4 Choosing methods and data to assess skill needs for the green transition

Both qualitative and quantitative methods can be used to estimate current and future skill needs related to the green transition. This chapter discusses the specific advantages and disadvantages of quantitative, qualitative, and mixed method approaches and how they can be applied. The insights are supported by examples of approaches to measuring changing skill needs in the green transition from countries around the world.

Introduction

Broadly speaking, there are two sets of methods for estimating current and future skill needs: (1) quantitative methods that use data and statistics, such as labour market statistics and employer surveys, to estimate current and future skill needs; and (2) qualitative methods that use written or oral input from experts, collected through interviews, surveys, desk research or workshops. 'Mixed methods' approaches combine quantitative and qualitative methods and data. Both qualitative and quantitative methods have advantages and disadvantages, and the choice depends on the specific policy use (OECD, 2016[1]; Cedefop, 2008[2]; ILO, 2017[3]). The same holds for the choice of data sources, output variables and experts to include in SAA, which depends on the definitions and scope of the exercise.

This section focuses on how the different methods can be applied when estimating the impact of the green transition on current and future skill needs, as well as on the specific advantages and disadvantages to using each methodology. Overall, the SAA exercises covered in this report are quite evenly split between quantitative and qualitative exercises. Most countries use a mix of the two and in many cases, the same SAA exercise combines qualitative and quantitative methods (see Table 4.1).

Table 4.1. Methods used in green SAA exercises

Country	Institution	Quantitative	Qualitative
Australia	Federal Government		
	Jobs and Skills Australia (JSA)	●	●
	Infrastructure Australia		●
	Department of Employment and Workplace Relations (DEWR)	●	●
	State Government		
	Victorian State Government	●	●
	Independent		
	Deloitte	●	
	RACE for 2030		●
Austria	GWS	●	
	Just Transition Action Plan		
	Austrian Energy Agency		●
	WIFO	●	●
France	National Observatory for Jobs and Occupations in the Green Economy	●	●
	Skill Forecast: Occupations 2030	●	
	EDEC	●	●
	ADEME	●	
	The Shift Project	●	●
	Scénario négeWatt		●
Norway	Norwegian Committee on Skill Needs	●	●
	Virke – Circular Economy		●
	Virke – Virkebarometer		●
	NHO – Skill barometer		●
Sweden	Public Employment Service	●	●
	Vinnova		●
	Confederation of Swedish Enterprises		●

Source: Authors' elaboration based on policy questionnaires.

Quantitative methods and data

Quantitative approaches to SAA involve analysing various indicators of current and/or past demand and supply of workers and their skills, in order to project future trends under given assumptions. For green SAA exercises, this typically involves employment projections that take into account the fact that the green transition increases the demand for specific occupations or industries (e.g. in the green energy sector) while decreasing demand in others (e.g. in fossil fuel sectors). Several statistical and econometric techniques are exploited in quantitative SAA exercises, although the most frequent are the following:

- Time series models, which make use of historical trends, for instance on the number of workers by occupation, and extrapolate these trends to project the future supply.
- Regression models, which assume that the forecast variable (such as the demand for renewable energy workers) is related to other variables (such as the level of decarbonisation), and create forecasts based on those assumptions.
- Computable general equilibrium (CGE) models, which are used to analyse the economy-wide effects of potential shocks and scenarios, such as the change in industry composition due to change from carbon-intensive to carbon-neutral economy.

Other examples of quantitative SAA models are optimisation models, generic mathematical models, stock-and-flow models, input-output models, social accounting matrices, and simulation models (Safarishahrbijari, 2018[4]). Additionally, with the increasing availability and quality of Big Data, techniques such as machine learning and natural language processing are increasingly being used, for instance to map out skill requirements in occupations, to identify green jobs using vacancy data, or to identify education and training programmes that teach the skills that will be needed for the green transition. The following section focus entirely on the use of Big Data for green SAA exercises.

