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CEDEFOP

Cities in transition

How vocational education and training can help cities become smarter and greener

POLICY BRIEF

POLICY BACKGROUND

In this section

Cities: a pivotal role in the green transition

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Among the challenges facing European cities, climate change is the most pressing. More frequent disruptive weather events such as extreme heat and storms, water scarcity and flooding will strongly affect them. These adverse impacts, which already affect urban areas given their concentration of inhabitants, assets, infrastructure, and productive activities, are likely to intensify. While cities cover only 4% of the EU's land area, they host almost 75% of EU citizens today and this share is expected to increase to 85% by 2050 ([1]). Cities also have a responsibility to act to address climate change: their carbon footprint accounts for 70% of CO_2 emissions worldwide.

Climate change will affect cities differently depending on their geographic position. In many southern European countries, cities are already experiencing more extreme heatwaves, while northern European cities are faced with more frequent floods. While it is difficult to quantify economic losses in cities due to climate change, it is obvious that the economic and social costs of extreme weather and other climate change manifestations experienced by cities are enormous. This justifies faster, more effective and scalable policy responses which target cities' resource consumption in the short and long term and enable and empower their citizens to become change agents in the green transition.

The European Green Deal (EGD) is the EU's growth strategy and the bloc's policy response to the challenges related to climate change and environmental degradation. It sets the ground for the EU to become a competitive and resource-efficient economy with net zero greenhouse gas emissions by 2050, while ensuring a just transition for all. A Cedefop skills forecast scenario, which looked at the implications of the EGD up to 2030 from a vocational education and training (VET) and skills perspective, shows that skills formation – both initial and during working life – will be crucial for filling the additional jobs created and enabling workers to transition into greener sectors and occupations (Cedefop, 2021).

While there are clear employment winners and losers among sectors more directly linked to sustainability and climate change, employment gains are also expected for almost all occupational categories, including middle-skilled and elementary occupations. Given that the twin (green and digital)

([1]) More information is available on the EU mission: climate-neutral and smart cities web page.

...while cities **cover only 4%** of the EU's land area, they **host almost 75%** of EU citizens today and this share is expected to increase **to 85% by 2050**...

...**Cedefop skills forecast scenario: skills formation** will be crucial **for filling the additional jobs** created and enabling workers **to transition into greener sectors**...

...**VET** has a key role to play in **accommodating economic and social change**...

transitions mutually reinforce one another, alongside green transition skills many green jobs will also require better digital skills compared to jobs in 'brown' sectors, irrespective of skill level. Delivering such skills, VET has a key role to play in accommodating economic and social change. VET needs to cooperate with governments, employers, universities and research institutions and regional and local players.

Municipal authorities have a key role to play in the transition towards a green economy because they are typically in charge of policy domains and services which directly impact the environment and the health of citizens. Cities' strategic role as local hubs for the implementation of the EGD stems from their capacity to develop and steer the local implementation of actions that directly contribute to meeting nationally and internationally agreed green commitments and targets. The importance of cities in attaining carbon neutrality is also reflected in European Commission activities and EU initiatives, such as the Green deal going local, the Local green deals guide from the European Commission's Intelligent cities challenge and the Mayors Alliance for the European Green Deal.

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Shifting from economic development driven by resource consumption towards innovation-driven, sustainable and circular development to reduce cities' CO_2 footprint requires action on many fronts. It involves scaling up renewable energy generation (e.g. solar panels, biofuels), prioritising sustainable waste management, promoting investment in green transportation solutions, and making buildings more energy efficient (as in retrofitting). Cities can also promote investments in nature-based solutions, such as green infrastructure, reforestation, and urban farming. Via education, training, guidance and information campaigns, cities can foster citizens' awareness of the importance of green transition and contribute to shaping a new generation of environmentally responsible consumers, employers, employees and voters.

