a just transition, it is essential to protect the most vulnerable workers by ensuring their access to decent jobs, in particular through training and retraining programmes.

To operationalize Belgium's climate transition, different pathways have been proposed and further detailed in the "Scenarios for a climate neutral Belgium by 2050" (FPS Public Health - DG Environment et al., 2021). Beyond the specificities of each pathway, this study focuses on labour market implications of the transition.

The climate transition, by its systemic nature, involves all professions, though through various degrees. A successful transition, at the required pace, can only be achieved if all actors including the workforce are climate aware and equipped with the right skills and mindset.

The transition is expected to lead to small net job gains in Belgium. However, job losses are expected in some sectors, either because of a reduction in certain activities or where actors fail to transform their activities. It is essential to look beyond statistics and recognize that every job displacement may cause worry and hardship for those affected, no matter their number. Care needs to be taken to offer them support and create new opportunities.

The transition needs to be carefully managed all along the way and to be regularly adapted based on learnings and market developments.

This study aims to evaluate the transformation of the Belgian labour market required for or induced by the climate transition. It provides some insights on labour market implications of climate neutrality pathways and proposes a set of policy considerations to mitigate risks and leverage opportunities.

Specifically, the study discusses, anchored in a participative methodology and broad literature review:

(1) **how the labour market is likely to evolve independently of the climate transition**, looking into the labour market impacts of several megatrends (such as demographic change and digitalization). Opportunities and risks between these megatrends and the climate transition are identified.
(2) **labour market impacts of the climate transition in Belgium** and the required evolutions in training and education to make the climate transition possible.
(3) **three case studies to refine the analysis and provide case-specific recommendations**: climate renovation of buildings in the Brussels-Capital region, circular economy in Flanders and digitalization in Wallonia.
(4) **overarching policy considerations**.

Main conclusions from the study are the following:

1. Megatrends such as digitalization and demographic change interplay with the climate transition

Megatrends, such as digitalization, demographic change, education and training evolutions are expected to impact the labour market and interplay with the climate transition. Megatrends provide opportunities to meet some of the labour market needs required by the transition. For instance, one of the trends in education and training is an increase in life-long learning, which will be key to upskill and reskill workers for the climate transition. Climate transition needs can even be opportunities to reduce risks associated with megatrends. A notable example is that some of the middle-skill lost jobs due to digitalization could be absorbed by the need for middle-skill jobs in the context of the climate transition. Megatrends also pose risks with regards to the transition, such as population ageing: older workers are generally harder to reskill and less economically mobile. These risks should be monitored and, as much as possible, mitigated. Finally, reflections on a just transition must go beyond the climate transition and consider the impact of all megatrends.

2. The climate transition is expected to lead to small net job gains in Belgium

Reviewed reports point to a positive net employment gain for Belgium, estimated to be between 1% (Eurofound, 2019) and 1.7% (Climact, Oxford Economics and Belgian Federal Planning Bureau, 2016) by 2030. Job creation in the context of the transition can be split into three categories: emerging jobs specifically created for the climate transition (e.g. deep energy renovation coordinator), existing jobs whose skillset need to evolve to include green skills (e.g. architects), and existing jobs whose skillset *does not* need to change (e.g. bus driver). The net positive impact on jobs is only possible if the right framework, intensified coordination and accompanying measures/policies are put in place.

3. *Impacted sectors represent about half of the jobs*

Together with the FPS Health, Food Chain Safety and Environment, we performed an exploratory analysis linking decarbonization levers with economic sectors. The aim of the analysis is to **provide a holistic view on which sectors are likely to be impacted by the transition, in terms of jobs and/or skills, and through which decarbonization levers this occurs**. We found that, in Belgium, directly impacted sectors represent 25% of jobs while indirectly impacted sectors 20%. Sectors that are not significantly impacted have a slightly higher labour intensity (jobs per added value).

4. *Job impacts are unevenly distributed among Belgian sectors*

EU-level and country-wide studies estimate the transition to affect sectors differently**.** Though the literature on Belgium is limited, current evidence suggests this applies to Belgium as well. Sectors estimated to have the most net job gains by 2030 are, among modelled sectors and in absolute terms, the **service sector and the construction sector**, followed by the manufacturing industry, transport and communications, and agriculture (Climact, Oxford Economics and Belgian Federal Planning Bureau, 2016). The energy sector is estimated to witness a limited net job loss, most likely because of a reduction in fossil-fuel demand (thus impacting fossil fuel-producing and refining industries). However, it hides job growth in the renewable energy sector. The literature suggests (The Shift Project, 2021) there may be great differences within aggregated sectors, for instance, in the transport sector: significant net job gains in the biking sector and losses in the automotive sector. **Therefore, we recommend a new study on the matter, with a more detailed estimation of job gains and losses across sectors and sub-sectors in Belgium.**

5. *New skills are necessary in the Belgian workforce*

The transformation of the Belgian economy, on top of mobilizing existing skills (e.g. driving a train), will require additional skills (e.g. installing heat pumps). In some cases, these new skills will be required from workers in existing professions, e.g. heating system specialist installing heat pumps. In other cases, these skills will be required from workers in "emerging green professions", e.g. climate renovation coordinator or off-shore wind turbine engineer.

6. *With appropriate support, skills may be transferable from carbon-intensive to low-carbon activities*

The literature suggests that skills may be transferable from carbon-intensive to low-carbon activities, depending on the sector, workers' prior experiences (OECD, 2019) and reconversion support. Transferability is facilitated because science, engineering, and technical skills are typically in high demand in both brown 'fossil fuel' occupations and green occupations. For instance, there is much reconversion potential for workers in the fossil-fuel vehicles sector to low-carbon vehicles and biking sector. Successful reconversions from brown activities to low-carbon activities have the potential to both (1) reduce unemployment tied to job losses in brown activities and (2) supply needed skills in green activities. *Public authorities have a key role to play in supporting reconversions, including insuring the availability and affordability of reskilling trainings.*

7. All skills level may benefit from the transition

The transition is expected to require workers of all skills level. Furthermore, the impact of the transition across the skills and income distribution is estimated to be balanced to some degree. In the short term, initiating the transition may benefit more high-skilled labour. However, studies projecting in the medium term (2030) suggest much of the net employment creation is expected at the low- and medium- skilled levels. For instance, many buildings renovation, waste management and circular economy jobs are middle and low skilled jobs. In the long run (2050), these same sectors may also favour higher skills as they will integrate finer technologies and become more capital-intensive. Hence, all skills level may benefit from the transition, though with varying temporalities. It is worth noting that the need for middle-skilled labour in the transition context may help to mitigate polarisation of the labour market.

8. Key messages from case studies

The three cases highlight the need (1) to **reskill/upskill existing workers through life-long learning programs** and (2) to **adapt training and education curricula so that the right skills are taught**.

a. *Deep renovation of buildings*: the Belgian construction sector is expected to be one of the most directly impacted sectors by the climate transition. We estimate that 130 thousand sustained jobs are necessary for the period up to 2050 to renovate the Belgian buildings stock, of which 59 thousand are in the construction sector.

b. ***Circular economy:*** The transition to a circular economy could contribute up to 32% of GHG emission reduction by 2050. Similarly to the renovation of buildings, this transition is expected to require a high number of jobs. Specifically, for Flanders, 30 thousand additional jobs are expected by 2030, with the biggest potential in machinery repair, rental and leasing and repair sectors (Willeghems & Bachus, 2019).

c. *Digitalization*: there is an ongoing debate among experts on whether digitalization will contribute or impede GHG reduction efforts. However, it is clear that there are both opportunities and risks to be aware of. In any case, digitalization is likely to lead to job transformations more than losses or gains.

9. Overarching policy considerations:

Significant changes to policies and to regulations are necessary (1) to accompany the transformation of the labour market required for the climate transition and (2) to reach a fair distribution of the impacts of the transition across individuals and economic actors.

9.1 Equip learners and educators with the knowledge and skills needed for the climate transition.

Less than 5% of the courses taught in universities and 2.2% in university colleges in Belgium cover climate and environmental challenges (The Shifters, 2022). Overall, more than 60% of higher education programs in Belgium do not contain any course referring to these topics. Furthermore, various studies find that teaching institutions in key transition sectors, such as construction,

do not sufficiently include energy-climate skills and circular practices in their curricula (Conseil Central de l'Economie, 2021). We propose to:

A) **Add a climate change and sustainability module in all educational programmes**, at all levels. An example of best practice is the University of Barcelona, which will offer a mandatory "Climate Crisis" module to all students (Burgen Stephen, 2022).
B) **Revise educational programs and offering new ones** to ensure the skills required for the climate transition are taught.

9.2 Support the energy-climate reskilling and upskilling of workers.

A maximum of 5% of workers, managers, and decision-makers received an education which included climate and environmental issues (The Shifters, 2022). Upskilling training aims to *update existing skills* to accompany *job changes*, for instance, training on low-carbon materials for architects. Reskilling training intends to teach *new skills* to take on a *different job,* for example, training for industry electricians to become managers in renewable energy. On the one hand, these trainings are important to equip the workforce with necessary skills to carry out the climate transition. On the other hand, upskilling/reskilling trainings help workers remain employed, whether through keeping their job or professional reconversion. The public sector has an important role to play to:

A) **Ensure relevant reskilling and upskilling trainings are available to workers**.
B) **Ease training access,** through **fiscal incentives** pinpointed to training initiatives for companies (especially SMEs) and **centralizing information** on training opportunities and financial support on a single platform.

9.3 Attract current and potential workers towards jobs related to the low-carbon transition

Workers need to be attracted to carry out energy-climate jobs. This will be especially challenging in the construction sector, where many workers will be needed, while the sector is already experiencing large workforce shortage. Information regarding opportunities linked to future occupations and skills needed for the low-carbon transition is currently scattered. We propose to:

A) **Centralize and broadcast information on education, training, and job opportunities** related to the low-carbon transition
B) **Boost women employment in transition sectors,** as women are under-represented in these sectors
C) **Improve the integration of foreign workers to help fill shortages** in transition activities

9.4 Ensure decent working conditions for climate transition jobs

Ensuring decent work conditions for jobs created by the transition is key for (1) the transition to be just and (2) to attract workers towards these jobs. There is indeed a risk of inadequate conditions in several transition activities, including climate renovation activities or circular business models such as servitization or sharing platforms. We propose to:

A) **Map transition jobs most at risk** of inadequate working conditions
B) **Design/reinforce policies to safeguard decent working conditions**, such as controls, social inspections, and strict social criteria in public tenders

9.5 Enhance joint action and cooperation between actors

Limited dialogue on education and training needs related to the climate transition can induce a duplication of initiatives, increased expenditure and increased complexity for the beneficiaries. Effective governance and coordination will be key to transform the economy and the labour market. We propose to:

A) **Increase collaboration between all governmental levels** to design & implement a climate transition education & training strategy
B) **Increase collaboration between private and public entities**

10. Next steps

As a next step to this study, co-construction of a joint action with all relevant stakeholders should be the focus to move from a report with a list of considerations to concrete and fast actions. The federal administration can play a role in the emergence, facilitation and coordination of such co-construction and joint action process.

The study has been realised by CLIMACT with the support of HIVA - Research Institute for Work and Society from KU LEUVEN and LENTIC from Liège University. Many stakeholders have been associated with the research; we thank them for their valuable inputs. However, the insights provided in the study are the sole responsibility of the authors.

This study collects and structures numerous relevant elements to support policy makers in best navigating the transition. It provides a structured list of more than twenty policy actions, with varying level of maturity.

Resources and timings did not allow to perform an economy-wide macro-economic study on job impacts of the transition. Input/output quantitative analyses would complement this study (although modelling the quantitative impacts also present limitations due to complexity and uncertainty).

The study focuses on mitigation of greenhouse gas emissions; labour market evolutions linked with climate adaptation are not covered and need to be further studied.

1. INTRODUCTION

1.1 Context

In the face of climate change and the urgency to address it, countries worldwide have committed to implement (new) measures. Under the UN Framework Convention on Climate Change (UNFCCC), 193 nations and the European Union have agreed to the Paris Agreement. This legally binding international treaty sets long-term goals, among which to "substantially reduce global greenhouse gas emissions to limit the global temperature increase in this century to 2 degrees Celsius while pursuing efforts to limit the increase even further to 1.5 degrees" (United Nations, 2020).[1] This transposes into reaching an equilibrium between anthropogenic greenhouse gas emissions and removals, also known as climate neutrality. Climate neutrality necessitates a systemic transition towards a decarbonised economy at all levels – international, national, regional and local.

The European Union and Belgium's federal government are aiming at climate neutrality by 2050. As early as 2011, the European Union ambitioned to reduce greenhouse gas emissions by 80 to 95% by 2050 compared to 1990 levels. In 2019, the European Green Deal went one step further as it stated the aim for Europe to be climate-neutral by 2050 and this objective has been anchored in the European Climate Law adopted in 2021. Belgium's federal policies also have evolved to address GHG emission reduction goals, through the Inter-federal Energy Pact in 2017 and the National Energy and Climate Plan in 2019 for instance. Belgium approved its long-term strategy in February 2020 and subsequently submitted it to the EU in accordance with the Governance Regulation, as well as to the UNFCCC. However, climate neutrality by 2050 is not stated in Belgium's long-term strategy. The four governments in Belgium committed to reviewing the strategy, agreed upon in 2020 and which is seen as a "'minimum' engagement". In 2021, the federal administration published a prospective analysis on the different scenarios to reach climate neutrality in Belgium by 2050 (FPS Public Health - DG Environment et al., 2021).[2] The objective of this document is to support the elaboration of visions, long term strategies and policies in the context of climate neutrality by 2050.

Yet, the transition towards climate neutrality needs to be a just transition as well. The concept of a just transition has been defined by the International Labour Organization (ILO) (2021) as "greening the economy in a way that is as fair and inclusive as possible to everyone concerned, creating decent work opportunities and leaving no one behind" (International Labour Organization, 2021). This concept can now be found in climate-related international agree-

[1] United Nations. (s. d.). *The Paris Agreement*. https://www.un.org/en/climatechange/paris-agreement

[2] The study was based on the *2050 Pathways Explorer – Belgium* developed by Climact.

ments and policies: both the Paris Agreement in 2015 and the Solidarity and Just Transition Silesia Declaration in 2018 highlighted the need of decent and quality jobs as part of the climate transition. The European Green Deal also intends to guarantee a just transition by protecting vulnerable workers and enabling access to professional reconversion programs and to jobs in emerging sectors. The just transition is included in Belgium's climate policies as well. A conference on a just transition for Belgium, spearheaded by the Minister of Climate, Environment, Sustainable Development and Green Deal, will be carried out in 2023. It should involve all stakeholders and seek to respond to the question 'How to implement a just transition in Belgium' (Institut fédéral pour le Développement durable, 2022). In 2024, a conference on just transition will be organised during Belgium's presidency of the Council of the European Union as it will be one of the priorities for Belgium within the Environment Council.

The evolution of the labour market remains indeed one of the crucial issues of this systemic transition. The transition impacts all sectors of production and consumption of goods and services, with some sectors developing, others maintaining, others transforming, and still others reducing their activities. It is essential to anticipate effects on employment, both in qualitative and quantitative terms, and on the acquisition of skills needed to best respond to these changes for the entire population.

1.2 Objectives of the study

The objective is to **inform the policy debate on the implications of the climate transition on employment and training in Belgium**. This objective is further declined into two sub-objectives:

(1) Evaluating the transformation of the Belgian labour market and training offer **required for** or **induced by** the transition to climate neutrality by 2050
(2) Formulating policy considerations

The climate transition requires the implementation of transformative measures to reduce greenhouse gas emissions in the energy production, industry, transport, buildings, agriculture and forestry, and waste sectors. Such transformations will impact all components of the economy, including employment and training. In the context of decarbonization, **some economic activities will grow** (e.g., renewable energy production, building deep renovation), others will be **transformed** (e.g., motor vehicle manufacturing, agriculture), and still others will **decline or even disappear** (e.g., oil refining). These profound changes in the economy can generate different types of impacts on the labour market, such as the **creation of new jobs**, the **transformation of existing jobs**, and the **disappearance of jobs** that have become obsolete. It is essential that workers who lose their jobs or whose jobs are transformed are accompanied through professional retraining programs. This is key to ensure the Belgian workforce possesses the necessary skills to trigger the transition and to ensure no one is left behind. **Based on our findings, we formulate policy considerations in this regard in Chapter 5.**

The results of the study aim at informing the debate in order to support not only policy makers but also all stakeholders concerned, both at federal level and at regional and community level in Belgium.

1.3 Methodology

This study discusses implications of the climate transition on Belgian employment and training. The report is divided into four sections that reflect the results of four underlying research activities:

(1) **how the labour market is likely to evolve independently of the transition**, looking into the labour market impacts of several megatrends (such as demographic change and digitalization). Opportunities and risks between these trends and the climate transition are identified;
(2) **labour market impacts of the climate transition in Belgium** and the required evolutions in training and education to make it possible;
(3) **three case studies to refine the analysis and provide case-specific recommendations**; climate renovation of buildings in the Brussels-Capital region, circular economy in Flanders and digitalization in Wallonia;
(4) **overarching policy considerations**.

Research methods included thorough literature reviews, interviews, stakeholder workshops, an input-output multiplier analysis, and an exploratory analysis linking decarbonization levers with economic sectors.

The methodology is further specified in each chapter.

2. EXISTING MEGATRENDS ARE EXPECTED TO IMPACT THE LABOUR MARKET AND INTERPLAY WITH THE CLIMATE TRANSITION

The transformation of work and training is already occurring and is driven by a series of important trends (megatrends). To adopt the appropriate policies and measures to accompany the climate transition, it is key to identify these trends and understand how the labour market is likely to evolve independently of the transition. Further, it is important to evaluate how these megatrends may interplay with the climate transition to harness opportunities and mitigate risks.

We analysed four megatrends, selected based on the literature and supported by the steering committee[3]: 1) digitalization 2) demographic changes 3) education and training; 4) public investment policies. For each, the following paragraphs provide a description of (1) the trend and its impact on the labour market as well as (2) opportunities and risks tied to the climate transition.

In terms of **research methods**, information has been collected by two means. First, experts' perceptions and discourses on the topic were gathered via semi-structured interviews on selected trends. Experts interviewed came from the public (Technifutur, VLAIO, SERV, Flanders Chancellery), non-profit (Institut Jules Destrée, IDD) and private (Microsoft) sectors. Second, this was complemented by an analysis of key papers provided by the experts.

For more information, especially on the four megatrends and their impacts on the labour market, see the annex produced by the LENTIC research team.

2.1 Digitalization

Digitalization is an ongoing megatrend that will have major impacts on the labour market. Digital and data skills will become an increasingly important part of a whole range of jobs and no job will completely escape the impact of digitalization (Deloitte & Agoria, 2023). Furthermore, being considered as a central pilar of the European climate transition political strategy, policies should be designed to harness the potential of digital solutions while mitigating risks.

Understood in a broad sense, digitalization (automation, data management, AI, etc.) is expected to lead to vast job transformation with a continuous need for digital training (life-long learning) to stay up to date. Experts interviewed were cautious to attribute a causal relationship between digitali-

[3] The steering committee played a central role in this study. It was composed of civil servants from the FPS Public Health, Food Chain Safety and Environment, from the FPS Employment, Labour and Social Dialogue, and from the Federal Planning Bureau. It defined the framework of the mission and ensured its proper execution. Further, it contributed to the study, the quality of the work and it validated major methodological choices.

zation and net job gains or losses in Belgium. Indeed, beyond the vivid discussions generated by some prospective studies on the negative impact of digital transformation on jobs (Frey & Osborne, 2017; McKinsey Global Institute, 2017; PwC, 2018) and their transposition in the Walloon context (IWEPS, 2017)[4], it is increasingly accepted that digitalization will lead mainly to job transformations rather than job losses and/or job creation. Job transformations induced by digitalization may lead to increased **job polarization: an increase in both high-skill jobs and low-skill service jobs at the expense of middle-skill and routine jobs**. This could potentially increase **inequality.** The demand for digital and data profiles will grow strongly in the coming years, while the nature of administrative profiles will radically change with more collaborative tasks linked to digital tools, requiring greater business expertise, and more soft skills to challenge the results of AI and explain them to end users.

Opportunities: **digital technologies may help curbing part of greenhouse gas emissions**, for instance by maximizing the efficiency of solar panels and wind turbines through enhanced weather predictions, using engineering algorithms to increase the lifetime of products, or facilitating energy efficiency in the buildings, transport and power sectors through smart appliances. A high level of digital literacy among the workforce and population would help in the design and use of promising solutions. **Some of the middle-skill lost jobs due to digitalization could be absorbed by the need for middle-skill jobs in the context of the climate transition** (see "Chapter 3. The climate transition is expected to lead to small net job gains in Belgium and to require mostly job transformations").

Risks: In terms of risks, **digitalization may impede the transition through its heavy carbon footprint**. Additionally, **uncertainty remains** on the extent to which expected **energy savings** from energy efficiency (enabled by digitalization) are **cancelled out due to rebound effects.** The growing use of data generates a heavy carbon footprint, for instance through non-fungible tokens and the mining of cryptocurrencies via blockchain technology. The share of greenhouse gas emissions from the digital sector and digitalization is a key issue that needs to be considered with the greatest of attention. Rebound effects, taken in a broader sense beyond the impacts of digitalization, are large: a recent literature review of above thirty studies found that over 50% of energy saved from energy efficiency measures are cancelled due to rebound effects (Brockway et al., 2021)**.** It is therefore key that technological solutions are accompanied by **behavioural changes**.

[4] Several major methodological problems and limitations were revealed such as the subjective designation of occupations likely to be fully automatable in the Frey and Osborne study (2013, 2017) (https://melbourneinstitute.unimelb.edu.au/publications/working-papers/search/result?paper=3197111).

2.2 Demographic changes

Two main drivers will contribute to demographic changes in Belgium and in Europe. **First, population size** is expected to continue to **increase**, mainly driven by **immigration**. Second, **population ageing is expected to continue in the 2050 timeframe**. Whereas the Federal Planning Bureau predicts a continuous increase in life expectancy (Bureau fédéral du Plan, 2022), this assumption is challenged by several sources who state that life expectancy **in good health** should stabilize in 2050 as already shown by recent trends (Institut pour un Développement Durable, 2020). **Population ageing will not necessarily lead to a significant decrease in the Belgian workforce**, as young seniors (55+) are expected to continue working. **More active employment policies for seniors will however be needed**.

Opportunities: **immigration could be an important source of skills and knowledge to be mobilised to address the climate transition**, which could somewhat **counterbalance several job shortages** in Belgium. For instance, immigrants could help fill in the need for a high volume of construction jobs necessary for the climate renovation of buildings, in a context of an already existing workforce shortage in the Belgian construction sector. This will however need policy actions to simplify and accelerate their access to the labour market.

Risks: In terms of risks, three aspects should be considered:

- First, population ageing will not necessarily lead to a significant decrease in the Belgian workforce, as young seniors (55+) are expected to continue working, a tendency already visible today in statistics with more than 55.5% of seniors working in 2022 (compared to 25% only in 2000). However, **more active employment policies for seniors will be needed to cope with their specificities.**
- Second, **population ageing could somewhat impede climate upskilling/reskilling efforts.** While upskilling training aims to *update existing skills* to accompany *job changes*, reskilling training intends to teach *new skills* to take on a *different job*. Indeed, **older workers are generally harder to upskill/reskill** and **participate less in formal education** and **on-the-job training**, and are **less economically** mobile (change of occupation, sector, and region (University of Cambridge Institute for Sustainability Leadership, 2020). Belgian statistics confirm that older workers are significantly less likely to follow lifelong trainings[5] (Conseil Supérieur de l'Emploi, 2021a).
- Third, at EU level, warnings that **the ageing of population raises risks of inequality** (University of Cambridge Institute for Sustainability Leadership, 2020). This is because inequalities in dimensions such as health, education, digital skills and earnings reinforce each other over the life span.

[5] By lifelong education, we understand the pursuit of "additional education and the development of further skills beyond an individual's formal or compulsory education", either for personal interests or professional development. Generally seen as "self-motivated, informal and voluntary"(Further Education - Inside Government UK, 2022).

2.3 Education and training

Experts identified **five major emerging trends** in the educational and training ecosystem susceptible to impact the Belgian labour market and the skills of the workforce:

- a **digitalization of learning and teaching**
- **knowledge transfers** between experts via digital tools
- skill transfer through **project-based** and **interdisciplinary levers**
- an increase in **life-long learning** (upskilling and reskilling)
- growing **connections between the job market** and **educational actors** in order to match training and skill needs (e.g. via in-factory training and training programs proposed by large companies to employees and/or to professionals using/installing/selling their products).

While these trends are expected to change learning and teaching in the next 30 years, some are still **at the emerging phase**; much work will be required to make them a reality (e.g., establishing a strong life-long learning culture for all). Additionally, there will be a strong need to increase **life-long learning for teachers to accompany them through these multiple changes** and to support their acquisition of new skills.

Opportunities: There are many synergies between the trends and the climate transition. Indeed, the climate transition requires **agile and interdisciplinary workers**. Additionally, **life-long learning will be key** to accompany the necessary transformation of jobs (climate reskilling). Further, a greater connection between the job market and educational actors will improve the match between training and skill needs. Lastly, an increase in private sector training **increases reskilling and upskilling opportunities** for workers. Indeed, trainings developed by sectoral funds or other third-party actors (technology vendors for instance) **may fill in some of the gaps** left by public training, even for SMEs. As an example, while heat technician public training typically does not yet include heat pump installing techniques, some heat pump producing companies provide such training. The greater speed at which private training curricula can be designed and updated is an asset in a fast-paced and continuously evolving environment.

Risks: In terms of potential conflicts with the climate transition, we identified one significant risk linked to such an increase in the private training offer. **While some training activities could help workers in their 'climate reskilling', others might be at odds with the climate transition**. In other words, if workers increasingly turn towards private companies for training, there needs to be enough public guidance to make sure that long-term key issues are correctly addressed. This is an important challenge for public training operators and public authorities.

2.4 Public investment policies

Public investment policies are defined as the political orientations taken at Belgian federal and regional levels likely to influence public expenses in the next decades. When considering the public expenses likely to support the transition to carbon neutrality in the long run, the **metaphor of war against climate change is sometimes used to emphasize the necessity to reorient public expenses on key levers to support the transition**: renovation of buildings, massive investment in public transportation, low-carbon power generation and infrastructures, profound transformation of fiscal regimes, etc. However, it is difficult for experts to anticipate budgetary choices by 2050, given the political uncertainties and the complex institutional landscape in Belgium. Therefore, interviewed experts proposed to **focus the prospective discussion on the recovery plans** recently adopted by the federal and the regional entities, in which significant investments are envisaged for the next decades.

Opportunities: **the federal and regional recovery plans have a strong emphasis on supporting the climate transition. Half of the budget** of the federal recovery and resilience plan **contributes to the objective of a transition to a low-carbon, sustainable and climate-resilient economy**. The Flemish regional plan aims to **reduce carbon emissions**, in line with the objectives of the 'Flemish Climate-Energy Plan 2030' and the national 'Long-term Climate Strategy 2050'. On the side of the Walloon Region, the regional plans including 'Get Up Wallonia!' intends to **reduce greenhouse gas emissions by 55% in 2030 and accompany decarbonization**, the development of sustainable industries and resources. Concerning the Brussels-Capital Region, the recovery plan is integrated within 'GO4Brussels 2030', the regional Plan of **Sustainable Development**, the **Good Move** plan and the Integrated **Air, Climate and Energy plan**.

Recovery plans include measures on jobs, skills, and training, which directly or indirectly contribute to the transition. In the federal recovery plan, the **building sector** is strongly targeted, which will entail actions of **reconversion to green jobs** in cooperation with the Communities and the Regions. In the **Flemish** recovery plan, different axes of action exist around the labour market and training with the objective of **making work sustainable and keeping workers skilled and competent**. A major goal is to identify unskilled people and to help them with upskilling initiatives. In the Walloon plan, the various training and skills centers will be reorganized to update the tools and infrastructures and adapt them to the expectations of the labour market. The plan insists on a massive effort for **vocational training**[6] and digital training (reskilling and upskilling), the development and updating of skills **for emerging and technical jobs**, **future jobs** and those in shortage (health, social work or food, etc.). One of the main axes of the recovery plan for Brussels relates to the economic transition: it involves a reinforced support to self-employment and training actions for the development of quality jobs.

Risks: **No major conflicts between the recovery plans and the climate transition were identified.**

[6] Education that prepares people to work as a technician or to take up employment in a skilled craft or trade as a tradesperson or artisan.

2.5 Conclusion: synergies to harness and risks to mitigate

Despite the limitation that no quantitative analysis comparing the impact of megatrends with that of the climate transition was performed, several conclusions can be drawn from our research. The megatrends discussed above will lead to major transformations of the labour market; the climate transition being only one of the transformative forces. Megatrends provide opportunities to meet some of the labour market needs required by the climate transition. For instance, one of the trends in education and training is an increase in life-long learning, which will be key to reskill workers for the climate transition. Moreover, climate transition needs can be opportunities to reduce risks associated with megatrends. A notable example is that some of the middle-skill lost jobs due to digitalization could be absorbed by the need for middle-skill jobs in the context of the climate transition. Megatrends also pose risks with regards to the transition, such as population ageing: older workers are generally harder to reskill and less economically mobile. These risks should be monitored and, as much as possible, mitigated. Finally, reflections on a just transition must go beyond the climate transition and consider the impact of all megatrends.

3. THE CLIMATE TRANSITION IS EXPECTED TO LEAD TO SMALL NET JOB GAINS IN BELGIUM AND REQUIRE NEW SKILLS

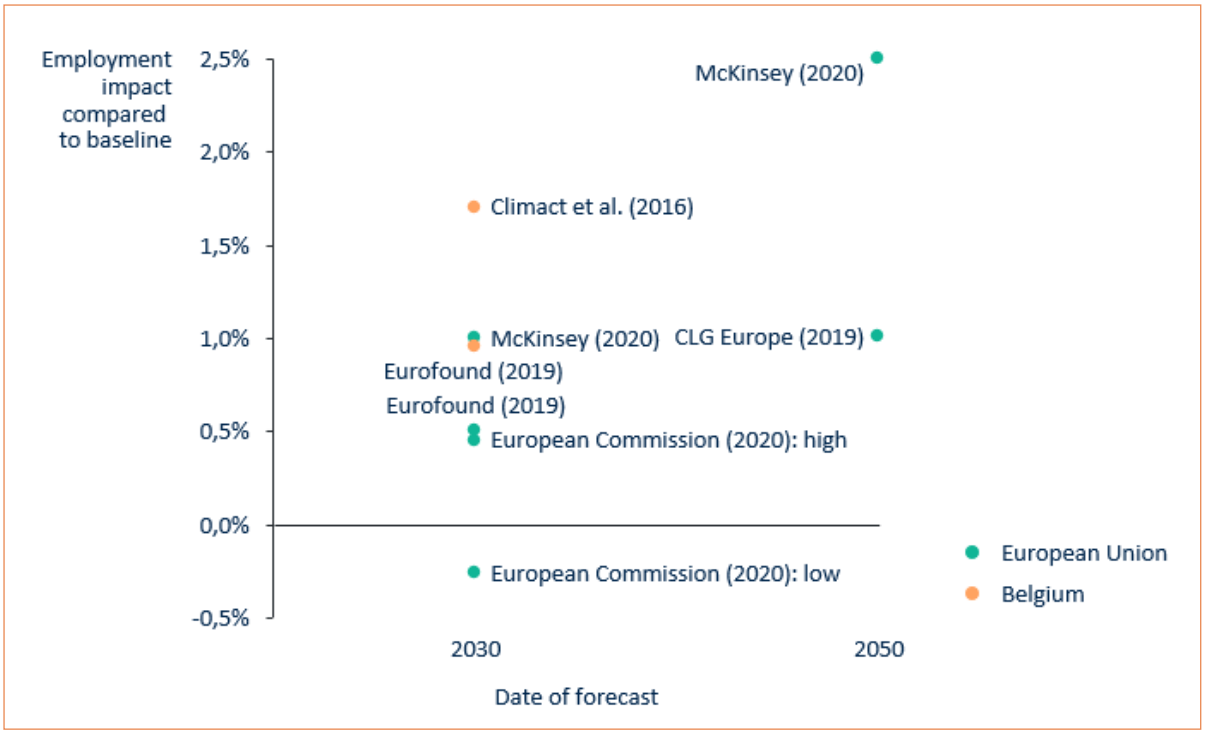
This section describes the expected job and skill impacts of the climate transition in Belgium. It is based on the insights from a thorough literature review of reports and studies at regional, national and international levels, and on an exploratory analysis on linking decarbonization levers with economic sectors, conducted with the FPS Health, Food Chain Safety and Environment.

The available literature offers a broad view of expected outcomes on the labour market induced by the climate transition. However, comparing results among studies proved somewhat difficult. Assumptions (baseline scenario, emission reduction goals, timeframe, etc.), models, and economic sector classifications differ widely among studies (see the appendix for assumptions and results from key studies). Moreover, most Belgian studies are sectoral and/or regional, i.e., they do not cover the full Belgian territory nor the full scope of the economy. Despite methodological heterogeneity, several key messages could be extracted. These will need to be refined and revised in light of new evidence.

Key messages from the literature and preliminary results were shared with stakeholders in a first workshop. Stakeholders included relevant federal and regional public administrations, business federations, trade unions, and NGOs (see the appendix for a detailed account). Stakeholders' feedbacks helped to refine the results and guide the research.

3.1 Macro-economic modelling suggests small net job gains

Quantitative studies based on conventional macroeconomic modelling point to a small net employment gain for Belgium. Indeed, at Belgium and EU levels, the climate transition, if properly managed, is expected to have a small net positive impact on total employment levels. The net impact for Belgium by 2030 is estimated to be between 1% (Eurofound, 2019) and 1.7% (Climact et al., 2016). Such gain is explained by the required increased investments to trigger low-carbon transformations, concomitant with lower spending on fossil fuel importations (de Ridder et al., 2020; Eurofound, 2019). Additionally, "low-carbon industries typically require a relatively larger workforce per unit of output", so that job gains in low-carbon industries may surpass job losses in carbon-intensive industries (Cedefop, 2013). Finally, it is also shown that policy choices to reach the required GHG emission reductions, such as for instance the implementation of a carbon price and the recycling of its public revenues in order to lower labour costs, can also have a strong impact on the net amount of jobs created.



Other studies, with different methodologies, geographical and sectoral scope, also estimated net job gains. Roland Berger (2021) estimated a creation of 30.7k jobs in energy-intensive industries in Flanders by 2035, while PWC (2019) estimated a net creation of 7.6k to 11.4k jobs in the Flemish construction sector by 2030. A study by VITO et al. (2012) estimated job impacts of transitioning to 100% renewable energy sources (RES) by 2050 in Belgium. It found that such a transition could, by the end of 2030, create an extra 20k to 60k full time equivalent jobs compared to the reference scenario. This results from a relatively large creation of additional employment through the renewable value chains. At any point in time, according to this study, renewable scenarios create more jobs than the reference scenario (Eurofound, 2019) (Cambridge Institute for Sustainability Leadership & Corporate Leaders Group Europe, 2020; De Ridder et al., 2020) (Roland Berger 2021) (PWC 2019).

Despite the overall positive estimated employment impact in the EU, disparities exist between countries, and attention should be paid to each country's context: forecasts cannot be transposed from one country to another. For instance, the *Plan de Transformation de l'Économie Française* forecasts a job contraction in the housing sector despite a heightened energy renovation demand, due to a reduction in housing space by person. In Belgium, no such contraction is expected. One of the suggested reasons is that Belgium has a "relatively old building stock, and major needs for renovation and retrofitting of dwellings to improve energy efficiency" (European Commission, 2019), which will require a high number of workers.

Figure 1. Employment impact of the low carbon transition according to key studies
[In EU and Belgium, by 2030 and 2050, % difference from baseline]

Sources: McKinsey (2020), Climact et al. (2016), CLG Europe (2019), Eurofound (2019), European Commission (2020)

Job creation in the context of the transition can be split into three categories (adapted from European Commission, 2019)**:**

- **Emerging jobs** specifically created for the climate transition (e.g., deep energy renovation coordinator),
- **Existing jobs whose skillset need to evolve** to include green skills (e.g., architects),
- **Existing jobs whose skillset *does not* need to change** (e.g., bus driver).

Emerging jobs are new in the sense that they involve new activities and skills. However, with appropriate training, they can be carried out by existing profiles. We will further develop this point in section 3.4.

3.2 Macro-economic modelling suggests job impacts to be unevenly distributed among Belgian sectors

The transition is expected to affect sectors differently. This stood out from our review of EU-level studies (Eurofound, 2019; Cambridge econometrics, 2021) and country-wide studies (e.g. France: The Shift Project, 2021), with varying levels of net job growth in certain sectors and losses in others. Although the literature on Belgium is limited, current evidence suggests this applies to Belgium as well. Climact, Oxford Economics and Belgian Federal Planning Bureau (2016) is the main accessible study quantitively estimating the impact of the transition on a selection of Belgian sectors. It is complemented by other studies, such as Roland Berger (2021) and PwC (2019), which estimated employment impacts for a single sector.

According to Climact, Oxford Economics and Belgian Federal Planning Bureau (2016), sectors estimated to have the most net job gains by 2030 among modelled sectors are, in absolute terms, the **service sector and the construction sector**, followed by the manufacturing industry, transport and communications, and agriculture (see Figure 2). The energy sector is estimated to witness a net job loss. This negative figure likely arises (mostly) because of a reduction in fossil fuel demand, which would negatively impact fossil fuel producing and refining industries. However, it hides job growth in the renewable energy sector.

In relative terms, the construction sector is the most positively impacted (+12%), followed by agriculture (+6%), transports and communications (+3%), and manufacturing (+2%). The energy sector is the only negatively impacted sector (-13%).[7]

There are several caveats to take into consideration. As the authors remark, "market imperfections, real world inefficiencies, consumer preferences, costs resulting from climate change, potential lock-ins or co-benefits are not always fully represented by any single macroeconomic model". Additionally, the agriculture sector is not fully represented in the macroeconomic models used

[7] We calculated the impact in relative terms. We could not estimate "other market services" in relative terms due to the absence of a clear definition in the study.

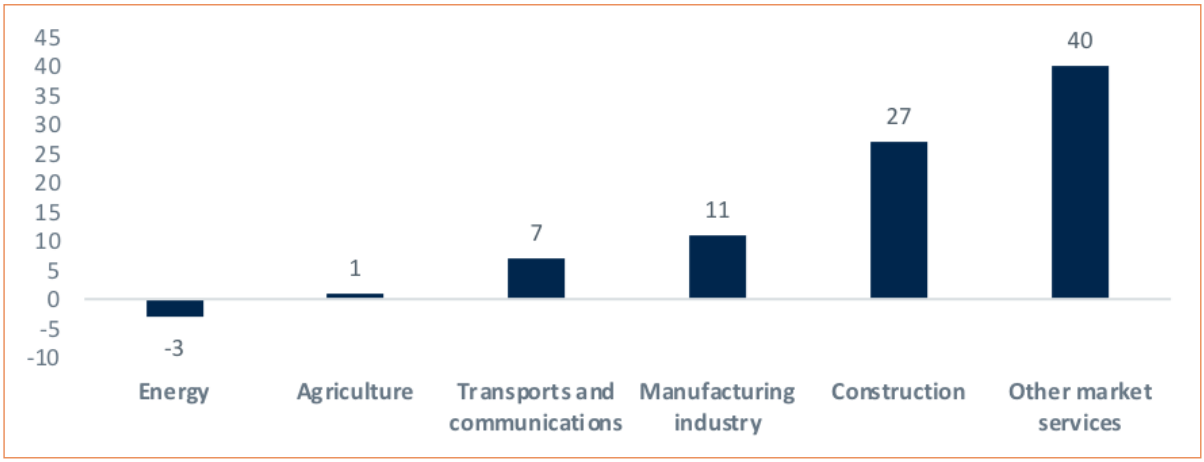


Figure 2. Employment impact of the low carbon transition on a selection of Belgian sectors
[By 2030, net job impact in thousands of jobs]

Source: Climact, Oxford Economics and Belgian Federal Planning Bureau (2016)

in the study. Further, the study assumed an 80% greenhouse gas emissions reduction by 2050 instead of climate neutrality. Lastly, similarly to most studies in the literature, a strong reduction in indirect emissions (emissions resulting from activities in Belgium but emitted outside of Belgium) does not seem to be in the scope of the emission reduction pathway.

Net job gains in Belgian sectors may hide large variation within subsectors, with potential net job losses in several subsectors. For instance, although net job gains are expected in the sector "transport and communications", net job losses may incur in the automotive sector. Indeed, the CORE-95 scenario targets less than 2 million cars by 2050, instead of over 5.5 million in 2015 (FPS Public Health - DG Environment et al., 2021). Further, the share of electric vehicles would strongly increase, and such vehicles require typically less maintenance than fuel vehicles (Alternative Fuels Data Center). In France, the PTEF[8] has anticipated a net negative evolution of jobs in the automotive sector, with a decrease of 35% by 2050 (312 000 jobs) (The Shift Project, 2021). This downward trend is explained by a reduced personal car use in favour of more public transport, carsharing and active mobility. Relocating part of the industry in France, as well as supporting the development of a French battery industry for example, would not compensate for the decrease in automotive manufacturing. The estimated shrinking of this subsector within "transport and communication" contrasts with the high estimated growth of another subsector: the biking sector. The PTEF evaluates a growth of 1221% (232 000 jobs). In light of the large expected differences within sectors, we **recommend a new study with a higher level of granularity, to ensure a refined understanding of job gains and losses in Belgium.** Such study could also consider the workers flow in between regions and/or sectors to include the geographical mobility component not addressed in the present report.

[8] Only on sectors considered as most likely to be impacted by the low-carbon transition in terms of jobs. This represents 4 million FTE and 15% of the current total workforce in France (The Shift Project, 2021).

3.3 Directly and indirectly impacted sectors could represent half of the jobs in Belgium

Given the inherent limitations of macroeconomic modelling[9], we performed, together with the FPS Health, Food Chain Safety and Environment, a complementary, exploratory analysis linking decarbonization levers with economic sectors. The aim of the analysis is to **provide a holistic view on which sectors are likely to be impacted by the transition and through which decarbonization levers this occurs**.

Our research differs from traditional macroeconomic modelling in several ways. A notable difference is that we take decarbonization scenarios as a starting point rather than induced changes in energy systems/prices. Among other things, this allows us to take into account a large range of levers/policies tied to decarbonization (e.g. behavioural and socio-economic levers) and not only energy levers/policies. Another difference is that, whereas economic sectors are typically highly aggregated and/or only a selection of sectors are covered, we covered all 64 (2-digit NACE code) sectors. However, our analysis does not provide quantitative impacts, neither at sectoral nor at a macro level, and is mostly based on expert judgement. **As such, it should be seen as *exploratory* and *complementary* to traditional macroeconomic modelling and sectoral deep dives.** For further methodological information, see the appendix.