Some of the key advantages of using quantitative methods for green SAA exercises are that they can cover large numbers of occupations and sectors at the same time, are relatively easily repeated, and do so in a consistent and transparent way across occupations, sectors and years. Most SAA exercises using quantitative methods follow a whole-of-economy approach. This is important due to the fact that: i) there is a relatively high level of uncertainty about greening policies and their impacts may require more frequent updating (see next sections for more information), and ii) the green transition likely impacts more than 'green jobs' alone. For instance, Deloitte in Australia uses CGE, input-output and mixed time series models to estimate the impact of different levels of decarbonisation and a shift towards a net zero economy on all jobs in the (local) labour market (Deloitte Access Economics, 2021[5]; Centre for Policy Development, 2022[6]).

This whole-of-economy approach allows taking into account that some jobs that are not directly related to implementing the green transition may be affected too. It also allows researchers and policy makers to address fears that decarbonisation will result in large and permanent job losses, by estimating what share of total employment is affected. For example, the GWS estimates that while the transition to a new, lower-emission economy by 2030 has far-reaching structural effects on the Austrian labour market, it will lead to a net-increase in total employment by 0.3% (Großmann et al., 2020[7]). Similarly, Deloitte estimates that most workers in Queensland (Australia) will not be directly impacted by the economic transformation underway due to decarbonisation (Deloitte Access Economics, 2021[5]). A whole-of-economy approach can also take into account that workers who lose their job as a result of the green transition may continue to work in other jobs and sectors. By analysing skill similarities across occupations using O*NET, Deloitte shows that more than 80% of the tasks required in clean economy jobs are already being performed by workers in Queensland (Australia) today, because an electrician working in a coal mine can, for instance, relatively easily work as an electrician in another growing industry, given his current skill set (Deloitte Access Economics, 2021[5]).

Most countries using quantitative methods to conduct a green SAA exercise generally build on existing, broader SAA exercises that rely on data regularly collected by national statistics offices, such as flows in and out of employment by occupation and sector, trends in wages by occupation, trends in hours worked by occupation, vacancy surveys, employer surveys, surveys of recent graduates, and administrative data (e.g. data on enrolments in and graduation from various levels of education). This is exemplified in the Swedish exercise by the PES that will incorporate their SAA exercise within existing tools such as occupational forecasts which are made by the Swedish PES and currently based on register data from Statistics Sweden (Swedish Public Employment Service, 2022[8]). In France, the "Skill Forecast: Occupations in 2030" SAA exercise has been carried out since the 1990s, and an analysis on the transition to a low-carbon economy was added in 2012 (France Stratégie, 2022[9]).

The crucial challenge in adding a green element to an existing SAA exercise is to identify jobs, sectors or skills relevant to the green transition within existing data, according to the specific definition and scope of the exercise. As the ILO has previously pointed out, it can be extremely difficult for research into skills for green jobs to use only standard classifications (ILO, 2015[10]), because they often do not (yet) include a green category, and when they do, it is often at such a granular level that it requires vast amounts of data. In France, the National Observatory for Jobs and Occupations in the Green Economy has identified green occupations through a review of the national nomenclatures of existing occupations, and cross-referencing these with statistical data sources (Ministry of Ecology, Energy and Territories, 2021[11]). For many countries, particularly those that have fewer resources, it may not be possible to have enough data of sufficient quality to conduct analyses at such granular level. Nevertheless, Briggs et al. (2020[12]) show that, within a specific industry, it might be possible to carry out informative and fruitful quantitative analyses on green jobs or skills at a more aggregate level. Not only do the authors conduct their analysis on renewable energy jobs in Australia at the detailed occupational level, but they also apply it to the 1-digit occupational level within the mining sector and renewable energy sector.

Other challenges specific to quantitative approaches to SAA in general are: (i) they typically require high levels of technical capacity such as econometric and statistical skills, (ii) they may give a false impression of certainty, and – most importantly – (iii) it can be difficult to estimate skill needs *per se* (OECD, 2016[1]). The latter shortcoming is particularly challenging. Indeed, quantitative green SAA exercises typically focus on occupations or qualifications, rather than skills, although it is possible to translate occupational-level findings into skill-level results using a mapping of skills in occupations. For instance, O*NET produced a list of "green occupations", JSA in Australia developed the Australian Skills Classification including skills and tasks related to environmental management, and ESCO provides a list of "green skills" in occupations in the European Union. France's National Observatory for Jobs and Occupations in the Green Economy is in the process of extrapolating a definition of green skills from the group of identified green occupations, in order to quantify those skills and in turn identify greening occupations – that is, occupations not directly involved in the green transition, but affected by it nonetheless (Ministry of Ecology, Energy and Territories, 2021[11]). Even if a specific mapping does not suit a study's purpose perfectly, it may be possible to adapt it. For instance, Deloitte adjusted O*NET's green jobs classification (which are coded in SOC) and mapped it onto the Australian ANZSCO occupational classification system, in order to identify green skills in Australia (Deloitte Access Economics, 2021[5]).

