

How apprenticeships can lead to a greener labour market: policy lessons from the ‘greenification’ of a chemical sector training module

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6.1. Introduction

Policies to mitigate climate change will have a profound impact on the way we produce and consume, and will therefore also affect future jobs and skills and the labour market as a whole. The transition to a low-carbon, resource efficient and green economy can only be made by developing the right skills, knowledge and competences. Both the Paris Agreement and the European Green Deal recognise that the development of skills for the green transition ⁽⁷⁸⁾ will play an indispensable role in achieving the transition to a sustainable society.

Initial education is an important in equipping students with the necessary knowledge, skills and attitudes to contribute to the green transition. However, this influx of skills will not be sufficient, especially in the context of an already tight labour market. For a successful transition, it will also be essential to upskill and reskill the current workforce, to equip workers with the skills they will need to perform their job in the future and/or to support employee mobility across jobs and sectors.

This paper looks at how apprenticeships can play a major role in both helping young people to acquire skills for the green transition through initial training/education and in upskilling and reskilling workers and unemployed people in green themes. A case study on the greenification of a 7-day train-

ing module for both students and employees in the chemical sector, combined with several interviews, is used to identify the barriers and critical success factors for acquiring these skills through training and education.

6.1.1. Skills outlook for the energy-intensive industry in Flanders

The paper builds on a recent study Skills roadmap for the Flemish climate transition, conducted by Roland Berger on behalf of the Flemish government Department of Work and Social Economy. That study identified, for the first time, the concrete skills challenges facing the traditional energy-intensive industries (chemicals, petrochemicals, primary metals and rubber and plastics) in Flanders for the period 2020-35. The research team built on an extensive literature review, quantitative analysis of several skill forecasting studies, and interviews with more than 50 industry experts (Roland Berger, 2021).

First, major changes that can be expected in the workplace in the coming years as a result of the green transition were identified. Typical examples include smart metering, augmented operators and environmental impact monitoring. In addition, main technological changes by 2035 were also considered, such as carbon capture and electrolysis for hydrogen production (Deloitte, 2020). This analysis demonstrates that the green and digital

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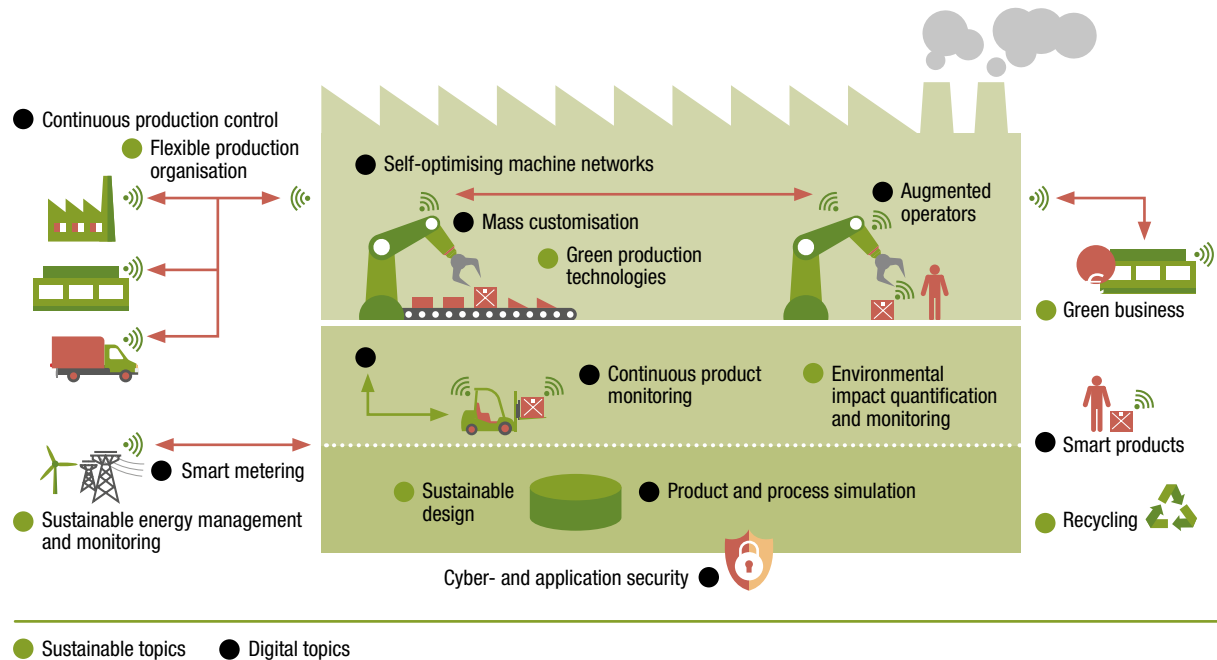
⁽⁷⁵⁾ Department of Work and Social Economy.