Main results: impacted sectors represent about half of the jobs

Directly and indirectly impacted sectors represent about half of the jobs in Belgium. By direct impact, we mean that the policies aimed at activating the levers directly affect the activities concerned. For example, air transport levers and policies will directly affect aviation-related activities and indirectly affect travel agency activities. Specifically, directly impacted sectors (at 2-digit NACE code) represent 25% of jobs while indirectly impacted sectors 20% (Figure 3). To be sure, this does not mean that half of the jobs will be impacted. Rather, that half of Belgian jobs are in sectors which are likely to be significantly impacted (indirectly or directly) by the transition. Some of the jobs in impacted sectors will not be impacted, some may require additional skills, some may be created, and some destroyed. In terms of added value, 58% could be significantly impacted (28% direct and 30% indirect, see Figure 3). Sectors that are considered as not being significantly impacted have a slightly higher labour intensity (jobs per added value). "Significantly impacted" should be understood as impacted in terms of jobs gains, losses and/or job transformations (change in tasks and potentially in skills).

[9] There are several limits to traditional macroeconomic models in assessing employment impact of climate transition scenarios. Impacts are modelled mainly through changes in the energy system and changes in energy prices. This means that many socio-economic aspects of transition scenarios and their linkages (e.g. with circular and bioeconomy) are often not comprehensively captured. Additionally, behavioural changes are rarely captured, meaning value-based changes are disregarded. In other words, change only comes from a profit-maximizing motive. Disruptive changes, whether from a behavioural or technological perspective, are usually poorly reflected. Economic sectors are often highly aggregated and/or relatively many sectors are excluded from the analysis. Lastly, the scope of analysis is usually on job gains and losses, excluding job transformation.

We consider this number as a conservative estimate of the potentially impacted jobs. For instance, the public administration jobs and education jobs have not been considered as significantly impacted. Indeed, although we expect a high (indirect) impact for a limited number of jobs in these two categories, given the large volume of jobs not impacted within these categories, we decided not to consider them as "significantly impacted".

Organizations in sectors which are not categorized as significantly impacted do still have a role to play in the climate transition. Indeed, every organization has levers through which it can reduce its carbon footprint: for instance, through employee travels (encouraging travelling by train instead of plane for medium distances) or the heating of buildings. The term "significantly impacted" only considers impact in terms of jobs and/or tasks.

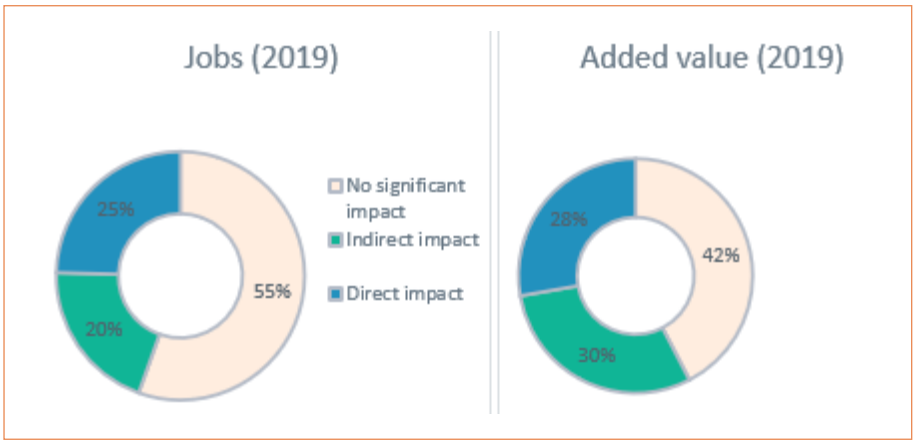


Figure 3. Sectors impacted by the climate transition, shown in terms of jobs (left) and added value (right)
[Belgium, 2019]

Table 1 shows the ten directly impacted sector with the highest number of jobs. These sectors are impacted by different levers, including buildings (top 1 construction), transport (top 2, 4, 5, 9 and 10), industry (top 3, 7, 8) and agriculture and land use (top 3, 6). The directly impacted sector with the highest number of jobs is **construction**, with 287 000 jobs (5.9% of total jobs) and 5.3% of total added value. For a detailed description of how the climate renovation of buildings will impact the construction sector, see the first of the three deep dives.

The first column lists the top 10 directly impacted sectors. The second column shows the number of jobs (thousands) for each of the top 10 sectors. The third column shows the share of this sector in the total number of jobs (%) and the fourth column shows the share of directly impacted jobs (%). Column five, six and seven show respectively the cumulative number of jobs (thousands) for each of the top 10 sectors, the cumulative share of this sector in the total number of jobs (%) and the cumulative share of directly impacted jobs (%).

To see a comprehensive list of all sectors and whether they are expected to be significantly impacted by the transition, see the appendix.

Table 1. The ten directly impacted sectors with the highest number of jobs [Belgium, 2019, in thousands of jobs or shares]

	JOBS	SHARE TOTAL	SHARE DIRECT	CML JOBS	CML SHARE TOTAL	CML SHARE DIRECT
41-43 Construction	287	5.9%	24%	287	6%	24%
49 Land transport and transport via pipelines	122	2.5%	10%	409	8%	34%
10-12 Manufacture of food products, beverages, and tobacco products	101	2.1%	8%	509	10%	42%
52 Warehousing and support activities for transportation	95	1.9%	8%	604	12%	50%
45 Wholesale and retail trade and repair of motor vehicles and motorcycles	76	1.6%	6%	681	14%	57%
01 Crop and animal production, hunting and related service activities	57	1.2%	5%	737	15%	61%
25 Manufacture of fabricated metal products, except machinery and equipment	52	1.1%	4%	789	16%	66%
20 Manufacture of chemicals and chemical products	43	0.9%	4%	832	17%	69%
53 Postal and courier activities	36	0.7%	3%	868	18%	72%
29 Manufacture of motor vehicles, trailers and semi-trailers	30	0.6%	3%	898	18%	75%

Under some simplifying assumptions, we have also mapped the sectors with the corresponding skills and with the share of employed men and women[10]. In terms of skills, **directly impacted sectors tend to have a much higher share of medium skilled workers**: 64% versus 34% for not significantly impacted sectors (see Figure 4).

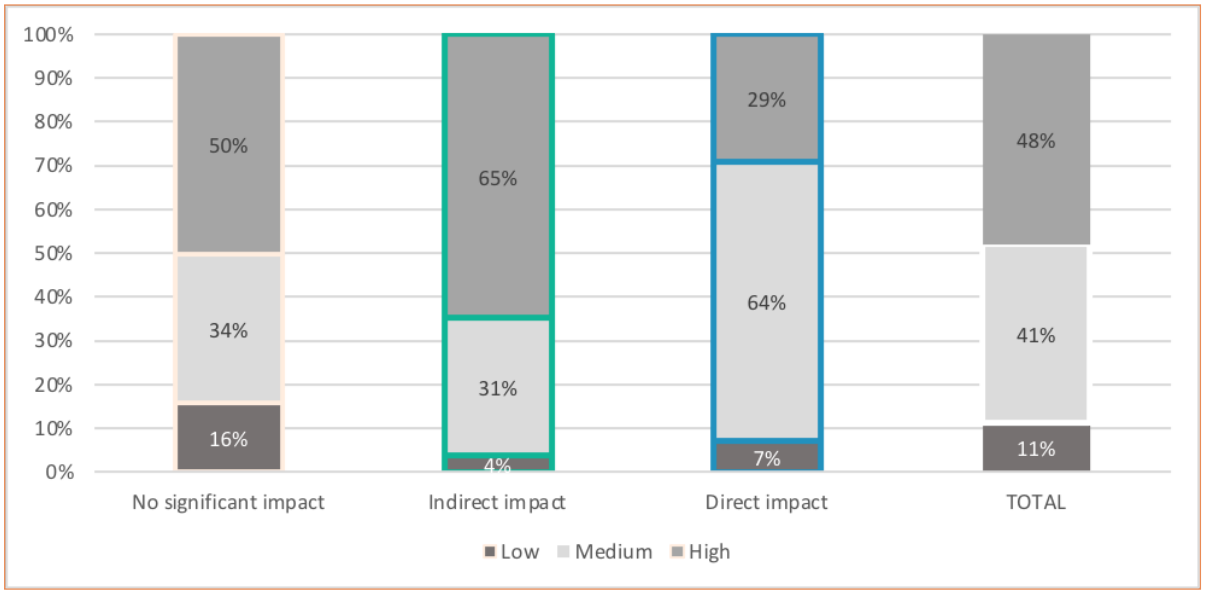


Figure 4. Skills distribution in sectors (not) impacted by the climate transition [Belgium, 2019]

[10] These results need to be used cautiously given the limitations in data from the Labour Force Survey (LFS): first, assumptions have been made to reconcile the data with the NACE-2 digit codes; second, the samples from the LFS are particularly small in some cases.

Note: some simplifying assumptions have been made with regard to sectoral attribution

Age profiles tend to be relatively homogeneously distributed within each of the three groups (no significant impact, indirect impact, direct impact) and directly impacted sectors tend to have a share of workers above 45 that is slightly higher than in the other groups of sectors.

Finally, women are clearly underrepresented in the sectors impacted by the transition. Specifically, sectors most directly impacted employ 21% of women versus 62% in sectors not significantly impacted (see Figure 5).

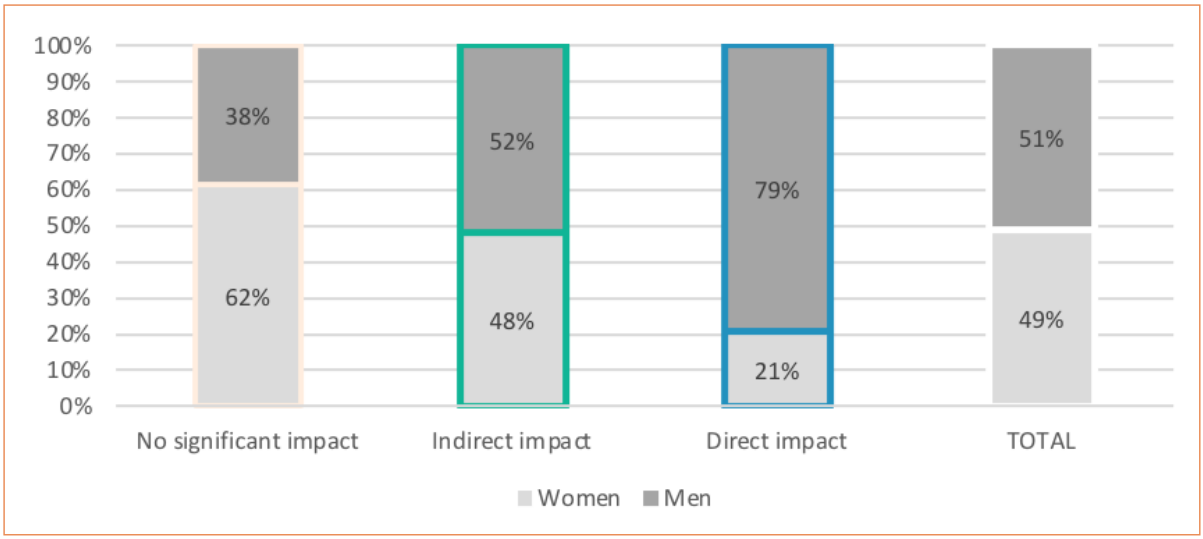


Figure 5: Share employed men – women in sectors (not) impacted by the transition
[Belgium, 2019]

3.4 The climate transition requires new skills

Beyond the creation or destruction of jobs, the climate transition will require additional skills (e.g. installing heat pumps), on top of mobilizing existing skills (e.g. driving a train). In some cases, these additional skills will be required from workers in existing professions, e.g. heating system specialist installing heat pumps. In other cases, skills will be required from workers in "emerging green professions", e.g. climate renovation coordinator or off-shore wind turbine engineer. The table below shows examples of new skills required by existing jobs in the construction sector.

Monitoring the change in supply and demand of skills tied to the transition is necessary. This is all the more important given that a mismatch between supply and demand of skills has been reported in Belgium, which recorded in 2018 "the highest level of macro-economic skills mismatches across the EU" (European Commission, 2019). Some of the reasons are linked to the poor employment rate of low-educated people, but also the lack of attractiveness for some low-skilled professions as well as the lack of certain skills in individuals.

The literature suggests skills may be transferable from carbon-intensive to low-carbon activities, depending on the sector, workers' prior experiences (OECD, 2019) and how they are accompanied in their skill development. For instance, there is much reconversion potential for workers in the fossil-fuel vehicles sector to low-carbon vehicles and biking sector. Successful reconversions from brown activities to low-carbon activities have the potential to both

Table 2. Examples of new skills required by the climate transition in the construction sector

TYPE OF CONSTRUCTION JOB	EXAMPLE OF A JOB	EXAMPLE OF SKILLS TO DEVELOP
Structural, completion and finishing work	Roofer	– Ensure water and air tightness, as well as the insulation of the pre-constructed roofing elements during the realization in workshop as well as during the assembly on site – Take into account the passage of cables of the electrical installations for photovoltaic or solar panels – Apply an external roof insulation, of the "Sarking" type
Conception work	Architect	– Analyze different possible solutions in terms of EPC – Knowing the qualities and potentials of the materials, including secondary materials – Optimizing the circularity of the building by avoiding downcycling (some consider this to be out of the architect's scope) – Integrate electrical technologies in the overall design (including charging stations) – Use the TOTEM tool to measure the environmental impact of building materials
Heating, electricity, ventilation	Heating system installer	– Increase (hybrid) heat pumps installation skills/knowledge (in the Netherlands and Germany: no more installations of gas boilers even in existing buildings) – Need to master digitization of heating systems (connected devices, interactions between the heat pump and the PV inverter, …) – Adapt to the different emerging technologies – Master the different techniques of heating and hot water production

Source: translated and adapted from Forem (2021)

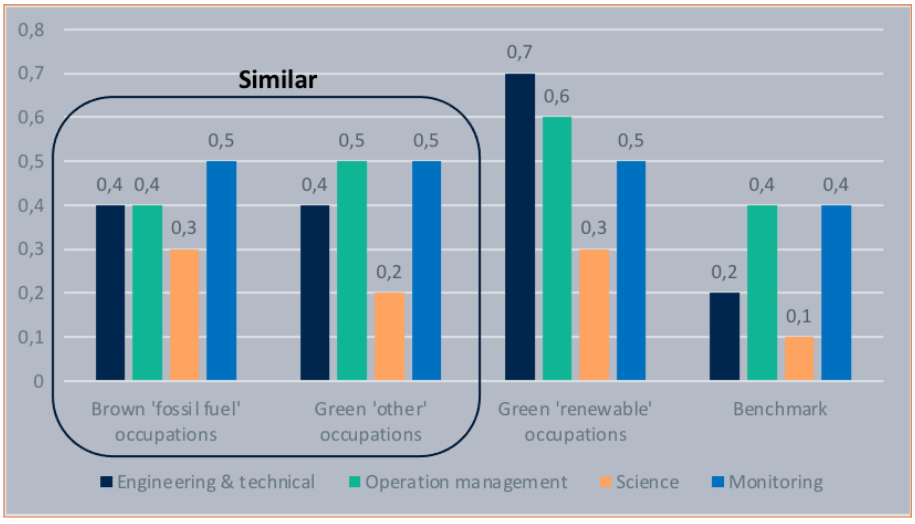


Figure 6. Skill requirements for green and brown jobs in the US [Importance of the macro groups of skills in brown and green occupations, from 0 to 1]

Source: adapted from Popp et al. (2021). "Brown 'fossil fuel' jobs are occupations that are specifically employed in fossil-fuel related industries, according to BLS-OES data for 2019." Green 'other' jobs are occupations with a high share of tasks that are green, but not related to renewable energy (wind or solar). Green 'renewable' jobs are occupations with a high share of tasks that are green and related to renewable energy (wind or solar). "The benchmark is defined as all non-green and non-brown occupations in SOC 2-digit major groups with at least one green or brown occupations".

(1) reduce unemployment tied to job losses in brown activities and (2) supply needed skills in green activities. Based on a study in the United States, the Figure 6 shows that **broad skillset requirement is similar for brown (fossil fuel) occupations and green occupations**. Indeed, science, engineering, and technical skills are typically in high demand in both brown 'fossil fuel' occupations and green occupations. The skillset is especially similar between brown occupations and green occupations that are not related to wind or solar energy (defined as "green 'other' occupations")[11].

Public authorities have a key role to play in supporting reconversions, including ensuring the availability and affordability of reskilling trainings. Learnings from previous initiatives in other countries can be leveraged. The table below provides insights from a selection of countries, for selected reconversions from an initial occupation to a new one. It shows key elements of core initial training that were assets (i.e., transferable knowledge and skills), and the mix of knowledge, hard skills and soft skills at stake in the retraining program. The main take away is that **for each reconversion opportunity, an analysis of the transferable knowledge and skills and the retraining needs should be carried out**.

Table 3. Foreign examples of occupation reconversion programs illustrate transferable skill opportunities and the need for specific retraining programs

	INITIAL OCCUPATION	CORE TRAINING	RETRAINING	NEW OCCUPATION
Denmark	Industry electrician / energy technologist	Vocational education and training (VET) qualifications / tertiary engineering qualifications	Knowledge of energy sources, ability to integrate energy systems, project management	Manager in renewable energy
	Industrial operator / industry electrician	VET qualifications / upper secondary qualifications	Assembly, installation of parts, use of tools	Wind turbine operator
Estonia	Construction worker	No professional standard	Knowledge of energy systems, data analysis, project management	Energy auditor
France	Recycling sector worker	General certificate of vocational qualification	Sorting and reception techniques, knowledge of conditioning and storage	Waste recycling operator
	Product design and services	22 initial training courses with varying specialisation	Integrating environmental	Eco-designer
United Kingdom	Commodity trader / broker	Tertiary qualification	Practical skills on functioning of carbon market, understanding of trading tools	Carbon trader / broker

Source: Cedefop (2010). From OECD Green Growth Papers (2019)

[11] Although the labour markets in the EU and in the US present large differences, the research team provides the analysis as it can contribute to better understand skills requirements for different sectors.

The need for new skills has major implications on training and education, including the adaptation of curricula and providing reskilling and upskilling training to current workers. These implications are discussed in section 5 (overarching policy considerations).

3.5 All skills levels may benefit from the transition

The transition is expected to require workers of all skills level (European Commission, 2019). Furthermore, the impact of the transition across the skills and income distribution is expected to be balanced to some degree (European Commission, 2019).

The demand for low-, middle-, and high-skilled jobs is likely to vary as the transition unfolds. In the short term, initiating the transition may benefit more high-skilled labour (European Commission, 2019). However, studies projecting in the medium term (2030) suggest much of the net employment creation is expected at the low- and medium- skilled levels (Eurofound, 2019; European Commission, 2020; Cambridge econometrics, 2021). For instance, many buildings renovation, waste management and circular economy jobs are middle and low skilled jobs. In the long run (2050), these same sectors may also favour higher skills as they will integrate finer technologies and become more capital-intensive (European Commission, 2019). **Hence, all skills level may benefit from the transition, though with varying temporalities.**

The high need for middle-skilled labour in the transition may help to mitigate polarisation of the labour market. Partly due to digitalization, future job creation is expected to polarise the labour market, i.e. an increase in high- and low-skilled labour at the expense of middle-skilled labour. The literature as well as our analysis suggests a significant need for middle-skilled labour in the context of the transition. Indeed, we found that 64% of jobs in Belgian sectors likely to be impacted by the transition are middle-skilled jobs, compared to 41% in the entire economy (see section 3.3).

Having discussed the estimated impacts of the transition on the Belgian economy, we now turn to the case studies for more depth on three selected topics.

4. THREE CASE STUDIES TO UNDERSTAND KEY CHALLENGES AND BETTER FRAME POLICY CONSIDERATIONS

4.1 Three case studies

Based on the previous analyses, the research team proposed to further explore the challenges and opportunities through in-depth studying of three cases (deep dives).

The cases were selected with the steering committee, based on their total job creation potential and the significant job and skills evolutions and transformation they represent. The aim of these deep dives is to assess more specifically the labour market evolutions within the respective cases, including job evolutions, profiles of impacted or needed workers, the need for skills generated by the transition, the adequacy between currently available skills and the needed ones, implications for training and education, and the specific impacts on vulnerable groups, including the access to decent jobs.

Together, the cases cover the three Belgian regions. The "Scenarios for a climate neutral Belgium by 2050" have been used to frame the analyses, in particular the "CORE95" scenario, which is a scenario that combines behavioural and technological levers to achieve a 95% greenhouse gas emission reduction by 2050 (FPS Health, Food chain safety and Environment, 2021). The research process was coordinated by CLIMACT. The cases are the following:

- Climate renovation of buildings, in the Brussels-Capital Region, led by CLIMACT,
- Circular economy, in the Flemish Region, led by HIVA,
- Digitalization, in the Walloon Region, led by LENTIC.

In this report, a summary of the findings of each case is presented. **Extensive reports are available as separate documents.**

Research methods differed between the cases and are fully described in each annexed report. Methods used included literature reviews, an expert/stakeholder workshop, and bilateral expert/stakeholder interviews.

The cases were presented at a second stakeholder workshop (see the appendix for the list of participants). Feedbacks helped to refine the results.

Each case below is structured as follows:

1. The necessary transformations to reach the 2050 climate objectives,
2. Labour market requirements in terms of jobs,
3. Availability of workers in a context of Belgian/regional workforce shortages (if relevant),
4. Requirements in terms of skills,
5. Training needs,
6. Considerations for a just transition and policy considerations.

4.2 Climate renovation of buildings

Climate renovation of buildings towards a carbon neutral buildings stock is central to the climate transition. While the challenge of triggering demand for climate renovation in the required pace (>= 3% yearly) remains "untackled" and is the focus of most policy measures, ensuring the availability of sufficient qualified workers across the supply and value chains (in the right volume and with the right level of skills) is important and uncertain, and is less addressed by current and planned policy measures in Belgium.

Both EU and Belgian studies forecast the construction sector to be the sector with the most net job creation due to the low-carbon transition (Climact, Oxford Economics and Belgian Federal Planning Bureau, 2016; Eurofound, 2019; Cambridge econometrics, 2021). Moreover, analysis based on linking Belgian decarbonization scenarios with economic sectors shows that construction is the largest sector directly impacted by the low-carbon transition.

A successful transition requires the availability of sufficient qualified workers in the sector and its supply chain. This is necessary, not only to have workers that are able to renovate buildings, but also to stimulate the demand for renovations. Indeed, workers such as general contractors and architects influence their clients' demands through dissemination of information and the work they propose. Obtaining the necessary skilled workforce will require recruiting additional workers and upskilling and reskilling a significant share of current workers. Current policies remain insufficient. Without a successful strategy to transform the construction labour market (and its fast implementation), **reaching the 2030 and 2050 climate targets for the buildings sector may be severely hampered.**

Beyond decarbonization, investing in building renovation can have many benefits on public budgets, such as increasing revenues from income & corporate taxation and VAT, reduced unemployment benefits costs, and lower direct & indirect health expenditures (BPIE, 2020).

4.2.1 The transformation of buildings sector to reach 2050 climate objectives

Labour market requirements stem from climate renovation objectives. In this study, we adopted the objectives of the Belgian CORE95 scenario, i.e. 95% greenhouse gas emission reduction by 2050 (FPS Health, Food chain safety and Environment, 2021), and the long-term regional renovation strategies. Main targets include:

- **More renovations**. 3% renovation rate per year. In the residential sector, this amounts to 180,000 deeply renovated dwellings a year in Belgium.
- **Deeper renovations**. Long term target of label A or 100kWh/m^2/year.
- **Fastened decarbonization of energy**. This is achieved mostly through heat pumps and district heating.

In Belgium, to achieve the 3% renovation rate objective, the renovation rate of

- non-residential buildings should be **three times higher**
- residential buildings should be **fifteen times higher** (National Climate Commission, 2021; European Commission, 2019).

To achieve these objectives at the required pace, the following practices in the buildings sector will need to be accelerated:

- **Circularity**, a key to reduce the environmental footprint of the sector.
- **Standardization and industrialization** of renovation products and processes (reduction of cost, labour intensity, shorter project lifetime, eased waste management).
- **Digitalization,** which is an enabler of circularity and industrialization.

4.2.2 Labour market requirements in terms of jobs

We estimate that 130 thousand sustained jobs are necessary for the period up to 2050 to renovate the Belgian buildings stock. Moreover, 59 thousand of these jobs would be in the construction sector, which represents about 20% of the current construction workforce. The other 71 thousand needed jobs are in construction's supply chain. Our estimations are based on regional climate

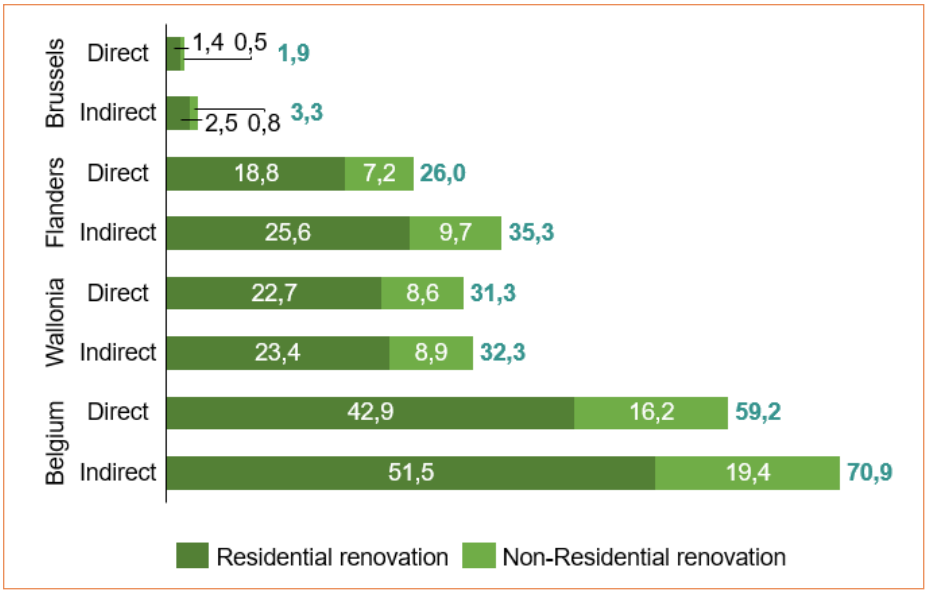


Figure 7. Required jobs per year (in thousands) in the three regions, differentiating between direct (construction) and indirect (supply chain) jobs, as well as between renovation of residential and non-residential buildings. For the detailed methodology of calculation, see appendix 6.4.

renovation budgets and input-output multipliers of the Federal Planning Bureau.

The net increased workforce demand in construction and its supply chain depends on the extent to which the demand for climate renovation is met by a retargeting of construction activities to climate renovation or is added on top of current demand. Estimations based on input-output only specify the number of required jobs, not whether these jobs are fulfilled by the current workforce or if there is a need for additional workers. According to the CORE95 scenario, newbuild activities should significantly *decrease*. This could lead to a shift of workers from newbuild to climate renovation. The extent to which this shift will take place is unknown. Therefore, the net increased workforce demand will depend on the extent to which this shift will take place (along with other shifts from current activities to climate renovation). We **expect a significant increased workforce demand** (1) given the structural workforce shortage in the construction sector, estimated at 20 thousand workers (European Commission, 2020) and (2) uncertainty on the decreased demand for newbuild.

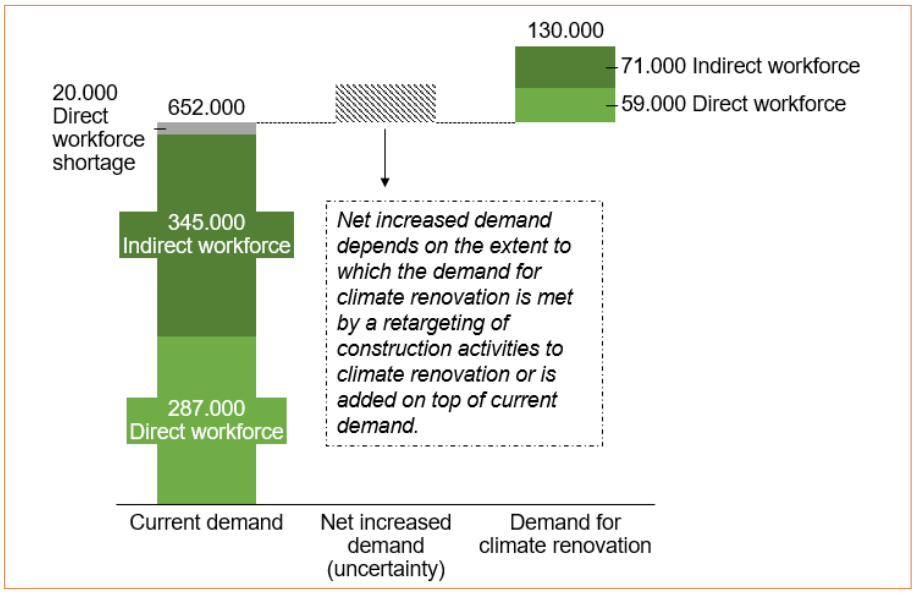


Figure 8. Evolution of direct and indirect workforce demand in the construction sector for the climate renovation of buildings (2050 climate target)

Not all jobs will be required at the same time; temporary needs will trigger peak demand for certain jobs. This leads to two challenges: (1) ensuring the sufficient availability of skilled workers during the peak and (2) making sure that, once the peak has passed, "peak" workers can find work in related activities or are successfully reconverted. We propose policy considerations to address both challenges.

4.2.3 Availability of workers in a context of workforce shortage

As explained previously, we **expect a significant increased workforce demand** (1) given the structural workforce shortage (2) uncertainty on the extent to which newbuild activities will decrease. Therefore, attracting additional workers is necessary.

The workforce shortage is, among other things, due to insufficient trainings, low attractiveness of the sector, hard work and low salary (Conseil Central de

l'Economie, 2021). Policies to tackle these causes are required and would benefit the entire construction sector.

Some profiles could fill in the gap and take on climate renovation jobs (young people, unemployed, reconversion workers, immigration workers), **but several challenges remain**:

- How to attract these profiles in a sector with low attractivity?
- How to successfully train them?
- How to support companies to hire them?

We identified solutions to these challenges, including:

- Valorising construction professions in the eyes of the public, especially the youth.
- Designing policies to facilitate the integration of women on construction sites.
- Increasing visibility on the renovation market evolution.
- Designing better policies targeting illegal work and social fraud in the buildings sector (Confédération de la Construction, 2019).

4.2.4 Requirements in terms of skills

The labour market needs/impacts of the climate renovation extend beyond the requirement of a volume of workers. To qualitatively understand the requirements as well as the impact on the job market, we clustered needs/impacts into five categories:

CATEGORY	DESCRIPTION (IN THE CONTEXT OF CLIMATE RENOVATION)	EXAMPLE
1. Emerging climate renovation jobs	New jobs created specifically for the climate renovation of buildings.	Deep climate renovation coordinator
2. Increased demand for existing jobs	Existing jobs whose demand will increase due to climate renovation but whose skill set remain unchanged	Market services (such as banking services) for climate renovation companies
3. Transformed jobs	Jobs whose skill set need to evolve to incorporate climate renovation skills.	Real estate agents
4. Increased demand and transformed jobs (combination of 2. And 3.)	Jobs whose skill set will need to evolve to incorporate climate renovation skills AND whose demand will simultaneously increase due to climate renovation.	Heating system installers
5. Lost jobs	Jobs lost due to climate renovation.	Fossil-fuel based jobs who fail to transform

The Figure 9 below gives a qualitative visualisation of the impact of the transition on each category, distinguishing between direct and indirect jobs. It is based on a non-exhaustive screening of jobs impacted by the transition.

Many **existing construction jobs** will require additional skills while simultaneously being in higher demand (category 4), including:

- **Climate renovation skills specific to each job.** For instance, skills related to insulation, ventilation, installing and monitoring new devices.

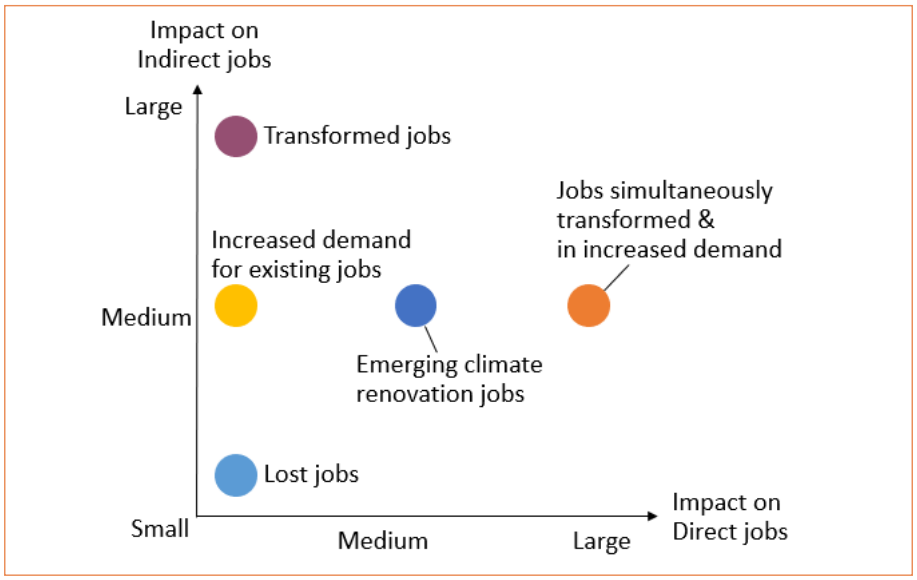


Figure 9. Qualitative estimation of the impact from the climate renovation on direct and indirect constructions jobs

- **Learning to adapt to supply chain disruptions and work with new approaches** and materials (i.e., prefabricated solutions, bio-based insulation materials, etc.)
- Adapting to **the digitalization** of work, including oversight/monitoring tools.
- **Better understanding the job of the other workers** in renovation projects, in order not to destroy their work or not to make it harder.

There are also new jobs that need to be created specifically for the climate renovation of building (emerging climate renovation jobs (category 1)). **These jobs require new skills.** They include deep climate renovation coordinator, district renovation coaches, jobs related to heat network development (facilitator, technician, urban planner) and the industry of climate-neutral heating system production (heat pumps) and its supply chain (e.g., calorific fluid), etc. In terms of skills, these jobs typically require:

- A first cycle of tertiary education diploma
- In-depth climate renovation skills and knowledge
- Technical skills (e.g. in heating, electricity, conception work)
- Transversal skills such as soft skills (management, flexibility, communication, adaptation, creativity) and digital skills to adapt to a changing market and environment

We expect a significant number of jobs that will be transformed without being in higher demand (category 3.), such as real estate agents, several jobs in public administration, and teachers for the many jobs linked to climate renovation (e.g. heating technician teacher).

Finally, we expect **limited lost jobs,** assuming a successful (1) upskilling of workers in jobs who will be transformed and (2) successful reconversion of peak workers.

4.2.5 Training needs

To ensure workers possess the necessary climate renovation skills, there is a need for (a) upskilling & reskilling current workers and (b) ensuring learners (future workers) are adequately trained.

a) **Current construction workers (in jobs linked to climate renovation) should be upskilled via short life-long trainings. Specific measures will be necessary to help upskilling construction workers.** Most construction businesses in Belgium are micro (<10 employees) and small (<50) businesses. These businesses have limited time and financial resources for upskilling and reskilling employees. To help them train workers, we propose:

- ameliorating the offer of
  - affordable, short, and practical training
  - affordable on-site training
- training subsidies modulated according to company size (greater support for smaller companies)
- incentivizing to follow climate renovation upskilling trainings by delivering a "climate renovation" certificate.
- combining temporary unemployment with climate renovation reskilling/upskilling training.

b) **Trainings for both emerging climate renovation jobs and existing construction jobs should be improved.**

- Emerging climate renovation jobs: for some jobs (e.g. deep energy renovation coordinator), trainings exist but they should be **mainstreamed** in more teaching institutions. For other jobs (e.g. district renovation coaches), there are currently no available trainings, so **new trainings should be developed.**
- Existing construction jobs (e.g. roofer): **the curriculum should be adapted to include climate renovation skills and knowledge.** Worryingly, **most job and training profiles in the construction sector have not been updated by the Francophone Service of Jobs and Qualifications (SFMQ) since 2011-2013** (Bassin EFE Bruxelles, 2021)**.** In the Flemish community, the Agency for Higher Education, Adult Education, Qualifications and Scholarships (AHOVOKS) has started a catch-up the last several years to update outdated occupational qualifications to contemporary standards, including sustainability requirements. However, no statement of a specific focus on the climate transition could be found (AHOVOKS, 2016, 2017, 2018, 2022; Baisier, 2015).

Specific measures will need to be implemented to address peak demand. The main ones are (1) increasing marketing and incentives of trainings before and during the peak and (2) making sure reconversion trainings are available after the peak.

We also **propose the creation of a special trainer status for end-of-career workers**, to tackle the shortage of construction trainers.

Finally, we propose several solutions to **enhance communication and collaboration between training stakeholders.**

4.2.6 Considerations for a just transition

From a job market perspective, we see the climate renovation as benefiting some vulnerable profiles on the labour market. Indeed, many of the jobs created are an opportunity for low skilled workers, manual workers that lost their jobs due to automation, unemployment, etc. However, adequate training will need to be available and affordable.

Since some of the current jobs in the construction sector raise questions (for instance regarding fair income, secure employment, safe working conditions, equal opportunities and treatment for all, offering prospects for personal development) (de Wispelaere, 2022; Sanen, 2021), **there is a risk that the creation of work in the context of the energy renovation reinforces inadequate working conditions.** We recommend further designing/reinforcing policies to safeguard decent working conditions, such as controls, social inspections, and strict social criteria in public tenders.

4.2.7 Policy considerations

Throughout this study, we identified policy considerations to the labour market challenges and needs tied to the climate renovation. In the last chapter of our annexed report, we summarized policy considerations into six clusters:

- **Ensuring the availability of sufficient workers** in a context of workforce shortage
- **Ensuring** learners (future workers) are **adequately trained**
- **Upskilling & reskilling the current construction workforce**, especially older and lower skilled workers.
- **Anticipating peak demand for certain jobs** and accompanying workers before, during, and after the peak
- **Addressing the shortage of construction teachers**
- **Enhancing communication and collaboration between trainings stakeholders**

4.3 Circular economy

4.3.1 The transformation to a circular economy to reach 2050 climate objectives

Global resource use has exceeded 90 billion tonnes, and this number is expected to double by 2060 (OECD, 2019). In recent years, in the slipstream of the climate transition, the debate on the circular economy has remarkably gained traction. The circular economy (CE) is introduced as an important factor to make resource use more sustainable, and to move towards 'a sustainable, low carbon, resource efficient and competitive economy' (European Commission, 2015). For Belgium, it is estimated that two thirds of the total greenhouse gas emissions are linked to material-related activities, such as manufacturing, freight transport and building activities (FPS, 2021). As such, the circular economy could contribute up to 32% of greenhouse gas emissions reduction by 2050.

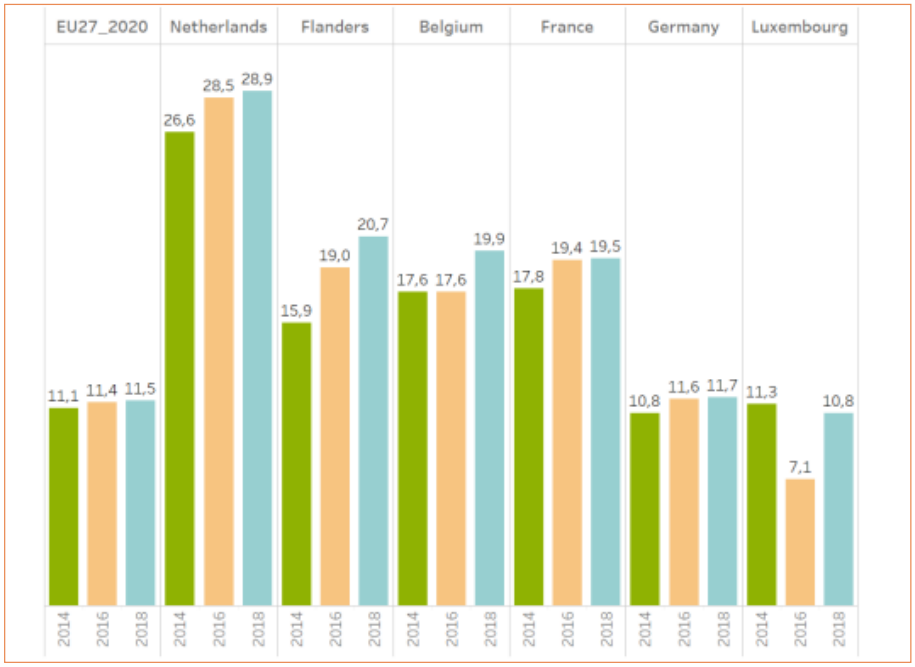


Figure 10. Cyclical material use rate (CMUR) for Belgium, Flanders and neighbouring countries

Source: Christis and Vercalsteren (2021)

Since the 1980s, Flanders and Belgium have built up a strong reputation in terms of – initially – waste management, and – more recently – progress towards a circular economy. In the 2021 Environmental Performance Review, the OECD called Flanders a 'pioneer for their initiatives for the transition to a circular economy' (2021). However, Flanders' and Belgium's progress towards a circular economy was recently measured at 21% (for data year 2018), up from 16% in data year 2014, which shows that (1) there is good recent progress, but also that (2) there is still a long road ahead[12], as is illustrated by Figure 10.

4.3.2 Labour market requirements in terms of jobs

While the circular economy is a horizontal trend that is increasingly permeating all economic sector, particularly the ones processing goods and materials (the primary and secondary sectors), there is no easily usable methodology to measure the progress of CE in economic and labour market terms. The common way to monitor employment in sectors, is using the so-called NACE codes, which classify companies according to their economic activities. However, the circular economy does not have separate NACE codes. Therefore, the research usually measures CE employment based on six NACE codes that refer to activities that are considered to be 100% circular:

DESCRIPTION	NACE CODES
Repair	33.110-33.190, 95.110-95.120, 95.210-95.290
Rental and leasing	77.200-77.299, 77.300-77.399
Waste	37.000, 38.110-38.120, 38.211-38.222, 38.310-38.329, 46.771-46.779
Maintenance of motor vehicles	45.201-45.209, 45.310-45.320, 45.401-45.402
Second-hand	47.791-47.793
Restauration of buildings	43.995

[12] Measured by the indicator 'cyclical material use rate (CMUR)', source Christis and Vercalsteren (2021).

Based on recent HIVA research, Figure 11 shows that job growth in circular sectors in Belgium exceeded general job growth between 2012 and 2020.

