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SKILLS FOR SMART SPECIALISATION IN MOLDOVA

Understanding and managing skills as a key resource for growth and competitiveness

THE EU AGENCY SUPPORTING COUNTRIES TO DEVELOP THROUGH LEARNING

Report drafted by Vera Chilari and Corina Gribincea for the European Training Foundation.

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1. INTRODUCTION

Science, research and technology are omnipresent when discussing smart specialisation. Despite human capital and skills having been recognised as framework conditions for innovation ecosystems, they are not fully reflected in the framework (tools and methodologies) that guide the design of smart specialisation strategies in the European Training Foundation (ETF) partner countries.

Technological, environmental and demographic changes, alongside globalisation, are changing the nature of work, the content of jobs and the demand for training. Across the ETF partner countries, there is a need for continuous review and updating of the formal education and training provision, and the role of non-formal and informal learning is growing exponentially. The competitiveness of countries and their regions depends on their flexibility and capacity to effectively adapt to global changes and the implications on skills and competences. All countries need to ensure that: (i) skills shortages and mismatches do not inhibit growth; (ii) the workforce possesses the right skills mix needed for innovation (e.g. soft skills, digital skills and entrepreneurship key competences); (iii) there is flexible provision of vocational education and training (VET); (iv) lifelong learning is designed to respond to future skills needs; and (v) improvements are made to the adaptability and employment mobility of an ageing workforce.

Smart specialisation is at the intersection of economic, industrial, innovation, labour market and education and training policies. Skills shortages and mismatches often emerge as a priority during the entrepreneurial discovery process of smart specialisation when the 'mapping' (i.e. analysis of economic potential and identification of preliminary priority areas) is shared with and dialogue opened with employers. Employers are the ones that voice the changes in labour market requirements, including increasing use of new technologies, and the need for smart specialisation strategies to be accompanied with relevant and quality VET, upskilling of the workforce and ability of small and medium-sized enterprise (SME) skills to adapt to new working practices and advanced products and services.

Micro, small and medium enterprises (MSMEs) are a major source of job creation and an increasing share of employment in ETF partner countries. Yet MSMEs invest significantly less in skills development than their larger counterparts and depend on the labour market to supply them with qualified labour. If smart specialisation adopted a more human capital centred approach, it would have the potential to fuel MSME innovation and growth through relevant supply of skilled workers, networking and cooperation with VET providers on equipment, research and development (R&D) expenditure, and be able to address capacity constraints relating to knowledge, innovation and creativity or cross-country cooperation, e.g. through centres of vocational excellence.

To address the challenge of connecting VET to the broader drive for innovation, growth and competitiveness, the ETF started, in 2019, to develop and test a practical guide for analysing skills implications of economic prioritisation (smart specialisation strategies). The work was initiated in mid-2019 at national level in Montenegro, followed up by the Republic of Moldova (hereafter Moldova). The analysis sought to explore skills data at subsectoral level in the context of changing jobs and modes of working against the backdrop of global value chains and the search for competitiveness and innovation. Exploring different levels of quantitative and qualitative data highlighted limitations and offered opportunities to improve current approaches to labour market information and intelligence. It also revealed gaps and opportunities to link data on human capital to growth and competitiveness. On provision, it revealed areas where economic prioritisation should be supported in terms of relevance of skills in a lifelong learning continuum, importance of business–education partnerships, and support to

entrepreneurs and SMEs, all connected through interregional cooperation, a key element in globalised economies (through the priority areas of smart specialisation).

In 2020–21, the ETF aims to review the methodology, addressing the lessons learned from the analysis implemented in Montenegro and Moldova, as well as to adapt it to the regional context in two pilot regions in Ukraine.

1.1 Policy context

Although VET has an important role to contribute to innovation and smart specialisation (the Copenhagen Process and the Riga Conclusions underscore the role of VET and skills in the European growth and jobs agenda), most European Union (EU) Member States currently focus on higher education, to some extent covered in smart specialisation analysis ('mapping'), and only a handful (e.g. Finland) include VET and skills in their innovation clusters and strategies. The same is valid for the countries in the enlargement region, which have also committed to developing and implementing smart specialisation strategies.