Global insights

Quantitative methods in the Netherlands

In the Netherlands, the Research Centre of Education and Labour Market (ROA) and the Environmental Assessment Agency (PBL) – which is the national institute for strategic policy analysis in the field of the environment – conducted an SAA exercise for the green transition in 2022 at the request of the Economic and Social Council and several ministries involved in climate policy (e.g. Ministry of Economic Affairs and Climate Policy). ROA and PBL applied quantitative forecast models to provide insights into possible bottlenecks in the labour market for achieving green targets. In particular, the PBS-ROA model forecasted employment shortages in 63 sectors and 12 provinces over the next five years (up to 2026) based on a scenario in which each economic agent implements all necessary measures and investments to achieve a greenhouse gas reduction goal. Using additional data from the Labour Force Survey, the ROA School Leavers Information System, as well as benchmark estimates from the Ministry of Education, the SAA exercise also provided useful information on skills and adult learning needs (PBL Netherlands Environmental, 2022[13]).

Qualitative methods and data

Qualitative methods often involve gathering groups of experts and/or stakeholders to collect their informed views on how the skill needs in the labour market are likely to evolve in light of the green transition. These may include focus groups, stakeholder consultations, foresight methods, Delphi methods, and analyses of open-ended questions in surveys. Participants and respondents may include representatives of employers and industries, education and training providers, academics and experts on green technologies, and trade unions.

One of the key advantages of using qualitative methods for green SAA exercises is that they facilitate analyses of future employment and skill needs that might not (yet) be observable in quantitative data. This is crucial for green SAA exercises, considering that the green transition may create demand for entirely new occupations. For instance, based on interviews and workshops with employers and industry associations, governmental and intergovernmental organisations, academics, consultants and non-governmental organisations, RACE for 2030 concluded that sections of the standard Australian occupation and industry codes may need additional categories in order to reflect the changes in the workforce caused by the green transition (RACE for 2030, 2021[14]). Additionally, with the help of an external expert panel and extensive stakeholder consultations, the Victorian Skills Authority in Australia is identifying new skills and roles that are needed to support its clean economy ambitions (Victorian State Government, 2022[15]).

Since skills are difficult to quantify, qualitative approaches to SAA are typically also well suited for analysing skill needs directly, without going through forecasts of green jobs demand (OECD, 2016[1]). This is particularly important for green SAA exercises, because the green transition will likely affect not only the level of employment in certain occupations, but also the skill requirements and tasks within occupations. For instance, in order to identify how tasks within the trade and service industry will be affected by the green transition in Norway, Virke conducted 18 qualitative interviews with representatives from the sectors of procurement, logistics, and design (Virke, 2020[16]). As part of the Austrian Just Transition Action Plan, the Austrian Energy Agency analysed which future skills will be needed in the areas of construction and renovation, electricity from renewable sources and renewable heat (Tretter et al., 2022[17]). They did so based on desk research and a workshop with educational providers where the respective future competencies were ranked according to their short- to medium-term effectiveness. RACE for 2030 conducted literature reviews, interviews with subject matter experts representing industry associations and

education providers, workshops with various stakeholders and employer and industry surveys, to investigate the skills and workers that are required by 2030 to deliver a clean energy transition to net zero by 2050 in Australia (RACE for 2030, 2021[14]). Their study highlighted that not only does the green transition change the demand for specific technical skills such as those of wind turbine blade technicians, but it also calls for non-technical cross-cutting skills such as project management, raising awareness, communicating and convening dialogue across a range of sectors and disciplines, and fostering a shared vision and commitment between diverse actors.