The economic and social effects of the COVID-19 pandemic and the policy responses to mitigating its impact contributed to elevating the sustainability approach at city level in the policy agenda. Clean mobility and circular economy initiatives at city level boomed and were generally well-received by local communities (OECD, 2022). Cities that only recently set in motion action to become greener or have a considerable way to go can greatly benefit from the experience of cities that have fully embraced the 'smart and green city' (SGC) concept and – as a result – are forerunners in the green transition.

Smarter cities, greener societies

With the proliferation of smart cities, expanding internet-based interconnectivity and increased information flows became transversal innovation drivers in urban settings. The smart city concept has its roots in the 1950s, when transport planners began to use computers to model traffic flows. Today, a city is viewed as 'smart' when it can control and make effective use of information collected via sensors, networks and related technologies for policy development in domains relevant to the urban environment (e.g. transport, waste, air quality, and brownfield site development).

Cities are not smart just because they implement innovative ICT solutions on their territories, but rather because they make use of them and of data they produce to achieve specific goals set to improve the sustainability and wellbeing of their residents. The process is about harnessing the potential of technologies such as industry 4.0 and the internet of things, to bring beneficial change to the urban environment by improving efficiency and strengthening sustainability.

At the crossroads of the twin (green and digital) transitions, smart and green cities (SGCs) can become hubs driving the achievement of EGD-set objectives. These include, for example, accelerating the shift to smart and sustainable mobility by stepping up action to reduce carbon emissions (e.g. through reducing pollution from vehicles) and building and renovating in an energy and resource-efficient way. Improved waste management and more efficient energy use are also central to boosting the implementation of the EGD at city level.

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Foresighting skills to guide city green transitions

To support EGD implementation, cities have to focus on encouraging and enabling significant structural change across a wide spectrum of economic activities. Transforming the demand for occupations and skills, this will also have major labour market impacts. The importance of upskilling and reskilling in accommodating change to make the green transition happen has been recognised by the EGD and EU VET and skills policy documents, most notably the European Skills Agenda, the Commission's communication on a European Skills Agenda for sustainable competitiveness, social fairness and resilience, the Osnabrück Declaration and the Council Recommendation on VET.

While the policy debate recognises that skills are drivers of cities' green transitions, applied research and policy analysis has not yet paid enough attention to exploring systematically what types of skills and occupations will be crucial. The skills foresight exercise conducted by Cedefop, as reported by this policy brief, seeks to address this research gap (p.7). It aimed to identify the occupations, jobs and skills needed to enable cities to transition towards a 'greener' and 'smarter'/more intelligent and sustainable future and to explore what role vocational education and training (VET) can play in the process.

To understand the skill needs of smart and green cities in a dynamically changing environment, from both short- and long-term perspectives, Cedefop engaged extensively with experts, analysing and synthesising their insights to develop evidence to help policy-makers and VET providers make informed decisions.

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Explained: Cedefop foresight on smart and green cities

Cedefop's work on exploring the links between the EGD and smart and green cities was part of a green foresight study that also covers waste management, the circular economy and agri-food. More detailed information about the project and a list of contributing experts is available here.

In the first online workshop, experts were asked to look towards the future (2030 and 2050) and to identify the occupations/skill profiles that enable a city to transition towards a 'greener' and 'smarter'/more intelligent future to accommodate the necessary changes the EGD implies. They also explored the role of VET in enabling the development of identified skill sets. The results from the first workshop discussions were used to develop a two-round Delphi-style survey. The first questionnaire was designed to gain more insight into the issues raised in the workshop and assess the extent to which there was consensus around various issues among the experts.

The results of the first survey were then used to design a second survey, which focused on the role VET might play in meeting the skill needs identified in the first survey round. Findings from all stages of the foresight study were reported back to experts and discussed and validated in a final workshop. The complete results will be published in a Cedefop 2023 report along with the results of the other three sectoral foresights.

Source: Cedefop.