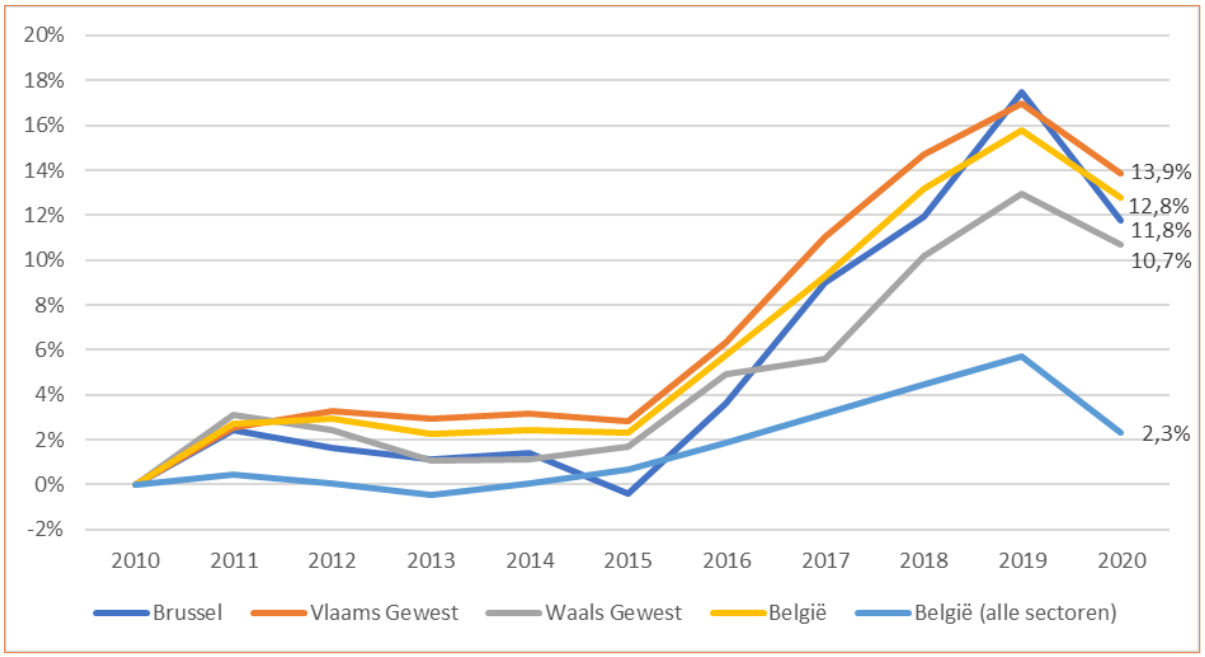


Figure 11. Evolution of the number of employees in the circular sectors (Belgium, three regions), compared to employment in the whole economy (Belgium all sectors).

Source: Multani, & Bachus (2022), based on data of the Crossroads Bank for Social Security

Looking at the future, based on existing studies for many countries, the circular economy is regarded as an engine for economic and job growth. For Belgium, a study by Cambridge econometrics found an increase in jobs of 0.3% by 2030 (European Commission. Directorate General for the Environment, Cambridge Econometrics, Trinomics, and ICF, 2018). For Flanders, 30,000 additional jobs are expected by 2030, with the biggest potential in machinery repair, rental and leasing and repair sectors (Willeghems and Bachus, 2019). This is in line with the estimates found in research concerning other regions. Moderate scenarios up to 2030 expect a median change of 0.1% on a regional level varying from 0.0 to 0.8%. In ambitious scenarios up to 2030, a median positive change of 1.6% is expected with estimations for EU countries ranging from 0.3 to 2.8%.

Generally, the sectors in which job losses could occur are mining and extraction sectors, the processing of these raw materials, and potentially sectors that produce durable goods (cars, machinery, electronics, etc.). For Flanders, these risks seem limited, although the fossil fuel industry, including oil refinery, could lose jobs in that segment. The sectors that are expected to grow are the waste sector, the repair sector, and some service sectors. Employment in the construction sector could slightly fall because of improved productivity with new (circular) building techniques, but this effect might be (more than) compensated by the acceleration of renovation activities for reasons of energy efficiency and climate change mitigation.

As soon as the circular economy unfolds, it is expected to create a shift to more labour-intensive sectors, such as repair and maintenance. However, other trends, such as continuing digitalization, and automation, could counteract this trend (European Commission. Directorate General for the Environment. et al., 2018).

4.3.3 The availability of workers in a context of Belgian/regional workforce shortages (the supply)

Knowledge for Flanders/Belgium on skills shortages resulting from the transition to a circular economy is still limited. At the end of 2023, HIVA and VITO will publish a report with more indications on what can be expected, in the framework of the MICHELLE project. What we know today, is that the circular economy (CE) will contribute to some already existing skills shortages:

- Specific CE skills, such as repair of electronic devices and clothing, already suffer from considerable skills shortages.
- Technical profiles, with a wide range of sub-profiles (electronics, mechanics, ICT, engineering, operators, automation,…) and skills levels (high, low and medium-skilled profiles) are already facing serious shortages.
- Transversal skills: our formal education systems are not always fit to deliver these profiles, and their increasing need is not only specific to the CE, but also to several other labour market trends, including the climate transition.

4.3.4 Requirements in terms of skills

In terms of skills that are needed in the transition to a more circular economy, most studies conclude that only minor changes in skills are needed. Especially in comparison to other labour market changes, the circular economy does not pose great challenges to the skills needed by workers. As a result, there is a general tendency to conclude that most jobs will require upskilling, rather than a complete new set of skills (Bachus, 2022; European Commission. Directorate General for the Environment. et al., 2018; ILO, 2019; Laubinger et al., 2020).

From the job numbers (4.3.2), we learnt that the sewage and waste sector will have the strongest job growth. Refuse workers are a category of workers that will see increased employment. Since the profile of these workers is low and medium-skilled mostly, the demand for these profiles is expected to rise. The expected new skills for such jobs are within the scope of the existing skills of these workers, which confirms the statement in the previous section that the CE can be expected to create a need for upskilling rather than transformation of jobs.

Furthermore, demand for cross-cutting skills, employees mastering several disciplines and skills, is expected to grow. This is linked with a shift to value chain thinking, where more people involved will need not only the knowledge on their own little step in the chain, but an overview of the previous and following steps in the value chain as well. As such, the importance of transversal ('soft') skills, adaptability, collaboration skills and problem-solving abilities is expected to increase.

On the highest level, entrepreneurs and CEOs will need to see the potential of market niches related to the CE, e.g. 3D-printing services, small-scale plastics recycling devices, … Furthermore, they will need to see the opportunity and necessity of making transformational shifts in terms of markets, product development, servitization, etc. to be competitive in the future (circular) economy.

Finally, the general management of SMEs will need to build (much) more strategic capacity in terms of adapting to the circular economy. Today, SMEs are lagging behind in terms of making the shift to the circular economy (Cliquot, Bachus et al., 2017).

4.3.5 Training needs

Formal education systems often lag behind on recent trends in the economy and the labour market. For instance, the increased need for transversal and value chain-oriented profiles is not well matched with the education programmes offered by universities in Flanders and Belgium, which tend to be mono-discipline-oriented.

As a result, the skills needed by the circular economy will be mostly provided by on-the-job training or in-company training. Vocational education and training (VET) will be the crucial element that governments and social partners alike will need to work on to absorb the changes smoothly (Goodwin Brown et al., 2021). It will therefore depend on the possibility, willingness and capacity of employers to train their employees whether the skill requirements will facilitate or inhibit the uptake of circular processes.

To somewhat bridge the gap, more coordination, collaboration and exchange between industry and education is needed, e.g. by having experienced sector representatives teach some classes in professional schools to get a better feel of 'the real world'. Conversely, teachers could be involved more actively in industrial companies to feel the needs and see the changes in the economy.

Lifelong learning (LLL) will be key in addressing all the changing skills needs caused by the CE. Flanders and Belgium are lagging behind in the uptake of LLL, both in terms of the participation rate and the willingness of the employees, and in terms of the willingness/acceptance/capacity to organize, allow, and fund training programmes for employers' existing staff. In this context, general recommendations to boost LLL on both sides should be taken into consideration. The recently adopted Flemish 'Action Plan LifeLong Learning' could be a step in that direction, although the Flemish Education Council (VLOR) criticized it for lacking a focus on concrete action. Examples of concrete actions taken from that plan include (1) more promotion of a positive attitude towards learning and training with individuals and (2) better guidance of employees to lead them towards the existing training offer.

4.3.6 Considerations for a just transition

The following four links between just transition and the circular economy in Flanders and Belgium can be observed. First, the CE holds a promising potential in terms of job demand for vulnerable groups on the labour market, because of the demand for low-skilled profiles and the deconcentrated nature of many CE jobs.

Second, circular business models, such as servitization or sharing platforms, could raise concerns of job security and social protection.

Third, safety nets for workers at risk of losing their jobs because of the transition are strong in Belgium, especially in industrial sectors. Moreover, most skills in those sectors are currently very much looked for in other industrial sectors, which is likely to facilitate the smooth reintegration of workers into the labour market.

And fourth, the CE holds a lot of potential for the social economy in Belgium. For instance, the social economy is an important driver of the second-hand economy (Delanoeije and Bachus, 2022). In the future circular economy, the social economy could create additional jobs in repair and maintenance, refurbishment, and reuse. These jobs will benefit vulnerable profiles in the labour market.

4.3.7 Policy considerations

The first recommendation we draw from the existing knowledge on circular jobs, is that the federal government should raise the ambition level of its circular economy policies. Accelerating the circular economy transition will not only make an important contribution to the achievement of the Belgian 2030 climate targets, but also increase resource and energy security, and boost GDP and employment.

Second, the social economy has a high potential to create circular jobs. While the competences related to the development of the social economy are predominantly on the regional level, the federal government still has an important role in supporting entrepreneurship and economic policy in general, where circular social economy accents can be integrated.

Third, in terms of skills, coordination at national level can be impactful, e.g. by using the powerful fiscal, employment, and social security competences. The focus should be on creating a culture of LifeLong Learning (LLL), the development of general technical skills, specific circular economy skills (e.g. electronics repair, sorting goods for reuse, machine maintenance), and transversal skills (e.g. collaboration, problem-solving).

Fourth, federal economic policies could be used to incentivize (1) SMEs to think about their role in the future circular economy, and (2) their CEOs to follow training and increase their awareness of and knowledge on the business opportunities the circular economy has to offer. Fifth, health and safety and other federal employment competences could follow the emergence of the circular economy with caution, to monitor the evolutions and to be able to react to risks that could arise related to working conditions in the circular economy.

Finally (sixth), to realise the circular economy transition and deal with the concomitant labour market challenges, coordination between policy levels will be important. The federal government could take up the role of initiating the concertation with the three regions; it could even be integrated in the national coordination and concertation related to the climate transition, which will be even more crucial. A national coordination point for the labour market impact of green transitions could be a way to organise this.

4.4 Digitalization

In this deep dive, we have explored the main expected opportunities and consequences of digitalization in two areas related to the climate transition: new work practices (section 1) and the expected developments in the transport and logistics sector (section 2). In methodological terms, the emergence of new work practices was explored through a brief literature review, pre-existing expertise built along various previous projects of collaborative research in companies and bilateral interviews of academic experts and key HR managers with special attention to the probable evolutions linked to digitalization when considering the CORE 95 scenario. The focus on transport and logistics results from a brief literature review and a focus group discussion with key experts and representative actors from the field with special attention to the evolutions needed to achieve the CORE 95 scenario.

4.4.1 The digital transformation to reach the 2050 climate objectives

New work practices due to digitalization

For white-collar jobs in all sectors, the future of work is presented as a combination of 3 main locations (3H): increased work from the **residence (*Home*)**, a limited number of travels to the **corporate office (*Headquarters*)** and a growing recourse to **third places (*Hub*)**, close to the home and allowing a better separation between professional and private life. We consider hybrid work arrangements as highly probable in the future of companies, whatever the policies launched to reach the 2050 climate objectives. According to current estimates, about 40 to 50% of the labour force is involved in such work arrangements.

However, more and more experts wonder whether such organizational evolutions will effectively contribute to the transition to carbon neutrality. Several experts develop critical warnings, highlighting the risk of increased journeys among different working locations, heavier data exchanges and requests to central data centers and therefore enhanced digital pollution, more intensive use of e-commerce platforms due to extended working hours, leading to more traffic on the roads, etc.

Digitalization in the transport and logistics sector

According to the participants of the focus group, **the growth of the transport and logistics sector in Wallonia is expected to be very high**. However, this growth is usually envisaged in strictly economic terms (more jobs, more traffic, more fiscal incomes, etc.) while its speed and scope are **not always aligned with the objectives of a transition to carbon neutrality**. This is why the potential impacts of digitalization in this sector are interesting to explore.

The Walloon landscape in transport and logistics is mainly composed of small and medium companies where the level of digitalization is rather low. Similar remarks can be made for the quality of data, highly depending on the digital maturity of organizations and their size. Walloon companies display a low ability to connect with partners because of a lack of adequate tools and a lack of qualitative and standardized data to exchange. Moreover, when a technical possibility of interconnection exists, **confidentiality** issues unavoidably appear, according to the participants of the focus group, which could hinder the acceptance of such solutions by Belgian companies without appropriate guarantees. Another important trend is the fast development of **e-commerce**, reinforced by the Covid-19 crisis. A customer-centric value chain implies sharp Key Performance Indicators (KPIs) for deliveries in terms of time, quality, costs, tracking, etc. according to the requirements of the climate transition. It conveys great logistics challenges not only for delivery but also for return policies and practices. Public initiatives like the competitive cluster Logistics in Wallonia play a very important role in the digital transformation of the sector, by stimulating and supporting partnerships between poles of technical expertise and companies in their journey to carbon neutrality.

4.4.2 Labour market requirements in terms of jobs

New work practices due to digitalization

As already discussed in the megatrend linked to digitalization, the growth of new work practices among white collars is not expected to have significant effects on job creation and/or job losses. In contrast, hybrid work arrangements will lead to a profound transformation of the way of working, with a redefinition of the relations to work and other daily activities.

Digitalization in the transport and logistics sector

In a similar perspective, few quantitative impacts of digitalization are expected in the transport and logistics sector, but once again, qualitative effects on the ways of working are expected. The few job creations linked to digitalization in the transport and logistics sector will probably be linked to **Mobility as a Service (MaaS)** providers, in the same vein as Logistics as a Service (LaaS). The major responsibility of MaaS providers will consist in managing the integration of different modes of transport through multimodal digital infrastructures.

4.4.3 Requirements in terms of skills

New work practices due to digitalization

Hybrid work arrangements may contribute to a significant transformation of at least four categories of jobs:

- **Mobility managers** will have to build their legitimacy by linking their initiatives not only to the corporate strategies but also to the local ecosystem of smart cities and by developing integrated apps interconnecting different transportation services from and to the 3H (home, headquarters, hub).
- **(Chief) Data officers** will have to include in their digital developments and strategic IT choices the critical question of digital pollution and thus acquire new skills, not only in technical terms (data-centric) but also in managerial and strategic terms (value-centric). They should also be able to integrate sustainable data management and mobility plans for all workers.
- **Middle managers** will have to learn how to manage and coordinate hybrid teams. They will have to make important choices concerning the activities which require on-site presence and those which are more efficient when organized remotely. They will have to create a team spirit and define the modalities of remote work via clear and regularly updated objectives while paying permanent attention to the work-life balance and the well-being of team members.
- **HR managers** are expected to play an important role in the implementation of sustainable HRM policies through extended sourcing practices, training initiatives, renewed appraisal procedures and indicators, appropriate reward programs, etc. They are also supposed to be at the forefront of the digital transformation of companies.

If the first category of jobs is still under development, the three others already concern several thousands of jobs and should continue to grow.

Digitalization in the transport and logistics sector

Given the workforce shortage in transport and logistics and regardless of skill level, workers are difficult to find, attract, and retain. In this context, **digitalization could offer levers to increase productivity in existing jobs, filling a part of the workforce shortages**. For example, the capabilities of automated vehicle technology can be a way to resolve the driver shortage in freight trucking while improving the quality of the working life of drivers for long-distance deliveries. As a result, training efforts basically remain focused on mature technological tools to meet immediate business needs.

Few job creations are expected in this sector but mainly job transformations due to better job performance and less labour intensity. A first major and transversal transformation concerns the **enhanced quality and standardization of data**. Thanks to a higher degree of digitalization, standardized data would become easier to integrate and process, therefore simplifying the tasks for administrative staff, coordination jobs, analysts, warehouse operators, etc. Accurate information will certainly facilitate order picking and optimize loading operations. Obviously, existing technologies to support handling and heavy tasks could be further developed and therefore relieve workers. However, these evolutions may be detrimental to workers whose jobs become oversimplified and standardized, with a probable resurgence of neo-taylorist methods based on intensive formalization of work processes via apps and other digital tools, strict adherence to hierarchical instructions and an increase in the number of platform workers.

4.4.4 Training needs

New work practices due to digitalization

In order to support the growth of hybrid work arrangements, **peer learning and/or communities of practices** can be developed, supplemented by **dedicated executive education initiatives** for mobility managers, middle managers and HR managers. Data officers will have to be trained on digital pollution and the way to reduce it. This could be done through **digital sobriety certificates** as suggested by Nicolaï & Peragin (2021) referring to the existing energy efficiency certificates. Adapted modules can be introduced in the curricula of ICT studies.

More generally, **lifelong learning initiatives** can be developed for all categories of workers concerning the mastery of software packages, communication skills, digital sobriety, time and stress management in the context of remote work, etc. in order to avoid the growth of new digital divides. A special attention should be paid to older workers in order to avoid growing inequalities.

Public authorities could play a leading role here, by launching and supporting experimental initiatives, in partnerships with business sectors.

Digitalization in the transport and logistics sector

Driving **simulators** are already used in continuous education concerning heavy trucks, buses, forklifts, onboard technologies, and are under development for airport equipment. Moreover, mobile simulators are available to sensitize and train students at school. They might be a powerful lever to prepare current and future drivers for the challenges of the transition to carbon neutrality. **Demon-**

stration spaces where companies can test various digital tools before investing already exist in Flanders and should be created in Wallonia.

N**ew vehicles and equipment** will necessitate appropriate training especially in vehicle sharing and multimodal approaches. The existing curricula need to be updated and adapted to these new challenges. Besides driving, another change brought about by automated vehicles concerns their maintenance. Once again, there is an urgent need for new training paths, especially targeting technicians and mechanicians in partnership with field actors (schools, competence centers, companies, sectorial training funds, etc.).

4.4.5 Considerations for a just transition and policy considerations

When exploring the contribution of digitalization to climate neutrality, it is important to keep in mind the need to avoid new social divides linked to the possession of specific skills and the adoption of appropriate behaviors. If new ways of working may contribute to the transition to climate neutrality, they must not be reserved for a social elite composed of highly skilled workers and managers. It is also important to implement the right to disconnect —like in France— and to better protect privacy against any attempt of automatic control in the workplace. Therefore, a just digital transition must be understood as inclusive, by optimizing the benefits of new ways of working and minimizing their potential drawbacks.

New work practices due to digitalization

To support the growth of hybrid work arrangements in a sustainable perspective, a series of appropriate training initiatives must be launched by public authorities, as shown in the table below.

Job transformation

	Mobility manager	Data Officer	Middle manager	HR manager
Effects on jobs & skills	• Implement integrated mobility policies according to national objectives • Make links with Smart Cities projects • Collaborate with IT to develop sustainable hybrid work (e.g. carpool applications)	• Integrate sustainable data management practices (production & stockage) • Optimize digital carbon footprint	• Manage hybrid teams (and hybrid meetings) • Manage the balance between onsite and remote activities • Develop new performance control practices • Manage the WLB and well-being of remote workers	• Link news ways of working and sustainable management • Build HR KPIs leading towards sustainable mobility and work practices • Improve digital, job-related and soft skills
Effects on training	*Topics* • Systemic view on mobility *Policy recommendations* • Develop appropriate initiatives in executive education • Encourage companies to create communities of practices on this topic	*Topics* • Digital sobriety *Policy recommendations* • Develop appropriate modules in bachelor and master studies in ICT • Develop digital sobriety certificates in partnership with employer associations	*Topics* • Hybrid management *Policy recommendations* • Support knowledge sharing on technical and organizational devices to manage hybrid meetings • Develop appropriate initiatives in executive education	*Topics* • Sustainable HRM *Policy recommendations* • Develop appropriate modules in bachelor and master studies in HRM • Co-develop sensitization initiatives with HR professional associations

However, the growth of hybrid working arrangements must be considered in a systemic way in order to reach the 2050 climate objectives, and accompanied by a series of measures launched by governments:

- **renovation of living spaces and working spaces** in order to decrease energy consumption at places of residence, as considered in the CORE 95 scenario;
- **provision of new opportunities in spatial mobility and transport** in order to diminish the use of cars to and from headquarters and hubs, but also to other locations;
- **appropriate relocation of infrastructures** (shops, schools, leisure centers, etc.) in order to avoid the multiplication of journeys linked to working remotely;
- communication campaigns and sensitization of companies to support new working behaviours (an appropriate balance between on-site and remote activities, digital sobriety, work-life balance and the well-being of "hybrid" workers);
- **implementation of appropriate reconversion policies and land use planning actions** in order to avoid new digital divides due to hybridization (blue/white collars, employed/unemployed, urban space/countryside with more adapted infrastructures in terms of mobility and workplace locations).

Digitalization in the transport and logistics sector

The digital transformation of the sector can stimulate the emergence of innovative models but can also make employment more precarious. It is therefore crucial that public policies provide relevant **training packages** with these risks in mind in order to support job reconversions and avoid the rise of new digital divides.

Beyond the need of anticipating new digital tools and competencies via simulators and demonstration spaces, new training paths should be developed concerning urban logistics, automated vehicles and their maintenance, or again job reconversion initiatives, in partnership with sectorial actors.

Public authorities could also play a crucial role in supporting the development of new poles of **technical expertise on multimodal digital infrastructures** in order to support the crucial role of MaaS providers.

Regulatory stability should become the norm. The transport and logistics sector is typically a domain where Belgian regulation is complicated because of changing and intertwined federal and regional policies as well as European ones. A clear and coherent fiscal framework must be defined in order to support the transition toward carbon neutrality with for example tax exemptions or incentives for R&D investments in multimodal digital infrastructures and digital traffic monitoring, and financial support for training initiatives combining the acquisition of technical expertise and sensitization to the challenges of the climate transition. Future developments of autonomous vehicles will also depend on the ability of public authorities to define clear rules concerning truck platooning or intermodal infrastructures for traffic monitoring.

Moreover, an adaptation of the existing labour regulation in terms of universal access to social security and social protection (Semenza & Pichault, 2019) —

with a package of social rights likely to be transferred from one job status to another— and a growing recognition of such work activities by trade unions (see for instance the current initiative launched by CSC-ACV called United Freelancers) are needed in order to avoid the re-emergence of neo-taylorist methods and precarious working conditions linked to the rise of platform work.

Finally, the volume of goods in circulation on the market questions the evolution of **consumer choices** as well as the pursuit of profit at all costs by companies. In order to favour more sustainable growth in this sector, compatible with the local objectives of a circular economy, a solution suggested in the focus group could be the fragmentation of the supply chain at regional and/or sub-regional levels. Due to the difficulty to establish an international governance likely to challenge the hegemony of global companies like Amazon, local **experimental initiatives** supported by public authorities could be an interesting solution to reach the 2050 climate objectives (cf. the Urbike initiative supported by the regional authorities in Brussels, which aims to combine efficiency in the last mile delivery and decent working conditions).

4.5 Differences and similarities between the cases

The three cases' similarities and differences are discussed below for each topic at stake, i.e. jobs and skills, training and support.

4.5.1 Similarities

The cases' similarities stand out as neither region nor sector specific. They represent potential priority areas for further actions for the federal government and other public stakeholders.

Jobs & skills

The cases show that the climate transition will impact existing jobs, yet the risk of job loss strictly related to the climate transition seems to be low. The cases also identified impacts on work organisation and supply chains. Indeed, the climate transition could incur disruptions and/or new ways of management of the supply chain. Existing jobs would then need to adapt to such changes, and the risk of job loss due to the inability to adapt is considered low – given appropriate support. The cases highlight the need to pay attention to work quality and decency to favour a just transition.

The cases confirm the need to develop transversal and soft skills, increasingly important for both existing and emerging jobs. Moreover, the different cases point out job-specific skills that will be increasingly in demand with the climate transition.

Trainings

There is a consensus on the need to further encourage lifelong learning. Dedicated trainings enable workers to learn new 'green' skills for their current jobs (via upskilling), as well as to carry out professional reconversion (via reskilling). The cases on circular economy and buildings call for a *culture* of lifelong learning. This is seen as a necessary shift for the regular acquisition of pertinent 'green' skills throughout the workers' career.

There is a need to revise curricula to include relevant skills for the transition. The case on circular economy notes that current university curricula in Flanders and Belgium do not match some skills needs, and that a better collaboration between educational entities and industries should help bridge the gap. As for the digitalization and building cases, they highlight the need to revise formal education curricula to better include new modules in line with the climate transition.

Finally, both the cases on circular economy and digitalization evoke the benefits of executive education[13]. It could provide companies' executives with better labour force management as well as a wider understanding of potential circular business opportunities.

Support

Regarding support, the cases identified the need to implement or further support fiscal incentives to boost training and meet skills need. Both the circular economy and buildings case highlight the need for public authorities to focus on SMEs, as they face greater barriers to reskilling/upskilling workers (due to financial and time constraints).

4.5.2 Differences

The impact of the climate transition on job growth and job creation differs across the studied cases:

- In the buildings and circular economy case, a clear positive impact has been identified if the transition is handled well. There is a significant potential in the creation of jobs in social and circular economic activities and in climate renovation.
- Digitalization would mainly lead to job transformation rather than job loss or creation, and few job creations linked to digitalization are expected in the transport and logistics sector.
- **Once unfold, the circular economy is expected to shift towards more labour-intensive sectors while the job transformation linked to digitalization is said to evolve towards less labour intensity**.

The effects in terms of needed skills are distinct:

- The job transformation and needed skills related to digitalization are mostly linked to management and monitoring. In contrast, the skills needed and the emerging jobs in circular economy and the building sector are more related to manual tasks.
- New skills will be needed in the digitalization and building sectors. In circular economy, however, no major change in skills has been identified but rather upskilling needs.

[13] Trainings addressed to business leaders, "calibrated to address the most critical challenges and problems facing managers and their organisations […] from developing the kinds of next-generation leadership competencies that businesses need in order to thrive in complexity, to building specific knowledge and skills to position [their organisations] at the vanguard of digital transformation and beyond" (Imperial College Business School, 2021). https://www.imperial.ac.uk/business-school/blogs/executive-education/what-is-executive-education/

The question of low-skilled employment features differently in the cases:

- The transition to a circular economy and renovation of buildings require a significant number of workers in a labour market already facing labour shortages. Considering that many jobs in these sectors are low and middle-skilled, this is seen as a an opportunity to answer unemployment among lower skilled profiles.
- On the other hand, the digitalization case raises the risk of polarization of the job market, with more over-simplified jobs and a risk for a decreasing work quality.

4.5.3 Key messages

A coordinated strategy for the development of 'green' skills and trainings for both existing and future workers is needed. There is a need to revise curricula to include relevant skills for the transition. Supporting a culture of lifelong learning is seen as key to upskill and reskill workers for the transition. To favour a just transition, attention should be placed on upskilling and reskilling training (for workers to remain employed), as well as on work decency, quality and accessibility.

5. OVERARCHING POLICY CONSIDERATIONS

This section identifies policy challenges and related policy actions that need to be considered to accompany the Belgian labour market in the context of the climate transition. Conclusions build on stakeholder workshop discussions and a thorough review of the literature, not only focusing on Belgium, but also considering experiences in neighbouring and pioneering countries.[14]

Over twenty policy actions are proposed in this section. Some of them have already been undertaken at different stages by various institutional actors in Belgium. One of the next steps of this study is to carry out a mapping between the actions listed here and the actions currently undertaken.

The levers on education and training are split among a multitude of actors. Since this study is commissioned by the Federal Public Service (FPS), we flagged all actions with a federal lever.

Policy considerations and actions are grouped around the following objectives:

1) **Equip learners and educators with the knowledge and skills needed for the climate transition**
2) **Support reskilling and upskilling of workers**,
3) **Attract current and potential workers** towards jobs related to the low-carbon transition**,**
4) **Ensure decent working conditions for climate transition jobs**
5) **Enhance joint action and cooperation between actors**

A list of over eighty policy actions structured by challenge and competency level can be found in a separate Excel (document provided to the Federal Public Service Health, Food, Chain Safety and Environment).

The policy actions have varying levels of maturity; while some are more specific and actionable, others remain broad and **will need to be further refined** into concrete sub-actions. As a next step to this study, these actions should be turned into a concrete joint action plan together with a clear implementation plan.

Some actions have applications beyond the needs of the climate transition. Discussing these broader applications exceeds the scope of this study.

In general, the issue of access for disadvantaged groups to certain training measures is an important attention point. Barriers to access trainings for these groups (e.g. financial, digital illiteracy, etc.) should be identified and addressed.

[14] These are the following countries: France, the Netherlands, Germany, the United Kingdom, Canada, New Zealand, and Costa Rica.

5.1 Equip learners and educators with the knowledge and skills needed for the climate transition

Context: less than 5% of the courses taught in universities and 2.2% of the courses taught in university colleges in Belgium cover climate and environmental challenges (The Shifters, 2022). Overall, more than 60% of higher education programs in Belgium do not contain any course referring to these topics. This is problematic, as the low-carbon transition is a systemic transition and concerns all professions – though to varying degrees. Furthermore, various studies have shown that Belgian institutions training buildings professionals do not sufficiently include climate renovation skills and knowledge & circular practices in their curriculum (Be Circular, 2019; Conseil Central de l'Economie, 2021). Overall, **it is crucial to equip learners and educators with the knowledge, skills, and attitudes needed for the climate transition (EC, 2022)**. To this end, curricula need to be continuously adapted to reflect existing labour market needs and anticipate them. On the one hand, it would prevent students from entering the labour market with skills that are likely to be outdated. On the other hand, it would translate in students reaching the labour market with a sustainability-oriented mindset, regardless of the study program chosen. Any further training would then be better assimilated and implemented.

Policy action #1: Map current education offer

It is important to map the current educational offer as it is the first step towards an assessment of:

- Existing programmes;
- Programmes considered as currently missing;
- Programmes considered as not sufficiently in line with the climate transition;
- Successful programmes, understood as attracting students and providing pertinent contents for the climate transition;
- Existing educational providers & entities;
- The repartition of the different programmes as per the different entities.

Indeed, for curricular changes to be effective, a clear picture of the current offer is necessary. It is also important to gather information on all curricular changes set in motion and their expected implementation date, in order to align them with other processes i.e. raising awareness on education linked to the climate transition (see 5.3.2). The ongoing work regarding a 'Federal learning account' and the 'individual learning account' should be mentioned, since one of its goals is mapping the education offer. Nevertheless, its inputs will mostly have to come from the regions – with the exception of information about training courses offered by sectoral funds, for example. Therefore, both the regions and the federal level should be implicated in activating this policy action.

Policy action #2: Add a basic training on climate change and sustainability in all educational programs, at every level.

An early sensitization in primary school would help pupils to get objective information and better integrate a new common reference. Secondary school curricula would dive further into climate change and sustainability challenges. Lastly, higher education would provide students with (1) a finer understanding of climate change and (2) skills for the transition related to their fields of study (The Shift Project, 2019).

Inspiring initiatives:

The University of Barcelona will implement a mandatory "Climate Crisis" module for all students from the 2024 academic year (Burgen Stephen, 2022). This recent announcement states that the module will be worth five credits in the students' curricula, and the academic staff will have to undergo a climate issues training.

In France, a project entitled ClimatSup Business between the Shift Project and Audencia Business School aims at adapting curricula to integrate environmental issues. These include climate-energy challenges and planetary boundaries, among others (The Shift Project, 2022).

Climate change and sustainability are central to Finland's basic education curricula. Sustainability became "one of the seven transversal competences in the curriculum" in 2014 (Niinistö S. et al., 2017).

Costa Rica is considered as a frontrunner as its educational programs comprise environmental education within the primary and secondary education since the 1980s, and a clear reference to climate change in the curriculum since 2016 (Ministerio de Educación Pública, 2015).

In order to provide basic training on climate change and sustainability at all levels, lecturers have to be trained too. Therefore, the Vrije Universiteit Brussel (VUB) together with the five Flemish universities have developed a 'Massive Open Online Course (MOOC)' to train lecturers in higher education on how to teach for and about sustainability (VUB, n.d.).

(The Shift Project, 2022)

Policy action #3: Carry out a profound revision of programs for professions most related to the transition to include new skills and knowledge, and where needed create new programs.

Some professions will be especially impacted by the climate transition, with professionals requiring new skills (e.g. car mechanic or heating system installers). It is key that (OECD & LEED, 2012) students training for these professions learn the latest technologies adapted to the low-carbon transition, rather than only achieving fossil fuels-oriented competencies.

Previous experience suggests that hiring full-time program managers is essential to the success of the curricular transformation (The Shifters, 2022). Program managers would have the necessary time, resources and adequate experience to pilot the change, in collaboration with teachers and other stakeholders.

Secondly, **educators, from primary school to university, must be trained** to be able to teach climate-energy challenges.

Possible specific actions are:

- Create new programs for emerging jobs related to the transition,
- Hire program managers to lead the curricular transition,
- Train the educators.

Inspiring initiatives:

The creation of a new course of renewable energy engineering for the 2021 academic year in France illustrates the transition-related evolution of curricula (Ensiate, 2021).

Trainings such as *Enseigner le Climat* can be implemented to help teachers retrain. An easier and more widespread access for teachers to relevant learning material and workshops such as the ones provided by Brightlab.be can prove also useful (Brightlab, n.d.).

Policy action #4: Further enhance STEM studies and STEM skills within educational programs

Standing for Science, Technology, Engineering, and Math, STEM studies are seen as fundamental to the development of skills and knowledge pertinent for the low-carbon transition (European Training Foundation, 2022; Green Jobs Taskforce, 2021). STEM skills include problem solving, critical analysis, digital literacy, communication, and collaboration among others. In Belgium, there are too few graduates in STEM, both among upper secondary graduates from vocational programmes and among tertiary graduates.[15] Efforts are needed to further increase the number of women and other underrepresented groups in STEM studies. The question of attractivity will be further developed in the third section below.

Inspiring initiatives:

On its memo dating from 2020, the economic, social and environmental Council of Wallonia calls to strengthen STEM courses attractivity. One identified practice is a better articulation between secondary education and higher education in order to foster higher enrolments in scientific and technical fields (CESE Wallonie - Pôle Politique Scientifique, 2020).

In Flanders there are multiple initiatives already in place, like the STEM-academy, STEM-platform and Da's Geniaal, that aim to boost the image of STEM studies and increase the interest of children of all ages (Da's Geniaal, n.d.; Vlaams Ministerie van Onderwijs en Vorming, n.d.; VLAIO, n.d.). A next step the Flemish Government wants to work on is to create better connections and collaborations between these initiatives (Departement Werk en Sociale Economie, 2021; Roland Berger, 2021).

[15] *Council Recommendation of 12 July 2022 on the 2022 National Reform Programme of Belgium and delivering a Council opinion on the 2022 Stability Programme of Belgium,* EUR-Lex - 32022H0901(01) - EN - EUR-Lex (europa.eu).

Policy action #5 Adapt educational programs to fit the needs of both students and organizations

The offer for vocational education and work-study programs must be expanded to reinforce the practical aspect in learning and bring education closer to the organizations' requisites. The skills acquired would be indeed more tailored to the needs of businesses pioneering in developments related to the climate transition, as they would be job-specific and imparted through a hands-on approach rather from an academic viewpoint purely.

Moreover, a diversity of flexible and modular program formats, such as evening classes or apprenticeships, should be made available to students, so as to accommodate their different preferences and needs (Skiba, 2020).

Possible specific actions are:

- Expand the offer for vocational education[16] and work-study programs,
- Expand the offer of flexible and modular program formats.

Inspiring initiatives:

To facilitate the students' progression in their education path and encourage flexibility, the United Kingdom has mapped progression routes and bridges between vocational and academic programs (British Council & UK Skills Partnership, 2021).

5.2 Support reskilling and upskilling of workers

The public sector has a key role to play in supporting the reskilling and upskilling of workers. Upskilling training aims to *update existing skills* to accompany *job changes*, for instance, training on low-carbon materials for architects. Reskilling training intends to teach *new skills* to take on a *different job,* for example, training for industry electricians to become managers in renewable energy. On the one hand, these trainings are important to equip the workforce with necessary skills to carry out the climate transition. On the other hand, upskilling/reskilling trainings help workers remain employed, whether through keeping their job or professional reconversion. Policy action is needed to (1) ensure relevant trainings are available to workers, (2) improve the training and incentive frameworks and (3) centralize training information.

[16] Education that is designed for learners to acquire the knowledge, skills and competencies specific to a particular occupation or trade or class of occupations or trades. Vocational education may have work-based components (e.g. apprenticeships). Successful completion of such programmes leads to labour-market relevant vocational qualifications acknowledged as occupationally-oriented by the relevant national authorities and/or the labour market. UNESCO UIS, 2013.

5.2.1 Offer reskilling/upskilling trainings better adapted to the low-carbon transition

Context: A maximum of 5% of workers, managers, and decision-makers received an education which included climate and environmental issues (The Shifters, 2022). Around 40% of current workers in Belgium need new skills to keep their jobs or to change career path (Conseil Supérieur de l'Emploi, 2021b). All workers should have access to basic climate-energy training. Yet, some sectors such as construction or the automobile industry are or will be more impacted by the low-carbon transition. Reskilling and upskilling in these sectors will be all the more essential.

Policy action #6: Map existing training offer

It is crucial to map the current training offer as it is the first step towards an assessment of:

- Existing trainings;
- Trainings considered as currently missing;
- Trainings considered as not sufficiently in line with the climate transition;
- Successful trainings, understood as attracting workers and providing pertinent contents for the climate transition;
- Existing training providers & entities;
- The repartition of the different trainings as per the different entities.

Indeed, for reskilling/upskilling changes to be effective, a clear picture of the current offer is necessary. It is also important to gather information on all training change set in motion and the expected implementation date, so as to time it with other processes i.e. raising awareness on training linked to the climate transition, see 5.3.2). Both the federal and regional levels have levers to activate this policy action.

Policy action #7: Advocate for basic energy-climate training for all current workers

Energy and climate related trainings are essential for society as a whole to move towards the low-carbon transition (The Shift Project, 2021). It is necessary to involve all actors, regardless of the qualification or responsibility levels. Indeed, for a successful transition to unfold, everyone should be made aware of his/her responsibilities, not only high-level decision-makers. Including all stakeholders in these trainings can thus lead to a global appropriation of the issue and the necessary change to carry out. Given the difficulty to train everyone at once (The Shifters, 2022), elected representatives and civil servants should be prioritized, as they are an essential part of public policy making.

Inspiring initiative:

In France, la Fresque du Climat (la Fresque du climat, n.d.) has already devised dedicated climate awareness workshops specific to elected representatives, civil servants and general citizens.

Policy action #8: increase the offer of energy-climate upskilling/reskilling trainings

It is key that current workers find accessible energy-climate upskilling/reskilling trainings. There is a need for:

- new programs teaching skills for emerging energy-climate occupations, such as geothermal energy technicians.
- Trainings to upskill workers in existing occupations that require new hard and soft skills. For instance, it is expected that mechanics will spend less time assembling parts, as electrical vehicles contain less of them, but will be required to operate and maintain automated systems (Cambridge Institute for Sustainability Leadership & Corporate Leaders Group Europe, 2020). In terms of soft skills, the transition often requires enhanced adaptability and communication skills. This is well exemplified in energy renovation projects, where workers are required to adapt to new technology and materials, as well as to better understand the job of the other workers, in order not to destroy their work or not to make it harder. Vocational trainings will be one of the keys to reskill/upskill workers.
- Reskilling programs to facilitate professional reconversions (see table 3 for various examples).

Inspiring initiative:

Starting 2022, The Walloon Institute for Work-Study Training, Self-Employed, Small and Medium Entreprises (IFAPME) started offering a one-year training in deep climate renovation coordinator(IFAPME, n.d.).

Brussels launched in 2021 the project 'Build Circular.Brussels' which aims to prepare workers for the requirements of tomorrow and educate them about the latest circular techniques. With this project, Brussels intends to impact both the core functioning of the enterprises as well as reskill their workers through different training programmes (Build Circular.Brussels, n.d.; Ecobuild, 2021).

5.2.2 Centralize information on training opportunities and financial support in one single platform

Context: The training offer is currently fragmented with many public and private entities, and the lack of a comprehensive view may deter workers from taking the first steps towards training.

Policy action #9: Create a digital platform for lifelong learning for all

Employers, workers and job seekers alike would benefit from the centralization of information on training opportunities and financial support in one single platform, regardless of their geographic location within the country. In Belgium, the law of the 5th of March 2017 and its application – still in discussion – would provide the creation of an individual training account, with a training entitlement of five days (Service public Fédéral Emploi, n.d.). However, these dispositions currently exclude companies of ten employees or less. This is problematic, as small companies will play a key role in the low-carbon tran-

sition, for instance in climate renovation of buildings. In Brussels, micro (<10 employees) and small construction businesses (<50 employees) make up 98 % of companies and represent around 50% of the workforce. The federal government could facilitate the creation of a digital platform for lifelong learning.

Regrouping in one platform all information on available trainings and incentives as per the recipient status would clarify one's entitlements and avoid lost opportunities due to a fragmentated and unintelligible offer. It would improve the visibility of all trainings, with the possibility to make specific ones stand out – such as roofer trainings to palliate the identified shortage for example.

The digital platform should be complemented with appropriate services for workers with no or lower digital background.

The European Commission is also working on 'Individual learning accounts', offering potential synergies:

"In its 2021 Work Programme, the European Commission announced a planned new legislative and non-legislative initiative, as well as an impact assessment on 'Individual learning accounts'. The topic is also one of the 12 flagship actions of the European Skills Agenda, under the title 'Individual learning accounts', with the following goal: "Help close existing gaps in the access to training for working age adults and empower them to successfully manage labour market transitions". Individual learning accounts should give people of working age a budget to spend on training to improve their skills and employability." (European Parliament, 2023)

Possible specific actions are:

- Include all workers, regardless of the company size,
- Regroup all individual training accounts in one single digital platform,
- Feature climate-energy trainings prominently on the digital platform,
- Complement the digital platform with appropriate services for workers with no or lower digital background
- Make the connections with and build on the Individual Learning Account being worked out at European level

Inspiring initiative:

The French platform Moncompteformation (Ministère du Travail, n.d.) is a good example of a user-friendly collection and rationalization of all information regarding available training and financial support. Any person that has worked or is currently working accumulates training entitlements across occupations and time. Personal quota but also appropriate trainings and financing solutions can be consulted on the platform.