⁽⁷⁶⁾ Roland Berger.

⁽⁷⁷⁾ Acta vzw.

⁽⁷⁸⁾ Such skills are generally referred to also as ‘green skills’, that is the total set of skills required to make the transition to a greener economy. The paper will refer to such skills as ‘skills for the green transition’.

Figure 1. In the factory of the future the green and digital transition go hand-in-hand



Source: Roland Berger (2021).

transitions will go hand-in-hand at the workplace (the so called 'twin transition') (Figure 1).

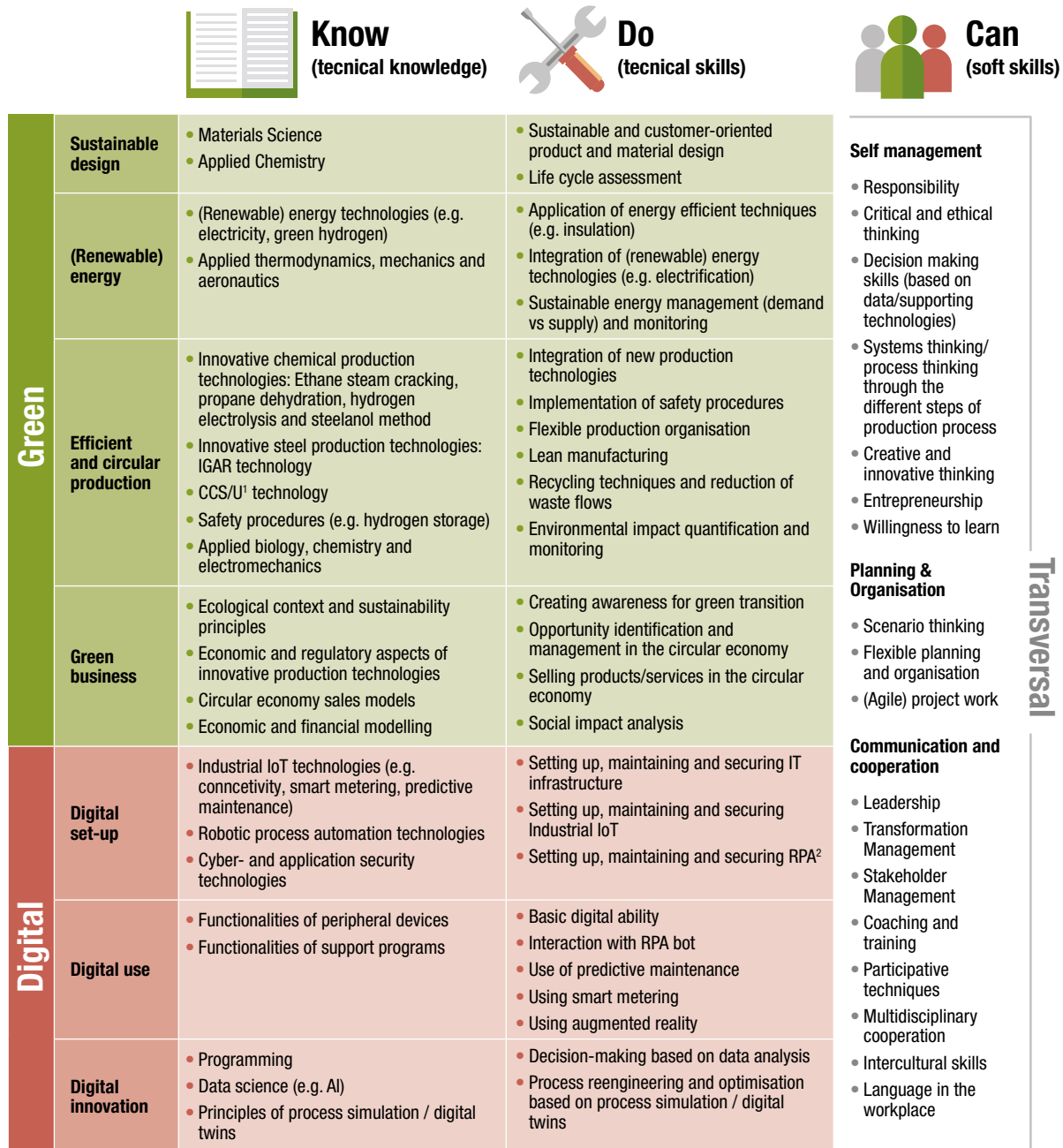
In a next step, these changes were translated into competences to acquire, resulting in a new competence framework. The overarching framework consists of three elements: technical knowledge, covering the subjects in which knowledge needs to be built; technical skills, covering the measurable and objective abilities that will gain importance; and soft skills covering the subjective and non-tangible abilities that are becoming increasingly important. The total set of future skills required to make the transition towards a greener economy are referred to as skills for the green transition.