EVIDENCE

In this section

Jobs and skill changes for greener and smarter cities

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When asked to reflect on what drives the shift towards smart and green cities (SGC), experts underlined the complex interplay of technological, societal, and environmental trends and challenges; this demands a cultural shift among citizens and in local administrations and institutions towards more collaboration and partnerships (Figure 1). It is additional to municipal staff having knowledge of green technologies and understanding of innovative green solutions, sustained through regular upskilling, which are prerequisites for cities to procure, develop and deliver services (e.g. water, waste management) in a greener way. City 'smartness' is supported by digitalisation, which allows cities to make decisions based on big data collection and analysis, also driving green innovation. To benefit fully from such technologies, city administrations need to commit to using them in the context of greening and to empower their staff via adequate digital skills training.

While all the above contributes to achieving circular economies, the circular economy concept goes much further, being also largely driven by changes in producer and consumer behaviour. Therefore, having in place a balanced approach to policy development which builds on political engagement and greener regulation, as the EGD does at EU level, is a *sine qua non* for instigating an SGC perspective at national and local levels. Experts pointed out that achieving a just green transition in a digitalised world does not merely benefit the sustainability agenda, but also opens many opportunities to serve ageing populations better. Making optimal use of smarter and more digital approaches can play an important role in addressing generational digital divides.

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...making optimal use of **smarter and more digital approaches** can play an important role in **addressing generational digital divides**...

Figure 1. **Drivers of change in smart and green cities**

REGULATION & POLITICAL WILL to adopt 'smart and green' practices & technologies

DIGITALISATION, TECHNOLOGY & INNOVATION

CITY STAFF KNOWLEDGE & CAPACITY

PRIVATE-PUBLIC PARTNERSHIPS (powered by open access data policies)

SERVE AGEING POPULATION NEEDS SUSTAINABLY

CITIZEN AWARENESS, ABILITY, & WILLINGNESS

CIRCULAR ECONOMY & WATER MANAGEMENT

CLIMATE CHANGE MITIGATION

Source: Cedefop skills foresight on smart and green cities.

Wanted! More staff in knowledge-intensive occupations

Emerging skill needs in municipalities aiming to become smart and green relate to establishing and using an SGC approach. This involves designing, developing and constructing the infrastructure necessary to introduce smart and green solutions; managing this infrastructure; delivering smart and green services in an urban setting; monitoring, follow-up and evaluation; and building and maintaining citizens' engagement and active participation.

The range of skills which municipalities need to obtain to prepare for and shape the future is wide, and significant changes are expected to take place in the roles of city managers and urban planners. To deal with the complexity of smart cities, their managers need a varied skills mix, including city planning capabilities, legal competences, soft skills, and financial resource management competence (Michelucci et al., 2016).

The complex nature of SGCs will increase the demand for other knowledge-intensive occupations, particularly those linked to the use of smart and green technologies. Infrastructure and software tools can be used in almost every area of a municipality's administration, including energy supply, mobility/transport, waste and e-services to citizens. Artificial Intelligence (AI), blockchain, big data analytics, and online platforms have the potential to disrupt the way in which municipal services are delivered, while the emergence of digital twin cities is likely to transform city governance and planning.

Demand for 'twin transition skills' will soar as more specialist knowledge is needed to customise and apply green technology, and more fundamental understanding of environmental and sustainability issues is required compared to the past, e.g. for ICT professionals. New job roles identified in existing smart city research include smart city planner, smart city IT manager and smart city IT officer (Fitsilis and Kokkinaki, 2021), artificial intelligence and machine learning scientists, data scientists, cybersecurity analysts, app and software developers, network support engineers, civil engineers, digital marketers, geospatial and mapping scientists, cloud architects, energy efficiency engineers, and integration engineers (Goddard, 2021). While many of such roles involve applying advanced IT technology, this is not the case for all jobs needed to support green activities in an SGC. Examples of less IT-driven SGC jobs include tree maintenance professional, urban farmer and solar panel installer.