All in all, these recommendations aim to adapt the workforce to **the challenges brought by the low-carbon transition**, with more cross-skilled and agile workers. The **flexibility and incentive schemes, with a focus on SMEs, can translate to a higher attendance of trainings.**

5.2.3 Improve the legislative and incentive frameworks related to reskilling and upskilling

Context: Workers and organizations (especially SMEs) face significant barriers to access trainings, including lack of time and resources.

Policy action #10: implement appropriate incentives for reskilling or upskilling opportunities related to the low-carbon transition

Incentives and support should focus primarily on SMEs as these experience structural difficulties to reskill workers the most, mainly due to lower training budget and available time. In addition, incentives should be addressed to workers also, so that trainings do not result in income loss thus deterring workers from attending the trainings. Further consideration should be focused on other types of aid for workers, such as childcare, as it has been identified as a stumbling block to attend training (Conseil Supérieur de l'Emploi, 2021b).

These can take the form of fiscal incentives and favourable tax treatments for reskilling or upskilling opportunities related to the low-carbon transition and could be activated by the federal level. Further financial support could also be designed for specific target groups.

Inspiring initiative:

The Recovery Plan for Wallonia contains a project related to the improvement of training incentives for occupations experiencing shortages.

The Brussels Economy and Employment Regional Service offers various financial incentives and compensations for workers that are keen on following an additional/new training, like paid educational leaves, training premiums and training fund service vouchers (Brussels Economy and Employment, n.d.).

Policy action #11: Make trainings accessible to all workers

Trainings need to be accessible to all through a flexible and modular approach, with as few limitations as possible regarding prior qualifications. The latter has been indeed clearly requested via the response to the National Skills Fund consultation in the United Kingdom (Department for Education, 2022b). An open access to basic training empowers individuals to reacquire outdated competencies before proceeding to upskilling. Additionally, modular approaches enable workers to reskill or upskill without having to undergo a full course, hence giving them the opportunity to get specialized skills in an efficient manner. Evening classes, for example, allow them to keep a steady day occupation and corresponding income throughout their training.

Inspiring Initiative:

The Open University in the United Kingdom has been long known to offer accessible distance learning. They offer higher education diplomas, but also stand-alone modules. Most of their courses do not have any entry requirements, thus giving would-be students the chance to acquire new skills and knowledge. Examples of such modules are "Communica-

tion skills for business and management" or "Technologies in practice" (The Open University, n.d.).

The Dutch-speaking Open Universiteit, with study centres in Flanders, also offers distance learning, with a focus on part-time study. Most of their undergraduate programmes do not involve prior requirements either.

5.3 Attract current and potential workers towards jobs related to the low-carbon transition

Information regarding opportunities linked to future occupations and skills needed for the low-carbon transition is currently scattered. The following policy actions will help meeting this challenge through actions to raise awareness on upcoming opportunities and dedicated strategies.

5.3.1 Centralize and broadcast information on skills and jobs related to the low-carbon transition

Context: Emerging occupations – deep renovation coordinators, offshore wind energy workers, solar panels installers, recyclers or digital shared mobility platforms developers, etc. – could be better known in the general population.

Policy action #12: Provide intelligence on future jobs & skills nationwide, easily accessible for all Belgian residents

Job observatories currently exist in each of Belgium's regions. Yet, a rationalisation of relevant information (in the context of the transition) would be helpful for current and potential workers. The information provided could include a yearly-updated list of present and future energy-climate skills in demand (Confederation of British Industry, 2021). A monitoring of the progress and evolutions brought to the education and training system could also be made public (The Shifters, 2022), as well as a publication of information sheets on emerging climate-related jobs with the corresponding skills set and trainings to complete.

Possible specific actions are:

- Provide a list of present and future energy-climate skills in demand,
- Monitor the change,
- Publish information sheets on emerging energy-climate jobs.

Inspiring initiative:

India has launched in 2015 a Skill Council for Green Jobs aiming at identifying the skill needs related to green jobs industries and outlining the corresponding programs.

5.3.2 Raise awareness on education, training and job opportunities related to the low-carbon transition

Context: Some trainings related to the transition struggle to attract workers. Concomitantly, several sectors such as construction are experiencing a workforce shortage, e.g., the shortage in construction is estimated at 20,000 jobs in Belgium.

Policy action #13: Launch communication campaigns to make skills and job opportunities related to the low-carbon transition well-known and visible.

Along with an effort to raise interest in related training programs, technical education & professions – today seen as less attractive (Cedefop & ReferNet, 2018) – should be valorised. These actions need to be well-timed. Regarding education, they should be reinforced towards the end of educational cycles (e.g. last year of secondary school), when students are deciding on their next educational step. School themselves could relay all pertinent information regarding climate-related careers. For existing and potential workers, such campaigns should start as soon as possible to attract potential workers ahead of the foreseen peak in demand for these jobs. Both the federal and regions public employment services could have an interest in launching communication campaigns to make skills and job opportunities related to the low-carbon transition well-known and visible.

Inspiring initiative:

Our Human Energy, by Efficiency Canada, can be an example of such campaigns, encouraging workers across the industry to showcase their activities and to "create opportunities for energy efficiency workers to connect with each other around shared pride and shared challenges" (Efficiency Canada, 2020).

Policy action #14: Provide adequate career guidance for students and workers

It is crucial to advise students and workers on the needs of the labour market tied to the low-carbon transition, and to disseminate all necessary information on potential courses and trainings (Conseil Supérieur de l'Emploi, 2021b; Green Jobs Taskforce, 2021). The information needs to be up-to-date and comprehensive.

Inspiring initiative:

The United Kingdom has recently published a statutory guidance as part of its Skills for Jobs policy. It stresses the importance of information regarding access to the labour market, making it mandatory for schools to "provide pupils with independent career guidance" (Department for Education, 2022a).

5.3.3 Plan actions to mobilize the inactive population and boost women employment in key transition sectors

Context: Women are under-represented in sectors such as the energy sector, according to a study carried out by the International Energy Agency. Women would "make up 39% of the overall labour force, [yet] only 16% of conventional energy sector employment, and less than 14% of senior management roles in the energy sector" (International Energy Agency, 2022).

Policy action #15: Carry out dedicated communication and training strategies to attract the inactive population and women towards climate transition-related sectors

Through social economy policies, not discussed within this study, and dedicated communication actions further elaborated in the next section, a greater part of the inactive population could be mobilized and may come into play in the low-carbon labour market. Dedicated strategies could be carried out to attract the inactive population[17] and women towards sectors in demand for the low-carbon transition.

Inspiring initiative:

The recent Energy Advisor Recruitment, Training and Mentorship campaign in Canada focused on supporting projects to increase the training and representation of indigenous people and women among the growing energy advisor workforce.

The initiative "Energia+Mujer" in Chile resulted in a private-public plan to include more women in the energy sector along with a business model for the industry (Ministerio de Energía, 2018).

5.3.4 Improve integration of foreign workers to help fill shortages in transition activities

Context: Foreign workers, though possessing skills and experience, may struggle to access the labour market in Belgium and to occupy a position related to their professional background (International Labour Organisation, 2019; Rakotonarivo, n.d.). According to the Federal Ministry for Economic Affairs and Climate Action, in Germany, "many thousands of additional workers could come on to the market if people with a migrant background were given more support in terms of integration and training" (Federal Ministry for Economic Affairs and Climate Action, 2020). This constitutes untapped potential to fill shortages in transition activities, such as the renovation of buildings.

[17] An economically inactive person means that "he or she is not part of the labour force, [thus] neither employed nor unemployed. The set of people outside the labour is also called the "inactive population" and can include [children], students, pensioners and housewives or -men, for example, provided that they are not working at all and not available or looking for work either; some of these may be of working-age", Eurostat (2020).

Policy action #16: Enhance the language course offers for foreign workers

Language is one of the barriers that can prevent foreign workers from entering the workforce. Ameliorating the language course offer for foreign workers can help to address this barrier. Additionally, training centers could offer courses in English, so that workers with insufficient knowledge of national languages may follow them.

Inspiring initiative:

The Luxembourg Lifelong Learning Centre offers a selection of courses in English, stating that "many English-speaking employees are faced with language and subject matter challenges when it comes to training" (Luxembourg Lifelong Learning Centre - Chambre des salariés, 2020). A wide selection of evening classes, seminars and certification can then be carried out in English.

Policy action #17 Ensure the adequate evaluation and recognition of foreign workers past qualifications and skills

The official recognition of foreign past qualifications and skills should ensure that there are no lost opportunities. The International Labour Organization, through the publication in 2020 of a guide to facilitate the skill validation of foreign workers, insists on the benefits for both the country's economy and population (International Labour Organisation, 2020).

Inspiring initiative:

In Germany, an online platform provided by the Federal Ministry for Economic Affairs and Climate Action provides descriptions of foreign vocational training systems and professional qualifications. "This enables the relevant bodies (the professional chambers) to improve their assessment of foreign professional qualifications and to make the recognition process quick, uniform and transparent" (Federal Ministry for Economic Affairs and Climate Action, 2020).

5.4 Ensure decent working conditions for climate transition jobs

Ensuring decent work conditions for jobs created by the transition is key for (1) the transition to be just and (2) to attract workers towards these jobs.

Context: For the climate transition to be just, ensuring decent working conditions for the jobs created is necessary. Indeed, it is an essential part of the ILO's (2021) just transition definition: "greening the economy in a way that is as fair and inclusive as possible to everyone concerned, **creating decent work opportunities** and leaving no one behind". For the European Commission, work is considered decent when it includes "a fair income, secure form of employment, safe working conditions, equal opportunities and treatment for all,

includes social protection for the workers and their families, offers prospects for personal development and encourages social integration, and workers are free to express their concerns and to organise."(European Commission, n.d.)

There is a risk that some of the jobs created for the transition would not offer decent working conditions. For instance, circular business models, such as servitization or sharing platforms, could raise concerns of job security and social protection. This also applies to jobs created in the construction sector for the climate renovation of buildings. Indeed, there is a great input of foreign workers in the Belgian construction sector, especially from Eastern European countries with lower social security costs (Colpaert, 2018). For foreign workers with a self-employed status, which is as high as 40% for Polish workers, for example, the Belgian minimum wages and working conditions do not apply (de Wispelaere & Pacolet, 2017). This creates an environment for inadequate conditions. It is an existing problem today with scandals and investigations regarding unsafe working conditions and social dumping (through subcontractors, e.g.) in recent years (de Wispelaere, 2022; Sanen, 2021). Hence, it should be safeguarded that all jobs, current and new, are decent. A statement made by Building and Wood Worker's International (BWI) together with C40 highlights the importance of a just transition with decent jobs (BWI & C40 Cities, n.d.). Moreover, governments need to be careful not to unintendedly facilitate undeclared work practices (BruPartners, 2021). Public procurements are often handed to larger construction firms that work with subcontractors and that make more use of posted foreign workers – which are more prone to social fraud.

Yet another attention point concerns job creation in the **cyclo-logistics sector**. Fierce competition between transport operators on home delivery prices led to a cascading system of subcontracting, leading to a **precarisation of first line workers**). Today, except foodtech transport companies, the Belgian cyclo-logistic sector remains relatively untouched by the economic models that lead to precarization. However, these models entered the parcel distribution sector in several European cities, and there is a risk that further deployment of cyclo-logistics would lead to such developments in Belgium (SPW, Urbike and Step, 2020).

Finally, jobs with inadequate working conditions **deteriorate the image of such jobs**. This is clear in the construction sector (Confédération de la Construction, 2019). Hence, ensuring decent working conditions is key to attract sufficient workers towards climate transition jobs.

Policy action #18 Ensure decent working conditions for climate transition jobs

The public sector, including federal authorities, can take an important role to safeguard decent working conditions. We propose:

A) A mapping of transition jobs most at risk of inadequate working conditions
B) Designing/reinforcing policies to safeguard decent working conditions, such as controls, social inspections, and strict social criteria in public tenders

To avoid the precarization of first line workers in cyclo-logistics, SPW, Urbike and Step (2020) propose to set strict social criteria for, for example, eligibility for certain subsidies, public contracts or financial support mechanisms, for obtain-

ing approvals or for accessibility to certain logistics infrastructures intended for sustainable distribution players. At minimum, they recommend the following criteria:

- Hourly pay for couriers (no performance by task/race)
- Minimum hourly wage (see scale CP 140.03)
- Compulsory social security contributions paid in Belgium
- Headquarters in Belgium
- Insurance in order
- Training required for couriers
- Equipment in order
- Compulsory protective equipment

In the construction sector, current policies insufficiently address illegal work and social fraud. It is necessary to reinforce controls and social inspections (Confédération de la Construction, 2019).

Inspiring initiative:

Several cyclo-logistics companies founded the Belgian Cycle Logistics Federation (BCLF) to represent collectively the sector and work for the enhancement and protection of bicycle delivery work.

5.5 Enhance joint action and cooperation between actors

Limited dialogue on education and training needs related to the climate transition can induce a duplication of initiatives, increased expenditure and increased complexity for the beneficiaries. Effective governance and coordination will be key to transform the economy and the labour market. Policy actions are needed to further develop adequate strategies together with all stakeholders and to ensure consistency between policies.

5.5.1 Develop and implement adequate training strategies

Context: Trainings today are not enough the result of concerted strategies. It is key for all relevant stakeholders to be strongly involved in the design of training strategies, from public entities – such as regional training agencies – to companies, trade unions and employers' associations. Ultimately, stakeholders should seek to be aligned on the skills and knowledge needed for the low-carbon transition and trainings must evolve accordingly to be consistent with these needs. Within this joint endeavour, public entities can play a significant coordination role as well as supporting organizations with their training strategies.

Policy action #19 Increase dialogues between the private and public entities

Increasing dialogues between entities will enrich data gathered on education and training needs, and will favour an optimization of time and resources.

Synergies can be identified within the scope of new training strategies for the low-carbon transition, through a higher understanding of the stakeholders'

needs and deeper collective intelligence between public and private entities. Pooling resources and sharing good practices would increase efficiency (Conseil Supérieur de l'Emploi, 2021b).

It is then important to rationalize the training offer across industries with the participation of all stakeholders. This way, the training offer can reflect the actual needs of the different industries. Acute communication around the strategies put in place and a prior mapping of the existing program offers and needs is then essential before revisiting their modalities and contents.

Possible specific actions are:

- Pool resources across entities,
- Increase the sharing of good practices,
- Further rationalize the training offer.

Inspiring initiative:

As an example, the Hydrogen Education for a Decarbonized Economy initiative in the United States sets to develop qualifications, certifications and materials through a more acute collaboration with industries and university partners.

Policy action #20: Support training strategies through public procurement/ tender

A mandatory energy-climate training provision within public procurements/ tenders would compel companies to invest in upskilling for the low-carbon transition, especially if training evidence is then required (Construction Leadership Council, 2019). In addition, an initiation to carbon footprint calculation and tools could be offered to the selected companies.

Possible specific actions are:

- Include a mandatory energy-climate training provision, requiring evidence of workers' training
- Offer a carbon footprint initiation.

Inspiring initiatives:

These recommendations have been voiced also in the new Construction Procurement Guidelines in New Zealand (New Zealand Government Procurement, 2019): "Agencies must consider and incorporate questions about the upskilling and development of the construction workforce when procuring construction works".

They have been partially implemented in South Africa since 2011 through the Renewable Energy Independent Power Producer Procurement Programme (REI4P), where companies must support workers during the span of a project, including for education and skill development.

In the Netherlands, the ambition from 2030 onwards is to have circular tenders on all governmental levels (Mohamed Juliëtte, 2021).

5.5.2 Ensure consistency between policies and an effective framework

Context: Successful decarbonization requires that public authorities provide stable and robust regulatory frameworks proportionate to the emission reduction goals rather than incremental and fast-changing policies. These frameworks are key to guide public and private investments along the way. This would provide stable planning and investment signals that would create incentives for low-carbon technologies and business models. Furthermore, they would incentivize green reskilling/upskilling.

Policy action #21: Monitor past and current policies to build on key success and failure factors

It is essential to evaluate the outcomes of past and current policies to see how relevant they are to the low-carbon transition of the labour market. All levels of government in Belgium could do this. Objective data as well as insights from stakeholders need to be gathered and difficulties from failing policy measures must be identified (Conseil Supérieur de l'Emploi, 2021b). Proper identification of the potential resistances to change and successful experiences can help to pinpoint pertinent next steps to take.

To that end, **a systematic monitoring of the policy measures should be realized**. This monitoring should be made in cooperation with the diversity of stakeholders. **A standardized reporting framework across Belgian entities** with high-quality statistics should help benchmark past and current measures in terms of costs and efficacy.

Possible specific actions are:

- Identify points of resistance and successful experiences,
- Implement a standardized reporting framework.

Inspiring initiative:

The Recovery Plan for Wallonia seems to move in this direction. It defines Key Performance Indicators to evaluate the performance of each project selected, such as the number of jobs created or the reduction in greenhouse gas emissions.

Policy action #22: Implement acute collaboration and coordination between all governmental levels in Belgium

Discrepancies between policies prevent stakeholders from getting a clear message from public entities and from actively engaging in training and education strategies. A clear articulation of responsibilities and implementation mechanisms between competency levels is therefore essential.

To that end, regional, community, and federal policies need to be coordinated to form a comprehensive strategy. Beyond coordination, a simplification of the institutional landscape might increase the efficacy and efficiency of the development of dynamic policies. The EU DG REFORM through its Technical Support Instrument[18] could help further this reflexion.

[18] https://eufundingoverview.be/funding/the-technical-support-instrument-tsi

Inspiring initiative:

The association 'Synerjob' has been created in 2007 to combine the efforts of different public employment services in Belgium. Their concerted work aims at analysing the Belgian labour market, work collaboratively on challenges and share good practices, among others. Such initiative is positive as it provides a united front and a platform for joint work.

Policy action #23: Simplify administrative procedures

An administrative simplification will also help to engage companies, especially SMEs as they structurally lack both time and means to address administrative and regulatory constraints (The Shift Project, 2021). Administrative simplification makes incentives and enrolment schemes clearer and saves time and resources from SMEs. It could then induce a higher mobilization of companies and subsequent attendance to trainings.

Inspiring initiative:

Switzerland has realized such simplification, "to reduce the administrative burden for SMEs as much as possible": a SME compatibility test assessing how a new law will affect SMEs has been created for this purpose (Confédération suisse - Portail PME, 2021).

Further consideration should be given to the articulation of responsibilities between stakeholders, with a particular attention to financial contributions, both public and private.

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APPENDICES

APPENDIX 1

1. Stakeholders present at the workshops

The following stakeholders have contributed at one or both of the workshops:

- **Federal public administrations**: FPS Economy; Federal Council for Sustainable Development (FRDO CFDD); National Employment Office (RVA/ONEM); FPS Employment, Labour and Social Dialogue; FPS Public Health, Food Chain Safety and Environment; FPS Finance, Khattabi Office
- **Regional public administrations**: Flemish Public Employment and Professional Training Service (VDAB); Forem; SPW Wallonie; Bruxelles Environnement; Vlaams Energie- en Klimaatagentschap (VEKA)
- **Business federations**: Federation of Enterprises in Belgium (VBO/FEB)
- **Trade unions:** Confederation of Christian Trade Unions (ACV/CSC); General Labour Federation of Belgium (FGTB, ABVV); European Trade Union Institute (ETUI)
- **Others**: National Bank of Belgium; King Baudouin Foundation; Reset Vlaanderen, Benelux General Secretariat

2 Main sources from the literature review

2.1 EU-level studies: impact of the climate transition on jobs

STUDY	EMISSION REDUCTION	COUNTRIES	PROJECTION DATE	NET EMPLOYMENT IMPACT	SECTORS WITH SIGNIFICANT NET GAINS IN EMPLOYMENT (FROM MOST TO LEAST)	SECTORS WITH SIGNIFICANT NET LOSSES IN EMPLOYMENT (FROM MOST TO LEAST)
European Commission (2020)	-55% by 2030 vs 1990	EU	2030	-0.26 % to +0.45 %. Estimates vary within this range according to policy setup and modelling assumptions. Fragmented action is assumed in all cases.	Electricity supply; construction	Fossil-fuel extracting sectors; energy intensive industries (note: outcome depends on policy setting. Under certain conditions, the impact can be close to zero or even slightly positive. Likely to be most affected: ferrous metals, followed by non-metallic minerals)
Eurofound (2019)	Below 2 degrees target	EU28	2030	+0.5% in EU28; almost +1% in Belgium	Construction (increasing energy efficiency of buildings + building renewable plants); manufacturing (manufacturing sectors which are linked to renewables & energy efficiency equipment) ; business services ; distribution, retail, hotel, catering ; agriculture ; transport and communications ; non-business services	Mining (energy extracting sector); utilities
McKinsey (2020)	-55% by 2030 and -100 % by 2050 vs 1990	EU27	2030 2050	+1% by 2030 and +2.5 % by 2050	Power; buildings; agriculture	Industry (oil and gas), transportation
CLG Europe (2020)	Climate neutrality by 2050	EU27+UK	2050	+1.01 %	N.A.	N.A.

2.2 EU-level studies: impact of the climate transition on skills/education/occupation/wage/task

STUDY	EMISSION REDUCTION	COUNTRIES	PROJECTION DATE	SKILLS/EDUCATION LEVEL	OCCUPATION	WAGE LEVEL	TASK INTENSITY	NEED FOR TRAINING/RESKILLING
European Commission (2020)	-55% by 2030 vs 1990	EU	2030	Small changes in skills level. Depends on policy set-up. Ranges are: Low skills: -0.17% to +0.15% Medium skills: -0.25% to +0.08% High skills levels: -0.31% to 0.00%	Small changes. Depends on policy set-up. * Positively impacted occupations: Skilled agricultural workers (+0.93% to +1.37%) Craft and related trades workers (-0.20% to +0.21%) Elementary occupations (-0.18% to +0.14%) * Negatively impacted occupations: Plant and machine operators and assemblers (-0.03% to -0.50%), Service and sales workers (-0.04% to -0.31%), Clerks (-0.31% to 0.00%), Technicians and associate professionals (-0.02% to -0.31%), Professionals (-0.30% to -0.04%), managers (-0.33% to +0.04%).	N.A.	N.A.	Need for substantial investment in human capital by individuals, the private and public sector (for training/reskilling workers)
Eurofound (2019)	Below 2 degrees target	EU28	2030	Relatively minor changes in education level. Substantially more job growth at the low and medium education levels than at the high.	Very similar to baseline scenario. Most positively impacted occupations: Building and related trades workers; Metal, machinery and related trades workers.	More employment created at the bottom and middle of the wage distribution than at the top.	Very small differences. Less intellectual tasks and autonomy, more routine.	N.A.
McKinsey (2020)	-55% by 2030 and -100 % by 2050 vs 1990	EU27	2030 2050	More educated and higher-skilled workforce compared to baseline. Note: no numbers communicated to back-up the claim.	N.A.	N.A.	N.A.	Up to 18 million workers could require skills training. Especially relevant for jobs that are currently inexistant (almost 3.4 million by 2050) and jobs that would disappear (2.1 million by 2050).

STUDY	EMISSION REDUCTION	COUNTRIES	PROJECTION DATE	SKILLS/EDUCATION LEVEL	OCCUPATION	WAGE LEVEL	TASK INTENSITY	NEED FOR TRAINING/RESKILLING
CEDEFOP (2012)	N.A.	Germany Greece Italy Hungary the Netherlands Slovakia Finland the UK	N.A.	Demand for medium-skilled will increase more than high-skilled	Nanotechnologist, engineering technologist and environmental engineer Energy auditor, transport vehicle emissions inspector, insulation worker, electrician, solar photovoltaic installer and sheet-metal workerRefuse/recycling collector	N.A.	N.A.	Mixed evidence but gap is more on practical skills than generic skills. Skills shortage in brown jobs: sheet-metal workers, electricians and insulation workers. Mainstreaming required (e.g. giving young people second chance to reskill to STEM and practical skills) Provide green skills in the curricula of learning providers, particularly for insulation workers and SPV installers.
Consoli et al. (2016	N.A.	US	N.A.	Green jobs: - Exhibit higher levels of non-routine (e.g. creative problem solving) analytical skills, cognitive adaptability - Higher interpersonal skills - Higher intensity of formal education, work experience and on-the-job training	Existing occupations may experience a change in work content. Wholly new occupations in the green economy.	N.A.	N.A.	No binary logic of green versus brown jobs: - Jobs that are changing to green economy require formal education, work experience and on-the-job training - New jobs in green economy require on-the-job-training (i.e. learning-by-doing is important)

2.3 Studies at the Belgian level: impact of the climate transition on jobs

STUDY	EMISSION REDUCTION	COUNTRIES	PROJECTION DATE	SECTORS	NET EMPLOYMENT IMPACT	SECTORS WITH NET GAINS IN EMPLOYMENT (FROM MOST TO LEAST)	SECTORS WITH NET LOSSES IN EMPLOYMENT (FROM MOST TO LEAST)
Climact, Oxford Economics and Belgian Federal Planning Bureau (2016)	-46% by 2030 vs 1990 (in line with -80% by 2050)	Belgium	2030	All	~ 80 000 additional jobs = +1.7%	Other market services (40 000); construction (27 000); manufacturing industry (11 000); transports and communications (7000); agriculture (1000)	Energy (-3000) (includes impact on fossil fuel-producing and refining industries, power generation and distribution sector)
Eurofound (2019)	Below 2 degrees target	Belgium (EU level but ventilated by countries)	2030	All	Almost +1%	N.A. (no ventilation by countries)	N.A.
Roland Berger (2021)	N.A.	Flanders	2035	Energy-intensive industries (chemicals, primary metals, rubber & plastics, petrochemicals)	+30 750 in energy-intensive industries (aggregated needs 2020-2035)	Chemicals (+15 573), primary metals (+6152), rubber & plastics (+6721), petrochemicals (+1100)	N.A.
PWC (2019)	N.A.	Flanders	2030	All	N.A.	Buildings: additional jobs per year from 2021 to 2030: buildings (residential): + 5797 to + 8695; buildings (tertiary): +1804 to +2706 Transport: unclear Industry: for companies active at local or European scale: little impact; for companies whose competitors are outside of Europe: unclear. Renewable energy: not researched Waste: + 244 jobs by 2030 Agriculture: little to no impact expected	N.A.

2.4 Studies at Belgian level: impact of the climate transition on skills/education/occupation/wage/task intensity/training

STUDY	EMISSION REDUCTION	GEOGRAPHY	SECTORS	PROJECTION DATE	SKILLS/EDUCATION LEVEL	OCCUPATION	WAGE LEVEL	TASK INTENSITY	NEED FOR TRAINING/RE-SKILLING
Climact, Oxford Economics and Belgian Federal Planning Bureau (2016)	-46% by 2030 vs 1990 (in line with -80% by 2050)	Belgium	All	2030	N.A.	N.A.	N.A.	N.A.	Training will be necessary
Berger (2021)	N.A.	Flanders	Energy-intensive industries (chemicals, primary metals, rubber & plastics, petrochemicals)	2035	Mismatch btw number of STEM graduates and necessary recruitment, especially at bachelor's and secondary education. Compounded annual growth rate (2020-2035) for required hires: STEM at master's level: +3.6%, at bachelor's & secondary education level: +4.4%	New jobs will be mostly for technicians, operators, scientists and engineers.	N.A.	N.A.	Need for upskilling in green themes for around 59 000 workers. In particular: 7000 workers in sustainable design, 34 000 in (renewable) energy, 58 000 in efficient & circular production, 12 000 in green business. Authors propose to establish a cross-sectoral training platform. Need for attracting more STEM profiles, as there is a mismatch btw the number of STEM grads and the required recruitment.
Koning Boudewijn Stichting (2019)	N.A.	Belgium	All related to a circular economy	Baseline	Opportunity for low skilled people, less risk of automatization	Resource and environmental stewards System broker	N.A.	Complexity of tasks increases	Overall, heterogenous result Reskilling needed for complexity More technical skills needed
OECD (2017)	N.A.	Flanders	Agro-food Construction Chemicals	N.A.	Construction: no (because of stable and predictable regulatory framework) Agro-food: yes but limited awareness of need for green skills Chemicals: highly technical and multidisciplinary skills required	N.A.	N.A.	N.A.	Need for more technical skills Mainstreaming environmental and sustainability principles in all education curricula Address linkages between school and work, through practical training and skills development

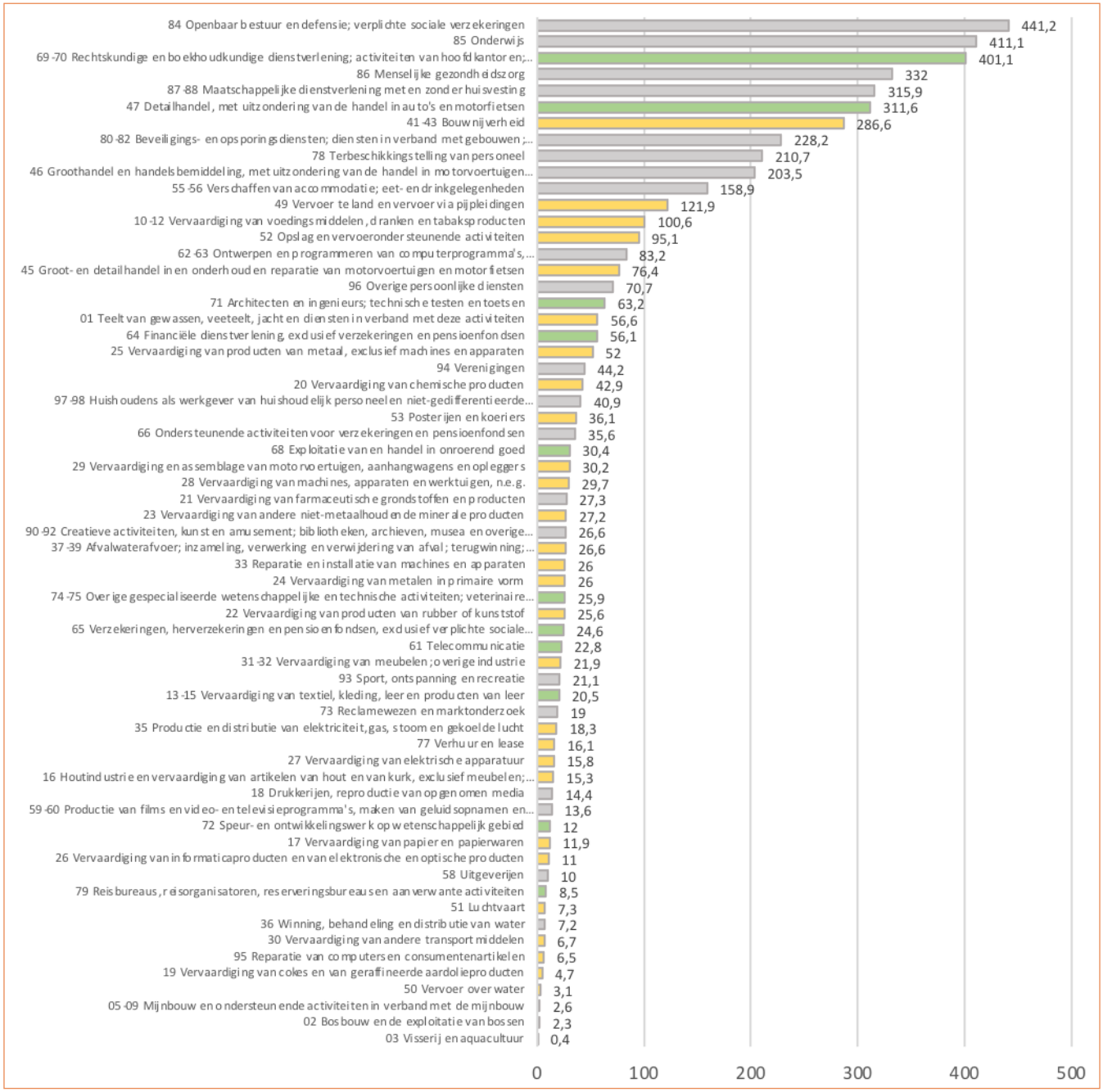
3. Methodology of the exploratory analysis

As decarbonization scenario, we used the technical decarbonization scenario developed for Belgium (FPS Health, Food chain safety and Environment, 2021). The analysis is centred around the CORE95 scenario. It is a scenario that combines behavioural and technological levers to achieve a 95% GHG emission reduction by 2050 (with regard to 1990) as well as so-called negative emissions of 5%, thereby reaching "climate neutrality" by 2050. Note that this concerns production-based emissions (territorial emissions) and not consumption-based (adjusted for trade). The scenario includes 31 decarbonization levers from 5 GHG emitting sectors: buildings, industry, power, transport, agriculture, forestry and other. Though the analysis has been conducted with the CORE95 scenario in mind, results remain mostly valid across the other scenarios (the intensity of impact may vary according to the scenario, but this intensity is not quantified in our analysis).

In terms of economic sectors, we covered the 64 Belgian economic sectors (NACE 2 digits), for which we have the following data (National Bank of Belgium): number of jobs in 2019 – NACE 64; value added in 2019 – NACE 64; status (employed vs self-employed); and under some simplifying assumptions: skills (low, medium, high), age class, men-women.

Based on expert knowledge, we evaluated the extent to which economic sectors are impacted in terms of volume and/or skills by the decarbonization scenario, categorizing impact as: direct impact, indirect impact and no significant impact.

4. Exploratory analysis: expected impact of decarbonization scenarios on all economic sectors



No significant impact (volume and/or tasks)
Indirect impact (volume and/or tasks)
Direct impact (volume and/or tasks)

Expected impact of decarbonization scenarios on Belgian economic sectors

[total number of employed people, in thousands of people, 2019]

Note: Given the large number of employed people within (1) public administration & defence and (2) education who will not be significantly impacted by the transition, these two sectors are categorized as not being significantly impacted. Nonetheless, it is clear that a consequential number of jobs within these sectors will be significantly impacted.

5. Methodology for the calculation of jobs required for the climate renovation of buildings in Belgium

We based our calculations on few parameters found in 3 different sources:

1) Investment estimated in Wallonia to reach 2050 renovation target: 120 billion euros for the residential buildings and between 34 to 57 (mean of 45.5) billion euros for the non-residential (Service Publique Wallon, 2020).
2) Investment estimated in Flanders to reach 2050 renovation target: 150 billion euros for the residential buildings and 57 billion euros for the non-residential (Vlaamse Regering, 2020).
3) The regional multipliers of the Belgian Federal Planning Bureau: we calculated the mean of the multipliers most relevant for climate renovation. Specifically, we included four of the six multipliers in the construction sector, excluding "road and waterway construction" and "demolition, site preparation, test drilling and drilling ". This gave us the following multipliers in the 3 regions:
   a. Wallonia: simple multiplier of 11.5 and type I multiplier of 2.0
   b. Flanders: simple multiplier of 8.9 and type I multiplier of 2.4
   c. Brussels: simple multiplier of 9.3 and type I multiplier of 2.7

As there is no official budget estimation for Brussels, we had to make our own calculations. In the Flanders calculations, they based their investment estimation on the number of dwellings and the surface of their non-residential buildings. Following this logic, we divided the investment estimations per building for residential and non-residential in Wallonia and Flanders. Then we multiplied the mean investment per building by the number of buildings in Brussels in 2020, still distinguishing residential from non-residential (Institut Bruxellois de statistiques et d'analyse, 2022). This results in a budget estimation of 13 billion euros for the residential buildings and 4 billion euros for the non-residential in Brussels to reach 2050 climate renovation target. As all investments were estimated on the global objective until 2050, we assumed it could be linearly distributed on the 30 years between 2020 and 2050, to get an investment per year.

The second step is to use the regional multipliers on the investment per year estimations. Using the simple multiplier, we get the total number of required jobs to cover the new demand (i.e. estimated investment) *[investment(million €)*simple multiplier = total number of jobs]*. The type I multiplier is used to differentiate the number of jobs required in the construction sector (direct jobs), from the number of jobs required in the supply chain of the construction industry (indirect jobs) *[total number of jobs/type I multiplier = number of direct jobs]*. As a results, we have the number of jobs required per year to cover the renovation investments in residential and non-residential buildings for the 3 regions of Belgium.

APPENDIX 2
FOUR MEGATRENDS AND THEIR IMPACTS ON THE LABOUR MARKET

1. Introduction

The emerging transition to carbon neutrality is a major topic in current societal debates. This transition has and will have inevitable and undeniable implications for the world's population, at various levels, including on the labour market and on training requirements. However, the transformation of work and training is already occurring and is driven by a series of important trends. In order to adopt the appropriate policies and measures to accompany the climate transition, it is critical to firstly understand how the labour market is likely to evolve independently of the transition, in a baseline scenario.

This part aims to investigate such megatrends that are likely to have significant impacts on employment, jobs, and training. More specifically, we will analyse four trends[19] at work in Belgium regarding the type and quality of jobs required in the sectors of a mutating economy, the willingness (i.e., quality) and the capacity (i.e., skills) to provide such jobs, and the training offer that would enable the balance between supply and demand to be reinforced. The four investigated trends are as follows: 1) demographic change: migration flows and the evolution of inequality and precariousness; 2) digitalisation: technological disruptions in the production and consumption of resources; 3) roles of the different public and private actors in education and training; 4) public investment policies, and current and future territorial specificities. Obviously, some of these trends are, to some extent, interlinked with the climate transition. These linkages will be highlighted when necessary.

This analysis will make it possible to identify the main challenges in terms of employment and training in Belgium for all sectors and, especially, the expected development in terms of jobs created, jobs lost, jobs transformed and skills required. It is worth noting, however, that this project, and this part, is drawing on a forward-looking approach and provides an introduction to the potential and future influences of different trends on work and training.

2. Method

For this second part of the project, information has been collected by two means. First, as the main source of information, we explore experts' perceptions and discourses on the matter via semi-structured interviews on selected

19 The selection of these four trends has been validated by the Steering group based on a proposition by the research team.

trends. Second, a document analysis based on key papers provided by the experts and the research team has complemented the information collected via interviews. In total, 7 experts have been interviewed regarding four trends (see Table 1).

Table 1. Interviews with 7 experts about trends affecting work and training

TRENDS	EXPERTS
Digitalisation	Bruno Schroder (Microsoft) Peter Van Humbeck
Demographic change and migration flows	Philippe Defeyt (IDD)
Public and private interventions in education and training	Thierry Castagne (Technifutur) Ellen Cardon (VLAIO)
Public investment policies Current and future territorial specificities	Didier Paquot Julie Bynens (secretary-general Departement Kanselarij)

Interviews were conducted using a structured canvas, which was agreed upon by the Steering group. This canvas contained the 4 trends discussed in this section, subdivided into questions. All interviews were transcribed into French for proper data analysis.

3. Digitalisation

a. Trend evolution by 2050

The vast majority of trends mentioned by the experts related to data. The growing availability of data leads to the creation of data spaces and data markets (see for example the EU Gaia-X project[20]) for enterprises. With confidential computing (i.e. privacy protection technology) on its way to being solved in the next 5 years, companies will be able to contribute to different repositories depending on the projects they work on. We will also very likely see an evolution from static open data (e.g. temperature history in a specific place until 2020) to dynamic open data (e.g. live feedback about the current weather in a specific place). In the next 5 to 10 years, there is also little doubt that the inter-operability of cloud computing (i.e. the ability for the different cloud systems to talk to each other) will take place. The future work environment to be imagined in 10 to 15 years from the combination of these trends is quite transformative. It is one in which data will flow from one company to another, coming not only from companies but also from other sources and exploited in real time for market opportunities (e.g. deduce buying peaks in hiking shops according to the weather over the next weeks and the price of train tickets and fuel; and adapting supply chain production accordingly).

Within companies, process management and quality are driven more and more by artificial intelligence, notably in the understanding and valorisation of failure records. However, the relatively strong inertia in terms of the majority of

20 https://www.data-infrastructure.eu/GAIAX/Navigation/EN/Home/home.html

production processes (the lifetime of a plant often stretches over more than 30 years) makes it difficult to predict where exactly we will see an improvement.

b. Impacts on jobs

Beyond the controversies generated by some well-known prospective studies on the impact of digital transformation on jobs (Frey & Osborne, 2017; McKinsey Global Institute, 2017; PwC, 2018) and their transposition in the Walloon context (IWEPS, 2017), it is now more and more accepted that digitalization will lead to job transformation rather than job losses and/or job creation.

Despite this consideration, the jobs being most at risk are the ones that deal with standardized processing of data elements and data encoding, i.e. procedures that can be represented through flowcharts and workflows. This can be linked to the question of job polarisation, i.e., the argument that digital technologies have a skill-biased effect on jobs, leading to a significant increase in the number of high-skills jobs and a probable increase in the number of low-paid service jobs at the expense of middle-skills and routine jobs.

According to the prospective study of IWEPS (2017), the main sectors likely to be affected by digitalization in Wallonia would be: trade and repair of motor vehicles and motorbikes (15.2% of jobs submitted to radical transformation); human healthcare and social aid (14.3%); manufacturing industry (12.6%); public administration (11.9%) and construction (8.6%). Such evolutions can be explained by the categories of jobs concerned: direct service to customers, administrative staff, low-skilled jobs in services and high-skilled jobs in industry likely to be automatized. The extent to which jobs will be effectively transformed will however depend on the specificities of each organizational context (Boyd & Holton, 2018).

The most radical transformations are already observable in specific occupations like customer care, accountancy, network management, etc. but they will probably apply to almost any type of occupation. Job transformations are frequently linked to the automation of tasks, the suppression of physical labour and mind-numbing administrative work and the generalization of algorithmic devices in the work environment. Along with job transformation, job mobility and the shift of the workforce between sectors may create some bottlenecks when considering jobs subject to radical transformation.

The needs in terms of data gathering and processing will increase dramatically. The ability to produce and extract information will become crucial for competitiveness and market intelligence. Regarding job needs, coming first will be jobs that relate to the development and programming of electronic systems, applications and software to produce and capture information. The existing Belgian shortages of several thousands of electro-mechanics, computer engineers and automation technicians will increase, especially for the latter; and will become the main limiting resources. Next, the creation of data markets will lead to the emergence of a new type of profession —data broker— imagining data usages and selling companies intelligence of markets and products by combining various types of data. Finally, jobs related to the implementation of these infrastructures in interoperable environments will develop significantly.

c. Impact on training and skills

It is now largely admitted that the entire workforce will need to acquire basic digital skills including mastering basic digital tools (such as Zoom) and understanding digital fundamentals (AI, big data, etc.). As more flexible and variable software solutions will be developed, the ability to decompose a problem by elaborating a sequence of instructions or steps will become crucial. Workers need to be familiar with this method of problem analysis called algorithmic reasoning, which does not require the development of complex curricula. Finally, there is the ability to develop heuristics. Best acquired through video games, heuristics refers to the capacity of understanding our surroundings and developing a strategy for succeeding in uncertain and not fully controlled environments. Building heuristics is mobilized by workers confronted with multiple software solutions that interact with each other in unpredicted ways, and its teaching must be framed. Digital skills are also to be strengthened all throughout the working life and it connects with the bigger issue of lifelong learning.