The expected changes were analysed both qualitatively (type of skills) and also quantitatively (number of workers impacted). The research demonstrated that, for the chemical sector, the demand for workers in Flanders is expected to remain stable at circa 34 000 until 2035. Combined with an expected retirement outflow of 2.9% per annum, this leads to an important need to find circa 16 000 new workers until 2035. These 16 000 new workers are either individuals who are already in the labour market (and hence need to be reskilled/upskilled) or future labour market entrants (who need to get such training as part

of their initial education, including through VET/apprenticeship). The study also demonstrates that the ratio between different profiles will change (e.g. higher share of engineers, electricians, IT specialists), impacting also the incumbent workers in the chemical sector. Hence, a significant effort needs to be made to train new or existing workers on specific topics in response to the green transition within the sector. Starting from the new skills framework, the study shows that, between now and 2030:

- more than 26 000 workers (around 75% of the current workforce) need to be trained in 'efficient and circular production' topics (across all profiles);
- more than 24 000 workers (around 70% of the current workforce) need to be trained in 'use of digital technologies' topics (mainly operators, technicians, production workers/ drivers);
- approximately 22 000 workers (around 65% of the current workforce) need to be trained in 'renewable energy' topics (mainly engineers, operators and electricians);
- approximately 12 000 workers (around 35% of the current workforce) need to be trained in 'digital innovation' topics (mainly technicians and engineers).

Figure 2. A new competence framework for the energy-intensive industry



1) Carbon capture and storage / usage; 2) Robotic process automation

Source: Roland Berger (2021).

6.1.2. Apprenticeships as an effective way of developing new skills for both students and workers

The above analysis has identified which jobs and skills will be necessary to make the transition towards a greener economy; the next step is to develop ways and strategies to train people in these future skills, both through initial education

and training as well as via upskilling and reskilling the existing workforce.