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Data, technology and soft skills fuel the green transition

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More data, technology and soft skills underpin the process of making cities greener and smarter. These skills will be equally important for workers in the private sector who work for contractors to municipalities. As data collection and analysis is of critical importance in SGCs, there is a need for workers with generalist skills profiles, who can 'translate' data and findings into actionable policy responses and engage with politicians to demonstrate the importance of using data and technology in policy development. Transversal skills needed in such roles include data analytics, legal (e.g. GDPR compliance, artificial intelligence ethics), cybersecurity, and data manipulation (AI, machine learning). Soft skills needed to bolster innovation and communication, with and for different groups of citizens and stakeholders in SGCs, include outreach and engagement, entrepreneurship, and advanced communication skills.

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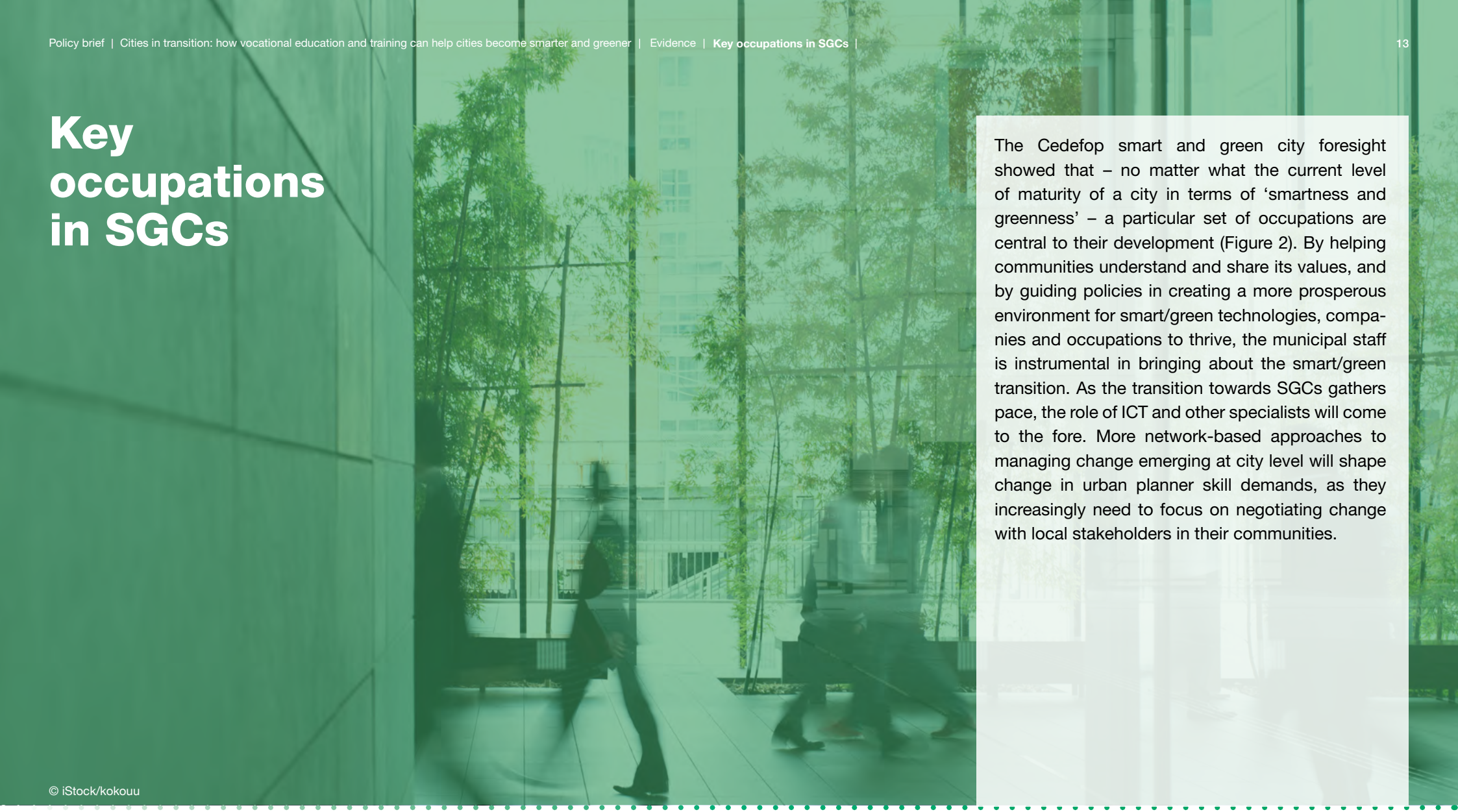
Key occupations in SGCs