Qualitative SAA exercises can also link skill needs to shortages and training needs. For example, in Sweden, the Confederation of Swedish Enterprises conducted surveys among 25 representatives of business organisations and 11 interviews with industry and company representatives across the labour market (including manufacturing and basic industries, construction and various service industries), in order to identify whether skills shortages are hindering the industry's green transition and where potential skill gaps lie (Confederation of Swedish Enterprise, 2021[18]).

Another advantage of qualitative approaches to SAA found in previous studies is that they are typically easier to set up with limited resources (OECD/ILO, 2022[19]). In many low and middle-income countries, conducting skills anticipation exercises is made challenging by weaker institutions, limited capacity, and poor governance systems. Additionally, many of these countries collect only basic labour market statistics and require significant investment to develop robust data sources. In these cases, qualitative exercises such as sector surveys can help provide useful information and fill data gaps when necessary.

Notwithstanding the advantages of qualitative green SAA exercises, there are also a number of drawbacks. First, qualitative methods typically focus on one specific sector or group of occupations. This is due to the fact that qualitative considerations are often sector specific and gathering and engaging experts can be time consuming, which makes a whole-of-economy approach less feasible. While the focus on specific sections of the economy can provide more in-depth insights, important dynamics such as transitions between declining occupations and industries towards those that are growing as a result of the green transition would be overlooked. Additionally, qualitative SAA exercises are more subjective and less systematic and more difficult to replicate and can therefore yield inconsistent responses between experts or when the exercise is repeated. This can be problematic, considering the relatively high level of uncertainty and the resulting need for regular updating of the results (see next sections).

Global insights

Qualitative methods in South Africa

In 2016, the Partnership for Action on Green Economy (PAGE) launched the Green Skills Programme, which involved conducting various qualitative assessments of the learning needs and opportunities related to the green economy. The research team consisted of experts from international organisations and universities, as well as from South African Ministries. The team conducted two surveys – one with 96 experts to verify the key levers that stimulate the transition to a green economy, and another one with 106 key actors to identify learning needs and opportunities. Twelve in-depth interviews were conducted with senior level individuals with exceptional experience in green economy and policy across green sectors, such as education for sustainable development, water, conservation and natural resource management, cities and mobility/transport, waste management and cleaner production and energy. PAGE also reviewed 170 existing vocational training courses, in order to assess the capacity of the training providers to offer courses that are in-line with demand, both in terms of number of classes and their topics, as well as the success factors and challenges that are faced in the green training space. Finally, the review conducted three cases studies of green economy policy actions, to identify and assess their success factors or enablers, as well as gaps and risks, with the objective of mapping

out competencies that are associated with taking actions needed to guarantee the success of green economy policy actions.

Various consultations and advice were provided from the phase of research design to the phase of drawing results through a roundtable and the finalising workshop with experts and stakeholders, including the Department of Environmental Affairs, International Labour Organization (ILO), and United Nations Institute for Training and Research (UNITAR). The review resulted in targeted recommendations to strengthen the green economy through planning, policy development, governance, management of skills and training provision, and human capacity management (South Africa - Partnership for Action on Green Economy, 2016[20]).

Mixed methods

Using a combination of quantitative and qualitative methods is generally viewed as best practice, because one method can be used to validate and complement the other thereby leveraging the advantages of each method, which should lead to the most robust and reliable results (OECD, 2016[1]; Cedefop, 2008[2]; ILO, 2017[3]). Although mixed method approaches to SAA are usually less common because they require vast amounts of data and technical expertise, as well as time investments from groups of experts, several exercises included in this study adopt this approach.