As is shown in previous research, apprenticeship training offers several benefits for both apprentices and companies. Apprenticeships provide learners with real-life work experiences and so offer a good learning environment for teaching specific professional skills, through presence of more

state-of-the-art tools, as well as soft skills (OECD, 2010). For companies, there are certain short-term benefits, like the productive contribution of apprentices during their period of apprenticeship. Moreover, when an employer can upskill/reskill employees through workplace learning, there is no indirect training cost of unworked paid hours in comparison with training for employees outside the workplace. However, there are additional long-term benefits for companies, like the recruitment of the most productive apprentices as valued employees after the end of the apprenticeship. Also, employers offering apprenticeships enhance their reputation as they may be seen as contributing to the common good. This may indirectly increase profits if companies seen as socially responsible are more likely to sell their products and services (though these benefits are difficult to measure) (Kuczera, 2017).

Despite these generally acknowledged benefits, in Flanders, apprenticeships ⁽⁷⁹⁾ are not very widespread. A reform in legislation of 2019 aims to improve the quality of the dual learning scheme at upper secondary level (initial education) ⁽⁸⁰⁾. Also, for jobseekers and the unemployed there are some possibilities to get trained on the job, offered by VDAB, the public unemployment agency ⁽⁸¹⁾. For workers who want to reskill or upskill, however, the options of engaging in apprenticeship training are rather scarce. This paper presents evidence on the advantages of apprenticeships in training young students and workers on new skills, in particular those linked to the green transition.

6.2. Greenification of an apprenticeship training module for chemical operators

6.2.1. The ACTA case

This section analyses the assumption about the advantages of apprenticeship training for the green

transition by means of a Flemish case study, hereafter referred to as the 'ACTA case'. In an effort to prepare learners better for the green transition, ACTA, a centre for technical training in the chemical sector, adapted one of its training modules by aligning it to the competence framework discussed above (Section 6.1).

The training module in question is part of the 'chemical process techniques' (CPT) training offered to apprentices in upper secondary education (initial education) ⁽⁸²⁾ and covers 7 non-consecutive days of technical training. CPT is an education programme consisting of three parts: theoretical training provided by a secondary school; work-based learning at a chemical company; and a technical training module offered by ACTA, partially in a simulated production plant.

Box 1. ACTA and the Chemical process techniques (CPT) programme

About ACTA

ACTA is a technical training centre situated in the Flemish-Dutch delta region, with a main office located in Brasschaat, near the port of Antwerp. It has experience providing experience-based learning since 1991. The organisation was founded as collaborative initiative between the Flemish sector of the chemical industry and the education sector. ACTA provides multiple learning platforms for innovation-driven knowledge transfer between industry experts, scholars and technology partners. ACTA's target groups include employees, teachers, students and the unemployed.

All training offers are facilitated by a chemical plant (400 m²) equipped to simulate training environments. The conditions are the same as in a real plant and observation of trainees is possible. ACTA staff consists over 30 people, including expert teachers and seconded industry experts in chemical process techniques, electro measuring and control technology, safety, and transportation. ACTA trainers have extensive experience over many years. Over 14 000

⁽⁷⁹⁾ This paper refers to the apprenticeship scheme Dual learning (upper secondary level). In 2019/20, 1 567 learners were enrolled in this scheme, which accounts for less than 10% of VET learners. See [Cedefop European database on apprenticeship schemes](#).

⁽⁸⁰⁾ See [Cedefop European database on apprenticeship schemes](#).

⁽⁸¹⁾ See information on the relevant [VDAB web page](#).

⁽⁸²⁾ Although the ACTA case comprises a training module in initial education, ACTA has plans to extend the lessons to other training modules and to other target groups, e.g. employees and jobseekers needing upskilling or reskilling.

workdays of training are provided yearly in real-life simulated working environments: 9 000 workdays for upskilling and reskilling of employees in the chemical industry and 5 000 workdays for training young people in initial education tracks. A few years ago, ACTA started investing in digital training modules, including e-learning offers and augmented reality (AR) and virtual reality (VR) training simulations.