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The Cedefop smart and green city foresight showed that – no matter what the current level of maturity of a city in terms of 'smartness and greenness' – a particular set of occupations are central to their development (Figure 2). By helping communities understand and share its values, and by guiding policies in creating a more prosperous environment for smart/green technologies, companies and occupations to thrive, the municipal staff is instrumental in bringing about the smart/green transition. As the transition towards SGCs gathers pace, the role of ICT and other specialists will come to the fore. More network-based approaches to managing change emerging at city level will shape change in urban planner skill demands, as they increasingly need to focus on negotiating change with local stakeholders in their communities.

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Figure 2. **Main occupations driving change in smart and green cities (expert assessment)**

Source: Cedefop skills foresight on smart and green cities.

SGC profiles and skills shortages delay SGC development

Cities are expected to face difficulties in attracting, finding and recruiting people to key SGC jobs and keeping the skills of their workforce up to date. Recruitment difficulties will be acute for ICT professionals, as municipalities will be competing with local companies and other sectors for the same talent. Recruitment difficulties for urban space specialists are likely to persist because of overall skill shortages for professionals in smart green management and skill gaps. For urban specialists, demand matches supply relatively well in absolute terms, but many professionals lack the skills SGCs need. The Cedefop foresight expert group identified several drivers of current and future skill shortages; these include demand from other cities for the same skills, insufficient supply from higher education, and accelerating technological change which makes it challenging to keep skills development opportunities up to date. Other bottlenecks to ensuring the green transition at city level include limited learning or training opportunities for municipal staff to reskill or upskill in line with the needs of SGCs and the perceived unattractiveness of jobs and careers in the green economy among VET learners and graduates.

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VET contribution to shaping SGCs

Cities and regions are the catalysts for environmental policy solutions and cannot rely solely on central government policy to achieve a green transition. For the eight occupations Cedefop foresight experts identified as central to SGC development, both IVET and CVET have the merits to strengthen young(er) and adult learners' skills (Table 1).

To align the content and focus of IVET and CVET programmes to SGC and wider skill needs, curricula need to reflect local, regional and national needs and trends. Applying insights emerging from experimentation and learning at local level can set in motion a bottom-up process for spreading relatively good practice throughout cities and regions. For this to happen, local stakeholders (municipal authorities, social partners, major employers, learners, VET providers, local /regional innovation platforms) need to become partners in designing and developing VET programmes and curricula. Partnership based approaches are indispensable in local or regional skills governance to aid and safeguard timely updates of IVET and CVET programmes. When asked what shape CVET should take for best support to up- and reskilling, experts favoured shorter and more job-related learning routes over longer programmes (Figure 3).