The EU places great emphasis on skills anticipation and more accurate matching capabilities. The Europe 2020 Strategy and, in particular, the Agenda for New Skills and Jobs recognise that anticipation and matching approaches and methods can help develop a skilled workforce with the right mix of skills in response to labour market needs, in a way that promotes job quality and lifelong learning. The South East Europe 2020 strategy mirrors the same goals and objectives as well as challenges.

In 2017, the Communication on Strengthening Innovation in Europe's Regions underscored the implementation of smart specialisation for regional innovation policy. In 2019, Skills and Smart Specialisation: The Role of VET in Smart Specialisation Strategies explored trends in VET and where it has contributed to smart specialisation.

For the Multiannual Financial Framework 2021–2027, the European Commission proposes modernising the Cohesion Policy and creating a component for Interregional Innovative Investments to further strengthen interregional and cross-border cooperation. The planned budget of EUR 970 million is aimed at supporting regions with matching smart specialisation priorities to build pan-European clusters based on complementarities and synergies in key sectors such as big data, circular economy, advanced manufacturing or cybersecurity.

1.2 Research steps

To document the foreseeable impact of economic prioritisation on skills supply and demand and capacity of education and training systems to adjust to newer skill sets required in the context of smart specialisation, the ETF developed a preliminary approach to explore skills data, at subsectoral and local/regional levels, and skill relatedness in the context of competitiveness and innovation and an important role for MSME employment.

The ETF agreed with two partner countries – Montenegro and Moldova – to pilot the new methodological approach. The work relied on existing ETF tools and methodologies, the use of labour force surveys (LFS) and other existing data sources in the countries as well as close interaction with the two countries' stakeholders at central and sectoral levels.

The analysis focused on two preliminary priority areas identified as a result of the smart specialisation process:

- Montenegro: (i) renewable energy source development, and (ii) sustainable health tourism; and
- Moldova: (i) agriculture and food processing, and (ii) energy.

The methodology applied is a comprehensive package and includes:

- assessment, from a quantitative perspective, of the skills dimension (supply and demand) in terms of qualifications (measured through the education level obtained), occupations and skills, taking into consideration demographic characteristics, such as sex, age and region;
- design of interview questionnaire (qualitative) and conducting of interviews (explorative in-depth semi-structured interviews) with employers, employees and other key stakeholders such as incubators, the Chamber of Commerce and Industry, central and local public administration;
- analysis of the relatedness of qualifications, occupations and skills (QOS) in the priority areas with similar/compatible QOS in shrinking areas with a view to identify possible alternative uses of skills;
- review of the content of existing training offer for initial vocational education and training (IVET), continuing vocational education and training (CVET), MSME training and other types of skills;
- identification of current and emerging skills trends and eventual gaps, in terms of QOS; and
- analysis of the capacity of training providers to match emerging requirements and develop recommendations for improving training content.