Chemical process techniques (CPT) programme

After finishing their 6 years of secondary education, Flemish students are able to opt for an extra seventh year to acquire additional technical/vocational skills for a specific job. 'Chemical process techniques' is one of those trainings and prepares young people in 1 year to become a process operator in the chemical industry. Some students take up this training right after graduating from secondary school, while others have already worked or studied for some years and decided to give training a turn. This results in a very diverse target population which forms an ambitious challenge for both the students and their teachers, trainers and mentors. The education side and the chemical industry work closely together and reinforce each other in organising this course. The secondary schools take care of the theoretical part of the training, while students undertake an apprenticeship in a chemical company to acquire practical skills. On top of the training at school and the company, ACTA delivers a part of the training. The students come to the ACTA training facilities for a module of 7 non-consecutive days where they are trained in subjects such as distillation, flow, pressure or temperature and where they learn to work with equipment such as pumps, measuring devices and steam generators. ACTA trains around 200 students in the chemical process techniques programme on a yearly base.

Source: Authors.

The training module in question had existed for more than 20 years and was developed together with schools and the chemical industry. As circumstances for operators are changing rapidly, due to digital and environmental challenges, ACTA decided to renew their training module and adapt it to the challenges lying ahead. The Skills roadmap for

the Flemish climate transition study was an ideal starting point for doing this. The study forecast that the following competences would be in high demand in 2035 for chemical operators.

Table 1. Important skills for chemical operators in 2035

Skills type	Important skills for chemical operators in 2035
Green skills	Applying energy-efficiency techniques
	Implementation of security procedures
Digital skills	Basic digital skills
	Use of smart metering
	Use of augmented reality
Soft skills	Flexible planning and organisation
	Decisiveness (based on data/assistive technologies)
	System thinking/process thinking through the different steps of the production process

Source: Roland Berger, 2021.

In response to the forecast changing skill needs, ACTA renewed the training module by including skills for the green transition in the learning objectives and by inserting a higher awareness of climate impact throughout the entire training module. Examples of the modifications are given below.

- (a) One part of the training module comprises the starting up and handling of a distillation column, an essential item used in the distillation of liquid mixtures to separate the mixture into its component parts, or fractions, based on the differences in volatilities. A distillation column is controlled by turning on a wheel, which might have a huge climate impact without operators always being aware of it. It was the intention of ACTA to raise the awareness among (future) operators of the ecological impact of their handling of the distillation column and to ensure that searching for the least polluting or most energy-efficient way to operate their equipment become an automatic reflex. In order to achieve this goal, ACTA created a game at the distillation column. For a certain amount of time, the learner has to keep certain values within specific limits by manipulating a combination of buttons. A digital display gives instant feed-

back about how their performance influences CO₂ emission and thus about their ecological impact. ACTA hopes to increase awareness and make ecological impact visible in this way.

(b) Another activity to create green awareness among the future chemical operators, is a quest in virtual reality to search for 'green crimes'. Students need to report spills or leakages.

(c) ACTA trainers continuously encourage the learners to have critical reflections about current procedures, and stimulate them to formulate new, innovative proposals on how things could be managed in a more sustainable way.

ACTA wants to increase the general knowledge of their learners about current problems, challenges and innovative solutions regarding the sustainability debate in the chemical industry. Therefore, the course books were supplemented with recent and relevant news articles.

6.2.2. Methodology

Different stakeholders involved in the CPT training course were interviewed and asked their opinion about skills for the green transition, the plans of ACTA to redesign their training module, and possible barriers to overall greenification of education and training modules. The interviews were conducted and analysed in June and July 2021 by two policy workers of the Department of Work and Social Economy and an employee of ACTA, and analysed by the authors of the current paper.

Box 2. Respondents and interview questions

The following respondents were interviewed:

- The head of Co-Valent, the joint (parity) sectoral training fund in the chemistry, plastics and life sciences sector
- An education and labour market specialist at Essensscia, the Belgian sector federation of the chemical industry and life sciences
- An HR representative at BASF, a multinational chemical company, training apprentices in the CPT course
- A chemistry teacher at a secondary school
- A production manager at BASF
- An apprentice supervisor at a secondary school
- A consultant at the Regional Technological Centre Antwerp (RTC) which contributes to qualitative

education at the interface between education and the labour market by various actions.