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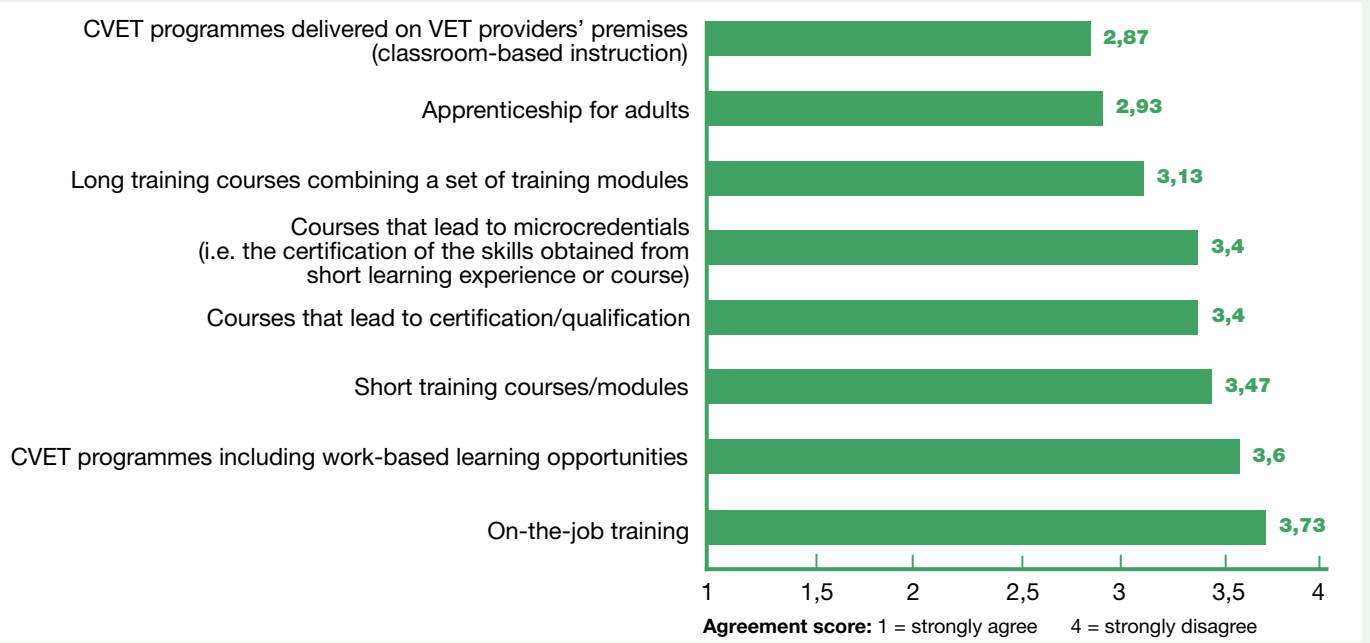
Table 1. VET pathways to providing skills for smart green cities

OCCUPATION/JOB	IVET OR YOUNG PEOPLE	CVET FOR ADULTS TO STAY IN THEIR CURRENT JOBS	CVET TO ENSURE ADULT TRANSITION TO SMART, GREEN CITY JOBS
Smart and green city management professionals		●	
ICT professionals	●	●	
Urban space specialists	●	●	●
Energy professionals		●	
Transport and mobility specialists	●	●	●
Environmental protection specialists	●	●	●
Specialists to boost citizen engagement	●	●	●
Construction and building specialists		●	

Source: Cedefop skills foresight on smart and green cities.

Figure 3. How CVET can support upskilling and reskilling (expert views)



Source: Cedefop smart green cities foresight – survey round 2.

Making SGC jobs (more) attractive

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Attracting learners to pursue 'tech' skill profiles, like software development and coding, will be crucial in addressing the recruitment challenges affecting several sectors. Municipalities and private employers offering services to municipalities will have to compete with sectors which jobseekers perceive as offering better job or career prospects. The rapid uptake of remote work in tech jobs may ease tensions for cities in attracting such talent, as it opens opportunities for recruiting candidates abroad. At the same time, the increasingly global talent pool may disadvantage smaller cities, because they will find it more difficult to attract talent than larger, more well-known cities.

Apart from targeted information campaigns on SGC job wages, working conditions and professional development prospects, breaking stereotypes is also a matter of giving young people opportunities to discover what work in/for SGCs is like. Short, supervised work experience, tasters, games and promoting apprenticeships where young people can earn as they learn can help put SGC job opportunities on young people's radar and contribute to easing recruiting difficulties.

With technology altering job content, occupations develop dynamically with respect to the way they contribute to the EGD 2050 net zero goal. Making people realise that they can play a part in improving citizens' lives and contribute to the green transition at local level by working for the city could increase the attractiveness of SGC jobs. Skills development for SGCs can be made more attractive by pointing out to learners that skills needed are often linked to ICT or energy and therefore transferable and usable in a broad range of occupations and sectors, offering attractive career development opportunities.