The Norwegian Committee on Skill Needs, which consist of experts and social partners, discusses the results from quantitative forecasts as well as qualitative results, for instance from interviews with environmental managers in the trade and service industry to evaluate their future green skill needs (Norwegian Committee on Skill Needs, 2020[21]). As part of the Just Transition Action Plan in Austria, the WIFO analyses the impact of a transformation towards climate neutrality and sustainability on the labour market, by combining desk research with input-output analysis and a workshop with experts on environmental and labour market policies in order to put the sectoral results into a regional context (Meinhart et al., 2022[22]). The Powering Australia Plan involves quantitative employment forecasts in three sectors (electricity, industry carbon farming, and transport), as well as surveys and focus groups with key stakeholders such as states and territories, industry and unions, in order to identify the occupations, skills and training pathways that are needed to transition to a clean energy economy (Department of Employment and Workplace Relations, 2022[23]). In 2020, the UTS Institute for Sustainable Futures gathered input from an industry-wide survey, as well as from interviews and expert consultations about workforce numbers, current skill shortages and recruitment issues, and the use of apprentices and trainees (Briggs et al., 2020[12]; Institution for Sustainable Future, 2020[24]). The surveys (supplemented with other data sources when necessary) were used to derive factors critical for the Australian green energy transition, such as deferral and state government energy policies, the pace of innovation and adaption of digital technologies, and Australian and international action on climate change. These factors are applied to scenarios developed by the Australian Energy Market Operator (AEMO) in its 2020 draft Integrated Systems Plan to estimate job creation into the future (Institution for Sustainable Future, 2020[24]). The Victorian State Government uses these scenarios and projections in their New Energy Skills and Training Gap Analysis, supplemented by desktop research and stakeholder consultations, for instance through an industry workshop, industry surveys and interviews with State Government and industry representatives such as the wind, solar, bio-energy and battery industries (Victorian State Government, 2022[25]). The Department of Education and Training of Victoria is also developing a 10-year clean economy workforce development strategy, based on a mixed methods approach that is managed by the Victorian Skills Authority. General equilibrium models that forecast industry and occupation trends, are supplemented with extensive stakeholder consultations to identify new skills that are required to support the green transition (Victorian State Government, 2022[15]).

Global insights

Mixed methods in India

In 2016, the Indian Skill Council for Green Jobs (SCGJ) conducted a skill gap analysis across three sub-sectors of the renewable energy industry, namely solar, wind and small hydro. Their green SAA exercise was based on quantitative anticipations in parallel with stakeholders' discussions. At the initial stage, extensive consultations with stakeholders in the three fields led to the identification of the key trends and manpower deployment patterns that will be affecting job requirements until 2030. Also policy changes, and legal and technological considerations had been collected in detail and used as basis for the following quantitative analysis.

In a second stage, a skill gap analysis was carried out to anticipate the skill requirements based on the total target capacity of each sub-sector, using the qualitative and quantitative inputs. Compound Annual Growth Rate projections of each sector were made to anticipate their future capacity based on the targets of the Ministry of New and Renewable Energy.[1] Qualitative discussions with stakeholders were organised once again after this stage in order to convert sub-sector capacity anticipations into workforce needs per unit capacity. Finally, based on the qualitative and the quantitative input, the anticipation of skill (workforce) gap was derived for each sub-sector until 2025.

The output of SAA will guide the development of National Occupational Standards (NOS) and Qualification Packs (QPs). NOS define an explicit key feature that is needed to execute a job such as standards of performance or the level of knowledge that is required to carry out a task. Furthermore, the QPs are based on a combination of NOSs that make up the qualifications of a job role. Both the NOSs and the QPs will be incorporated in curriculums of and assessments of training and education (Skill Council for Green Jobs, 2016[26]).

Dealing with uncertainty

Uncertainty is a key challenge when anticipating future skill needs. It is impossible to precisely predict the future, even in a baseline scenario in which the green transition is not taken into account. Additional complications for green SAA exercises are that there is still a lot of uncertainty about the policies needed to reach climate goals, the policies that will be implemented in practice (due to push back, for instance from workers who fear losing their jobs), and the effects that implemented policies will have on labour and skill demand. Moreover, most countries' climate goals are set in the next 10 to 30 years, and the longer the time horizon, the greater the uncertainty. Both under- and over-estimating future skill needs in green SAA exercises can be problematic. For instance, underestimations may hinder a country from reaching its climate goals, while overestimations may increase unemployment and mismatches of workers that are trained to support the green transition.