- Two process operators at BASF, who were former apprentices at BASF

Interview questions were, among others:

- Is there currently sufficient awareness of green themes in the existing training for the sector?
- How can we make progress in this area?
- Are there any obstacles?
- In what way can training providers get started with competence frameworks such as in the Roland Berger study?
- Are there specific points for attention regarding green skills in apprenticeship training?
- Which partners/stakeholders should be involved in make training modules greener?
- What is the role of companies?
- What is the role of training providers?
- What is the role of other actors?
- How can the ACTA case be a lever for introducing green skills into other courses as well?
- What do you think is needed from the policy to put the green theme on the (training) map?

Source: Authors.

6.3. Case study results

Trends and patterns that could be observed throughout the interviews, were identified and turned into several main findings.

6.3.1. Skills for the green transition cover knowledge and skills, plus attitude/awareness

The interviewees indicated that skills for the green transition are difficult to grasp, but that the competence exercise made in the roadmap study (Section 6.1) makes the concept for the chemical sector more concrete. The competence framework shows that skills for the green transition are a combination of knowledge, technical skills and soft skills, but interviewees added to this framework that skills lay also in a green attitude/awareness that needs to be formed. Hence, there is an important lever in embedding a 'green reflex' in the way

of executing tasks (see example of the distillation column game of ACTA).

6.3.2. It is difficult to teach skills for the green transition in a school context only; the company context is essential

As skills for the green transition are also a matter of attitudes, the interviewees indicated that the workplace context is better suited for acquiring these skills than the school context. An awareness or reflex can be best taught at the workplace, during repetitive handling and exposure, which makes apprenticeship training very effective in training green attitudes/awareness.

6.3.3. Short-term economic return still takes precedence over ecological thinking

A business context lends itself better to making skills for the green transition applicable and concrete compared to learning in the classroom. However, for this to be successful, companies should already focus on green transition priorities. Nowadays, most companies are still not always eager to work in a more ecological and sustainable way if this would mean a loss in profit in the short term, according to our interviewees. When companies are acting on green transition, this is often limited to the management and the research and development department. Hence, apprenticeships are only an effective training method for skills for the green transition when companies are really adopting ecological awareness.

6.3.4. Green themes are included in curricula and education objectives, but there is a lack of coordination and concrete course material

Most schools and teachers involved in the CPT programme are aware of the importance of green themes. There are often green policies at school, such as a ban on single-use plastic, and teachers include this in their courses. The new secondary education plans of the Flemish community also include transversal skills on 'sustainability'.

Nevertheless, there are also barriers and problems. First, there seems to be a lack of coordination on the topic and the attention to green themes is greatly dependent on single actions and initiatives of teachers or school leaders.

Another issue is the lack of concrete course material on the green transition. Including green themes into the curriculum and learning objectives is one thing; knowing how to teach them is another. Teachers involved in the CPT track expressed their concerns over whether sufficient material will be available to teach these competences.

Education professionals involved in the CPT are also worried about the inclusion of skills for the green transition in the curricula, especially regarding the content that will be lost at the expense of these new elements. The CPT training is a 1-year programme and is quite onerous, according to both teachers and students in the programme. Because of this, there is little room left during the lessons at school to focus on skills for the green transition. Perhaps this is not true for other education providers as green elements do not necessarily take up space from other subjects; ideally, they are integrated in other subjects.

Apprenticeships offer a good solution for the problems and issues mentioned. By acquiring skills for the green transition, mostly during workplace training, time is saved at school to focus on other skills and topics.