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CONCLUSIONS

In this section

Policy messages

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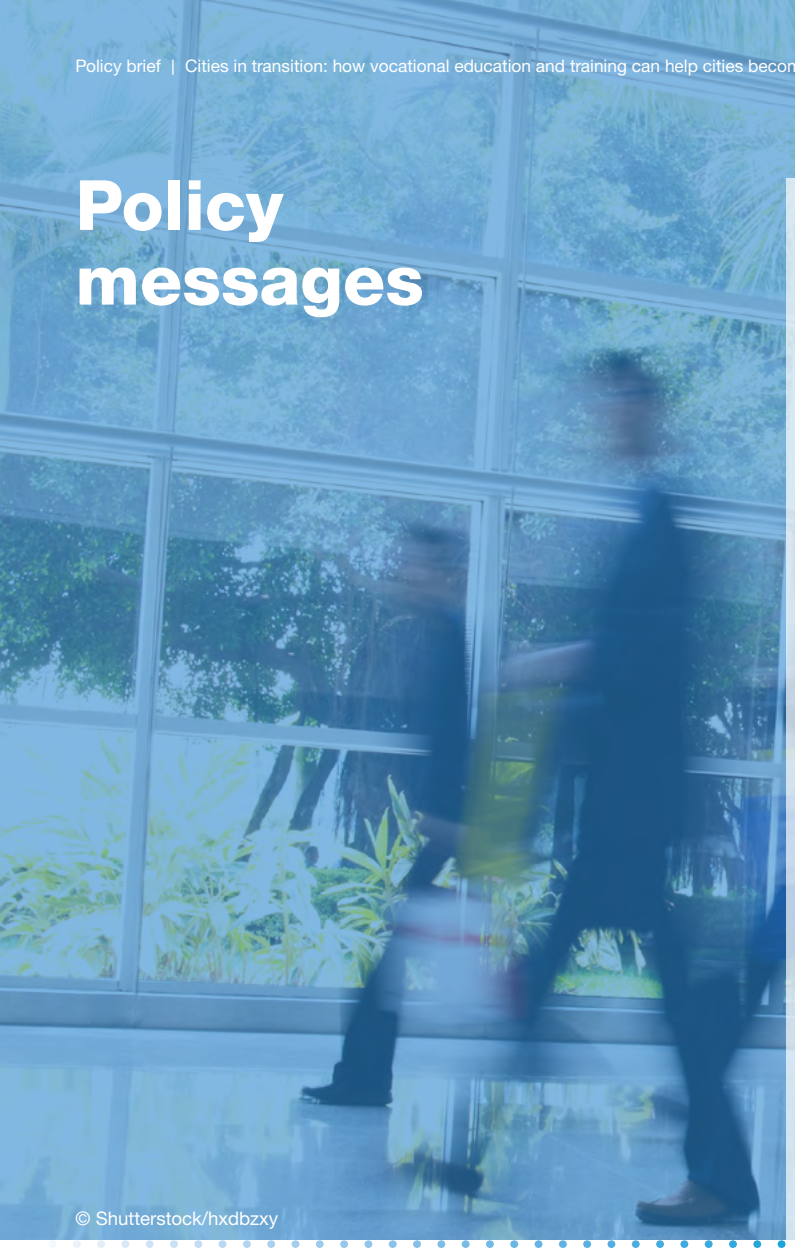
Policy messages



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Setting policy priorities at EU level has been a catalyst for change in VET systems and practices for over two decades. The current focus, and concentration of the policy agenda, on the digital and green transitions is setting new developments in motion. Innovative practices in cities that take a strong lead in managing and shaping change already show that the local level crucially matters in realising Europe's digital and green ambitions.