Beyond its content, a critical issue lies in the perception of the training and the broadening of the percentage of workers confident in their ability to master digital skills and to succeed in jobs that are more technical. Experiences have shown that there is a strong cultural factor in the ability to succeed in using a tool or understanding a technology. To cope with this, innovation and training programs to familiarise companies and students with IT, in partnership with the academic world must be set at an early stage and throughout the career. Internships or dual education systems are also ways to explore.

However, against the call for transversal training on digital skills, the majority of professional training is still organized within sectoral bodies financed via wage costs, which is a key factor hindering job mobility between sectors. Future employment agreements could therefore seek to enhance greater cooperation between sectors in this area, e.g. via inter-sectoral training funds on digital skills.

If many experts plead for the development of soft skills in addition to digital skills (Bughin et al., 2018; De Mauro et al., 2018), such as communication, empathy, logical reasoning, people management, creativity, emotional intelligence, etc., others remind us of the importance of job related skills, which will remain important to educate and challenge the outputs of digital machines and artificial intelligence. Human expertise will continue to be very important. It means that the future skill profiles must be envisaged as a specific balance between digital, soft and job-related skills. This must be kept in mind in any initiative dedicated to supporting the digital transformation.

d. Sectors and groups of vulnerable people

The digital divide refers above all to pre-existing social and economic inequalities: level of education, income and age are discriminating factors in access to information and communication technologies. On top of the material access to technologies, the digital divide is also expressed in the ability to use new technologies and to navigate them (digital illiteracy), and this is said to be related to illiteracy in general. According to DESI (2020)[21], only 61% of the Belgian

21 https://digital-strategy.ec.europa.eu/en/policies/desi-belgium

population possesses basic digital skills, a little bit more than the EU average but the number is in stagnation the last 3 years. Inclusive forms of training and policies should be developed to overcome this difficulty, by considering multi-media training with gesture interface, for example.

e. Policy recommendations

At the federal level, there is a plea for a digital/algorithmic research institute leading applied research. Within this institute, research projects would involve multidisciplinary teams developing projects aligned with the federal strategic technological axes. This would lead to the design of usable and tailored algorithms, prototypes and programs that will become absolutely critical for Belgium's competitiveness. The current academic structure does not favor the concentration of efforts on specific areas and research in higher education remains highly fragmented. Digital strategies from the various governments in Belgium are also compartmentalized and more bridges and cooperation between them need to be established, with the same idea of not multiplying the use of resources in the face of global competition.

At the regional level, as one expert puts it blatantly, "*we are wide of the mark with the training of electro-mechanic and automation technicians. The bachelor's degree in automation is a training that requires a lot of material investment and it is one of the least financed training programs in the French community, it is dramatic*". Without investment in up-to-date training equipment, such bachelors could become irrelevant for tackling the upcoming challenges of digitalization.

To anticipate the next technological innovations, research centers of big digital companies should also be consulted more frequently in political discussions about digitalization, as they are for now leading the operationalization and marketing of technologies that will be assimilated by companies in 5 to 10 years. This input must, of course, be combined with a multi-stakeholder critical analysis. The political world itself must be trained to the digital technologies, their issues and the digital skills mentioned earlier. The risk of diminishing the effectiveness of their policy implementation is important to consider.

f. Intertwining with the transition to carbon neutrality

On the one hand, the ability to implement effective energy efficiency and renewable energy strategies is strongly linked to the ability to develop planning software and forecasting models that integrate data from different origins (multimodal infrastructures, Mobility as a Service providers, etc.). As working patterns evolve with digitalisation, we will see a greater diversification and distribution of energy consumption and production points, between home, working hubs and headquarters (3H, see deep dive on digitalization in WP4). Aiming for a consumption of energy where and when it is produced, it is crucial to develop software at an ultra-fine level. If smart grids receive a great amount of attention, the relevance of small grids and the micro-management of energy consumption and production remain undervalued. Microsoft and PwC (2019) estimate that the application of AI to environmental problems could curb emissions by 1.5 - 4 % by 2030. In terms of jobs, Eurofound (2019) estimates that the environmental technology investments needed to achieve carbon neutrality will expand employment for the EU-28 by 0.5% in 2030. Ac-

cording to CLG Europe (2020), the creation of jobs linked to low-carbon technologies will therefore not counterbalance the potential net job losses linked to digitalization. We must however remind that such deterministic views on the impact of digitalization (either job losses or job creation) are more and more questioned by academic research (Boyd & Holton, 2018). The effective use of AI tools and advanced industrial robotics largely depends on the economic, political and social contexts in which they are introduced.

On the other hand, as we will see in the deep dive on digitalization, rebound effects may also be linked to digitalization. The growing use of data will generate a heavy carbon footprint, most notably through non-fungible tokens (NFTs) that are cryptographic assets with unique identification codes and metadata that distinguish them from each other and the mining of cryptocurrencies via blockchain technology. The share of greenhouse gas emissions from the digital sector and digitalization is a key issue that needs to be addressed with the great attention. Some experts (Canivenc & Cahier, 2021) develop critical warnings, highlighting the risk of increased journeys among different working locations, heavier data exchanges and requests to central data centers and therefore enhanced digital pollution, more intensive use of e-commerce platforms leading to more traffic on the roads, etc. According to these authors, remote working is currently responsible for 4% of global greenhouse gas emissions, especially with bandwidth-consuming video conferencing, and the growing production of digital devices and this tendency is growing.

4. Demography and inequalities

a. Trend evolution by 2050

By 2050, population ageing will continue to weigh on the age structure of Belgium. Whereas the Federal Planning Bureau predicts a continuous increase in life expectancy[22], this assumption is challenged by our expert who states that life expectancy in good health should stabilize in 2050 with growing inequalities between well-educated and low-educated people[23]. As indicated by CLG Europe, "the ageing of the population interacts with the increase in inequality, to create the risk of unequal ageing. Inequalities in dimensions such as education, health, employment and earnings reinforce each other over the course of life, with early-life factors being powerful predictors of financial well-being among older cohorts (2020: 16). Moreover, regional differences may already be observed today (the healthy life expectancy at age 50 for Walloon men is 4.1 years lower than for their Flemish counterparts) and they are expected to remain up to 2050[24].

Belgians are not expected to reach the replacement rate by 2040. This may still be the case in 2050 or later. Furthermore, regarding the population size in Bel-

22 https://www.plan.be/uploaded/documents/202202080741470.Persp_FLASH_DP21_12568_F.pdf

23 http://www.iddweb.eu/?m=202010#:~:text=Apr%C3%A8s%20des%20progr%C3%A8s%20notables%20entre,sant%C3%A9%20suivant%20le%20niveau%20%C3%A9ducationnel.

24 http://www.iddweb.eu/?m=202010#:~:text=Apr%C3%A8s%20des%20progr%C3%A8s%20notables%20entre,sant%C3%A9%20suivant%20le%20niveau%20%C3%A9ducationnel.

gium, and despite child birth staying below the replacement rate, the size of the population will continue to increase, mainly because of continued immigration, that can already be strongly observed nowadays. Migration flows have a net positive effect on population size, but once again with a risk of increasing inequalities in terms of education and income.

Although it is complicated to report because of the many uncertainties about the future, the number of births might be higher, according to one of our experts, because of a renewed confidence in the bright future for children, if major societal challenges such GHG and biodiversity are properly addressed by public authorities.

b. Impacts on jobs, training and skills

According to experts, an ageing workforce will not have a significant impact in terms of jobs, training and skills compared with the current situation. Older workers are however harder to retrain, less engaged in training programs and probably less open to digital skills (CLG Europe, 2020), but this is already the case today.

The future Belgian workforce will not decrease significantly due to ageing, as young seniors (55+) are expected to continue working. An ageing population will be more engaged in volunteering, given the population growth curve and the birth boom a few decades ago. This information is yet unclear, as it may be counterbalanced by less volunteering among 30-55 year-old workers. Young seniors will continue to be involved over time in different areas. Therefore, this megatrend is not expected to have any major impact on the 2050 labour market, in comparison with today.

Concerning migration flows, it is expected that Belgium will evolve towards an Anglo-Saxon model, which means more selective immigration, either by origin or by skills. In this perspective, immigration could involve more high or medium-skilled workers, but this remains uncertain.

According to CLG Europe (2020), an ageing population in advanced economies will have higher energy use and could induce higher emissions. However, younger generations could also be characterized by more energy consumption, particularly with higher demands for electricity at every stage of their lives.

c. Sectors and groups of vulnerable people

Limited risks are mentioned by most experts in this area. The income gap between the weaker and wealthier segments of the population is supposed to remain relatively stable. However, as reminded by one expert, inequalities should be measured through the evolution of living standards, as this takes account of non-monetary benefits (e.g. company cars). In this perspective, inequality of living standards could increase both within and between the different categories of the population unless appropriate policy measures are put in place (CLG Europe, 2020).

d. Policy recommendations

Two main paths may be followed by public authorities. The first one is to consider migrants as an important source of skills and knowledge to be mobilized,

which could counterbalance some of the shortages encountered in the country. Indeed, a significant number of migrants are well qualified and come from multiple disciplinary fields. If migrants are accepted with their socio-cultural differences, and supported in their transition, they could represent a relevant source of specific skills and knowledge (Ette et al., 2016; Ruhs & Anderson, 2012). The second path is through lifelong learning. Indeed, as we have shown above, the Belgian population will probably level off, but the concrete modalities of lifelong learning must still be defined, with different types of curricula and qualifications to be triggered over time and by changes in technology and labour market demands and needs. This lever is further emphasized in the next section on education and training, intertwining with low-carbon transition.

5. Education and training

a. Trend evolution by 2050

According to a recent report of OECD[25], Belgium is one of the 14 OECD countries where at least half of 25-34 year-olds have a tertiary education. The Belgian education and training ecosystem contains many layers of actors offering training. It consists of public, semi-public and private actors. Yet, educational matters are often decided at a regional/community level: it inevitably leads to differences between the three entities. However, strong similarities can be found between them. Public actors are primary and secondary schools, university colleges more oriented towards the labor market, universities, public services of training and employment that help the unemployed find a job, and, if needed, reskill & upskill or again change their career paths, and offer business-oriented training services. Semi-public actors are mainly unions, as some of them provide training. Private actors are sector funds which meet legal obligations to train employees, large companies that provide training programs, and service providers proposing skill development to individuals.

When looking at major trends in the educational and training ecosystem susceptible to impact the Belgian labor market and the skills of the workforce, experts see five of them: 1) digitalization of learning and teaching; 2) knowledge transfer via digital tools; 3) skills transfer in project-based and interdisciplinary manners; 4) life-long learning (upskilling and reskilling) to better adapt to major transitions (digitalization, automation, etc.) due to more frequent career changes; 5) growing connection between the job market (firms, etc.) and educational actors in order to match training and skills needs via in-factory training or internships, for instance.

b. Impacts on jobs

Digitalization will transform teachers' jobs but the current trends in education and training at the sectoral level are not expected to lead to a net gain (or loss) of jobs by 2050. At sub-sectoral level, however, we may expect an increase of tasks around digital tools (e.g. designing digital learning platforms

25 https://gpseducation.oecd.org/Content/EAGCountryNotes/EAG2022_Belgium.pdf

and preparing learning contents) and a decrease in teaching tasks, as part of the teaching job will be done digitally. The current shortage of teachers, due to many resignations[26], could therefore be reduced through the growing use of digital tools. We must however keep in mind that the latter cannot replace face to face interactions with teachers, enabling innovative learning pathways: the future of training will be probably more and more organized on a blended mode. The expected impact on the labour market should therefore mainly lead to job transformation, both in terms of teaching tools and methodology (e.g. project-based, interdisciplinary, coaching, problem-based learning, etc.).

c. Impacts on training and skills

In the majority of cases, new skills will replace more traditional skills because teaching will be less organized through lectures in front of the class while digital skills and soft skills (coaching, interdisciplinary and project-based teaching) will be more and more needed. We can anticipate a growing tension between a fragmented and rigid institutional landscape and a changing labour market with agile requirements. On this basis, there will be a strong necessity to develop life-long learning for teachers in order to support their acquisition of the new skills mentioned above. As such, the main risks in this megatrend are related to the need to upskill teachers quickly (in terms of digital and/or interdisciplinary methodologies), particularly secondary school teachers.

Moreover, the acquisition of skills and knowledge by students is changing. Whatever the length of studies, continuous education throughout the entire professional live will become crucial. The total duration of education will probably remain unchanged, but will be spread over a whole career and evolve according to the evolution of the job rather than being concentrated in the years before entering the labour market. This represents a profound challenge to the traditional educational model.

d. Sectors and groups of vulnerable people

The most vulnerable group of people (regarding the trends identified above) are the teachers of practical skills in such fields of construction or healthcare. These teachers were initially hired with a long experience in fieldwork. However, as very rapid changes are occurring in the associated jobs (e.g. digitalization in the construction or care sector), the type of practical skills that need to be taught is also changing very rapidly. Some teachers may not be able to keep up, especially if they are not sufficiently supported. All sub-sectors of education are potentially threatened. In addition, there will be a difficulty to access higher skill requirements concerning the digital, social and climate transition. A part of the population might be distanced from the educational system. As mentioned above, the Belgian labour market is facing a severe labour shortage in electro-mechanics. The very rapid changes observed in this area will not help to fill such shortage in the short run. The situation should be better addressed, in particular the lack of teachers with up-to-date practical skills.

26 https://www.lalibre.be/belgique/enseignement/2022/06/09/en-flandre-aussi-le-manque-denseignants-est-un-vrai-casse-tete-EN6MACNLSRBORGYUZ7OM55JZWI/

e. Policy recommendations

First, it is needed is to guarantee that training is constantly updated in order to match the skills, competences and knowledge needed in the labor market. Second, the Belgian education system is a regional/community competence, so regional/community governments have most of the leverage and must act as actors of change. Third, policy initiatives need to focus on long-term interventions, and training needs need to be integrated into workers' lives over time. This means that training should be directly relevant and applicable to workers. In other words, training should be associated with operational activities that could develop in any case. Fourth, special support should be provided to teachers of practical skills (as they represent a seriously vulnerable group of workers). This could, for example, take the form of guest lectures (e.g. industry workers come to the classrooms) coupled with teacher training on the content of the guest lectures.

f. Intertwining with low-carbon transition

According to the experts, to enable a successful transition, the circular and low-carbon economy logics need to be integrated and taught across the educational programs to develop appropriate mindsets. There is a need for sectoral training on circular and low-carbon practices, as well as for a strong partnership between the green sectors, innovation research centers and educational institutions to ensure that educational institutions teach the relevant skills and knowledge, especially in view of the rapid changes linked to climate transition and digitalization.

6. Public investment policies

Public investment policies are here defined as the political orientations taken at each federal and regional level likely to influence public expenses in the next decades. When considering the public expenses likely to support the transition to carbon neutrality in the long run, the metaphor of war against climate change is often used to emphasize the necessity to reorient public expenses on key levers likely to support the transition: renovation of buildings, massive investment in public transportation, radical transformation of fiscal regimes, etc.

However, we must admit that it is very difficult for experts to anticipate budgetary choices by 2050, given the political uncertainties and the complex institutional landscape in Belgium (federal and regional/community levels). This is why they have proposed to focus the prospective discussion on the recovery plans recently adopted by the federal and regional entities, in which significant investments are envisaged for the next decades and climate change is a key issue.

The National Recovery and Resilience Plan (RRP) has been adopted in June 2021 with 5.925 billion euros for the period 2021-2026. The National Recovery and Resilience Plan for Belgium is structured in six strategic axes: (1) climate, sustainability and innovation, (2) digital transformation, (3) mobility and transport, (4) social and living together, (5) economy of the future and productivity

and (6) public finances. In total, 49.6% of the Plan's expenditure contributes to the objective of transitioning to a low-carbon, sustainable and climate-resilient economy. Expenses on digital transformation account for 26.6% of total Plan expenditure.

Next to the National RRP, the 3 regional governments have launched their own recovery plan (Get Up Wallonia!, Flemish Resilience and post-Covid recovery plan for Brussels) to cope with the challenges and consequences of the global Covid-19 sanitary crisis and the recent flooding in Wallonia. Some projects in the national recovery plan are linked to projects in the Flemish resilience plan and Get Up Wallonia!. Both recovery plans involved task forces composed of experts of different backgrounds (private sector, social partners, academics). The Walloon government has decided to invest 7 billion euros in order to revitalize Wallonia, through 51 actions and 18 measures. These actions and measures cover various themes, such as breaking out of precariousness, implementing a strong and sustainable economic and industrial policy, strengthening energy independence and the energy transition, reinforcing continuous training initiatives, etc. These are built around 4 core 'missions': managing the health emergency, minimizing the economic and social impacts of the crisis, reviving socio-economic activity to produce a virtuous circle of progress, strengthening the resilience of society and its capacity to meet new challenges. The Flemish government wants to invest 4.3 billion euros in its recovery plan. This plan includes a series of projects on various themes, such as environment, education, healthcare, or the well-being of its Flemish population. These themes will be addressed through 180 projects. This Flemish recovery plan also aims to boost the long-term climate strategy 2050 and the long-term renovation strategy 2050. The Brussels government has decided to invest 500 million euros in the economic, social and ecological transition, including the optimization of the healthcare system and urban regeneration policies (mobility, housing, infrastructures, business activities, green spaces and leisure).

a. Impacts on jobs, training and skills

The national and regional recovery plans presented above will have a significant impact on the job creation and the job transformation.

In the national RRP, the building sector is targeted, which will entail reconversion actions to green jobs in cooperation with communities and regions. The digital transformation concerns the massive development of online administration in public services, healthcare, media and culture: this will unavoidably accelerate the transformation of jobs and will also need intensive reskilling and upskilling actions.

In the Flemish recovery plan, different axes of work exist related to the labour market and training with the objective of making work sustainable and keeping workers skilled and capable. A major goal is also to identify unskilled people and help them with upskilling initiatives. Moreover, the social partners are strongly involved in some projects. The Flemish government is also investing in a more systemic way, outside the recovery plan, in initiatives to activate workers through employment bonuses, for example. The impact of the plan's job creation is therefore important, as many jobs should result directly or indirectly from the projects presented by the Flemish government. Eventually, there will be significant investments in R&D, in particular, given the innovation capacities

existing in Flanders. The construction sector and the circular economy will also be valued.

The Walloon government will invest in jobs, training, and skills. The Forem will benefit from the investments of the recovery plan. In addition, the various training and skills centers will be reorganized to update the tools and infrastructures and adapt them to the expectations of the labour market. The Walloon recovery plan insists on a massive effort for vocational training and digital training (reskilling and upskilling), the development and updating of skills for emerging and technical jobs, future jobs and those in shortage (health, social work or food, etc.). Self-employment is also strongly encouraged by the Walloon government. Lastly, the measures and actions presented in the recovery plan have been selected for their potential to create quality jobs, to have added value and have a positive impact on the environment and the climate.

One of the main axes of the recovery plan for Brussels concerns the economic transition: it involves a reinforced support to self-employment and training actions for the development of quality jobs, with a special attention to gender inequalities and workers having lost their jobs after the Covid crisis.

b. Sectors and groups of vulnerable people

All recovery plans are largely focused on citizens considered as vulnerable, with reinsertion actions over the long run (e.g. young people, long-term job seekers, seniors, migrants, people with physical or mental disabilities , etc.).

c. Intertwining with low-carbon transition

The transition to a low-carbon economy is crucial in recent policy making and all recovery plans take these challenges into account. For instance, the Flemish plan aims to reduce the carbon emissions of the Belgian economy, in line with the objectives of the 'Flemish Climate-Energy Plan 2030', but also the 'Long-term Climate Strategy 2050'. This is actually one of the pillars of the Flemish recovery plan: the transition towards more sustainability but also towards the decarbonization of society. On the Walloon side, Get Up Wallonia! intends to fight against climate change and accompany decarbonization, the development of sustainable industries and resources. For what concerns Brussels, the recovery plan is integrated within GO4Brussels 2030, the Regional Plan of Sustainable Development, the Good Move plan and the Air, Climate and Energy plan.

7. Conclusion

This section aims to study the megatrends that are quite likely to have an impact on employment, jobs and training, whatever the initiatives taken to support the transition to carbon neutrality. Four megatrends were analysed based on a literature review and expert consultations: 1) demographic change including migratory flows and the evolution of inequalities and precariousness; 2) digitalization and technological upheavals in the production of resources; 3) education and training; 4) public investment policies.

Digitalization clearly will have structuring effects on jobs, skills and training in the mid- and long run. The majority of these effects will not concern job creations or job losses but rather job transformation: workers will have to adapt through intensive training activities during their whole working life. Most importantly, workers will need to feel capable of doing so. Specific efforts will be needed in digital literacy in order to avoid the development of new social divides, while coherent measures will have to be taken between the different communities and regions in order to support the massive public investments already planned. Federal and regional political authorities will have to become more aware of digitalization issues and build bridges among them and with companies.

The demographic megatrend will probably be less of influence. Indeed, life expectancy is likely to stabilize by 2050, while migration flows will contribute to the continuous growth of the population, with few risks of job losses or job transformation due to the nature of the jobs concerned. With the probable evolution towards more selective immigration policies, high or medium-skilled workers could be more numerous. In addition, future migrants could bring new skills and knowledge.

The educational megatrend will strongly interact with digitalization. Indeed, digital skills will have to be combined with job related and soft skills, and teachers will have to acquire new skills and knowledge as well as ways of teaching. In addition, vocational training institutions will have to focus on lifelong learning activities, given the speed of the digital and the climate transition.

When considering the public investment policies megatrend, we have seen that federal and regional governments have adopted recovery plans that focus on post-covid challenges and economic, social and environmental transition. Concrete actions and projects will be implemented, notably to activate the most vulnerable people, create and/or transform existing jobs, and above all to develop the knowledge and skills of the workforce, via reskilling and upskilling initiatives. Moreover, these plans have clear incidences on climate change and the low-carbon transition of society.

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APPENDIX 3
CLIMATE RENOVATION OF BUILDINGS

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Executive summary

Climate renovation of buildings towards a carbon neutral buildings stock is central to the climate transition. While the challenge of triggering demand for climate renovation in the required pace (>= 3% yearly) remains "untackled" and is the focus of most policy measures, ensuring the availability of sufficient qualified workers across the supply and value chains (in the right volume and with the right level of skills) is important and uncertain, and is less addressed by current and planned policy measures in Belgium.

Both EU and Belgian studies forecast the construction sector to be the sector with the most net job creation due to the low-carbon transition (Climact, Oxford Economics and Belgian Federal Planning Bureau, 2016; Eurofound, 2019; Cambridge econometrics, 2021). Moreover, analysis based on linking Belgian decarbonization scenarios with economic sectors shows that construction is the largest sector directly impacted by the low-carbon transition.

A successful transition requires the availability of sufficient qualified workers in the sector and its supply chain. This is necessary, not only to have workers that are able to renovate buildings, but also **to stimulate the demand for renovations.** Indeed, workers such as general contractors and architects influence their clients' demands through dissemination of information and the work they propose. Obtaining the necessary skilled workforce will require recruiting additional workers and upskilling & reskilling a significant share of current workers.[27] Current policies remain insufficient. **Without a successful strategy to transform the construction labour market (and its fast implementation), reaching the 2030 and 2050 climate targets for the buildings sector may be severely hampered.**

Beyond decarbonization, investing in building renovation can have many benefits on public budgets, such as increasing revenues from income & corporate taxation and VAT, reduced unemployment benefits costs, and lower direct & indirect health expenditures (BPIE, 2020).

This case study covers (1) the necessary transformation of the buildings sector to reach the 2050 climate renovation objectives, (2) labour market requirements in terms of jobs, (3) the availability of workers in a context of

27 Upskilling training aims to update existing skills to accompany job changes, while reskilling training intends to teach new skills to take on a different job.

workforce shortage, (4) requirements in terms of skills and (5) associated training needs, and (6) some implications for a just transition. To shape the way forward, (7) policy considerations are presented.

The transformation of buildings sector to reach 2050 climate objectives

Labour market requirements stem from climate renovation objectives. In this study, we adopted the objectives of the Belgian CORE95 scenario, i.e. 95% greenhouse gas emission reduction by 2050) (FPS Health, Food chain safety and Environment, 2021), and the long-term regional renovation strategies. Main targets include:

- **More renovations**. 3% renovation rate per year. In the residential sector, this amounts to 180,000 deeply renovated dwellings a year in Belgium.
- **Deeper renovations**. Long term target of label A or 100kWh/m^2/year.
- **Fastened decarbonization of energy**. This is achieved mostly through heat pumps and district heating.

In Belgium, to achieve the 3% renovation rate objective, the renovation rate of

- non-residential buildings should be **three times higher**
- residential buildings should be **fifteen times higher** (National Climate Commission, 2021; European Commission, 2019).

To achieve these objectives at the required pace, the following practices in the buildings sector will need to be accelerated:

- **Circularity**, a key to reduce the environmental footprint of the sector.
- **Standardization and industrialization** of renovation products and processes (reduction of cost, labour intensity, shorter project lifetime, eased waste management).
- **Digitalization,** which is an enabler of circularity and industrialization.

Labour market requirements in terms of jobs

We estimate that 130 thousand sustained jobs are necessary for the period up to 2050 to renovate the Belgian buildings stock. Moreover, 59 thousand of these jobs would be in the construction sector, which represents about 20% of the current construction workforce. The other 71 thousand needed jobs are in construction's supply chain. Our estimations are based on regional climate renovation budgets and input-output multipliers of the Federal Planning bureau.

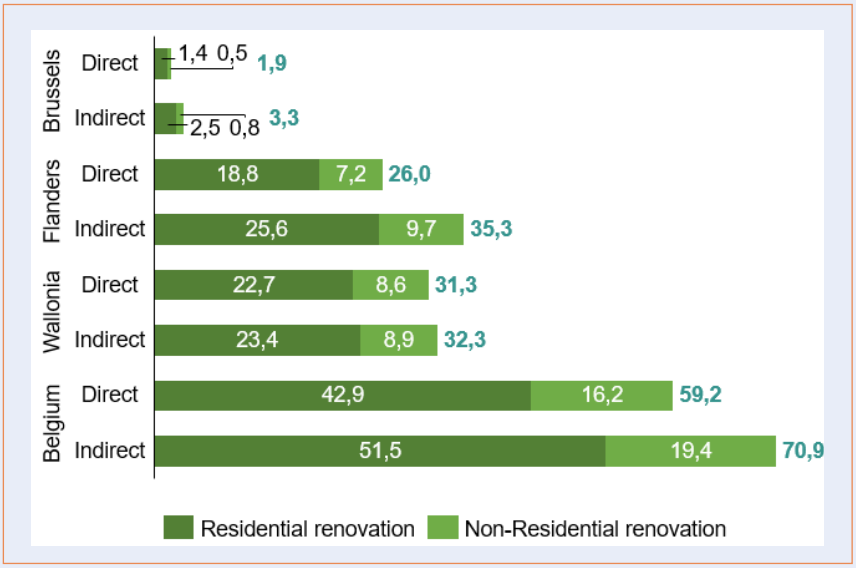

Figure 12. Required jobs per year (in thousands) in the three regions, differentiating between direct (construction) and indirect (supply chain) jobs, as well as between renovation of residential and non-residential buildings. For the detailed methodology of calculation, see appendix 6.4.

The net increased workforce demand in construction and its supply chain depends on the extent to which the demand for climate renovation is met by a retargeting of construction activities to climate renovation or is added on top of current demand. Estimations based on input-output only specify the number of required jobs, not whether these jobs are fulfilled by the current workforce or if there is a need for additional workers. According to the CORE95 scenario, newbuild activities should significantly ***decrease***. This could lead to a shift of workers from newbuild to climate renovation. The extent to which this shift will take place is unknown. Therefore, the net increased workforce demand will depend on the extent to which this shift will take place (along with other shifts from current activities to climate renovation). We **expect a significant increased workforce demand** (1) given the structural workforce shortage in the construction sector, estimated at 20 thousand workers (European Commission, 2020) and (2) uncertainty on the decreased demand for newbuild.

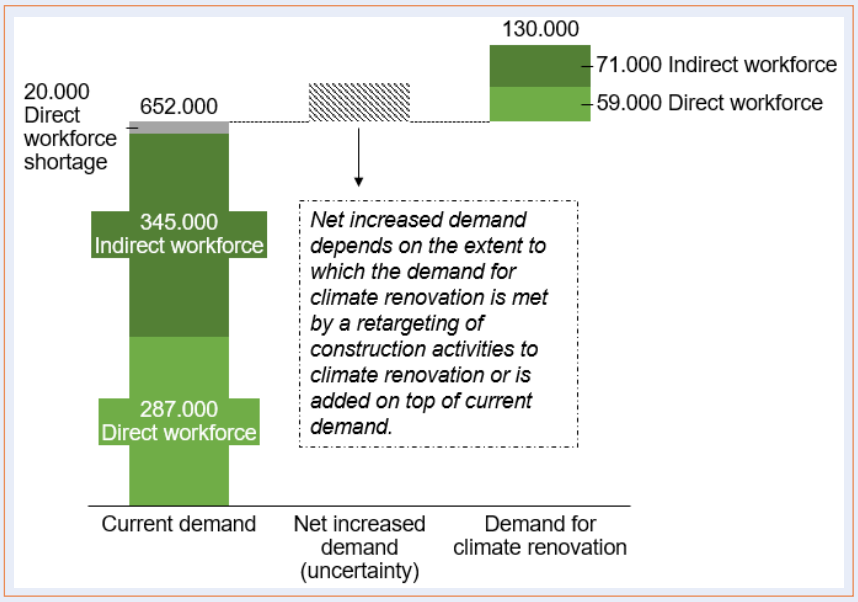

Figure 13. Evolution of direct and indirect workforce demand in the construction sector for the climate renovation of buildings (2050 climate target)

Not all jobs will be required at the same time; temporary needs will trigger peak demand for certain jobs. This leads to two challenges: (1) ensuring the sufficient availability of skilled workers during the peak and (2) making sure that, once the peak has passed, "peak" workers can find work in related activities or are successfully reconverted. We propose policy considerations to address both challenges.

Availability of workers in a context of workforce shortage

As explained previously, we **expect a significant increased workforce demand** (1) given the structural workforce shortage (2) uncertainty on the extent to which newbuild activities will decrease. Therefore, attracting additional workers is necessary.

The workforce shortage is, among other things, due to insufficient trainings, low attractiveness of the sector, hard work and low salary (Conseil Central de l'Economie, 2021)**.** Policies to tackle these causes are required and would benefit the entire construction sector.

Some profiles could fill in the gap and take on climate renovation jobs (young people, unemployed, reconversion workers, immigration workers), **but several challenges remain**:

- How to attract these profiles in a sector with low attractivity?
- How to successfully train them?
- How to support companies to hire them?

We identified solutions to these challenges, including:

- Valorising construction professions in the eyes of the public, especially the youth.
- Designing policies to facilitate the integration of women on construction sites.
- Increasing visibility on the renovation market evolution.

– Designing better policies targeting illegal work and social fraud in the buildings sector (Confédération de la Construction, 2019).

Requirements in terms of skills

The labour market needs/impacts of the climate renovation extend beyond the requirement of a volume of workers. To qualitatively understand the breath of requirements as well as the impact on the job market, we clustered needs/impacts into five categories:

CATEGORY	DESCRIPTION (IN THE CONTEXT OF CLIMATE RENOVATION)	EXAMPLE
1. Emerging climate renovation jobs	New jobs created specifically for the climate renovation of buildings.	Deep climate renovation coordinator
2. Increased demand for existing jobs	Existing jobs whose demand will increase due climate renovation but whose skillset remain unchanged	Market services (such as banking services) for climate renovation companies
3. Transformed jobs	Jobs whose skillset need to evolve to incorporate climate renovation skills.	Real estate agents
4. Increased demand and transformed jobs (combination of 2. And 3.)	Jobs whose skillset will need to evolve to incorporate climate renovation skills AND whose demand will simultaneously increase due climate renovation.	Heating system installers
5. Lost jobs	Jobs lost due to Climate renovation.	Fossil-fuel based jobs who fail to transform

The Figure 14 below gives a qualitative visualisation of the impact of the transition on each category, distinguishing between direct and indirect jobs. It is based on a non-exhaustive screening of jobs impacted by the transition.

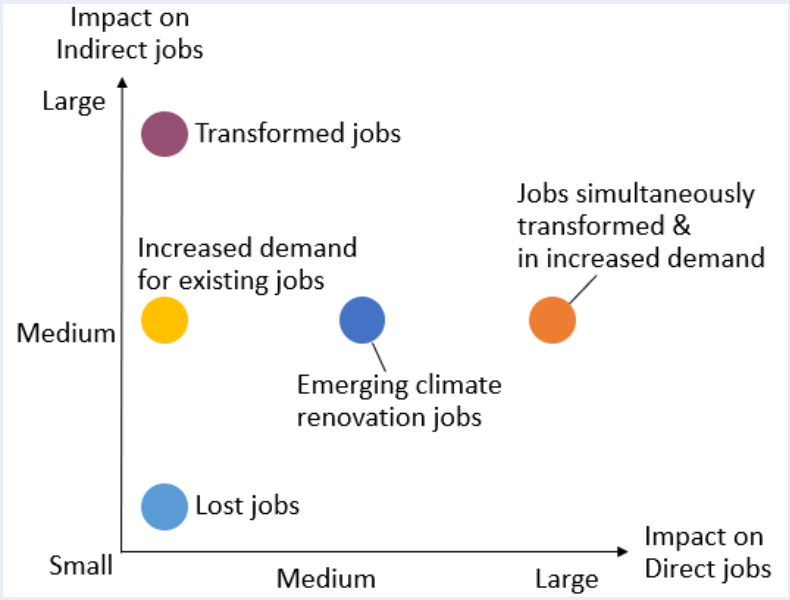

Figure 14. Qualitative estimation of the impact from the climate renovation on direct and indirect constructions jobs

Many **existing construction jobs** will require additional skills while simultaneously being in higher demand (category 4), including:

- **Climate renovation skills specific to each job.** For instance, skills related to insulation, ventilation, installing and monitoring new devices.
- **Learning to adapt to supply chain disruptions and work with new approaches and** materials (i.e., prefabricated solutions, bio-based insulation materials, etc.)
- Adapting to **the digitalization** of work, including oversight/monitoring tools.
- **Better understanding the job of the other workers** in renovation projects, in order not to destroy their work or not to make it harder.

There are also new jobs that need to be created specifically for the climate renovation of building (emerging climate renovation jobs (category 1)). **These jobs require new skills.** They include deep climate renovation coordinator, district renovation coaches, jobs related to heat network development (facilitator, technician, urban planner) and the industry of climate-neutral heating system production (heat pumps) and its supply chain (e.g., calorific fluid), etc. In terms of skills, these jobs typically require:

- A first cycle of tertiary education diploma
- In-depth climate renovation skills and knowledge
- Technical skills (e.g. in heating, electricity, conception work)
- Transversal skills such as soft skills (management, flexibility, communication, adaptation, creativity) and digital skills to adapt to a changing market and environment

We expect a significant number of jobs that will be transformed without being in higher demand (category 3.), such as real estate agents, several jobs in public administration, and teachers for the many jobs linked to climate renovation (e.g. heating technician teacher).

Finally, we expect **limited lost jobs,** assuming a successful (1) upskilling of workers in jobs who will be transformed and (2) successful reconversion of peak workers.

Training needs

To ensure workers possess the necessary climate renovation skills, there is a need for (a) upskilling & reskilling current workers (b) and ensuring learners (future workers) are adequately trained.

a) Current construction workers (in jobs linked to climate renovation) should be upskilled via short life-long trainings. Specific measures will be necessary to help upskilling construction workers. Most construction businesses in Belgium are micro (<10 employees) and small (<50) businesses. These businesses have limited time and financial resources for upskill & reskill employees. To help them train workers, we propose:

- ameliorating the offer of
  - affordable, short, and practical training
  - affordable on-site training

- training subsidies modulated according to company size (greater support for smaller companies)
- incentivizing to follow climate renovation upskilling trainings by delivering a "climate renovation" certificate.
- combining temporary unemployment with climate renovation reskilling/upskilling training.

b) Trainings for both emerging climate renovation jobs and existing construction jobs should be improved.

- Emerging climate renovation jobs: for some jobs (e.g. deep energy renovation coordinator), trainings exist but they should be **mainstreamed** in more teaching institutions. For other jobs (e.g. district renovation coaches), there are currently no available trainings, so **new trainings should be developed.**
- Existing construction jobs (e.g. roofer): **the curriculum should be adapted to include climate renovation skills and knowledge.** Worryingly, **most job and training profiles in the construction sector have not been updated by the Francophone Service of Jobs and Qualifications (SFMQ) since 2011-2013** (Bassin EFE Bruxelles, 2021)**.** In the Flemish community, the Agency for Higher Education, Adult Education, Qualifications and Scholarships (AHOVOKS) has started a catch-up the last several years to update outdated occupational qualifications to contemporary standards, including sustainability requirements. However, no statement of a specific focus on the climate transition could be found (AHOVOKS, 2016, 2017, 2018, 2022; Baisier, 2015).

Specific measures will need to be implemented to address peak demand. The main ones are (1) increasing marketing and incentives of trainings before and during the peak and (2) making sure reconversion trainings are available after the peak.

We also **propose the creation of a special trainer status for end-of-career workers**, to tackle the shortage of construction trainers.

Finally, we propose several solutions to **enhance communication and collaboration between training stakeholders.**

Considerations for a just transition

From a job market perspective, we see the climate renovation as benefiting some vulnerable profiles on the labour market. Indeed, many of the jobs created are an opportunity for low skilled workers, manual workers that lost their jobs due to automation, unemployment, etc. However, adequate training will need to be available and affordable.

Given that some of the current jobs in construction sector are not decent (i.e. fair income, secure form of employment, safe working conditions, equal opportunities and treatment for all, offering prospects for personal development, etc.) (ACV Nationaal, 2021; de Wispelaere, 2022; Sanen, 2021), **there is a risk that the creation of work in the context of the energy renovation will not be decent.** We recommend further designing/reinforcing policies to safeguard decent working conditions, such as controls, social inspections, and strict social criteria in public tenders.

Policy considerations

Throughout this study, we identified policy considerations to the labour market challenges and needs tied to the climate renovation. In this last chapter, we summarized policy considerations into six clusters:

- **Ensuring the availability of sufficient workers** in a context of workforce shortage
- **Ensuring** learners (future workers) are **adequately trained**
- **Upskilling & reskilling the current construction workforce**, especially older and lower skilled workers.
- **Anticipating peak demand for certain jobs** and accompanying workers before, during, and after the peak
- **Addressing the shortage of construction teachers**
- **Enhancing communication and collaboration between trainings stakeholders**

1. Introducing the case

Relevance of the case

The Climate renovation of buildings towards a carbon neutral buildings stock is one of the cornerstones of the low-carbon transition and contributes to 16 of the 17 sustainable development goals (IPCC, 2022).

While the challenge of triggering demand for Climate renovation in the required pace (>= 3% year) remains "untackled" and is the focus of most policy measures, ensuring the availability of sufficient qualified workers across the supply and value chains (in the right volume and with the right level of skills) is important and uncertain, and is less addressed by current and planned policy measures in Belgium.

Both EU and Belgian studies forecast the construction sector to be the sector with the most net job creation due to the low-carbon transition (Climact, Oxford Economics and Belgian Federal Planning Bureau, 2016; Eurofound, 2019; Cambridge econometrics, 2021). Moreover, analysis based on linking Belgian decarbonization scenarios with economic sectors shows that construction is the largest sector directly impacted by the low-carbon transition.

Beyond decarbonization, investing in building renovation can have many benefits on public budgets, such as increasing revenues from income & corporate taxation and VAT, reduced unemployment benefits costs, lower direct & indirect health expenditures (BPIE, 2020).

Outline of the case

This report covers the necessary transformation of the buildings sector to reach 2050 Climate renovation objectives (section 2.), labour market requirements in terms of jobs (section 3.), availability of workers in a context of workforce shortage (section 4.), requirements in terms of skills (section 5.) and associated

training needs (section 6.), and implications for a just transition (section 7.). To shape the way forward, policy solutions are proposed throughout the report and summarized at the end (section 8.).

Specific methodology of the case

We gathered data through:

- **A literature review** of about 30 studies and reports
- **Bilateral expert interviews** with actors such as Construcity, Actiris, the Construction Confederation, the Forem and Bruxelles Formation.
- **Participation** in 4 Renolution working groups

In terms of geographic scope, our focus is on the Brussels-Capital Region, especially for regional policy recommendations. However, we extended the scope to the whole of Belgium where possible.

2. Transformation of the buildings sector to meet the long-term climate objectives

To evaluate the labour market needs of the climate renovation of buildings, it is first necessary to clarify climate renovation objectives and explore how these will transform the building's sector. This is the subject of the present section.

In our analysis, we adopted renovation objectives outlined in the federal 2050 Belgian scenarios (climate neutrality by 2050) (FPS Health, Food chain safety and Environment, 2021), and more specifically in the CORE-95 scenario. A description of the scenario can be found in the Appendix A. These objectives are aligned with the long-term renovation targets of the three Belgian regions.

Climate renovation objectives

In the CORE-95 scenario, **the renovation rate and depth increase to achieve the GHG objectives.** Compared to the reference scenario, the renovation rate is three times higher, from 1% per year to about 3% per year. This is in line with the target of Renolution, which aims to achieve an EPC average of 100 kWh/m^2/year for buildings in Brussels by 2050, which is three times lower than its current average consumption(Bruxelles Environnement, 2022).

In Belgium, to achieve the 3% renovation rate objective, the renovation rate of

- non-residential buildings should be **three times higher**
- residential buildings should be **fifteen times higher** (National Climate Commission, 2021; European Commission, 2019).

Furthermore, current renovations are typically shallow, whereas deep renovation are needed to achieve the EPC target.

Another key aspect of the CORE-95 scenario is to make **electricity the main energy vector**, **complemented by bioenergy and synthetic fuels** when electrification proves not to be feasible or too costly. For instance, heat pumps would cover 65% of space heating. At the Belgian level, this translates into about 140 000 heat pumps installed in residential buildings every year up to 2050, or 2700 every week.

A last important objective of the CORE-95 scenario concerns district heating, which should be deployed to cover 30% of the heating energy demand.

Transformation of the building's sector

There is a need of specialization on quality climate renovation, on deep climate renovation in particular, and on deep climate renovation "in occupied site" (i.e. renovation with inhabitants remaining in their dwelling). This is a requirement if we are to reach the ambitious renovation targets.

To tackle 2050 objectives, there are also needs in terms of:

- Adequate **financing models**, tailored to the different user groups
- Business models for **one-stop shop** of integrated renovation services
- Business models in terms of **performance-based renovation services**
- **Standardization and industrialization** of renovation products and processes. This means more **prefabrication**, i.e. more off-site work. It is seen as fundamental to accelerate the renovation rate and depth.