6.3.5. Teachers are not sufficiently trained to teach skills for the green transition and not well aware of what is going on in companies

Teachers and trainers are not always sufficiently trained to teach skills for the green transition. Although schools find the topic important, there is little interest in investing in training courses or train-the-trainer modules for their teachers on green themes, at least for the chemical sector. Resources are scarce and guiding teachers in getting started with these skills is not always a priority for schools. Secondary education teachers, especially, are often distanced from the world of work and are not always aware of the major competence changes that the transformation to a carbon neutral society will bring. Apprenticeships might offer a good solution in bridging the gap between education and industry.

There are good practices, such as that of BASF, a company involved in the interviews that wants to play an exemplary role in the cross-fertilisation between education and the labour market. In the

case of apprenticeships (or longer internships), BASF requires school teachers to visit the production plant and offers additional opportunities for them to get to know the production environment. For instance, teachers visit the company with a number of students to give classes on site. BASF also offers teachers the opportunity to do internships in the company (varying from 2 hours to 2 weeks). This kind of activity provides insight into each other's living environment, with cross-fertilisation in both directions. BASF also brings mentors to the classroom, such as to experience lab activities together with their apprentice.

The ACTA case shows how the awareness of skills for the green transition in a training centre can raise awareness in general. The adaptation of the CPT training module created a wider green awareness among ACTA staff members, as a task force was created, and enthusiasts had some joined-up thinking. ACTA mentioned that teaching green awareness to students only becomes credible if the entire organisation lives by this philosophy and if other ACTA training modules for other target groups are adapted as well.

Besides adaptation to the training course, trainers and other staff members need to be informed and retrained. ACTA trainers need to become ambassadors of sustainability. Only if they truly live by these attitudes will they really influence their students.

6.3.6. Greenification of a training module requires close collaboration between companies, schools and private training providers

The strength of the current case is based on the good cooperation between the different stakeholders involved. Because apprenticeship programmes like CPT are composed of different parts (school-based training, company-based training and technical training at a simulated industry plant at ACTA) it is important that all those actors work closely together when greenifying the curriculum. ACTA took the lead in this case study by adapting their training module based on the competence framework described above (see Section 6.2). The schools were immediately involved and supported these plans. Also, BASF and the sectoral organisation were enthusiastic and stimulated this project.

In BASF, focusing on sustainability is important. To improve the quality of the apprenticeship training, they took various initiatives to reach out to the schools and were also prepared to include the green theme in their mentor training. The role of players at the regional level was equally important: the Regional Technological Centre Antwerp has the task of establishing connections between companies and schools and making them work together. They know all actors within the region well and are able to establish contacts in the field.

6.4. Policy lessons and recommendations

Four specific policy recommendations to stimulate the teaching of skills for the green transition through apprenticeships are offered.

Recommendation 1: Create awareness by investing in skills forecasts

Before skills for the green transition can be included in curricula and apprenticeships programmes, it must be clear which skills are desired. Skills assessments and anticipation/forecasting exercises give policy-makers, companies and training providers information on current and future skill needs. In employment and education policy, this type of information is necessary to update (re-)skilling programmes and curricula. While overall, comprehensive skills forecasting is needed to steer policy-making, specific additional skills forecasting for the green transition at sectoral or regional level is useful to create awareness around such skills. The study on skills for the green transition in the energy-intensive industry made these skills more concrete for stakeholders (sectoral actors, training providers and policy-makers) and demonstrated the urgency of taking action in this field. The ACTA case showed that a skill forecast study, as carried out for the energy-intensive sectors in Flanders, can be a good start to thinking about adapting training modules to skill needs for the green transition.

Recommendation 2: Provide financial and other incentives for education and training providers to adapt training programmes to future skill needs

It is important that skills forecasts do not remain a dead letter, but that the information is used by policy-makers, education actors and employers. To (re-) train (future) employees for the green transition, it will be necessary that these topics are covered in (re-)training courses and school curricula. The findings showed that skills for the green transition are not yet a topic high on the agenda in sectors and companies. Therefore, there is no demand stimulus for training providers to develop training courses. The findings in the ACTA case also indicated that it is often not profitable for training providers to offer a sole course on skills for the green transition. To solve this, it is recommended for governments to give financial support to education and training providers to adapt their courses to new developments regarding skills for the green transition. Ideally, these support measures are put in place simultaneously with measures to stimulate skills forecasting in clusters and sectors.