Making the shift towards or advancing as an SGC requires a new mindset, primarily among policy-makers and key actors in local ecosystems. Skills development needs to be seen as a transversal policy objective that is embedded in a strategic vision about how a city wants to develop in the future. Policy-makers need to be informed and trained on the benefits of the SGC approach so that they can lead the way in actively including social partners, VET providers, learners, and other actors in shaping a shared vision and priorities for the road ahead.

Changes in skill supply and demand and skill-matching challenges also concern private companies that provide applications and services to cities.

To accelerate the transition to SGCs via economic development strategies, public administrations can boost the involvement of local companies, particularly SMEs. Local companies can also become VET advocates and contribute to its uptake by promoting it as a key provider of skills that expand career prospects; this counteracts stereotypes of it being a less desirable educational route and a second-best education or training option.

The transition towards becoming an SGC is a journey that cities should take at their own pace, considering strategic priorities, aspirations and capacity. Collaboration, communication and transparency among all public administrations, academia, local industry and citizens (the quadruple helix approach) will help deliver quality results tailored to the needs of cities and benefiting their citizens. Every step counts, particularly for smaller urban centres that may lack the infrastructure and funding arrangements larger cities readily have at their disposal. Nonetheless, with climate change progressing and its repercussions intensifying, becoming smarter and greener will be a dominant trend and a reality for most, if not all cities.

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Empowering and enabling cities to become greener and smarter should be a core priority for VET. The key take-aways from Cedefop's smart and green cities foresight are the following:

01

There are opportunities for VET to take a stronger role in addressing up- and reskilling needs in cities. Given its close connection to the world of work and its ability to provide science- and technology-based theoretical knowledge and practical skills crucial for building, retrofitting, green construction, IT management, and other green economy areas at different levels, VET can play a major role in meeting skill needs of SGCs.

02

Robust and trusted skills intelligence, based on a variety of skills anticipation methods and tools, is essential for prompt action to inform policy-makers and VET providers about skill needs in the short to medium term. This is particularly crucial for SGC-relevant skills that are changing rapidly due to technological progress. Strong feedback loops between VET and labour market change – particularly for highly regulated types – facilitate flexibility and agility of programme and curricula.

03

Cedefop foresight experts acknowledged the importance of initial and continuing VET for SGC skills formation, up- and reskilling and matching. For young learners, high-quality IVET programmes linked to SGC goals with strong work-based elements (such as apprenticeships) in private and public service settings, modules on sustainability across specialisations and the development of teachers'/trainers'/mentors' skills were acknowledged as essential drivers of SGC development.

04

CVET offering up- and reskilling opportunities plays a key role in ensuring that the continuing development and proliferation of SGCs is not impeded by skill shortages and gaps. Work-based learning and on-the-job training opportunities are particularly well suited to delivering on skills that match needs in SGC jobs. Microcredentials can stimulate the uptake of such training; the certification and recognition of learning they provide can increase acceptance from employers, strengthen learners' employability and facilitate professional mobility.

05

To support CVET provision and delivery, effective feedback loops between employers and trainers, stimulating employer interest in training their staff, and ensuring that workers can balance training and work, are essential.

06

Local administrations, trade unions and employers have a role to play in making the transition just. They are well placed to take into consideration local specificities and the position of vulnerable groups and have at their disposal approaches and tools to promote gender equality in VET and employment in SGC-relevant jobs.

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Green Observatory

Cedefop Green Observatory **(Cedefop GO)** includes Cedefop's work on the **implications of the green transition on jobs and skills** across sectors and occupations in the EU

For more information on **Cedefop Go** visit the theme page

POLICY BRIEF

Cities in transition

How vocational education and training can help cities become smarter and greener

Cities are key players in mitigating climate change and shaping the green transition via services and through regulatory competence. Using the smart and green city concept in existing and new urban settings contributes to achieving European Green Deal ambitions. This policy brief reports on a Cedefop skills foresight study which looked at the occupations and skills that help cities become smarter and greener and the role vocational education and training can play in developing them.

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