Accelerating digitalization in the buildings sector is another key requirement. Digitalization allows to scale-up renovations (with more off-site work), reduces the time needed to renovate and enables circular practices (for instance, by facilitating inventorization). It is therefore a key component to realize the high number of renovations required. Building Information Modeling (BIM) and Reality Capture are seen as central digital tools suited for this purpose.

Finally, transitioning to a circular buildings sector should go hand in hand with renovation objectives. Circularity involves greater reuse and recycling of construction materials, thereby reducing indirect emissions stemming from the production and waste treatment of construction materials. Beyond indirect emissions, circularity is more consistent with other environmental objectives, such as decreasing pollution. Lastly, by reusing materials, circularity is a way to address the growing problem of resource scarcity.

Having clarified climate renovation objectives and the required transformation of the sector, we will now explore labour market needs in terms of jobs.

3. Required jobs for climate renovation

We estimate that 130 thousand sustained jobs are necessary for the period up to 2050 to renovate the Belgian buildings stock. Moreover, 59 thousand of these jobs would be in the construction sector, which represents about 20% of the current construction workforce. The other 71 thousand needed jobs are in construction's supply chain.

To estimate the number of required jobs, we used regional climate renovation budgets and input-output multipliers of the Federal Planning bureau. Wallonia and Flanders estimated the total investment required to renovate their residential and non-residential buildings. If we sum up this investment and add an estimation for Brussels, we reach a total of 389 billion euros to be invested up to 2050. Using the multipliers of the Belgian Federal Planning Bureau, it can be translated into a number of skilled workers needed to cover this demand (see Figure15). Assuming a constant investment over 30 years, the number of jobs required per year can be estimated, both in terms of direct (i.e.

construction) and indirect jobs (supply chain). For instance, in Wallonia, there would be over 31 thousand direct jobs and 32 thousand indirect jobs required per year for the energy renovation of residential and non-residential buildings. This is in line with the Forem (2021)'s estimation of 30 thousand additional direct workers.

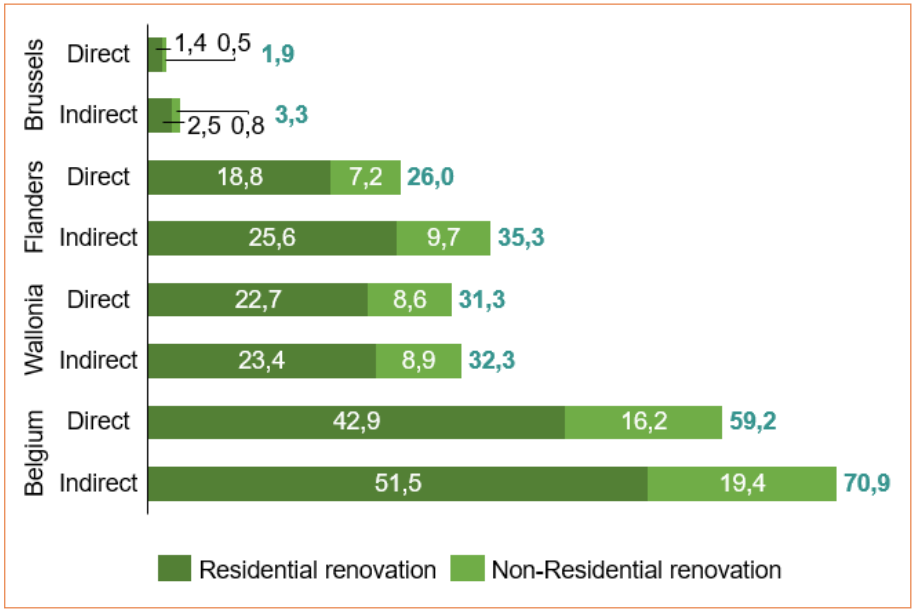

Figure 15. Required jobs per year (in thousands) in the three regions, differentiating between direct (construction) and indirect (supply chain) jobs, as well as between renovation of residential and non-residential buildings. For the detailed methodology of calculation, see appendix B.

It is worthwhile noting that estimations based on current input-output multipliers may somewhat overestimate the number of required workers. Indeed, a successful industrialization of renovation processes could lead to a lower direct job multiplier (less manpower per euro invested). This decrease in required jobs could however be partially compensated by an increase in indirect job multipliers, as there would be more jobs required in other sectors such as in industry.

The net increased workforce demand in construction and its supply chain depends on the extent to which the demand for climate renovation is met by a retargeting of construction activities to climate renovation or is added on top of current demand. Estimations based on input-output only specify the number of required jobs, not whether these jobs are fulfilled by the current workforce or if there is a need for additional workers. The required number of jobs is shown on the right side of Figure 16. The current demand is depicted on the left side, distinguishing between the current direct and indirect workforce and the direct workforce shortage estimated at about 20 thousand workers per year (European Commission, 2020). The net increased workforce demand tied to climate renovation is uncertain and shown in the middle. According to the CORE95 scenario, newbuild activities should significantly ***decrease***. This could lead to a shift of workers from newbuild to climate renovation. The extent to which this shift will take place is unknown. Therefore, the net increased workforce demand will depend on the extent to which this shift will take place (along with other shifts from current activities to climate renovation). We **expect a significant increased workforce demand** (1) given the structural workforce shortage in the construction sector and (2) uncertainty on the decreased demand for newbuild (European Commission, 2020).

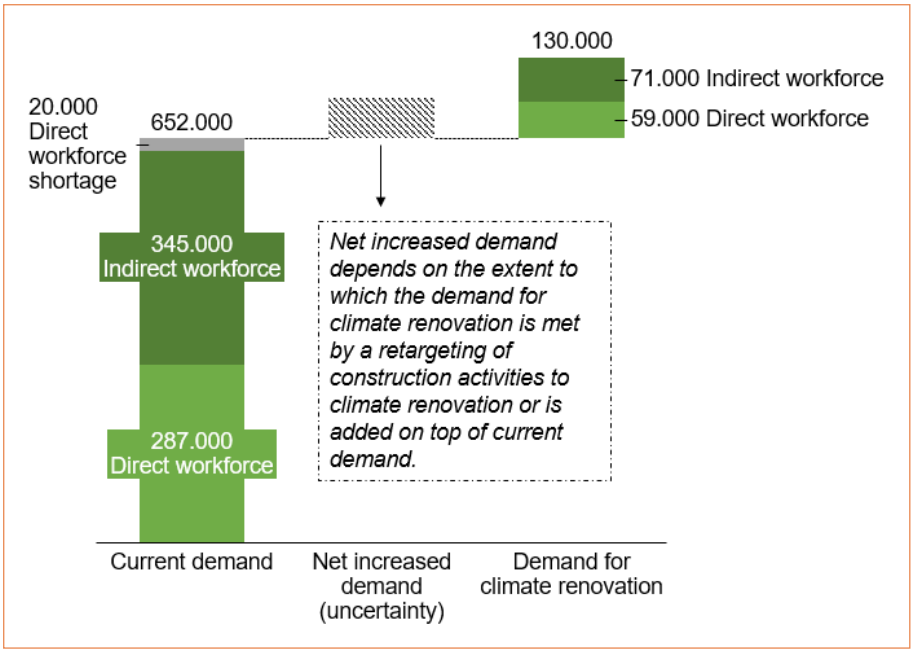

Figure 16. Evolution of direct and indirect workforce demand in the construction sector for the climate renovation of buildings (2050 climate target)

The labour market needs of the climate renovation extend beyond the requirement of a volume of workers. To qualitatively understand the breath of requirements as well as the impact on the job market, we clustered needs/impacts into five categories: (1) increases in the demand for existing jobs, (2) transformations of existing jobs in terms of needed skills, (3) increases in the demand for existing jobs with evolution of the needed skills (this is a combination of 1 and 2), (4) emerging climate renovation jobs, and (5) lost jobs (see Figure 16). Since discussing these categories is inherently tied to skills, we will discuss them in the skills section (section 5).

Having estimated the number of required workers for the climate renovation of buildings, we will now dive further into the question of availability of the workforce to fulfil this requirement.

4. Availability of sufficient workers in a context of workforce shortage

As explained in the previous chapter, while some of the required jobs for climate renovations can be fulfilled by the current workforce, **we expect a need for attracting additional workers**. This calls for answering the following questions: 1) who is available to take on climate renovation jobs (besides current workers)? 2) how to attract them towards the sector? 3) how to successfully train them? 4) how to support the sector in hiring them? After introducing the current workforce shortage, we discuss these questions successively. The question on training will be addressed in the training section.

Workforce shortage

Attracting additional workers is a key challenge, as the sector already fails to attract sufficient workers to meet today's demand, leading to an estimated workforce shortage of 20 thousand jobs/year (European Commission, 2020) This shortage has multiple causes, including insufficient technical trainings and low attractiveness of the sector, due to, among other things, hard work and low salary (Be Circular, 2019; Conseil Central de l'Economie, 2021). **Hence, attracting additional workers for the climate renovation requires increasing the sector's attractiveness and the training offer.**

Who is available to take on climate renovation jobs?

Besides current construction workers, people from the following groups could take on climate renovation jobs:

- unemployed and workers who lose their jobs (e.g.due to automation)
- young people (<18) who will join the workforce
- foreign workers. Reaching a sufficient number of skilled workers is only possible with a European/international view. The caveat is that (1) exporting expertise is less resilient and that (2) businesses are disincentivized to upskill foreign workers due to shorter stays in Belgium than Belgians. Nonetheless, it is clear that foreign workers will be necessary.

A significant share of these people would require trainings to take on climate renovation jobs. Promising training solutions are proposed in the training section.

How to attract people towards the sector?

Working on the sector's attractiveness is key to ensure sufficient people decide to enter the construction workforce. Besides low pay and hard work, other factors lead to a poor image, including illegal work & social fraud and a low social recognition of construction work. Additionally, the sector currently fails to attract/welcome women. To address these issues, we propose 3 key clusters of policies:

- **Valorize construction professions in the eyes of the public, especially the youth** (Confédération de la Construction, 2019). A key message to be popularized is that **construction workers play a central role in the climate transition.** This is still relatively unknown among the public. It would give a boost by valorising the profession and giving a clear sense of purpose to

current and potential future workers. Educational networks are one of the main channels to vehicle such messages.

- **Design policies to facilitate the integration of women on construction sites**. Since equality and non-discrimination is a federal competence, this lever can be activated by federal authorities.
- **Design better policies targeting illegal work and social fraud in the buildings sector** (Confédération de la Construction, 2019). It is necessary to reinforce controls and social inspections. Such policies also fall within the competences of the federal authorities. Moreover, governments need to be careful not to unintendedly facilitate undeclared work practices (BruPartners, 2021). Public procurements are often handed to larger construction firms that work with subcontractors and that make more use of posted foreign workers. This is an attention point as posted foreign workers are more prone to social fraud.

How to support the construction sector to employ workers?

There are a number of factors which complicate the sector's capability to employ new workers. These include financial and human risks associated with expansion (especially for micro and small companies) and poor visibility on market evolutions related to energy renovation. We propose the following policies to tackle these issues:

- **Fiscal policies to support the expansion of micro (<10 employees) and small businesses (<50 employees).** Support could take the form of a reduction of social charges.
- **Increase visibility on the renovation market evolution.** This can be done via a legislative MEPS framework, clear long term investments programs in public buildings renovation, framework agreements, etc.

In this chapter, we explored various ways to facilitate the uptake of additional workers for the climate renovation buildings. As stated previously, the labour market needs of the climate renovation extend beyond the requirement of additional workers. Indeed, workers working on climate renovations will need specific skills. This is the subject of the next section.

5. Identifying skill needs based on differing impacts on jobs

Beyond additional workers, new skills will be needed

A transformation of the buildings stock towards climate neutrality calls for specific skills. The right identification of these skills and of the target audience (existing jobs, new jobs) is essential to design the right training strategy discussed in the next section. Skills are strongly tied to jobs (a job requires a set of skills), which is why our discussion on skills will always be contextualized in terms of jobs.

To qualitatively understand the breath of requirements as well as the impact on the job market, we clustered needs/impacts into five categories: (1) increases in the demand for existing jobs, (2) transformations of existing jobs in terms

of needed skills, (3) increases in the demand for existing jobs with evolution of the needed skills (this is a combination of 1 and 2), (4) emerging climate renovation jobs, and (5) lost jobs.[28]

The table below provides a synthetic view of the categories.

CATEGORY	DESCRIPTION (IN THE CONTEXT OF CLIMATE RENOVATION)	EXAMPLE
Emerging climate renovation jobs	New jobs created specifically for the climate renovation of buildings.	Deep climate renovation coordinator
Increased demand for existing jobs	Existing jobs whose demand will increase due climate renovation but whose skillset remain unchanged	Market services (such as banking services) for climate renovation companies
Transformed jobs	Jobs whose skillset need to evolve to incorporate climate renovation skills.	Real estate agents
Increased demand and transformed jobs	Jobs whose skillset will need to evolve to incorporate climate renovation skills AND whose demand will simultaneously increase due climate renovation.	Heating system installers
Lost jobs	Jobs lost due to Climate renovation.	FF installators

The Figure 17 below gives a qualitative visualisation of the impact of the transition on each category, distinguishing between direct and indirect jobs. It is based on a non-exhaustive screening of jobs impacted by the transition.

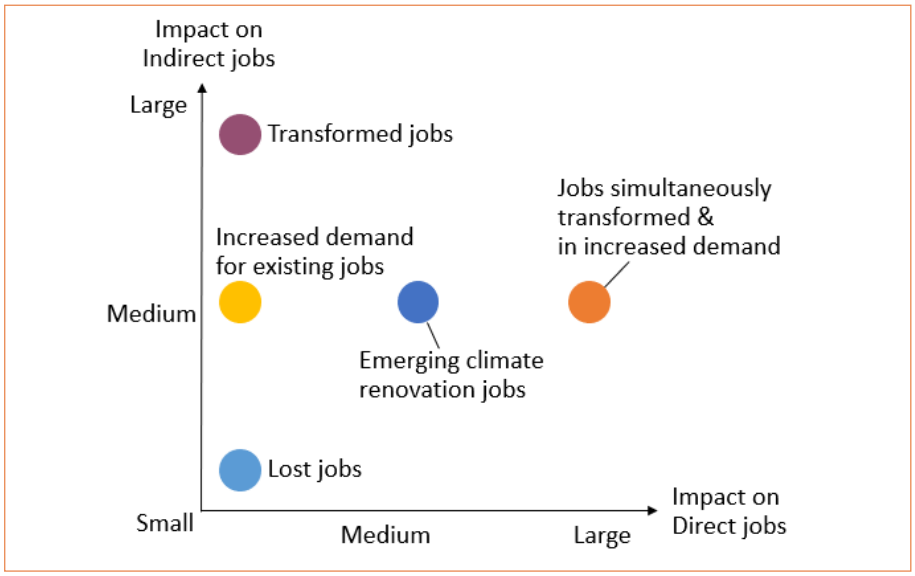

Figure 17. Qualitative estimation of the impact from the climate renovation on direct and indirect constructions jobs

In the rest of this section, we will dive into each category.

The main messages are that there will be:

- high increased demand for existing jobs with transformation of the needed skills (increased demand and transformed jobs) in the construction sector. To meet that demand there is a dramatic need for upskilling & reskilling and update of training curriculum as well as policies to ensure the availability of the required volume of jobs,
- some emerging climate renovation jobs requiring specific training,

28 Categories are adapted from (European Commission, 2019).

– significant job transformation requiring upskilling and update of training curriculum,
– some increased demand for existing jobs, with no change in needed skills
– limited lost jobs, provided workers are well-accompanied.

Increased demand & transformed jobs

A series of existing jobs will see an increased demand if the demand for renovation is triggered at the right pace (3%/year). Examples of these jobs are roofer, installation jobs (installation of (renewable) heating, sanitary and water treatment devices, etc.), ceiling installer, mason, general contractor, architect, engineer architect, construction site manager, R&D and engineering consultancy.

Further, these jobs will require new skills to ensure the quality of deep energy renovations. These skills have been identified and structured in Forem (2021). See the table below for some examples.

TYPE OF CONSTRUCTION JOB	EXAMPLE OF A JOB	EXAMPLE OF SKILLS TO DEVELOP
Structural, completion and finishing work	Roofer	– Ensure water and air tightness, as well as the insulation of the pre-constructed roofing elements during the realization in workshop as well as during the assembly on site – Take into account the passage of cables of the electrical installations for photovoltaic or solar panels – Apply an external roof insulation, of the "Sarking" type
Conception work	Architect	– Analyze different possible solutions in terms of EPC – Knowing the qualities and potentials of the materials, including secondary materials – Optimizing the circularity of the building by avoiding downcycling (some consider this to be out of the architect's scope) – Integrate electrical technologies in the overall design (including charging stations) – Use the TOTEM tool to measure the environmental impact of building materials
Heating, electricity, ventilation	Heating system installer	– Increase (hybrid) heat pumps installation skills/knowledge (in the Netherlands and Germany: no more installations of gas boilers even in existing buildings) – Need to master digitization of heating systems (connected devices, interactions between the heat pump and the PV inverter, …) – Adapt to the different emerging technologies – Master the different techniques of heating and hot water production
Construction site management	General contractor	– Coordinate the different jobs involved in deep Climate renovations – Ensure a rational management of orders and consumption of materials – Identify/know the ways to valorize scraps/waste from the construction site – Make subcontractors aware of environmentally friendly technologies and practices – Increase the collaboration between the various trades that follow one another on site – Manage construction sites with prefabricated elements, requiring specific logistics and implementation

Source: translated and adapted from (Forem, 2021)

In general, craftsmen involved in Climate renovation will need to:

- learn how to place **prefabricated solutions**,
- learn how to work with **bio-based insulation materials**,
- adapt to **the digitization** of work, including oversight/monitoring tools,
- **better understand the job of the other workers** in renovation projects, in order not to destroy their work or not to make it harder. This is crucial, as air and water tightness can be damaged by the slightest imperfection.

In terms of skill level, the jobs that fall under this category of impact require mostly secondary professional/technical diplomas, but also some first cycle of tertiary diplomas and a few second cycle of tertiary diplomas.

Depending on the profession, the level of autonomy/mastery ranges from routinized tasks to non-routine tasks.

The impact on transversal skills can be summarized as follows:

- ***Soft skills:*** amelioration of soft skills, in particular: communication, capacity to learn (as techniques change at a fast pace), flexibility & adaptation, innovation and creativity (to find new solutions). For more information, see (Forem, 2021).
- ***Digital skills***: enhanced general digital skills, ability to use digital machines and tools such as BIM, Reality Capture and Drone-driven buildings' diagnostic. For more information, see (Forem, 2021).

Emerging climate renovation jobs

There is a series of emerging jobs that will/need to be created specifically for the climate renovation of buildings, including: Deep Climate renovation coordinator, EPC auditor/advisor/certifier, Condominium masterplanner, District renovation coaches, Residential renovation aggregators, Jobs related to heat network development (facilitator, technician, urban planner), Industry of low-carbon heating system production (heat pumps) and its supply chain (e.g., calorific fluid), Energy community facilitator/manager, Emerging climate renovation jobs trainers, Material banks manager (circular economy), Valorist (circular economy)[29].

The term "new jobs" should be nuanced, in the sense that it should be understood as additional skills to existing profiles such as general contractor, engineer and construction site manager. The reason we employ the term "new jobs" is because the bulk of activities and responsibilities are typically new and extend beyond minor job transformation.

While some emerging climate renovation jobs are discussed in the literature, others are rarely presented, probably because certain jobs are currently near non-existent. Since most of these jobs are in the emerging phase, there is relative uncertainty surrounding the exact job descriptions, as well as whether, in certain case, the activities of the jobs will be carried by other professions.

29 The scope of material bank managers and valorists extends to most construction activities, not just climate renovation.

In the table below, we provide a short description of these jobs.

NEW CLIMATE RENOVATION JOB	DESCRIPTION
Deep Climate renovation coordinator	Assist the client in its request for renovation and coordinate the whole renovation process from analysis of the current situation, over creation of the renovation plans, to the completion of the project.
EPC auditor/advisor/certifier	Analyse the energy performance of dwellings, provide a recognised certificate and label of this performance and offer advice regarding the optimization of the energy performance (Buldit BV, n.d.).
Condominium masterplanner	Support the co-owners of a condominium in the creation of a renovation masterplan, together with experts, to establish a thorough renovation of the whole condominium at once (Stad Antwerpen, 2018).
District renovation coaches	Make residents from the same district (with similar houses) aware of renovation needs and corresponding opportunities and guide them towards a collective renovation project.
Energy community facilitator/ manager	Enable the creation of local energy communities between households that produce excess renewable energy and households that can use that excess energy, and manage the functioning of such communities (Basem, 2022).
Jobs in industry of low-carbon heating system production (heat pumps) and its supply chain (e.g., calorific fluid)	Manufacture and produce all different parts required for the low-carbon heating system, distribute it and install it. Focus on innovation of currently existing low-carbon heating systems and of new technologies.
Material banks manager	Coordinate and oversee the recovery and reuse of valuable materials from a to-be demolished dwelling into the construction or renovation of another dwelling, in order to make the construction sector more circular (Favreau, 2022; Maerckx, 2019).
Jobs related to heat network development (facilitator, technician, urban planner)	Analyse the potential for local heat networks, design them, mobilise residents of the examined area, install the heat networks and provide support during and after the project.
Valorist	Ensure the optimal usage of all (material) resources and maximise the valorisation of waste streams during renovation projects (Romnée et al., 2020).
Emerging climate renovation jobs trainers	Educate, train and reskill learners (including current workers) to meet the right qualifications and requirements to perform the jobs listed above as well as potential other emerging climate renovation jobs.

The skill level required for these jobs is typically the first cycle of tertiary education (spanning from one to three years) leading to a higher education certificate or an academic/professional bachelor. Some of the jobs may only require a secondary education certificate completed with a (short) training. They call for mostly technical profiles with good digital and soft skills. The ability to innovate and collaborate are especially important soft skills, given the novel and collaborative aspects of the work. They consist of a mix of non-routine and routine tasks, with the former being more consequent in the next couple of years due to innovation.

These jobs require in-depth Climate renovation skills and knowledge. As an example, the table below shows skills requirements for deep Climate renovation coordinators:

ACTIVITIES CARRIED OUT	SKILLS AND KNOWLEDGE
Physical examination of the building	Analyse the typology of the building from technical documents to determine the construction techniques needed.
	Identify the uses of the building
	Perform energy consumption measurements to qualify & quantify energy issues
Development of the energy diagnosis	Analyse the client's requirements based on regulations
	Compile technical and regulatory information to write the heat balance based on energy measurements taken on site
	Return the energy balance sheet to the client through a written report
Elaboration of the Climate renovation proposal	Evaluate the technical feasibility of the Climate renovation project and formulate energy efficiency targets to be reached
	Identify the technical solutions adapted to the typology of the building
Presentation of the Climate renovation proposal	Present the detailed Climate renovation project to potential hierarchical superior to obtain validation
	Present the Climate renovation project to the client and find agreement on proposed solutions, cost and timeline.
Reception and control of the construction site once the project is completed	Conformity check
	Explain to the client how to optimally use new equipment as well as maintenance requirements

Source: translated and adapted from Renovalt (2021)

Transformed jobs

Transformed jobs are jobs whose skillset will need to evolve to incorporate climate renovation knowledge and/or skills, such as bankers, real estate agents, jurists, certain jobs in public administration, teachers for the many jobs linked to Climate renovation (e.g. heating technician teacher), workers in fossil-based construction materials.

There is no significant increase in demand for these jobs; only an additional need for skills.

The skill level of transformed jobs is typically the first and second cycle of tertiary education. For some of these jobs (e.g. bankers), there is no effect on soft skills. For other jobs (e.g. construction trainers), there is a need to further develop the following soft skills: capacity to learn (as techniques change at a fast pace), flexibility & adaptation, innovation. The same applies to digitalization: while there is no effect for certain jobs (e.g. jurists), other jobs (e.g. construction trainers) will require enhanced digital skills.

The table below shows examples of additional skills needed:

JOB	ADDITIONAL SKILLS
Real estate agent	Understand the EPB and its implications
Co-ownership property manager	Understand energy audit, (financial) support instruments for energy renovation, acquire general knowledge about EPB and energy renovation.
Banker	Factor EPB topics in their financial products
Worker in fossil-based construction material	– Skills and knowledge related to less-carbon intensive construction material – understand and apply circular economy principles – Enhanced digital skills
Construction trainer (related to Climate renovation, e.g. roofer trainer)	– Learn and teach new Climate renovation techniques – Understand the importance of Climate renovation for climate action and increase student's awareness of it – Enhanced digital skills

Several interviewees stressed the importance of increasing climate change awareness among construction trainers. Greater awareness increases teacher's willingness to learn and teach the newest climate renovation techniques. Additionally, climate aware teachers increase students' awareness.

Increased demand

These are existing jobs whose demand will increase due to the climate renovation, but whose skillset will remain unchanged. In this case, they include jobs in the renovation supply chain who do not require additional skills related to climate renovation, for instance banking services for renovation companies. Also in this category are some circular economy jobs, e.g. jobs in recycling.

Since these jobs are not transformed, there is no effect on skills. The sole challenge is to ensure the availability of sufficient workers on the market (see section 4).

Lost jobs

We do not identify significant job losses in Belgium as a result of the climate renovation of buildings, nor do the various actors we interviewed. However, there are two caveats to this conclusion. **First, we assume a successful transformation of jobs/upskilling of workers within their job**. For instance, we assume heating technicians installing oil and gas boilers learn the necessary skills to install heat pumps. Insufficient support to workers whose jobs are transformed could cause job losses and (temporary) unemployment. **Secondly, we assume that workers employed during a peak (e.g. EPC auditors in 2025) will find employment after the peak has passed**. This will require careful and targeted support to workers during and after the peak. For more information on this, see the section on addressing peak demand.

Having covered skills needs, we now turn to identifying training needs to address the skill gaps.

6. Training needs

A well-designed training strategy is key to ensure workers possess the necessary skills for the transition. In this chapter, we successively address the following: (1) ensuring learners (future workers) are adequately trained, (2) upskilling & reskilling current workers, (3) addressing peak demand, (4) addressing the shortage of construction trainers, (5) enhancing communication and collaboration between trainings stakeholders.

Ensuring learners (future workers) are adequately trained

It is essential that people following construction training are equipped with the right skills for the climate renovation. This entails (1) designing new training for emerging climate renovation jobs (2) adapting the training of existing jobs. We successively discuss both points, and then discuss the potential of Individual Professional Training and work-study training.

Training for emerging climate renovation jobs should be created and/or mainstreamed

Emerging climate renovation jobs require new trainings, specifically designed for the new occupation. However, in some cases, the training can be incorporated in the training of current jobs, where it would then be one of the specializations to choose from.

The training offer for climate renovation jobs should be improved. Some new Climate renovation job trainings have just been created and are only available in one or few institutions. For instance, IFAPME offers a one-year training in deep Climate renovation coordinator, starting in fall 2022. This program should be mainstreamed across teaching institutions in Belgium. Other Emerging climate renovation jobs do not yet have associated training programs (to our knowledge), such as district renovation coaches. These trainings will need to be developed and mainstreamed. Finally, some of the more established Emerging climate renovation jobs already have widely available training, such as EPC auditors.

The necessary length of training varies from a few days (e.g. EPC Auditor training) to one year (e.g. deep Climate renovation coordinator) and more.

Adapting the training of existing construction jobs

Trainings for existing construction jobs must be adapted to ensure the necessary hard, digital and soft skills are taught. At the time of writing, Belgian institutions training buildings professionals do not sufficiently include climate renovation skills and knowledge & circular practices in their curriculum (Be Circular, 2019; Conseil Central de l'Economie, 2021). For instance, heat pump installation techniques are typically not taught in training centres. For a detailed study of what needs to change in the construction training offer in the BCR, see the 2021 study by Bassin EFE Bruxelles.

The Francophone Service of Jobs and Qualifications (SFMQ) should update construction job and training profiles to reflect the needs for the climate transition in the buildings sector. The SFMQ is the main lever to change the curriculum of French-speaking trainings. Its mission is to (1) produce job pro-

files that reflect the professional activities carried out by the workers and (2) produce training profiles that correspond to the job profiles. Francophone schools and training centres design their curriculum according to these profiles. Worryingly, **most job profiles in the construction sector have not been updated by the SFMQ since 2011-2013.**Consequently, new Climate renovation technologies and practices of eco-construction are not yet part of the curriculum. The SFMQ urgently needs to start the process of updating job and training profiles in the construction sector – especially given that the updating process lasts five years. In the meantime, pilot projects have been set up by the EFP/ SFPME and the CDR Construction to fill the gaps in the existing SFMQ reference system (Bassin EFE Bruxelles, 2021)

In the Flemish community, the Agency for Higher Education, Adult Education, Qualifications and Scholarships (AHOVOKS) has started a catch-up the last several years to update outdated occupational qualifications to contemporary standards, including sustainability requirements. However, no statement of a specific focus on the urgency of the climate transition and corresponding priority jobs could be found (AHOVOKS, n.d., 2016, 2017, 2018, 2022; Baisier, 2015). In 2021, the AHOVOKS updated 276 occupational qualifications, including for jobs in the construction sector, whereas this was only 182 in 2019 and even none in 2018 (AHOVOKS, n.d.). These updates of the qualifications, together with their approval and saving in the database happen in collaboration with the VKS (Flemish Qualification Structure). It is a positive signal that in the last couple of years the AHOVOKS has accelerated in updating the occupational qualifications, but a greater emphasis and clear public statement on the need for specific qualifications related to the climate transition would be welcome.

Enhancing the training offer through Individual Professional Training and work-study training.

The following regional policies would enhance the current training offer:

- **Extend the duration of the Individual Professional Trainings[30] from maximum 6 months to 2 years** (Working Group Renolution, 2022) In this particular form of training, jobseekers receive training in a company and are then employed by the company for a duration equal to the company training. The maximum duration for the internship is currently 6 months in all regions[31] but companies prefer longer internships (greater return on training investment)[32]. Extending the maximum period to e.g. 2 years would be a win-win for jobseekers and construction companies. More companies would agree to take-in FPI trainees. Also, longer internships allow jobseekers to develop their skills further and to get a longer job contract afterwards.
- **Promote and mainstream work-study training.** Students in work-study programs learn both in a training centre and in a company. Working in the field during studies facilitates students' insertion in the job market. This type of education has been identified by the Construction Confederation as a key solution to tackle the workforce shortage (Confédération de la Construction,

30 FPI (FR) / IBO (NL)
31 In Wallonia, the FPI can be extended to maximum one year under special circumstances.
32 Source: Renolution Working Group (2022)

2019) The Confederation calls for further promotion of work-study training by public authorities and mainstreaming of the concept by the competent regional authorities

Upskilling & reskilling current workers

Current construction workers (in jobs linked to climate renovation) should be upskilled & reskilled via short life-long trainings. In this section, we provide recommendations for upskilling & reskilling workers, taking into account the specificities of the construction sector.

Even if trainings are available (sometimes even for free), this does not ensure that workers will attend them. This is especially true for workers in micro and small construction businesses. These businesses **have zero to little means to invest in training**, both in terms of time and financial resources. Lack of time is especially true in a context of workforce shortage, where businesses are often fully booked for months, if not years. Additionally, **there is little incentive for businesses to invest in trainings** since, given the workforce shortage, there is an abundance of work. In Brussels, micro (<10 employees) and small construction businesses (<50 employees) make up 98 % of companies and represent around 50% of the workforce. They are expected to carry out most of the climate renovation of residential buildings, so it is crucial that workers in such businesses receive adequate upskilling & reskilling training.

The following solutions would help to tackle these obstacles:

- **the design of (1) affordable, (2) short and (3) highly practical trainings.** This aims to address the issue of limited time and financial resources, as well as the need for micro and small businesses to see that they will immediately reap the benefits of the trainings.
- **affordable on-site trainings**, i.e. trainings where the trainers coach trainees on the trainees' construction site. This significantly lowers the barrier to attend trainings, since businesses can continue working on their projects while following the training. In other words, workers are reskilled while doing the work they would have anyway had to do. This also ensures that the content of the training is immediately applied to the 'real world'. Nevertheless, it is important to keep in mind the operationalization and scale-up challenges of on-site trainings: they are typically costly (because time-consuming), they can be challenging to organise (mostly due to construction site uncertainties) and can only target a limited number of workers at once.
- **Subsidies and training aid policies modulated according to the size of the companies** (Belgian High Employment Council, 2021). Specifically, smaller companies should receive greater support than bigger companies.
- **Combining temporary unemployment with climate renovation reskilling/upskilling training**. In the Belgian construction sector, temporary unemployment is allowed for economic reasons (ONEM, 2022). In other words, companies can, for a limited time and because of economic reasons, put workers on temporary unemployment. This is untapped potential for workers to follow climate renovation reskilling/upskilling training, as workers in temporary unemployment have time to attend trainings. Hence, we propose a new policy that would incentivize (or even require) workers in temporary unemployment to follow (climate renovation) training.

- Incentivize following climate renovation upskilling/reskilling training by creating a "climate renovation certificate" for workers and companies.
  - A certificate would be delivered to workers when they follow climate renovation training.
  - A certificate, of the ISO type, would be delivered to companies who comply with a certain set of requirements (number of employees with the certificate, key personnel certified, etc.)
- Fiscal incentive for companies that reskill/upskill workers on climate renovations.

To reskill current workers, particular attention and support should be given to older and less qualified workers, as they have typically less financial capacity and opportunities to reskill than more qualified workers. Statistics show that older and lower skilled workers are significantly less likely to follow lifelong trainings: according to the adult education survey, only 13% of lower skilled workers and 20% of workers aged 55+ report having followed a lifelong training in the last months, compared to a Belgian average of 54% (Belgian High Employment Council, 2021).

Given the fast-paced changes in Climate renovation technologies and techniques, workers will need to continue to reskill themselves along their careers. This highlights the importance of instigating a culture of life-long learning.

Construction workers should also be aware of the urgency of climate action and the crucial role they play in it. Understanding the significance of the climate renovation of buildings is indeed key to ensure quality and meaningful work. Increasing climate awareness among construction workers is therefore needed. Some training centers, such as the FOREM, already include an energy and climate module in construction trainings. We encourage all construction training centres to do it, for instance, through organising climate fresk workshops.

Addressing peak demand

Training strategies must be adapted to a non-linear need for certain jobs, causing temporary peak demand. We first explain the challenges associated with peak demand and then provide potential solutions.

A good example of peak demand is EPC certifiers in the Brussels-Capital Region (BCR) in the next years, as there is a legal obligation to have an EPC certificate by 2025 in the BCR. Other examples include workers dismantling oil tanks and workers involved in roof/window isolation between 2025-2035 because of EPC legal requirements by 2035.

Peak demand twin challenges are (1) ensuring the sufficient availability of skilled workers during the peak and (2) making sure that, once the peak has passed, "peak" workers can find work in related activities or are successfully reconverted.

Tied to the first challenge is the **need to train sufficient workers before or at the beginning of the peak**. The example of EPC certifiers shows that this is far from easy. Indeed, in 2022, trainings for EPC certifiers are mostly empty and cancelled (Working Group Renolution, 2022) In this case, the issue lies not in an insufficient training offer but with a low demand for the trainings. Com-

plementary policies need to be developed to increase the demand for EPC trainings.

The second challenge, ensuring that "peak" workers do not become unemployed after the peak, is just as important. The danger is that training centres, faced with the need to quickly train workers to address the peak, design specific trainings to address the peak and train unskilled workers at performing only one task. Once the peak has passed, many of these workers are thrown back into unemployment. This (partially) happened with solar panel installers in Brussels, where workers trained only at installing solar panels struggled to find work or became unemployed after the peak demand for installing solar panels.

Possible solutions to ensure the sufficient availability of skilled workers during the peak

Regional policies:

- On the demand side (demand to follow trainings)
- **Increase marketing and incentives of trainings for peak demand jobs before the peak**
- On the supply side (the offer of trainings)
- **Ensure appropriate training for peak demand jobs are available before the peak**

Possible solutions to ensure peak workers find employment after the peak

Regional policies:

- **Propose reconversion training during and after the peak**. For reconversion training during the peak, this could take the form of working 4 days/week while following a training 1 day/week.
- **Encourage the training of workers who are already specialized in a related field**. The idea is that these workers would find work in their other field of expertise once the peak has passed. The major caveat with this solution is that workers who decide to follow such trainings have typically few skills and are often not specialized in a related field.
- **Propose trainings that are wide enough so that, once the peak has passed, workers have necessary skills to carry out other activities.**

Note that policies encouraging life-long training will be highly beneficial to peak workers.

Addressing the shortage of construction teachers

In the Brussels-Capital Region, there is currently a shortage of construction trainers/teachers. Addressing this shortage is necessary to ensure reskilling and upskilling of the workforce. We propose the following policy to address the shortage:

- **Create special trainer/teacher status for end-of-career workers.** There is a large untapped potential for end-of-career workers to become trainers/teachers. On the one hand, these workers have a large amount of valuable experience to teach, and on the other hand, some may no longer have the physical ability to continue working (in the case of hard work). Typically, experienced workers would lower their salaries by becoming trainers, in some cases dividing their salaries by two or three. The objective of this policy would

be to increase the incentive for end-of-career workers to become full-time or part-time trainers. This could be done via a bonus or a special status. This policy would also concern experienced workers in (long term) sick leave which could teach but not perform hard physical work. There are two existing and related policies for older workers: the "prime de passage/ overstappremie", which is a one-time bonus granted under certain conditions to an older worker who changes from a heavy to a light job and thereby suffers a loss of income, and "credit-temps fin de carrière/ tijdskrediet landingsbaan", which allows end-of-career workers to reduce working hours and receive a monthly replacement income (ONEM, 2021). However, these policies do not encourage part-time or full-time teaching. This contrasts with the following policy in Flanders: 'Target group reduction of mentor(s)', where companies get a compensation if they use older employees to train/mentor younger employees.

Enhancing communication and collaboration between trainings stakeholders

It is important that the many actors and stakeholders around climate renovation training communicate and collaborate, in order to collectively identify problems and solutions. These actors include construction businesses (represented by the Construction Confederation), labour unions, the different teaching institutions, public environmental institutions (e.g. Bruxelles Environnement in the Brussels-Capital Region), etc. At the moment, there is insufficient collaboration between the various training stakeholders.

Possible Solutions

Regional policies:

- **Creating working groups around climate renovation training, involving all relevant stakeholders.** This is already ongoing in the Brussels-Capital Region (BCR). Indeed, several working groups have been created on the matter, each with a different scope (training future workers, upskilling & reskilling current workers, attracting workers to the field). The working groups identify problems and design actionable solutions. The implementation of solutions is then led by a member (or several members) of the working group.

Federal policies:

- **Facilitating communication and sharing of best practices among stakeholders from different regions.** Since training is a regional and community competency, much work around climate renovation trainings is done within the regions & communities. From our interviews, it became clear that communication between stakeholders across different regions could be strengthened. The main existing communication chanel is Synerjob ASBL, which unites VDAB, Forem, Actiris, ADG and Bruxelles Formation. It remains to be seen how to concretely increase best practices sharing.
- **Creating a construction training campus in Brussels.** In the BCR, different construction training centres are scattered around the city. Centralising these different centres in a campus would lead to pooling of equipment and trainers, greater collaboration and mutual learning between trainers,

greater networking potential for trainees, and (potentially) enhanced attractivity of construction training. This campus would include trainings for practicing workers, job seekers, dual-learning apprenticeship, and secondary school students. A Beleris fund (federal fund) has been allocated to this project, but at the time of writing, it has not yet been realized. Moreover, several interviewees told us there are no clear signs of future realization.

In this chapter, we discussed training needs associated with the required evolution of skills. In the next chapter, we examine 'just transition' implications.

7. Some implications for a just transition

The concept of a just transition has been defined by the International Labour Organization (ILO) (2021) as "greening the economy in a way that is as fair and inclusive as possible to everyone concerned, creating decent work opportunities and leaving no one behind". For the European Commission, work is considered decent when it includes "a fair income, secure form of employment, safe working conditions, equal opportunities and treatment for all, includes social protection for the workers and their families, offers prospects for personal development and encourages social integration, and workers are free to express their concerns and to organise." (European Commission, n.d.)

In this section, we present some non-exhaustive implications for a just transition (further work will need to dive deeper into it).

Risks and opportunities regarding the creation of decent work opportunities

There is a risk that some of the climate renovation jobs created would not be decent, given that some of the current jobs in the construction sector are not decent,. There is a great input of foreign workers in the Belgian construction sector, especially from Eastern European countries with lower social security costs (Colpaert, 2018). For foreign workers with a self-employed status, which is as high as 40% for Polish workers, for example, the Belgian minimum wages and working conditions do not apply (de Wispelaere & Pacolet, 2017). This creates an environment for inadequate conditions. It is an existing problem today with scandals and investigations regarding unsafe working conditions and social dumping (through subcontractors, e.g.) in recent years (ACV Nationaal, 2021; de Wispelaere, 2022; Sanen, 2021) and hence, it should be safeguarded that all jobs, current and new, are decent. A statement made by Building and Wood Worker's International (BWI) together with C40 highlights the importance of a just transition with decent jobs (BWI & C40 Cities, n.d.). Moreover, governments need to be careful not to unintendedly facilitate undeclared work practices (BruPartners, 2021). Public procurements are often handed to larger construction firms that work with subcontractors and that make more use of posted foreign workers. This is an attention point as posted foreign workers are more prone to social fraud. **We recommend designing/reinforcing policies to safeguard decent working conditions, such as controls, social inspections, and strict social criteria in public tenders.**

Opportunity:

- Climate renovation will lead to the creation of jobs.
- Ensuring it will be decent work is crucial both intrinsically and to attract the necessary workforce
- Many policies suggested in this document aim to (in)directly improve working conditions
  - especially policies on addressing the workforce shortage, as addressing the shortage implies bettering working conditions. For instance: policies fighting social dumping and illegal work in construction sector, policies to promote gender equality and encourage greater gender balance, etc.
  - Policies encouraging training of employees

Risk and opportunities in terms of ensuring that workers who will lose their jobs or whose jobs will be transformed are not left behind

Risk:

- Peak demand workers after the peak (see the section "addressing peak demand")
- Due to difficulty of upskilling and reskilling in construction sector, some workers would not upskill/reskill, potentially losing their jobs

Opportunity:

- If the culture of life-long training is successfully pushed forward for the energy transition, chances are that such a training culture will persist and be useful for other purposes. In general, ameliorating the training offer can lead to benefits reaching beyond the climate- energy transition.

Employment impact of the transition on vulnerable profiles

From a job market perspective, we see the climate renovation as benefiting some vulnerable profiles (as there is a net job gain). The jobs created are an opportunity for low skilled workers, manual workers that lost their jobs due to automation, unemployed, etc. However, this assumes adequate training.