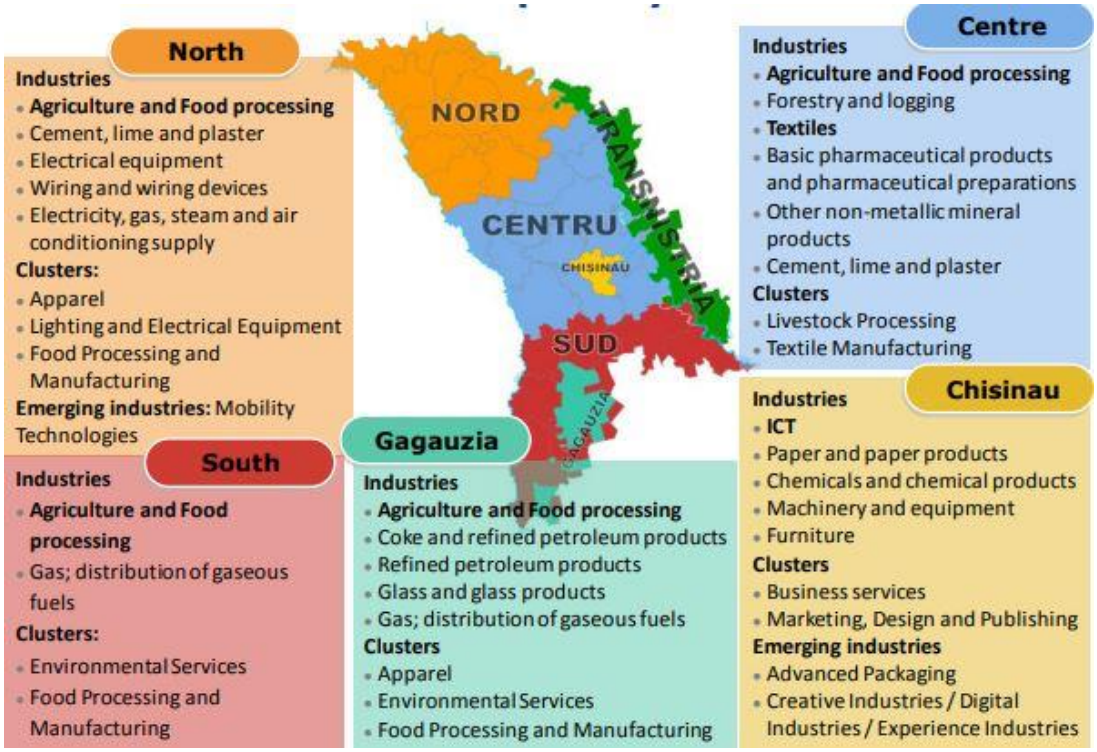
1.3 Moldova – the second pilot country

In 2016, the Smart Specialisation Platform of the Joint Research Centre started a pilot project addressing the needs and gaps in research and innovation by supporting processes in countries outside the EU, including Moldova.

The mapping of economic and innovation potential in Moldova was implemented in 2018, focusing on five regions: municipality of Chișinău, North, Centre, South and the autonomous territorial unit of Găgăuzia. For the mapping of economic potential, three main dimensions for smart specialisation and innovation policy were taken into consideration: economic, innovative and scientific potential (see Box 1.1). The mapping identified preliminary priority areas that were the entry point for the ETF to test the approach to analysing human capital as a key resource for growth and competitiveness.

BOX 1.1 OVERVIEW OF THE SMART SPECIALISATION PROCESS IN MOLDOVA (ONGOING)

The JRC (2018a) analysis on mapping of economic, innovative and scientific potential in Moldova resulted in the identification of preliminary economic priority areas for the five chosen regions as presented below.



The following preliminary priority areas based on innovation potential were identified: agriculture and food processing, in particular food chemistry (international patents) and wine, foods, planting (national patents); and pharmaceuticals (international patents). For scientific potential, the following were identified: agricultural and biological sciences; computer science; energy; and chemistry and chemical engineering. The preliminary priority areas were further analysed, and relevant actors identified (JRC, 2018b).

It is important to note that the preliminary priority area of energy was relabelled from 'renewable energy' in order to accommodate also the oil industry. For each of the identified areas, entrepreneurial discovery workshops were organised, aiming at identifying the main smart specialisation niches, that would then contribute to the efficiency of the research process geared to the needs of the national or regional economy.

Development of the smart specialisation strategy is ongoing, under the coordination of the Ministry of Education, Culture and Research.

When the analysis was done, the process to develop a smart specialisation strategy was still ongoing. Currently, the main related strategic documents are the Innovation Strategy of the Republic of Moldova for the Period 2013–2020: Innovations for Competitiveness and the Research and Development Strategy of the Republic of Moldova until 2020.

For the purpose of this study, two preliminary priority areas for smart specialisation were selected by the Ministry of Education, Culture and Research (MECR), namely 'energy and agriculture' and 'food processing'. This selection also reflects the results of the mapping, data availability and relevance to VET.

Given the broad scope of both preliminary priority areas, the following decisions were made. First, the analysis of the energy preliminary priority area began from a broader analysis of the energy industry. However, due to the size of the industry, when specifically addressing skills implications, the decision was made to focus just on renewable energy, not energy overall. In other elements, the wider energy industry is discussed[1]. Second, based on the request of the MECR, the analysis of agriculture and food processing focuses on food processing.

This paper presents the methodology and findings from the analysis in Moldova, including challenges and adaptations to the methodology done during the pilot phase, and the main findings related to innovation potential in the two priority areas and the skills development dimensions. Finally, it unpacks a set of key lessons and recommendations. In 2020/21, the ETF is further enriching the methodology to finally present a methodological toolkit that draws on the diverse methods – e.g. qualitative and quantitative methods – for countries to apply in addressing skills implications of smart specialisation strategies. The toolkit will also contain the outcomes and lessons learned as well as main conclusions and recommendations.