Among the green SAA exercises included in this study, scenario analyses are by far the most common strategy for dealing with uncertainty, particularly among the quantitative approaches to SAA. For quantitative SAA exercises, scenario analyses imply that the forecasting model is run under different assumptions or hypothetical future events, to show how they affect the forecasted numbers. However, some exercises focus on more than 'green scenarios', since future skill needs (including in 'green jobs') are affected by more than green policies alone. For instance, the Norwegian Committee on Skill Needs (2020[21]) investigates three different scenarios in their quantitative SAA exercise, based on five societal uncertainties that can affect future skill needs, only one of which is related to the green transition, namely 'the population's preference for climate- and environment-friendly solutions'. The other societal

uncertainties that feed into the scenario analyses are: 1) the population's acceptance of adopting new technological solutions, 2) the prioritisation of export-oriented technology industries, 3) the degree of international protectionism, and 4) the population's preference for free time. In France, the Skill Forecast: Occupations 2030 models a baseline scenario for occupations by 2030 based on variables such as demographic and macroeconomic trends, and the green policies that will be implemented (only those already approved are taken into account) (France Stratégie, 2022[9]). Additionally, several alternative scenarios are developed, including a "low-carbon" scenario that assumes substantial acceleration of investment to meet the objectives of the national low-carbon strategy 2030, as well as a "Covid+" scenario, which assumes a stronger impact of the pandemic on social distancing by 2030 (France Stratégie, 2022[9]).

A qualitative approach to scenario development involves asking field experts or policy makers about what the most relevant future scenarios might look like, how likely these scenarios are to happen, and how they would affect labour and skill needs in light of the green transition. In Norway, Virke developed future scenarios during a workshop. Approximately 100 people from various sectors, including finance, research, real estate and technology, as well as government representatives, were asked how they wanted their sector to develop until 2030, and how they think this could be achieved (e.g. skill requirements) (Virke, 2020[16]). For Austria, the GWS developed scenarios of different types of green policies and their CO2 savings potential based on desk research, in co-operation with Austrian partners. After discussing these scenarios with subject matter experts, certain assumptions were adjusted and some scenarios were dropped altogether because they were considered not to be realistically feasible by the year 2030 (Großmann et al., 2020[7]).

For SAA exercises in general, as well as for SAA exercises in the health sector (see OECD/ILO (2022[19])), other common strategies for dealing with uncertainty in the design are to provide ranges or confidence intervals instead of exact numbers, and to repeat the exercise frequently, such as every two or three years. The latter allows the researchers to incorporate emerging insights about changing future trends. For green SAA exercises, frequent repetition would allow the inclusion of green policies as they evolve, as well as emerging insights in their impacts on employment and skill requirements. However, as discussed in the previous Chapter, most exercises included in this study are carried out for the first time, and many are not intended to be repeated.

Finally, validating findings is a necessary step in producing high-quality SAA exercises. Validation usually includes discussing the findings with external experts during workshops, focus groups or other expert meetings, to ensure that the results, and the assumptions they are based on, are considered plausible before they are published. For instance, under the Just Transition Action Plan in Austria, several workshops are conducted including all relevant experts including employers and industry representatives, to discuss the results of the projects (Meinhart et al., 2022[22]). Other exercises are validated by sending the preliminary results to external experts and asking for their feedback, such as in Norway, where the work in progress of the Committee on Skill Needs is sent to experts for quality checks and review. Furthermore, the Committee is also composed in such way to ensure consensus of various actors and institutions as well as performing a first step of the validation process (Norwegian Committee on Skill Needs, 2020[21]). In France, Skills Forecast: Occupations in 2030 performs various validation exercises, including sending a questionnaire to the sectoral observatories and the regional employment and training observatories to validate and adjust their projections (France Stratégie, 2022[9]). In some cases, the validation is performed afterwards, in order to assess the effectiveness of the SAA exercise in reaching its policy objective. In Australia, the New Energy Apprenticeship Program's second phase will be informed by analysis from Jobs and Skills Australia's study on the needs of Australia's clean energy workforce. This will allow changes to the programme based on emerging evidence on what is needed to support the transition to a clean energy economy.

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Note

[1] The compound annual growth rate is the rate of return that would be required for an investment to grow from its beginning balance to its ending balance, assuming the profits were reinvested at the end of each period of the investment's life span.