8. Summary of policy options

Overarching recommendations:

1) Ensure the availability of sufficient workers in a context of workforce shortage

Aim: to increase sector attractiveness and to ensure the availability of sufficient workers

Policies on both regional and federal level:

- Valorise construction professions in the eyes of the public, especially the youth.
- Design better policies targeting illegal work and social fraud in the buildings sector.

Regional policies:

– Increase visibility on the renovation market evolution (long-term investment strategies in public buildings renovation).

Federal Policies:

– Design policies to facilitate the integration of women on construction sites.
– Support micro (<10 employees) and small businesses (<50 employees) in their expansion.

2) Ensure learners (future workers) are adequately trained

Aim: to ensure the necessary skills are taught (including soft skills and digital skills)

Regional & communal (language communities) policies:

– Create and/or mainstream training for emerging climate renovation jobs
– Urgently update the curriculum of construction job and training profiles so that climate renovation skills and knowledge are included.

Regional policy:

– Extend the duration of the Individual Professional Trainings from maximum 6 months to 2 years
– Promote and mainstream work-study training.

3) Upskilling & reskilling the current construction workforce, especially older and lower skilled workers.

– Design of (1) affordable, (2) very short and (3) highly practical trainings.
– Modulate subsidies and training aid policies according to company size.
– Combine temporary unemployment with climate renovation reskilling/upskilling training.
– Incentivize following climate renovation reskilling/upskilling training by creating a "climate renovation certificate" for workers and companies.
– A certificate would be delivered to workers when they follow climate renovation upskilling.
– A certificate, of the ISO type, would be delivered to companies who comply with a certain set of requirements (number of employees with the certificate, key personnel certified, etc.)
– Incentivize companies to upskill workers via fiscal incentives

4) Anticipate peak demand for certain jobs and accompany workers before, during, and after the peak

Aim: ensure the sufficient availability of skilled workers during the peak and avoid unemployment after the peak.

a) Ensuring the sufficient availability of skilled workers during the peak:

Regional policies:

– On the demand side (demand to follow trainings)
– Increase marketing of trainings for peak demand jobs before the peak
– Financially incentivize following trainings for peak demand jobs
– On the supply side (the offer of trainings)
– Ensure appropriate training for peak demand jobs are available before the peak

b) Ensuring peak workers find employment after the peak

Regional policies:

- Encourage the training of workers who are already specialized in a related field
- Propose trainings that are wide enough so that, once the peak has passed, workers have necessary skills to carry out other activities
- Propose reconversion training during and after the peak

5) Addressing the shortage of construction teachers

Policy on both federal and regional level:

- Create special trainer status for end-of-career workers.

6) Enhance communication and collaboration between trainings stakeholders

Regional policies:

- Creating working groups around Climate renovation training, involving all relevant stakeholders.

Federal policies:

- Facilitating communication and sharing of best practices among stakeholders from different regions.
- Creating a construction training campus in Brussels.

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10. Appendices

Appendix A.

LEVER	REFERENCE SCENARIO (BY 2050 VS 2015, UNLESS SPECIFIED DIFFERENTLY)	CORE95 SCENARIO (BY 2050 VS 2015, UNLESS SPECIFIED DIFFERENTLY)
Behaviour		
Living space per person.	**Keep** the living space per person	**Decrease** the living space by **16%**
Rational use of non-residential floor area	**Increase** the floor area demand by **22%** for each non-residential sector.	**Decrease** surface demand by **7.5%**
Residential buildings		
Cooling demand (when equipped with cooling systems)	**Keep constant** the cooling energy needs for cooled buildings	**Reduce** the cooling energy needs by **10%**
District heating deployment	**Maintain** the share of district heating in the heating energy demand to 2.5%	**Increase** the share of district heating in the heating energy demand to **30%**
Switch to biomethane, hydrogen, e-gas, bioliquids, e-liquids.	**0% of gas demand** is met by these alternatives	**30-100% of gas demand** met by these alternatives
Appliance ownership/use/efficiency	**Increase** the number of computers to **2.5** and of washing machines to **1** (per household). **Increase** appliances use by **14%** for all appliances except for fridges and freezers. By 2030, appliances consume **30%** less energy for similar levels of service	**Decrease** the number of computers to **1.7** and decrease the number of washing machines to **0.85** (per household). **Maintain** appliance utilization stabilized at baseyear's level. By 2030, appliances consume **40%** less energy for similar levels of service
Efficiency improvements for all technologies (except appliances)	The following efficiencies are considered for **heat production** technologies: 83%-100% For cooling, the energy intensity is kept **unchanged.**	Efficiencies for **heat production** technologies are higher compared to REF scenario : from over 85%-100% For cooling, the energy intensity of cooling systems is **reduced** by **29%** (non-residential)
Services sector buildings		
Services : Building enveloppe influence on cooling demand	Keep **constant** the cooling energy needs for cooled buildings	**Reduce** the cooling energy needs by over **10%**
Residential & Services sector.		
Space heating and cooling behaviours, Hot water demand	**Keep** the desired comfort temperature inside houses to 20°C **Maintain** demand level for sanitary hot water demand.	**Heat houses to a temperature 2 degrees lower** (i.e. 18°C), and **cool them to 2 degrees higher** (i.e. 22°C) **Reduce** the hotwater demand by **a third**
Fine particule standard (solid biomass)	**Same technology mix** for solid biomass fuel in residential buildings is used compared to 2015. Emission factors for each technology for Heating Stoves and Boilers correspond to Standards set in 2017.	Same as REF **except** that for Heating Stoves/Single House Boilers (Pellet and Other than Pellet) : emission factors for PM2.5 equals **50% of emission factors set in "Standard 2017"** (cfr eco-design)
Electrification of catering/cooking	The energy mix for cooking is kept **unchanged**	The share of electricity reaches **over 85 % (catering) and 80 % (cooking)**

Renovation rate	**1%/year** renovation rate is kept **unchanged**.	The renovation rate **increases** to a bit less than **3%** by **2025.**
Renovation depth	The average renovation depth is **unchanged:** - shallow: 80% - med-low: 15% - deep: 5%	By **2025**, the renovation depth is **increased** as follows: - shallow: 40% - med-low: 50% - deep: 10%
Demolition rate	**0.1%/year** demolition rate is kept **unchanged.**	Demolition/reconstruction activities **increase** to **over 0.20%/year** from **2025** onward
New build efficiency	**By 2025,** the construction mix is: - new built - shallow : **40%** - new built - moderate (low) : **50%** - new built deep insulation : **10%**	**By 2025**, the construction mix is: - new built - shallow : **0%** - new built - moderate (low) : **over 80%** - new built deep insulation : **over 20%**
Residential : Deployment of cooling systems	**Increase** the percentage of residential buildings equipped with cooling systems to **40%.**	**Slightly Increase** the percentage of residential buildings equipped with cooling systems to **3%.**
Electrification of space and water heating	**For space heating:** - heat pumps: 30% - direct electricity: 14% - solar-thermal: 1% **For hotwater production:** - heat pumps: 16% - direct electricity: 35% - solar-thermal: 0%	**For space heating:** - heat pumps: 65% - direct electricity: 11% - solar-thermal: 5% **For hotwater production:** - heat pumps: 50% - direct electricity: 29% - solar-thermal: 5%
Lighting, appliances and cooking demand	**No difference** between REF and CORE	
Contribution of solid biomass	**No significant difference** between CORE and REF	

Appendix B.

Methodology for the calculation of jobs required for the climate renovation of buildings in Belgium.

We based our calculations on few parameters found in 3 different sources:

1) Investment estimated in Wallonia to reach 2050 renovation target: 120 billion euros for the residential buildings and between 34 to 57 (mean of 45.5) billion euros for the non-residential (Service Publique Wallon, 2020).
2) Investment estimated in Flanders to reach 2050 renovation target: 150 billion euros for the residential buildings and 57 billion euros for the non-residential (Vlaamse Regering, 2020).
3) The regional multipliers of the Belgian Federal Planning Bureau: we calculated the mean of the multipliers most relevant for climate renovation. Specifically, we included four of the six multipliers in the construction sector, excluding "road and waterway construction" and "demolition, site preparation, test drilling and drilling ". This gave us the following multipliers in the 3 regions:
   a. Wallonia: simple multiplier of 11.5 and type I multiplier of 2.0
   b. Flanders: simple multiplier of 8.9 and type I multiplier of 2.4
   c. Brussels: simple multiplier of 9.3 and type I multiplier of 2.7

As there is no official budget estimation for Brussels, we had to make our own calculations. In the Flanders calculations, they based their investment estimation on the number of dwellings and the surface of their non-residential buildings. Following this logic, we divided the investment estimations per building for residential and non-residential in Wallonia and Flanders. Then we multiplied the mean investment per building by the number of buildings in Brussels in 2020, still distinguishing residential from non-residential (Institut Bruxellois de statistiques et d'analyse, 2022). This results in a budget estimation of 13 billion euros for the residential buildings and 4 billion euros for the non-residential in Brussels to reach 2050 climate renovation target. As all investments were estimated on the global objective until 2050, we assumed it could be linearly distributed on the 30 years between 2020 and 2050, to get an investment per year.

The second step is to use the regional multipliers on the investment per year estimations. Using the simple multiplier, we get the total number of required jobs to cover the new demand (i.e. estimated investment) ***[investment(million €)*simple multiplier = total number of jobs]***. The type I multiplier is used to differentiate the number of jobs required in the construction sector (direct jobs), from the number of jobs required in the supply chain of the construction industry (indirect jobs) ***[total number of jobs/type I multiplier = number of direct jobs]***.

As a results, we have the number of jobs required per year to cover the renovation investments in residential and non-residential buildings for the 3 regions of Belgium.

APPENDIX 4
CIRCULAR ECONOMY

Authors: Kris Bachus
and Matthias Multani

1. Executive summary

In recent years, in the slipstream of the climate transition, the circular economy has remarkably gained traction. It is estimated that two thirds of the total Belgian greenhouse gas emissions can be linked to material-related activities, such as manufacturing, freight transport and building activities. As such, the circular economy could contribute up to 32% of GHG emission reduction by 2050.

Next to this important environmental impact, a transition towards a circular economy will also have economic and social impacts, of which one is the impact on jobs and labour markets. In Flanders, job growth in sectors that can be considered as circular, was five times higher in the period 2010-2020 than for the whole economy. In terms of circular subsectors, the highest growth was recorded in rental and leasing, followed by the second-hand sector. The circular subsectors with the highest absolute number of jobs in Flanders are the recycling sector, and the repair and maintenance (including motor vehicles) sectors. Looking at current job characteristics, many of the circular jobs are for low and middle schooled profiles, which confirms the potential of the CE to reduce low-skilled unemployment, and offer job opportunities to vulnerable groups on the labour market. Moreover, the circular economy provides room for local employment (e.g. repair and second-hand), which could allow it to contribute to tackling local and regional imbalances on the labour market.

For the future, current job growth rates resulting from the circular economy are expected to continue. In Flanders, the biggest potential lies in the machinery repair, rental and leasing and repair sectors. In the EU, some sectors could be on the losing end, for example the mining and extraction sectors, the processing of these raw materials, and potentially sectors that produce durable goods (cars, machinery, electronics, etc.). For Flanders and Belgium, job loss risks are rather low.

The circular economy could have an impact on skills needs in the Flemish and Belgian economy as well. The change is expected to be gradual and parallel to other drivers of change, such as digitalization. It is expected that the demand for the following three types of skills will change. First, transversal skills ('soft skills') will be increasingly needed: communication skills, analytic capacities, problem-solving, interest for learning, critical spirit, etc. Second, the CE will increase the need for employees with a technical profile. And third, the need for specific CE-related skills, such as repair, sorting, circular business models, will be rising, but less than

the transversal and technical skills. In terms of skills shortages, the already severe shortage of all types of technical skills is expected to worsen, while the shortage of transversal profiles may grow because our formal education systems are not always fit to deliver these profiles.

The skills needed in the circular economy will be mostly provided by on-the-job training or in-company training. Vocational education and training (VET) will be the crucial element that governments and social partners alike will need to work on to absorb the changes smoothly. Lifelong learning (LLL) will be key, as will be increased coordination, collaboration and exchange between industry and education.

The circular economy holds the potential in terms of job demand for vulnerable groups on the labour market. However, to make sure the transition will be just, attention for job quality will be needed, especially in the sector of waste and recycling, as these sectors already have some jobs with health and safety risks at present. Furthermore, servitization[33] and circular business models will require some follow-up to deal with risks such as job security, social protection, and even exploitation of workers.

In conclusion, the transition to a circular economy in Flanders and Belgium has the potential to boost the economy and create new jobs. The main challenge will be to realize upskilling and lifelong learning in order not create a bottleneck that could slow down the transition.

2. Introducing the case

Relevance of the case

Global resource use has exceeded 90 billion tonnes, and this number is expected to double by 2060 (OECD, 2019). This massive extraction puts increasing pressure on global ecosystems. The availability of resources will be key to sustain our high levels of production and consumption in the near and distant future. The circular economy is introduced as an important factor to make resource use more sustainable, for ecologic, economic, geopolitical and social reasons. Additionally, the circular economy has a pivotal role in global climate change mitigation. The International Resources Panel of the United Nations Environment Programme has stressed that other environmental problems such as climate change can only be mitigated by decoupling economic activity, human well-being and resource use (UNEP, 2017). The circular economy is introduced as an important factor in decoupling and as an essential contribution towards 'a sustainable, low carbon, resource efficient and competitive economy' (European Commission, 2015, p. 2). For Flanders, it was calculated that over two thirds of total greenhouse gas emissions can be linked to material-related activities, such as manufacturing, freight transport and building

33 Servitization means that in the circular economy more products are not bought and owned by the user, but are a combination of goods and services, e.g. leasing office carpets including services such as cleaning and replacement at end-of-life.

activities (Borms et al, 2021). In conclusion, the transition to a circular economy, will be an essential strategy to mitigate climate change, both in Flanders and on a global scale.

Considering these systemic characteristics, a transition towards a circular economy will have economic, social and environmental effects, of which one is the impact on jobs and labour markets (Clube, 2022; Repp, Hekkert, & Kirchherr, 2021). This case study explores the impact the circular economy may have on the labour market, with a perspective up to 2050.

Definition of the circular economy

While many different definitions of the concept of a circular economy exist, the most prominent is the one put forward by the Ellen MacArthur Foundation, a not-for-profit aimed at promoting the circular economy (Kirchherr, Reike, & Hekkert, 2017). It presents the circular economy as "an industrial system that is restorative or regenerative by intention and design. It replaces the 'end-of-life' concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models" (Ellen MacArthur Foundation, 2013, p. 7).

Circular economy in Flanders

Since the 1980s, Flanders has built up a strong reputation in terms of – initially – waste management, and – more recently – progress towards a circular economy. In the 2021 Environmental Performance Review, the OECD called Flanders a 'pioneer for their initiatives for the transition to a circular economy' (2021). However, Flanders' progress towards a circular economy was recently measured at 21% (for data year 2018), up from 16% in data year 2014, which

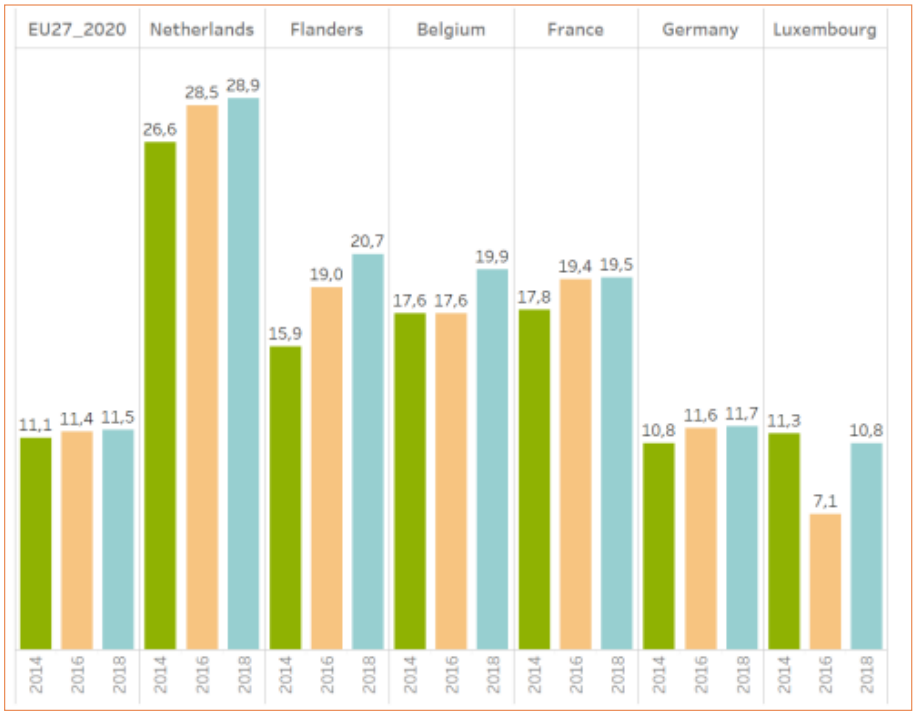

Figure 18. Cyclical material use rate (CMUR) for Belgium, Flanders and neighbouring countries

Source: Christis and Vercalsteren (2021)

shows that (1) there is good recent progress, but also that (2) there is still a long road ahead.[34]

As Figure 18 shows, the Flemish circularity rate does not differ substantially within the three Belgian regions. Comparing with the neighbouring countries, the Netherlands stand out, at 28.9%, whereas the German, Luxemburg and average EU level are substantially behind.

Other macro-level circular economy indicators, such as the Domestic Material Consumption (DMC) and the Raw Material Consumption (RMC) show less, or even no real progress in recent years, as is shown in the Figure 19.

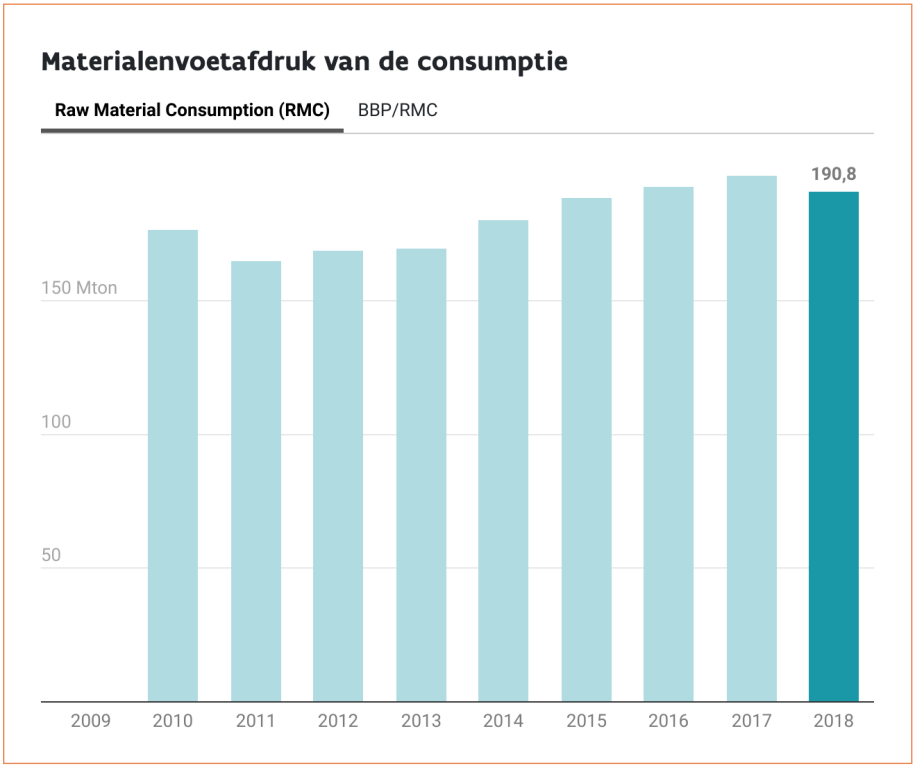

Figure 19. Domestic Material Consumption (DMC, megatonnes of material consumed) and the Raw Material Consumption (RMC, megatonnes of raw material consumed)

Source: Christis M. and Vercalsteren A. (2021)

Specific methodology of the case

The case study was carried out in parallel and interaction with several other research projects at HIVA. Methodologies include:

- Statistical database analysis for the measurement of circular employment
- Thorough literature study
- Several in-depth interviews with both employment and circular economy experts
- One focus group in the Flemish construction sector

34 Measure by the indicator 'cyclical material use rate (CMUR)', source Christis and Vercalsteren (2021).

3. Circular economy transition required to meet the objectives of the CORE-95 scenario

In this section, we link the various elements and measures of the CORE-95 scenario to possible circular economy strategies and measures in an explorative way.

There are several ways in which a more circular economy contributes to lower carbon emissions. on the one hand, the so-called 'inner circles' of the circular economy, which include the circular strategies of Refuse, Rethink, Reduce, Reuse, Repair, Refurbish, Remanufacture, and Repurpose, contribute the most directly. Less consumption or product lifetime extension as a result of repair or reuse entail lower demand for new goods and goods made from (only) virgin materials. On the other hand, the 'outer circle' of circular economy, which is primarily recycling, has a more indirect impact, reducing carbon emissions by replacing raw materials by recycled ones for the production of goods. The inner circles of the CE are considered as more transformative, requiring system-level change, while recycling is usually seen as a less transformative activity that can be realised without fundamental changes in the current production and consumption patterns.

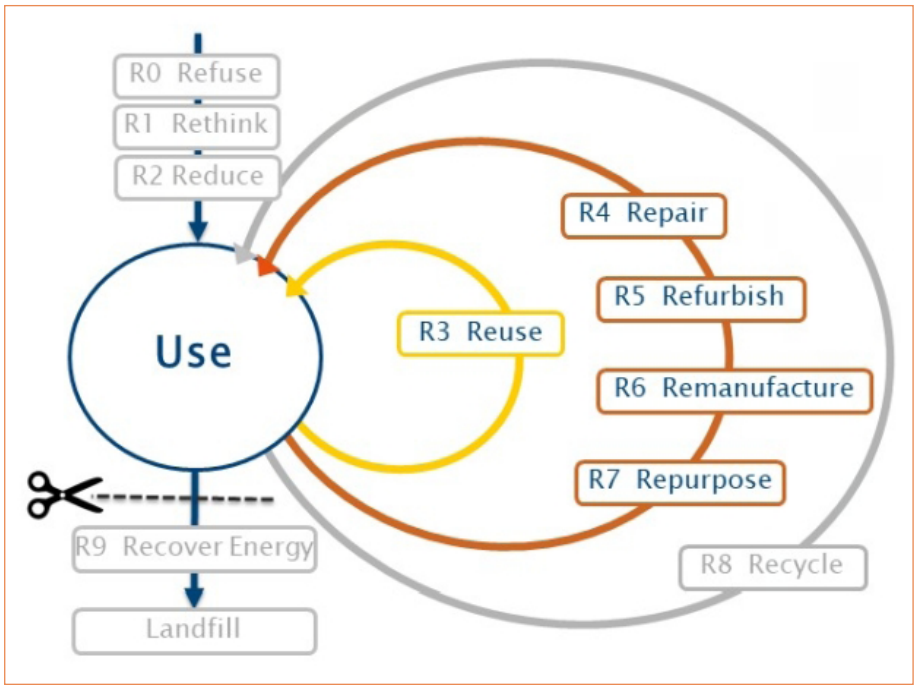

Figure 20. The inner and outer circles of the circular economy

Source: https://www.sirris.be/lets-not-forget-about-inner-circles-circular-economy

In the 2021 updated of the climate scenarios for Belgium, it was calculated that, in the CORE-95 scenario, the circular economy could contribute up to 32% of GHG emission reduction by 2050 (Climact and VITO 2021).

On a sectoral level, first, for the transport sector, new modes of transport, particularly car sharing, have the potential to have a significant impact, on the condition it would increase the average occupancy rate of vehicles. In logistics, a higher load factor of trucks and a shift to more inland waterway transport could also lead to a lower material demand. On the other hand, circular economy steps are expected to have no or only a limited impact on (1) reducing

transport demand, (2) the modal shift, (3) accelerated car electrification, and (4) higher efficiency for the (remaining) combustion engine vehicles. The potential of the circular economy seems to be predominantly in the embedded impact of vehicles. If the manufacturing of the vehicles (including the electric ones and their batteries) can be transformed towards more recycled content, and reuse of parts, carbon emissions related to vehicle production will drop. However, much of that impact will be realised abroad rather than in Flanders/Belgium.

A similar message can be drawn for the buildings sector. The CE is not likely to contribute much to (1) increasing the speed of renovations, (2) the transition from natural gas and heating oil to heat pumps, or (3) the upscaling of collective energy solutions including district heating. Again, the largest contribution could be in the embedded carbon in buildings: if more circular solutions, such as modular building, more recycled content for cement and concrete, or off-site standardized production have a breakthrough, important emission reductions would be realised. We expect a significant amount of these emission reductions could be realised on the Belgian territory, although for off-site production of (even large) building components, the picture could be mixed.

Third, for industry, we do see a higher potential. Increased use of recycled instead of raw materials, more component reuse and better design for longevity could lead to less carbon-intensive production patterns in all carbon-intensive sectors, including, steel, non-ferrous, cement, glass, lime, chemicals, pulp and paper, and food. As Flanders and Belgium have very open economies with lots of trade, further studies will need to determine where the strongest impact is: on imports, exports, or domestically consumed production, which will determine what the potential for Flanders and Belgium is in terms of domestic carbon emissions and carbon footprint.

In the above analysis, the difference between (territorial/domestic) carbon emissions and carbon footprint is essential: many CE measures will have a big impact on the carbon embedded in our imports (cars, electronics, clothing)… but not/less on our domestic emissions. If the focus of the Flemish and Belgian governments is strictly on the territorial carbon emissions, more analysis is needed on the net impact. By contrast, if their focus is on the (consumption-based) carbon footprint, then reductions abroad have the same value as domestic reductions. Considering the dominant focus by most governments (including the EU) on territorial emissions, that perspective is most likely to be prioritized in Flemish and Belgian policy-making.

4. Quantitative impacts of the circular economy on the labour market in Flanders

Current trends in circular jobs

In this section, we examine the impact of the CE on the number of jobs in the economy, or, in other words, the job gains and losses caused by the CE. Our perspective is on both looking back and looking forward.

In order to measure current CE employment numbers and their recent evolution, we need an indicator that is both a good measure for circular jobs, and can be found in available employment databases. Usually, the proxy that is needed to make this combination is to look at ***jobs in circular sectors***, based on NACE activity codes, rather than the circularity of individual jobs. The advantage of this approach is the good data availability of employment data. The downside is that this proxy has a lower validity in measuring the circularity of jobs, since the circular economy does not have separate NACE codes.

The Flemish Policy Research Centre is doing research on this indicator since 2018, and since 2020, the SBO research project 'Michelle' is continuing it. This research, carried out by HIVA-KU Leuven, has led to the adoption of this indicator in Flemish CE Monitor. In Willeghems & Bachus (2019), six sectors were labelled as 'circular':

DESCRIPTION	NACE CODES
Repair	33.110-33.190, 95.110-95.120, 95.210-95.290
Rental and leasing	77.200-77.299, 77.300-77.399
Waste	37.000, 38.110-38.120, 38.211-38.222, 38.310-38.329, 46.771-46.779
Maintenance of motor vehicles	45.201-45.209, 45.310-45.320, 45.401-45.402
Second-hand	47.791-47.793
Restoration of buildings	43.995

Based on recent HIVA research, Figure 21 shows the job growth in circular sectors in Belgium between 2012 and 2020, compared to the growth of the economy overall.

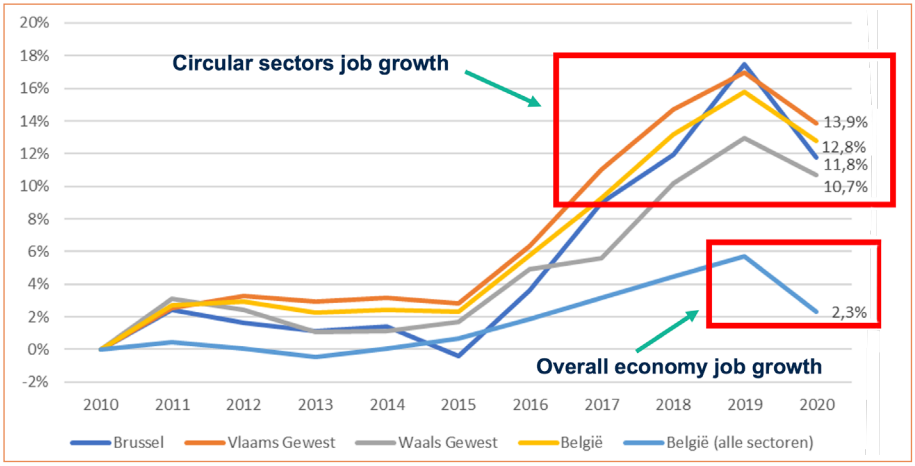

Figure 21. Evolution of the number of employees in the circular sectors (Belgium, three regions), compared to employment in the whole economy (Belgium all sectors).

Source: Multani, & Bachus (2022), based on data of the Crossroads Bank for Social Security

The conclusion from this graph is that employment in circular sectors in Flanders has grown three times faster than the average for the whole economy. It is save to conclude that already today, the circular economy is an engine for job growth.

A more detailed breakdown of employment in circular activities can be made, based on the division into six subsectors, as is shown in Figure 22.

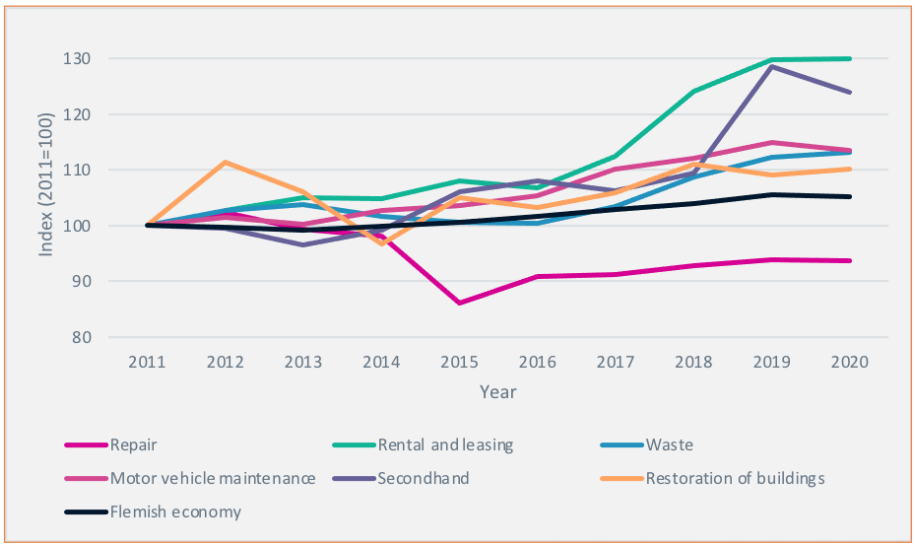

Figure 22. Number of employees in the circular sector in Flanders, 2011-2020

Source: Multani, Bachus et al. (2020), based on data from KSZ (adapted by Steunpunt Werk) and Bel-first.

The circular sectors with the highest employment numbers in Flanders are the recycling sector, and the repair and maintenance (including motor vehicles) sectors. Overall, no specific geographic clustering of circular activities in Flanders is found (Mitchell & Morgan, 2015; Willeghems & Bachus, 2019). More importantly, the circular sectors seem to be growing much faster than their regular counterparts (Multani, Bachus, & Ampe, 2021; Willeghems & Bachus, 2019).

The prominence of the recycling sector is, despite recycling being a 'low' circularity strategy according to the waste hierarchy, not surprising. Some authors already noted that recycling is becoming a dominant strategy in most circular economy practices (Barreiro-Gen & Lozano, 2020; Ghisellini, Cialani, & Ulgiati, 2016). The same can be noted at the EU level, whereas the EU declarations are at first sight rather comprehensive and holistic, the actual plans seem to be focused on recycling and are strongly market-oriented (Calisto Friant, Vermeulen, & Salomone, 2020).

The people working in these circular sectors are predominantly male: about 85% of circular employees in Flanders are men, compared to the average of 55% for the Flemish economy overall. Furthermore, looking at the educational attainment of these workers, they are low and middle schooled more than average (Willeghems & Bachus, 2019), which confirms the potential of the CE to reduce low-skilled unemployment, and offer job opportunities to vulnerable groups on the labour market.

Contrary to intuition, the circular economy in Flanders is less labour-intensive than other sectors (Llorente-González & Vence, 2020; Multani et al., 2021; Stahel & Clift, 2016). This is predominantly due to the large share of the waste and maintenance of motor vehicles sectors in Flanders, while all the other circular sectors are more labour intensive than the average economic sector. The detailed sectoral results are shown in the Figure 23.

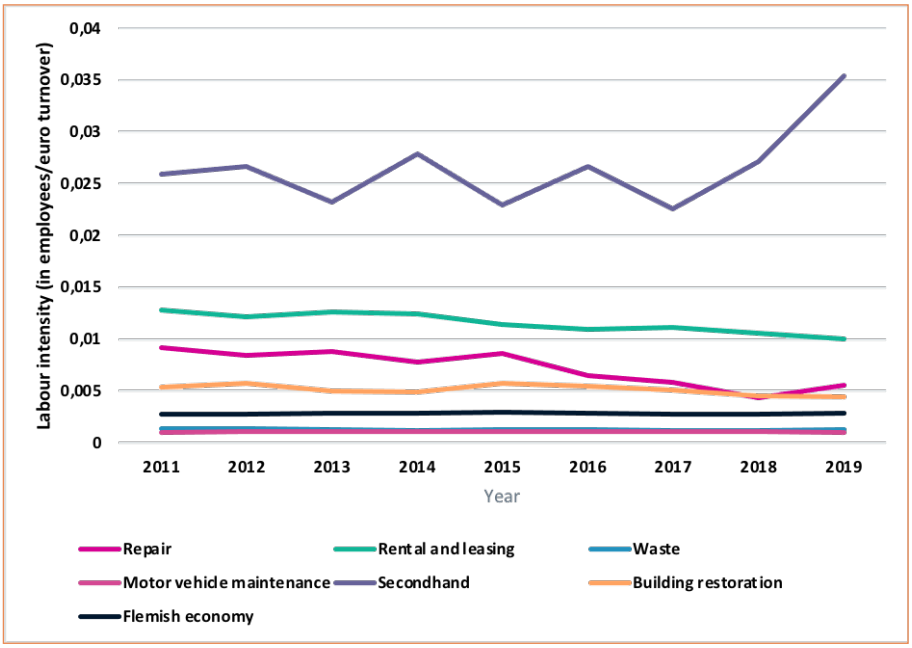

Figure 23. Evolution of labour intensity in the circular sectors and in Flanders

Source: Multani & Bachus, 2021

Impact of the CE on future employment

On future employment in circular activities, numerous studies have been done. Most studies rely on resource taxes to model reduced material inputs. For Belgium, a study by Cambridge econometrics found an increase in jobs of 0,3% by 2030 (European Commission. Directorate General for the Environment., Cambridge Econometrics., Trinomics., & ICF., 2018). For Flanders, 30,000 additional jobs are expected by 2030, with the biggest potential in machinery repair, rental and leasing and repair sectors (Willeghems & Bachus, 2019). This is in line with the estimates found in research concerning other regions. Moderate scenarios up to 2030 expect a median change of 0,1% on a regional level varying from 0,0 to 0,8%. In ambitious scenarios up to 2030, a median positive change of 1.6% is expected with estimations for EU countries ranging from 0.3 to 2.8%. The biggest differences in estimates can be explained by what happens with the revenue of taxes on resource use (e.g. lowering of distortive labour taxes) and the shift of employment to more labour-intensive sectors (Aguilar-Hernandez, Dias Rodrigues, & Tukker, 2021; European Commission. Directorate General for the Environment. et al., 2018; Laubinger, Lanzi, & Chateau, 2020). Generally, the sectors in which job losses could occur are mining and extraction sectors, the processing of these raw materials, and potentially sectors that produce durable goods (cars, machinery, electronics, etc.). For Flanders, these risks are limited, although the fossil fuel industry, including oil refinery, could lose jobs in that segment. The sectors that grow are expected to be the waste sector, the repair sector, and some service sectors. Employment in the construction sector could slightly fall because of improved productivity with new building techniques, but this effect might be (more than) compensated by the acceleration of renovation activities for reasons of energy efficiency and climate change mitigation.

The circular economy, however, does provide some potential for the spatial distribution of activities. Since certain circular activities are easily conducted locally (such as repair and reuse), while other activities do not necessarily require

large economies of scale (such as sharing schemes) or rely on the servitization of an activity, there is some potential for local employment (Wijkman & Skånberg, 2015). In this sense, a circular economy could provide a counterweight to the offshoring of production activities.

In terms of regional effects, it is expected that mostly eastern European and central European states may benefit in terms of employment. This effect is linked to lower imports of oil and durables which leads to a better trade balance and GDP (European Commission. Directorate General for the Environment. et al., 2018).

In the future, the CE could create a shift to more labour-intensive sectors, such as repair and maintenance. However, other trends, such as continuing servitization, digitalisation, and automation, could counteract this trend (European Commission. Directorate General for the Environment. et al., 2018).

5. Identification of the effects on jobs and their implications in terms of skills, training, and just transition

The skills question

In terms of skills that are needed in the transition to a more circular economy, most studies conclude that only minor changes in skills are needed. Especially in comparison to other labour market changes, the circular economy does not pose great challenges to the skills needed by workers. This way, there is a general tendency to conclude that most jobs will require upskilling, rather than a complete new set of skills (Bachus, 2022; European Commission. Directorate General for the Environment. et al., 2018; ILO, 2019; Laubinger et al., 2020).

From the quantitative analysis earlier in this deep dive, we learnt that the sewage and waste sector will have the strongest job growth. Refuse workers are a category of workers that will see increased employment. Since the profile of these workers is low and medium-skilled mostly, these profiles are expected to increase employment (there is only a relatively small shift to higher skill levels). The expected new skills for such jobs are within the scope of the existing skills of these workers, which confirms the statement in the previous section that the CE can be expected to create a need for upskilling rather than transformation of jobs.

Even though the changing skills needs are not as transformative as other drivers of change, it is not negligible. The change is rather gradual and parallel to other drivers of change, possibly amplifying future change. But in general, the impact is expected to be less important than other drivers of changing skill needs. Furthermore, demand for cross-cutting skills, employees mastering several disciplines and skills, is expected to grow. This is linked with a shift to value chain thinking, where more people involved will need not only the knowledge on their own little step in the chain, but an overview of the previous and following steps in the value chain as well. As such, the importance of transversal ('soft') skills, adaptability, collaboration skills and problem-solving abilities can be expected to increase.

Although the research on the skills questions is still in an early development phase, certain indications can already be drawn from our own past research and other literature:

- The CE will increase the need for employees with a technical profile, on a wide range of sub-profiles (electronics, mechanics, ICT, engineering, operators, automation,…) and skills levels (high, low and medium-skilled profiles).
- Transversal skills ('soft skills') will be increasingly needed: flexibility, interpersonal skills, risk-taking and creativity, communication skills, analytic capacities, problem-solving, interest for learning, critical spirit, etc. (Bachus, 2022; Cliquot, Willeghems and Bachus, 2018; Bachus et al., 2017; Bachus et al., 2016)
- The need for specific CE-related skills, such as repair, sorting, circular business models, will be rising, but less than the transversal, general skills.
- In terms of logistics, more skills will be needed in terms of circular logistics chains, including reverse logistics (take-back systems such as deposit-refund, as-a-service contract including maintenance and repair, extended forms of product warranty, extended producer responsibility (EPR) which extends the role of producers/suppliers, etc.)
- Circular business models[35] deserve special attention, fitting into the transforming relationship between the producer/supplier on the one hand, and the user/consumer on the other hand. Legal expertise is needed, as are different ways of communicating with consumers, and ways to build up a relation of trust.
- On the highest level, entrepreneurs and CEOs will need to see the potential of market niches related to the CE, e.g. 3D-printing services, small-scale plastics recycling devices, … Furthermore, they will need to see the opportunity and necessity of making transformational shifts in terms of markets, product development, servitization, etc. to be competitive in the future (circular) economy.
- Especially, the general management of SMEs will need to build (much) more strategic capacity in terms of adapting to the circular economy. Today, SMEs are lagging behind in terms of making the shift to the circular economy (Cliquot, Bachus et al., 2017).

Skills shortages

Knowledge for Flanders/Belgium on this topic is still limited. At the end of 2023, HIVA and VITO will publish a report with more indications on what can be expected, in the framework of the MICHELLE project. What we know today, is that the CE will contribute to some already existing skills shortages:

- Specific CE skills, such as repair of electronic devices and clothing, already suffer from severe skills shortages.
- Technical profiles, with a wide range of sub-profiles (electronics, mechanics, ICT, engineering, operators, automation,…) and skills levels (high, low and medium-skilled profiles) are already facing serious shortages.

35 Servitization, as-a-service, sharing, extended warranty systems, maintenance contracts, etc.

– Transversal skills: our formal education systems are not always fit to deliver these profiles, and their increasing need is not only specific to the CE, but also to several other labour market trends, including the climate transition.

Training needs

In previous sections, we indicated that skills needs changes in the future CE will be more a matter of upskilling than of transformation.

Formal education systems often lag behind on recent trend in the economy and the labour market. For instance, the increased need for transversal and value-chain oriented profiles is not well matched with the education programmes offered by universities in Flanders and Belgium, which tend to be mono-discipline-oriented.

As a result, the skills needed by the circular economy will be mostly provided by on-the-job training or in-company training. Vocational education and training (VET) will be the crucial element that governments and social partners alike will need to work on to absorb the changes smoothly (Goodwin Brown et al. 2021). It will therefore depend on the possibility, willingness and capacity of employers to train their employees whether the skill requirements will facilitate or inhibit the uptake of circular processes.

To somewhat bridge the gap, more coordination, collaboration and exchange between industry and education, e.g. by having experienced sector representatives teach some classes in professional schools to get a better feel of 'the real world'. Conversely, teachers could be involved more actively in industrial companies to feel the needs and see the changes in the economy.

Lifelong learning (LLL) will be key in addressing all the changing skills needs caused by the CE. Flanders and Belgium are behind in terms of take-up of LLL, on the side of both the participation rate and willingness on the employee side, and the capacity/willingness/acceptance to organize, allow, and fund training programmes for employers' existing staff. In this context, general recommendations to boost LLL on both sides should be taken into consideration. The recently adopted Flemish 'Action Plan LifeLong Learning' could be a step in that direction, although the Flemish Education Council (VLOR) criticized it for lacking a focus on concrete action. While a detailed analysis of LLL recommendations exceeded the scope of this deep-dive, we take just a few recommendations from Van Damme (2019), focusing on the (gradual) development of a culture of (lifelong) learning (for adults), which is limited at present:

– Awareness campaign on the importance of learning
– Improving accessibility and relevance of trainings
– Universities and university colleges should expand their programmes aimed at adult learners
– Initiate and incentivise workplace learning and dual learning in higher education programmes[36]
– Encourage collaboration between training companies, schools, companies, social partners and experts.