However, it is not enough to include this in objectives and school curricula. It must also be made transparent how teachers can get started developing skills for the green transition and how they can work on them in the classroom. The theme should, therefore, also be addressed in teacher training courses and classroom materials.

Recommendation 3: rely on apprenticeships to teach skills for the green transition

According to the interviewees, skills for the green transition are best taught in a combination of learning at school and at the workplace. The classroom or school, on the one hand, is necessary to gather theoretical knowledge on green technologies and innovations. The workplace, on the other hand, is a good place to develop a 'green attitude' when performing tasks, which complements knowledge of green technologies.

Apprenticeships can provide added value for developing skills for the green transition. Through dual learning, apprentices immediately apply learning content at the workplace. The interview with graduates showed that theoretical knowledge on green innovation and technology learned in the

classroom did not have the same impact on them as learning at the workplace during their apprenticeship at a company.

The cross-fertilisation between education and the labour market that is established through dual learning also depends on how this is implemented in reality (see challenges and best practices, Section 6.3). It is important that in-company trainers gain insight into the learning process of apprentices and learn how to challenge and facilitate them in their thinking. In this way, the pedagogical abilities of the mentors are increased.

Recommendation 4: create a strong partnership between education providers, companies, sectoral and regional players to teach green skills through apprenticeships

It will only be possible to develop skills for the green transition if education and business work together and join forces. Policy-makers should continue promoting and relying on apprenticeships, as this is a perfect way to bring the theme of skills for the green transition inside the education world.

The present case makes it clear that a strong (local) partnership is necessary for apprenticeships to work. The roles and tasks of the various players must be clear. Our case identified the stakeholders who are crucial.

- (a) Educational providers: schools and training providers, such as ACTA in this case study, must first see the urgency and need to make their training programmes future proof and include skills for the green transition in their training programmes. They must actively seek collaboration with companies to integrate the work-based and school-based training into a meaningful apprenticeship programme.
- (b) Companies: as a starting point it is necessary that the green theme is considered important by companies and they make investment in training for this a priority.
- (c) Sectoral players: sector bodies can encourage and support companies in their sector to put the topic high on the agenda. Sector funds, for example, can organise and financially support apprenticeship training for employees within the sector, as well as for in-company trainers. In this way, skills for the green transition can

be taught through apprenticeship training to (re)train future and existing workers.

- (d) Regional players: a real local ecosystem at regional level, in which companies and training providers (schools and ACTA) work together to provide apprenticeships training and programmes, would be an enabling condition.

6.5. Conclusion

In the coming years and decades, companies will have to radically shift the way they produce and do business to meet the ambitious and necessary targets on CO₂ reduction. This transition will require both future employees equipped with the right skills and massive up- and reskilling of the existing workforce. Specific forecasts dedicated to the green transition can raise awareness of this need for future skills and make skills for the green transition more evident for stakeholders. To

(re)train many employees and to provide students with skills for the green transition in a short time, apprenticeships may offer an important lever for companies and sectors.

A skills forecast for the energy intensive industry in Flanders showed that the transition will only be possible by investing in technical knowledge and skills, and soft skills. In the case presented in this paper, students, employees and jobseekers are taught skills for the green transition through a combination of classroom teaching and workplace learning. All stakeholders (education actors, companies, sectoral actors and students) agree that dual learning is an ideal way to develop skills for the green transition. As the demand from companies for training on these skills is still low, policy-makers should raise awareness through skills forecasting and incentivise training and education providers to adapt their training courses and curricula to future skill needs related to the green transition.

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