36 This is a combination of studying and working at the same time.

Ensuring a 'just' transition

Just transition is a concept that can have many meanings and interpretations. Following the definition used for this study (refer to definition in earlier part), we see the following links between just transition and the circular economy in Flanders and Belgium.

5.1.1 Potential in terms of job demand for vulnerable groups on the labour market

The CE holds a promising potential in terms of job demand for vulnerable groups on the labour market:

- As indicated in previous sections, quite a lot of the job growth can be expected in sectors with a high demand for low and medium-skilled labour;
- Several CE activities (repair, reuse) have the potential to be offered on a very deconcentrated, local scale, which is a good match with the – still important – barrier of commuting for vulnerable labour market groups, which is sometimes labelled as mobility poverty (Willeghems and Bachus, 2018).

5.1.2 Characteristics of the jobs of the new (and transformed) jobs in the CE:

These include job quality ('decent jobs'), in terms of health impact, wellbeing, gender equality, job duration (contract), etc. Up to now, no studies have been done on the specific impact the CE could have on these indicators. However, a few elements can be derived from existing literature:

- In the short and medium run, jobs in waste-related sectors can be expected to be boosted. However, in the long run, they may become obsolete again once the transition to a circular economy is in an advanced state, which would imply that the majority of waste to be treated has been eliminated (Bachus, 2022). This illustrates that both a short and a long-run lens is needed to anticipate the impacts.
- WHO has highlighted several risks, particularly related to managing waste and potential exposure to hazardous substances. Many of these risks frequently occur in the informal economy, and they are known to hit vulnerable groups disproportionally, including children and poor families (WHO Regional Office for Europe 2018).
- The breakthrough of circular business models, such as servitization or sharing platforms, could have a significant impact on the economy and on jobs. Sharing platforms, such as Uber and Airbnb, raise some concerns of job security, social protection, and even exploitation of workers. However, product-service systems do not necessarily require a change in employer-employee relation, so the concerns over large sharing platforms could be more a feature of the platform economy (than of the circular economy). While there is certainly ground for caution, the platform economy can be expected to create both good and bad jobs. (Kalleberg and Dunn 2016).
- 85% of the existing jobs in circular sectors are occupied by men. This extreme distribution is likely explained by the nature of the job (waste collection, car maintenance, …) rather than by inclusion issues. However, further research would be needed to unfold the reality behind those figures.

5.1.3 *Safety net for employees losing their job as a result of the development of the CE*

Again, no specific studies are available yet on this element. However, as Flanders and Belgium have only limited employment in the extraction of raw material and the manufacturing of electronics, job losses to be expected are modest. Oil refinery, and some subsectors of the manufacturing industry could be at risk. At first sight, these are sectors with good social protection and labour contract conditions. Moreover, most skills in those sectors are currently very much looked for in other industrial sectors, which is likely to facilitate the smooth reintegration of workers into the labour market. However, more research is needed to refine/test these first impressions/hypotheses.

5.1.4 *Opportunities for the social economy*

One area where some subsectors in the circular economy could serve just transition is the social economy. Many European countries have a strong sector of social economy companies whose primary aim is to provide employment opportunities to the people with vulnerabilities on the labour market. In some countries, such as Belgium, the social economy is an important driver of the second-hand economy (Delanoeije and Bachus 2022). In the future circular economy, the social economy could create additional jobs in repair and maintenance, refurbishment, and reuse. The fact that the transition to a circular economy would also create jobs far away from economic activity hot spots, further increases the potential match between the circular economy and the social economy.

6. Recommendations for policy actions by the federal government

The first recommendation we draw from the existing knowledge on circular jobs, is that the federal government should raise the ambition level of its circular economy policies. Accelerating the circular economy transition will not only make an important contribution to the achievement of the Belgian 2030 climate targets, but also increase resource and energy security. Moreover, the circular economy is a clear economic opportunity which has the potential to boost both GDP and, especially, employment. The implementation of a budget-neutral circular tax shift is a promising way to accelerate the transition to a circular economy, reduce labour taxation and create jobs, both in general and for low-skilled profiles in specific. This budget-neutral circular tax shift could be independent, i.e. implementing a materials tax while giving ('recycling') all the government revenues back to society, in the shape of a lump-sum payment to all citizens and/or a reduction of social security contribution or income taxation. However, an even more integrated and sustainable policy mix would be a climate tax shift with the addition of elements to support the circular economy. After all, reducing carbon emissions and the use of fossil fuels is in itself an important factor to boost the circular economy.

Secondly, the social economy has a high potential to create circular jobs. While the competences related to the development of the social economy are predominantly on the regional level nowadays, the federal government still has an

important role in supporting entrepreneurship and economic policy in general, and for SMEs in particular, where circular social economy accents can be integrated.

Third, in terms of skills needs and development, again more competences are at the regional level than at the federal level. However, coordination at national level can be impactful, e.g. by using the powerful fiscal, employment, and social security competences. The focus should be on creating a culture of LifeLong Learning (LLL), the development of general technical skills, specific circular economy skills (e.g. electronics repair), and transversal skills (e.g. collaboration, problem-solving).

Fourth, a mix of federal push and pull measures under the umbrella of economic policies could be used to incentivize (1) SMEs to think about their role in the future circular economy, and (2) their CEOs to follow training and increase their awareness of and knowledge on the business opportunities the circular economy has to offer.

Finally, while more research is needed on the quality of circular economy jobs, health and safety and other federal employment competences could follow the emergence of the circular economy with caution, to monitor the evolutions and to be able to react to risks that could arise related to working conditions in the circular economy.

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APPENDIX 5
DIGITALIZATION

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Introduction

This report depicts the results from a deep dive into digitalization in the context of long-term climate transition scenarios (i.e the CORE 95 scenario, which achieves 95% reduction in carbon emissions by 2050[37]). The ICT sector in Belgium represents a significant part of the total workforce but the amount of workers in this sector remains stable over time, with a slow growth during the last years. Some categories of jobs are subject to a very strong demand (coding), which has given birth to unusual training paths (Ecole 19, BeCode, etc.).

Total number of employees in the information and communication technology (ICT) services sector in Belgium from 2010 to 2019

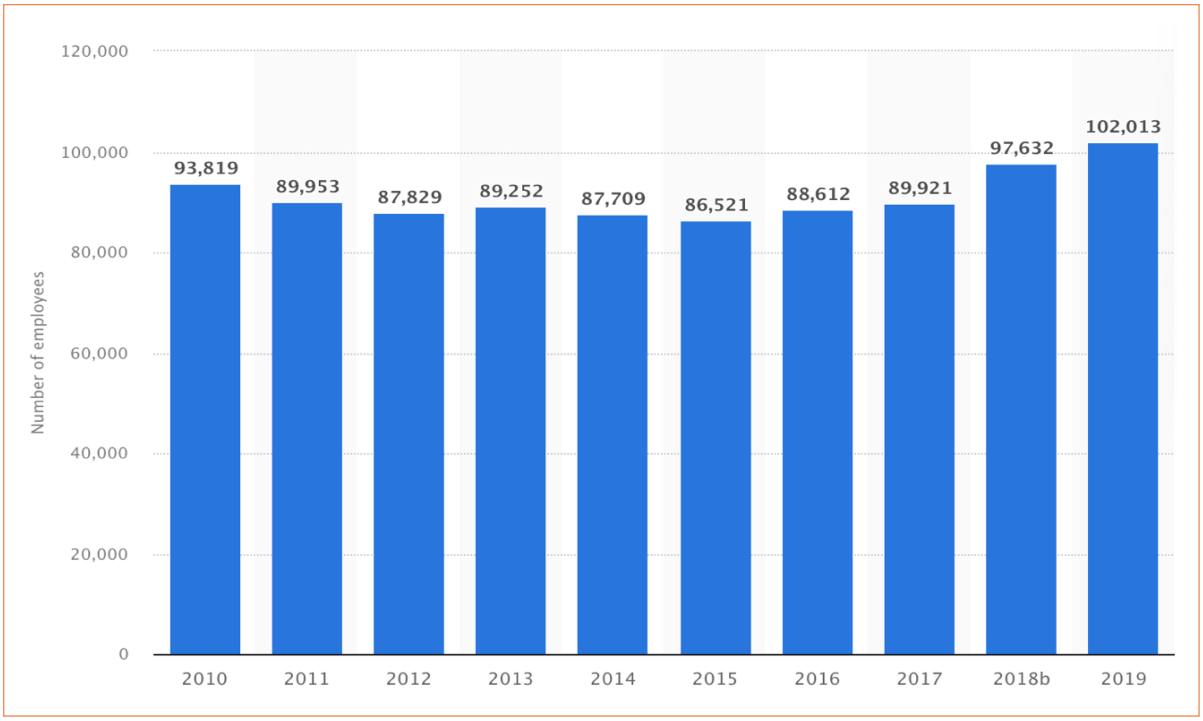


Figure 24
Source: Statistica, 2022

These figures may be compared with the calculations provided by FOREM, leading to very similar estimates. The second table shows that the large majority of jobs in the ICT sector are located in Flanders (60%) and in the Brussels area (25%).

37 https://climat.be/doc/climate-neutral-belgium-by-2050-report.pdf

Total number of companies, employees and self-employed in the Belgian information and communication technology (ICT) sector shared by regions

	NUMBER OF COMPANIES IN 2020	NUMBER OF EMPLOYEES IN 2020	NUMBER OF SELF-EMPLOYED IN 2020
Wallonia	1.348	13.195	561
Brussels	1.163	24.429	258
Flanders	3.803	56.618	1.430
Belgium	6.314	94.242	2.249

Source : ONSS/INASTI 2020, calculations by FOREM (location of headquarters)

The last figures show a clear prevalence of Flanders in the ICT sector (60% of all companies and workers). The future of jobs in the two other regions will largely depend on a reinforcement of public investments in skills development in this sector.

As reminded in the report on megatrends (phase 2), the impact of digital transformation will probably lead to job transformation rather than to job losses and/or job creation. This trend is more and more tangible with the ongoing evolutions towards Industry 4.0 (intelligent interconnection of complex machinery and IT systems such as 3D printers via networked sensors and software, in order to anticipate, control, and plan industrial operations): indeed, many industrial jobs are likely to be deeply transformed through current technological developments.

In order to discuss the interrelations between digitalization and the transition to carbon neutrality, we will here focus on the main expected consequences of digitalization in terms of new work practices, likely to contribute to carbon neutrality (section 1) and on the expected developments in the transport & logistics sector in which the ongoing evolutions could help companies face the challenges of climate change (section 2). In both cases, the ultimate aim is to identify effects on jobs, skills, and training.

In methodological terms, the emergence of new work practices was explored through a brief literature review, preexisting expertise built along various previous projects of action research in companies and bilateral interviews of academic experts and key HR managers with special attention to the probable evolutions linked to digitalization when considering the CORE 95 scenario.

The focus on transport and logistics results from a brief literature review and a 3-hours long focus group with key experts and representative actors from the field with special attention to the evolutions needed to achieve the CORE 95 scenario. More precisely, the aforementioned focus group was composed of seven experts in logistics, transport or education from the following organizations:

- Forem;
- FSTL (Fonds social transport et logistique);
- Centre de compétence Forem logistique;
- Logistics in Wallonia;

– SPF (Service Public Fédéral) Mobilité et Transports;
– Université de Liège;
– Urbike.

1. New work practices due to digitalization

1.1. The growth of hybrid work arrangements

After the pandemic, the evolution toward **hybrid work arrangements** is more and more taken for granted by HR professionals (Gauger et al., 2022). The future of work is presented as a combination of 3 main locations (3H): increased work from the residence (***Home***), a limited number of travels to the corporate office (***Headquarters***) and a growing recourse to third places (***Hub***), close to the home and allowing a better separation between professional and private life. During the pandemic, a large number of companies had to jump into the so-called new ways of working (Kingma, 2018), implying remote working, activity-based space in the office, higher autonomy at work and increased participative management. Beyond the main challenges linked to these new ways of working (difficulties of distant control, diminished collective identity, increased dualities between blue-collars and white-collars, lack of shared knowledge, loss of informal contacts, etc.), such a radical organizational transformation is suddenly viewed as a compulsory passage point to meet the challenges of the transition to carbon neutrality thanks to more balanced usage of corporate spaces, decreased travels to the office, limited number of meetings, empowerment of the workers, better work-life balance, etc. Hybrid work arrangements are often referred to as the "new normal" (Oseghale et al., 2022) and as requirement of newcomers on the labour market. In the last surveys among HR managers, building resilience for an increasingly hybrid world of work emerges as a top priority (Gartner, 2021) while centering the business strategy on sustainability is seen as the top priority for CEOs (McKinsey, 2021). These moral and mimetic pressures create a kind of isomorphic process (DiMaggio & Powell, 1983) leading companies to adopt similar organizational patterns. As a consequence, we can consider hybrid work arrangements as highly probable in the future of companies, whatever the policies likely to be developed to support digitalization.

However, we may wonder whether such organizational evolutions will effectively contribute to the transition to carbon neutrality. Several experts develop critical warnings, highlighting the risk of increased journeys among different working locations, heavier data exchanges and requests to central data centers and therefore enhanced digital pollution (defined as all digital actions emitting greenhouse gases), more intensive use of e-commerce platforms leading to more traffic on the roads, etc.

If employees only need to go to work two or three times a week, they may be encouraged to live away from their workplaces, which would then increase home-work journeys. There could be an increase in energy consumption at places of residence (electricity, heating). Remote working also increases the risks of digital pollution (responsible today for 4% of global greenhouse gas emissions and growing fast), especially with bandwidth-consuming video

conferencing, and the growing production of digital devices, which leads to more energy and resource consumption, as well as electronic waste production, a criterion that companies often fail to consider when measuring their carbon footprint (Canivenc & Cahier, 2021).

There is no consensus among experts about these questions but it is highly probable that "companies will need to be thorough and go into sufficient detail when claiming a positive environmental impact for remote work in their CSR reports or extra-financial performance statements" (Canivenc & Cahier, 2021).

Moreover, we must keep in mind that, despite what is presented as the "new normal" by consultants and HR professionals of large companies, a significant part of working activities will remain organized on-site[38] and/or require frequent travels to other places (shops, residences, health centers, etc.). According to a recent survey of LENTIC (2021) among HR managers of Walloon companies (mostly SMEs and public bodies), a significant part of the respondents (41%) do not support the expected evolution toward remote work after the pandemic (29% justifying on-site presence by operational constraints and 12% seeing their experience of telework as negative).

Any sustainable evolution toward hybrid work arrangements must be therefore considered in a systemic way and accompanied by a series of political initiatives:

- renovation of living spaces and working spaces in order to decrease energy consumption at places of residence, as considered in the CORE 95 scenario;
- provision of new opportunities in spatial mobility and transport in order to diminish the use of cars to and from headquarters and hubs, but also to and from shops, leisure centers, etc.;
- appropriate relocation of infrastructures (shops, schools, leisure centers, etc.) in order to avoid the multiplication of journeys linked to working remotely;
- development of relevant managerial attitudes likely to support new working behaviors (appropriate balance between on-site and remote activities, digital sobriety, work-life balance and well-being of "hybrid" workers, etc.)
- communication campaigns and sensitization actions in partnership with employer associations and trade unions in order to discourage "opportunistic picking" behaviors of companies;
- implementation of appropriate social policies and land use planning actions in order to avoid new digital divides due to hybridization (blue/white collars, employed/unemployed, urban space/countryside with more adapted infrastructures in terms of mobility and workplace locations);
- development of new systemic knowledge on the ecological impact of hybrid work arrangements in Belgium.

38 At the peak of the pandemic, it must be reminded that half of the workforce was still working on-site in most Western countries

1.2. Effects on jobs and skills

Beyond the debates generated by some well-known prospective studies on digital transformation and job losses (Frey & Osborne, 2017) and their transposition in the Walloon context (IWEPS, 2017), it is now accepted that digitalization will mainly lead to the transformation of jobs (more than job losses and/or job creation).

In this perspective and keeping in mind the CORE 95 scenario, hybrid work arrangements may contribute to a significant transformation of at least four categories of jobs.

Mobility managers will play an increasingly important role in modern companies in order to challenge the current tendency to design corporate mobility policies in a purely opportunistic way. Such actors will have to build their legitimacy by linking their initiatives not only to the corporate strategies but also to the local ecosystem of smart cities[39] (Oliveira et al., 2020) and by developing integrated apps interconnecting different transportation services (public transportations, shared cars, bikes, etc.) from and to the 3H (home, headquarters, hub), based on user experience (Trombin et al., 2020). Their growing influence will largely depend on the perceptions of top executives concerning the pros and cons of these new mobility policies in recruiting and retaining their employees.

(Chief) Data officers will have to include in their digital developments and strategic IT choices (cloud, video calls, centralized or decentralized data storage, etc.) the critical question of digital pollution (defined as all digital actions emitting greenhouse gases). They will have to acquire new competencies, not only in technical terms (data-centric) but also in managerial and strategic terms (value-centric). CDOs should more and more switch to experimentation, methodical failure and continuous learning to reinvent key business and operational processes from a sustainable perspective[40]. They should also be able to integrate sustainable data management and mobility plans for all workers.

Middle managers will have to learn how to manage and coordinate hybrid teams. Their role has been presented as critical in most studies during the pandemic (Spagnoli et al., 2021; Hassard & Morris, 2022), extending the findings of previous studies focused on their sensemaking activity during change processes (Rouleau & Balogun, 2011) and the implementation of new ways of working (Jemine et al., 2020). They will have to create a team spirit and define the modalities of remote work via clear and regularly updated objectives while paying permanent attention to the work-life balance and the well-being of team members. They will have to develop new digital skills in order to manage and animate hybrid meetings through more and more sophisticated devices (Standaert et al., 2021).

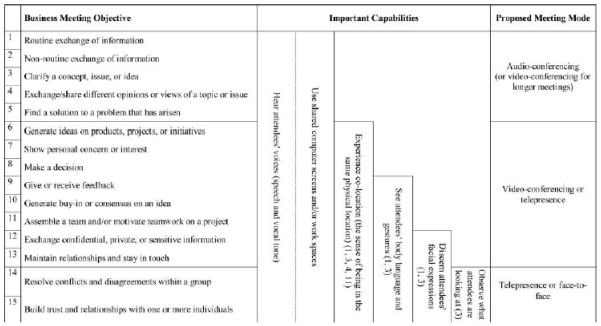
39 Cities using technological solutions to improve the management and the efficiency of urban environment.

40 https://www.techtarget.com/searchdatamanagement/tip/The-evolution-of-the-chief-data-officer-role

Meetings improve when business objectives drive technology choices

All meetings need good voice and task sharing capabilities but building trust and resolving conflict benefit from showing people's video streams.

- Standaert et al. (2021) used data from the organizers of 612 business meetings at a large global technology company to develop a decision matrix for how to match meeting goals/needs to communication modes.
- The ability to hear voice and share screens – but not video of participants – was identified by Standaert et al. (2021) as critical to all business meeting objectives. However, resolving conflicts and building trust were reported to benefit from views of gestures, facial expressions, and what people are looking at.
- Considerations may change when participants have disabilities (Das et al. 2021) (see also: "Collaboration systems need to be more accessible").



	Business Meeting Objective	Important Capabilities						Proposed Meeting Mode
		Hear attendees' voices (speech and vocal tone)	Use shared computer screens and/or work spaces	Experience co-location (the sense of being in the same physical location) (1, 3, 4, 11)	See attendees' body language and gestures (1, 3)	Discern attendees' facial expressions (1, 3)	Observe what attendees are looking at (3)	
1	Routine exchange of information							Audio-conferencing (or video-conferencing for longer meetings)
2	Non-routine exchange of information							
3	Clarify a concept, issue, or idea							
4	Exchange/share different opinions or views of a topic or issue							
5	Find a solution to a problem that has arisen							
6	Generate ideas on products, projects, or initiatives							Video-conferencing or telepresence
7	Show personal concern or interest							
8	Make a decision							
9	Give or receive feedback							
10	Generate buy-in or consensus on an idea							
11	Assemble a team and/or motivate teamwork on a project							
12	Exchange confidential, private, or sensitive information							
13	Maintain relationships and stay in touch							
14	Resolve conflicts and disagreements within a group							Telepresence or face-to-face
15	Build trust and relationships with one or more individuals							

Fig. 3. Business Meeting Objectives, Important Capabilities, and Proposed Meeting Modes.
Note: the numbers in parentheses in the columns with the important capabilities indicate the objectives (numbered in the left-hand column) for which a significant, positive relationship was found with meeting duration.

Standaert et al. (2021)

Figure 25

Important choices must be made by middle managers concerning the activities which require on-site presence and those which are more efficient when organized remotely. For instance, according to Autissier (2021), onboarding of newcomers and annual appraisal meetings should be organized in face-to-face, in order to capture all formal and informal interactions. In contrast, the operational follow-up of a project can be organized more efficiently in remote mode, which can significantly decrease the number of journeys to headquarters.

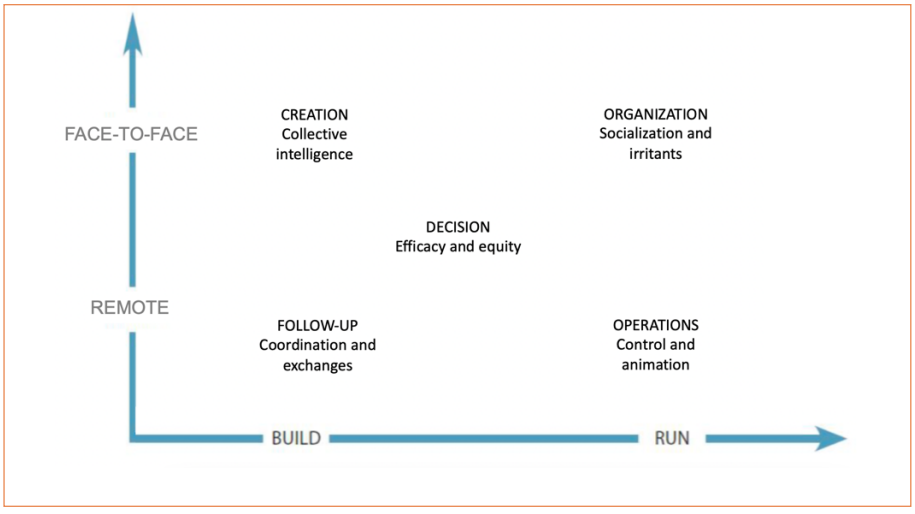


Figure 26. Onsite vs online activities in new ways of working

Source : Autissier, 2021 (our ranslation)

Far from some managerial utopias based on the so-called "liberated enterprises" (Carney & Getz, 2016), the role of middle managers will remain crucial for supporting the daily operations and the smooth-running of hybrid work arrangements.

HR managers are expected to play an important role in the implementation of sustainable HRM policies (Lopez-Cabrales & Valle-Cabrera, 2020; Duvnjak & Kohont, 2021; Liang et al., 2022) through extended sourcing practices, training initiatives, renewed appraisal procedures and indicators, appropriate reward programs, etc. They are also supposed to be at the forefront of the digital transformation of companies: their ability to establish a link between new ways of

working and sustainable management practices as well as their capacity to manage the paradoxical requirements of different stakeholders will become a central challenge for their function (Berger-Douce, 2021). In particular, the combination of digital skills, job-related skills (recruitment, training, appraisal, etc.) and soft skills will be a key success factor for their future role (Lawler & Boudreau, 2018). They are expected to co-develop with line managers new KPIs for personnel appraisal based on the achievement of specific and concrete objectives toward carbon neutrality.

Beyond the specific skill requirements linked to the categories of jobs mentioned above, all workers will have to learn managing data flows in a sustainable way, designing new work arrangements between different workplaces (home, headquarters, hub) with an appropriate balance between on-site presence and remote working, rationalizing their journeys to the office, working more autonomously with objectives to achieve, etc.

1.3. Effects on training in the perspective of a just transition

When exploring the contribution of digitalization to climate neutrality, it is important to keep in mind the need to avoid new social divides linked to the possession of specific skills and the adoption of appropriate behaviors. If new ways of working may contribute to the transition to climate neutrality, they must not be reserved for a social elite composed of highly skilled workers and managers. It is also important to implement the right to disconnect —like in France— and to better protect privacy against any attempt of automatic control in the workplace. Therefore, a just digital transition must be understood as inclusive, by optimizing the benefits of new ways of working and minimizing their potential drawbacks.

First and foremost, an utmost necessity would be to deliver **sensitization and training on digital transition** to the entire population in all age categories. The digital divide should be seriously addressed. The mode of training itself (for example through digital tools, tablets and / or distance learning) can be a way to increase the level of digitalization, if the access to resources is already solved.

Specifically, for the categories of jobs likely to be transformed with the growth of **hybrid work** arrangements, different training initiatives may be launched.

For **mobility managers**, peer learning and/or communities of practices can be developed, supported by dedicated executive education initiatives.

Data officers will have to be trained on digital pollution and the way to reduce it, probably through digital sobriety certificates as suggested by Nicolaï & Peragin (2021). Adapted modules can be introduced in the curricula of ICT studies.

Middle managers will have to be trained to manage telework and hybrid meetings (with special attention to the technical and organizational devices likely to support the management of hybrid meetings), probably via ad hoc coaching sessions and business cases discussed among peers, as well as appropriate actions in execution education in terms of work-life balance and well-being, work division between on-site and remote activities, development of new performance control practices based on the achievement of objectives (rather than on presenteeism), etc.

HR Managers will have to follow specific training packages linking hybrid work arrangements with sustainable HRM practices in higher education institutions

and/or through their professional associations (Westerman et al., 2021). Such training packages should cover the various HRM practices likely to be redefined in order to support the transition to carbon neutrality.

More generally, **lifelong learning initiatives** can be developed for all categories of workers concerning the mastery of software packages, communication skills (especially with customers), digital sobriety (individual awareness, collective action plans, feedback on implementation through communities of practices, etc.), time and stress management in the context of remote work, etc. Such initiatives must be designed in order to avoid the growth of new digital divides (blue/white collars, employed/unemployed, urban space/countryside).

The table below presents a synthesis of the main expected job transformations related to digitalization within the CORE 95 scenario and the policy recommendations likely to support this evolution.

Main effects of job transformations on skills due to digitalization and policy recommendations: a synthesis

	Mobility manager	Data Officer	Middle manager	HR manager
Effects on jobs & skills	• Implement integrated mobility policies according to national objectives • Make links with Smart Cities projects • Collaborate with IT to develop sustainable hybrid work (e.g. carpool applications)	• Integrate sustainable data management practices (production & stockage) • Optimize digital carbon footprint	• Manage hybrid teams (and hybrid meetings) • Manage the balance between onsite and remote activities • Develop new performance control practices • Manage the WLB and well-being of remote workers	• Link news ways of working and sustainable management • Build HR KPIs leading towards sustainable mobility and work practices • Improve digital, job-related and soft skills
Effects on training	*Topics* • Systemic view on mobility *Policy recommendations* • Develop appropriate initiatives in executive education • Encourage companies to create communities of practices on this topic	*Topics* • Digital sobriety *Policy recommendations* • Develop appropriate modules in bachelor and master studies in ICT • Develop digital sobriety certificates in partnership with employer associations	*Topics* • Hybrid management *Policy recommendations* • Support knowledge sharing on technical and organizational devices to manage hybrid meetings • Develop appropriate initiatives in executive education	*Topics* • Sustainable HRM *Policy recommendations* • Develop appropriate modules in bachelor and master studies in HRM • Co-develop sensitization initiatives with HR professional associations

2. Digitalization in the transport and logistics sector

2.1. A fragmented landscape supported by regional initiatives

The growth of the transport and logistics sector in Belgium is expected to be very high. Huge public investments have been engaged to support this growth (roads, motorways, airports, ports, high-speed trains, etc.), very often on behalf of employment, as highlighted by Meersman & Nazemzadeh (2017). We must however admit that this growth is usually envisaged in strictly economic terms (more jobs, more traffic, more fiscal incomes, etc.) while its speed and scope are not really aligned with the objectives of a transition to carbon neutrality. This is why the potential impacts of digitalization in this sector are interesting to explore.

The focus group on transport and logistics has been organized with the key objectives of the CORE 95 scenario in mind, as summarized hereunder:

- reduction of the volume of goods to be transported (circular economy and more local consumption);
- decrease in truck transport in favor of rail and waterways;
- development of rail infrastructure and services;
- development of multimodal hubs and interconnections;
- development of cyclo-logistics for last mile deliveries in cities;
- optimization of vehicle load factors;
- more intensive use of a reduced number of vehicles;
- technological improvements of vehicles (lightness, performance, etc.) to reduce their environmental impact;
- development of infrastructure for loading with new forms of fuel (e-fuels, electricity);
- R&D and production of high-tech trucks, including new forms of fuel (hydrogen, biofuel, etc.);
- development of soft mobility platforms;
- development of vehicle sharing platforms.

The experts spontaneously highlighted some important contextual challenges to consider in order to meet the abovementioned objectives.

First of all, the Belgian landscape in transport and logistics is mainly composed of small and medium companies (see the table below, with an average size of 21 employees), where the level of digitalization is rather low, as highlighted in the last report of ADN on the digital maturity of Walloon companies[41]. One reason can be found in their financial ability to invest. In these conditions, it is highly improbable that transport and logistics companies will be able to acquire hydrogen-powered trucks, for instance, even if the latter are often considered as key levers toward carbon neutrality. Therefore, the regulatory framework must be adapted in order to face the growing competition in this sector while the access to the capital market should be made easier.

Total number of companies, employees and self-employed in the Belgian transport and logistics sector shared by regions

	NUMBER OF COMPANIES IN 2020	NUMBER OF EMPLOYEE JOBS IN 2020	NUMBER OF SELF-EMPLOYED IN 2020
Wallonia	2.484	52.966	6.017
Brussels	1.379	32.265	3.748
Flanders	7.114	146.495	17.312
Belgium	10.977	231.726	27.077

Sources : ONSS/INASTI 2020, calculations by Forem (location of headquarters)

Similar remarks can be made for the quality of data, highly depending on the digital maturity of organizations and their size. Moreover, we can observe an **uberization of the market** by start-ups: last mile couriers, platform economy,

41 https://www.digitalwallonia.be/fr/publications/entreprises2020/

local and short cycle. Such a structural heterogeneity of actors rises many questions in terms of profitability. We can wonder whether an atomized market with lots of small actors can be a sustainable model without being organized in a real ecosystem. The competitive cluster Logistics in Wallonia, supported by regional authorities, plays a key role in federating large companies with SMEs, R&D institutions and training centers.

In line with the previous observations and on top of the internal weaknesses regarding digitalization, there are also difficulties in this sector in terms of **data sharing**. Walloon companies display a low ability to connect with partners because of a lack of adequate tools and a lack of qualitative and standardized data to exchange. Moreover, when a technical possibility of interconnection exists, **confidentiality** issues may appear. Indeed, competition is fierce and data undeniably confer assets and power that could damage cooperation instead of supporting it. A European project, i4Trust, currently tries to answer these issues.

Another important trend is the fast development of **e-commerce**, reinforced by the Covid-19 crisis. A customer-centric value chain implies sharp Key Performance Indicators (KPIs) for deliveries in terms of time, quality, costs, tracking, etc. according to the requirements of the climate transition. It conveys great logistics challenges not only for delivery but also for return policies and practices.

Finally, the sector usually lacks **resilience** towards contextual adversity and risks: it has been proven weak by some recent events such as the war in Ukraine or, to a less dramatic extent, the blockage of the Suez Canal. The rapid and complicated consequences for the whole logistical chain demonstrate the need to reinforce the cooperation between actors and diversify the supply channels. On a smaller scale, even if the technological maturity of power sources and their availability were overcome, it would not solve **mobility** problems. Traffic congestion is still a great challenge to address in Belgium.

As highlighted both by experts, several **digital solutions** already exist to answer these numerous challenges. Some of them concern the global activities of transport and logistics:

- supply chain management software;
- connectivity with infrastructures;
- development of Internet of Things (IOT), i.e. networked sensors and software enabling the intelligent interconnection of complex machinery and IT systems in Industry 4.0
- development of artificial intelligence to process data and support decision-making;
- blockchain;
- sharing platforms, crowd-sharing solutions, etc.

Some are more focused on logistical activities:

- automation of orders preparation;
- collaborative robotics;
- detectors and sensors.

Others mostly concern transport:

- intelligent tachograph;
- driver's cab and on-board equipment;

– eCMR (Electronic Consignment Note);
– high-tech and/or electric vehicles along with electric mobility solutions and services;
– driverless vehicles;
– NAP ITS (National Access Point for information on Intelligent Transport System)[42];
– intermodal transport platform, for example to allow truck drivers to book a safe parking lot;
– real-time traffic information services.

Once again, public initiatives like the competitive cluster Logistics in Wallonia are expected to play a very important role in the digital transformation of the sector, by stimulating and supporting partnerships between poles of technical expertise (universities and R&D centers) and companies in their journey to carbon neutrality.

2.2. Effects on jobs and skills

As stated by the experts in the focus group and the literature on digitalization in transport and logistics, few job creations are expected in the future but mainly job transformations. In the case of Belgian ports, for instance, "ICT introduction and automation will boost a polarized labor market, where a lot of middle-paid paperwork jobs will disappear, jobs on the floor will be more and more supported by robotics and data applications, and management jobs will become more and more complex. These major changes are strictly related to training programs that must include new skills like ICT, soft skills like teamwork and communication, and inclusion of females and non-natives in the port labor market. At terminals, in particular for containers, automation goes slower, but especially ICT introduction leads to the need for more ICT competencies. In the non-maritime cluster, digitalization and data sharing will become key issues" (Bottalico, 2021).

A recent study of Forem[43] listed the **professions likely to be deeply impacted** by digitalization:

a) In logistics
– warehouseman;
– charterer;
– logistics manager;
– supply chain manager;
– order picker;
– forklift driver;
– consultant / project manager;
– buyer / procurement manager;
– polyvalent worker;
– IT logistics coordinator;
– production / sales logistics support;

42 https://transportdata.be/
43 https://www.leforem.be/content/dam/leforem/fr/documents/20180116_Synthese_metiers_cles_par_DAS.pdf

b) In transport

- dispatcher;
- truck driver;
- truck mechanician;
- mobility / fleet manager;
- delivery driver;
- bus / car driver;
- train driver.

A major and transversal transformation is expected through **enhanced quality and standardization of data**. Thanks to a higher degree of digitalization, standardized data would become easier to integrate and to process, therefore simplifying the tasks for administrative staff, coordination jobs, analysts, warehouse operators, etc. in this sector. Additionally, with more accessible tools (in terms of investment as well as management), these jobs could develop in small companies. A first example relates to coordination tasks for the last mile delivery. Until now, interactions with various upstream companies required lots of work and efforts that could be diminished thanks to digitalization. Another illustration is the quality of goods data as such that could be improved (i.e. more precise information about size, weight, fragility, dangers, etc). Accurate information will certainly facilitate order picking and optimize loading operations. Obviously, existing technologies to support handling and heavy tasks could be further developed and therefore relieve workers.

However, these evolutions may be detrimental to workers whose jobs become oversimplified and standardized, with a probable resurgence of neo-taylorist methods based on an intensive formalization of work processes via aps and other digital tools and strict compliance with hierarchical instructions (Cuny et al., 2021) and an increased number of platform workers whose status is located in a grey zone, between traditional employment and pure self-employment (Prassl, 2018). Policy recommendations in this field will concern the necessity to accompany job transformations and job reconversions via compulsory lifelong-learning initiatives developed by companies either on a local or a sectorial basis and support the local management in order to empower workers via job crafting actions (possibility to enrich the daily work activities). Another relevant action could be to launch experimental initiatives to maintain decent work employment conditions facing the digitalization of the sector (cf. the Urbike experiment in Brussels[44]).

When considering intermodal logistics and transport initiatives, such as NAP ITS (National Access Point for information on Intelligent Transport System), a new critical role appears: Mobility as a Service (MaaS) providers, in the same vein as Logistics as a Service (LaaS). MaaS is a new concept where transportation solutions are shifting to on-demand services. Instead of individuals owning and operating their own vehicles, MaaS providers offer a wide range of transport options when and where the user requires them thanks to integrated digital solutions. Like LaaS, MaaS providers largely rely on cloud computing devices (Hung, 2019). The major responsibility of MaaS providers will consist in managing the integration of different modes of transport through multimodal

44 https://urbike.be/#pll_switcher

digital infrastructures. These new providers could be part of the few job creations linked to digitalization in the transport and logistics sector. Public authorities could play a crucial role here in supporting the development of new poles of technical expertise on multimodal digital infrastructures.

As a final consideration, it is crucial to highlight the current workforce shortage faced by the transport and logistics sector. According to the last ManpowerGroup Employment Outlook Survey, the greatest recruitment difficulties after the pandemics are in the IT sector (86%), followed by the Wholesale & Retail Trade / Supply Chain & Logistics sector (81%)[45].

In this context, digitalization could offer levers to increase productivity in existing jobs, filling a part of the workforce shortages. For example, the capabilities of automated vehicle technology can be a way to resolve the driver shortage in freight trucking while improving the quality of the working life of drivers for long-distance delivery (Yankelevitch et al., 2018).

2.3. Effects on training in the perspective of a just transition

Given the workforce shortage in transport and logistics and whatever the skill level, workers are difficult to find, attract, and retain. As a result, training efforts basically remain focused on mature technological tools to meet immediate business needs. **Anticipation** of new digitalized tools and competencies, even if addressed, remains a second-line objective behind urgent necessities. For example, intelligent onboard equipment is merely tested and not widely used for now, which may be an obstacle to further developments.

Several interesting practices must nevertheless be highlighted. Driving **simulators** are already used in continuous education concerning heavy trucks, buses, forklifts, onboard technologies, and are under development for airport equipment. Moreover, mobile simulators are available to sensitize and train students at school. They might be a powerful lever to prepare current and future drivers for the challenges of transition to carbon neutrality. **Demonstration spaces** where companies can test various digital tools before investing already exist in Flanders and should be created in Wallonia.

Obviously, **new vehicles and equipment** will necessitate appropriate training in the perspective of the transition to carbon neutrality, especially for what concerns vehicles sharing and multimodal approaches. The existing curricula need to be updated and adapted to these new challenges. As an example, the rise of urban bicycle logistics does not fit with current training programs and therefore does not beneficiate from appropriate support and recognition. Besides driving, another change brought about by automated vehicles concerns their maintenance. Once again, there is an urgent need for new training paths, especially targeting technicians and mechanicians in partnership with field actors (Logistics in Wallonia, sectorial funds, etc.).

The necessary evolution of **training modes** (and actors) must be understood in a global and articulated system. The right balance and partnerships have to be found between learning at school, competence centers, on-the-job training, sectorial training funds, etc.

45 https://www.manpowergroup.be/wp-content/uploads/2022/05/BE_EN_MEOSReport_3Q22.pdf

The digital transformation of the sector can stimulate the emergence of innovative models but can also make employment more precarious. Under the cover of digitalization, poor working conditions can emerge as mentioned earlier for logistical tasks likely to be simplified and standardized through digitalization or again for fast delivery services. It is therefore crucial that public policies provide relevant training packages with these risks in mind in order to support job reconversions and avoid the rise of new digital divides.

2.4. Policy recommendations

Beyond the need of anticipating new digital tools and competencies via simulators and demonstration spaces, new training paths should be developed concerning urban logistics, automated vehicles and their maintenance, in partnership with sectorial actors, or again job reconversion in order to avoid the growth of precarious working conditions. Public initiatives can also support the development of new poles of technical expertise in multimodal digital infrastructures, in which the integration of different modes of transport by MaaS providers could be encouraged.

In a more global perspective, the experts of the focus group insist on the necessity for governments to develop a **clear vision** about training initiatives and must be able to plan ahead. Setting a clear training path, even extremely ambitious, is the first necessity. However, public authorities must be pragmatic and accept that new contextual elements can emerge. Between long-term vision about the climate transition and the concrete reality of today's workers and citizens, one needs to develop a capacity to "zoom in and zoom out" and a real prospective approach.

Regulation stability should become the norm. The transport and logistics sector is typically a domain where Belgian regulation is complicated because of changing and intertwined federal and regional policies as well as European regulations in some cases, for example regarding the implementation of eCMR (Electronic Consignment Note) in vehicles. In such an instable and uncertain context, most companies do not know how to orient their investment strategies. A clear and coherent fiscal framework must be defined in order to support the transition toward carbon neutrality. Provided they could agree with each other and build consistent regulations, public authorities could play on fiscal levers (tax exemption or incentives for R&D investments in multimodal digital infrastructures and digital traffic monitoring or again financial support to training initiatives combining the acquisition of technical expertise and sensitization to the challenges of climate transition). Moreover, they are themselves key actors likely to guide the behaviors of companies in this sector through their own contractual criteria. An adaptation of the existing labor regulation is probably needed in order to avoid the re-emergence of neo-taylorist methods and precarious working conditions linked to the rise of platform work (Stewart & Stanford, 2017). Life-long learning initiatives incentivized by public authorities combined with a more extensive application of the EU social pillar in terms of universal access to social security and social protection (Semanza & Pichault, 2019) —with a package of social rights likely to be transferred from one job status to another— and a growing recognition of such work activities by trade unions (see for instance the current initiative launched by CSC-ACV called United Freelancers) are probably needed to overcome the pitfalls of precariousness in the gig economy.

Autonomous vehicles are one of the fields where clear rules defined by public authorities are needed. Until now, automated systems cannot predict the various behaviors of other road users. A possible solution to this problem lies in truck platooning, where only the first driver is fully aware of the traffic conditions while the others rest on technology. As far as congestion is concerned, vehicles could be connected to digital intermodal infrastructures where traffic managers can influence the traffic conditions and prioritize some users and vehicles (bikes, trucks, etc.). All these investments will be possible with more stability and simplification of the regulatory framework. A similar recommendation can be made concerning the acquisition of hydrogen-powered trucks in order to face the growing competition in the sector. Regulatory simplifications and adaptations may help SMEs —very numerous in the transport and logistics sector— prepare such long-term investments while a dedicated support can ease their access to the capital market.

In line with **data issues** and especially the problem of confidentiality, public actors could be part of the solution if they act as a third party in charge of securing the possibilities of data interchange between the actors directly involved (companies, customers, etc.) via digital solutions like cloud computing and/or blockchains.

Finally, the volume of goods in circulation on the market questions the evolution of **consumer choices** as well as the pursuit of profit at all costs by companies. E-commerce activities have exploded during the pandemic and all experts agree that the growth of the transport and logistics sector will remain exponential. In order to favor a more sustainable growth of this sector, compatible with the local objectives of a circular economy, a fragmentation of the supply chain at regional and/or sub-regional levels could be a solution to avoid the hegemony of worldwide companies like Amazon. Governments can play a proactive in this field, even if they may dislike openly constraining the behaviors of citizens and companies.

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