The report is made up of several chapters. Chapter 2 provides a detailed methodological section describing the research design, data collection tools, data sources and study limitations. Chapter 3 includes a short overview of the country's socio-economic context and key evidence related to labour market and skills. Chapters 4 and 5 look at the skills dimensions of the two priority areas (energy and food processing). Each preliminary priority area for smart specialisation is analysed with the focus on the current labour market situation in terms of occupations and skills within the priority areas, current education and training offer, and the impact of the economic prioritisation on the skills demand and supply. The analysis relies on both quantitative and qualitative research methods. Chapter 6 concludes with key findings and recommendations. Annexes, including the methodological guidance for qualitative analysis and the list of interviewed stakeholders, are included at the end of the report.

[1] This choice was made as earlier on in the smart specialisation process, the preliminary priority domain was renewable energy and only later renamed energy.

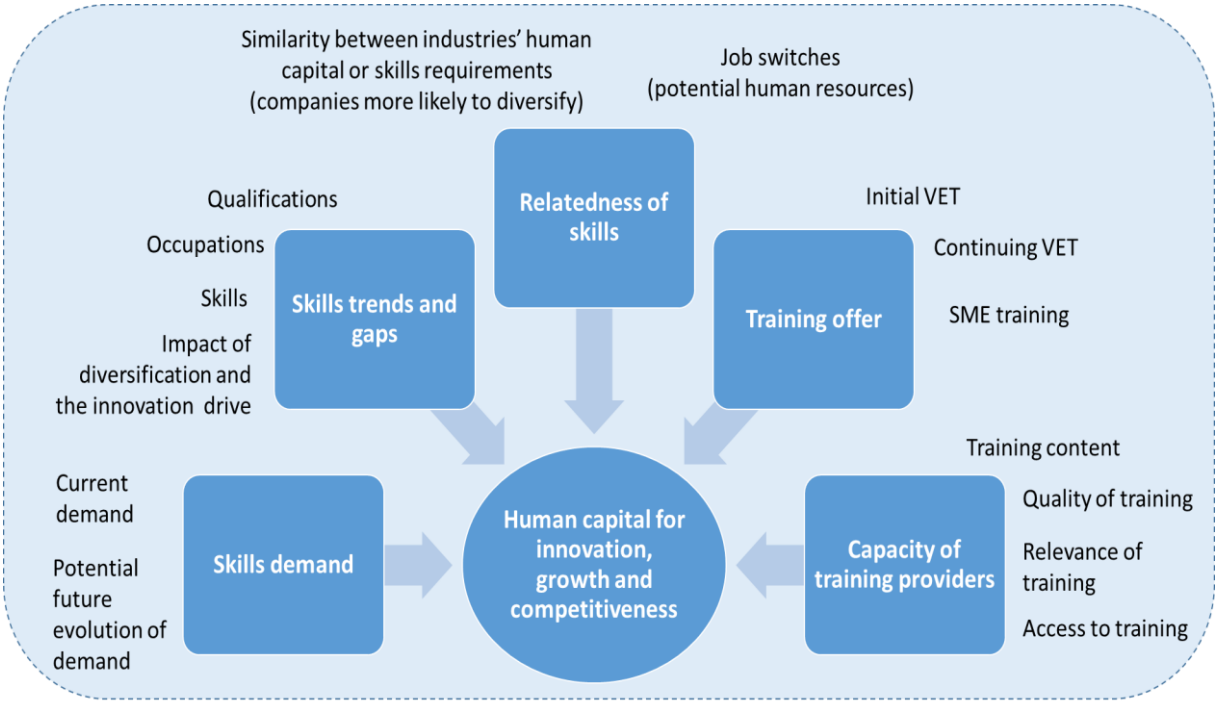
2. METHODOLOGY

The analysis relied on the preliminary results of the smart specialisation process coordinated by the Joint Research Centre together with national institutions. In general, the process consisted of three main parts. First, existing national and international data was analysed, including selected key socio-economic data as well as data related to the number and type of patents and scientific publications, with the aim of identifying preliminary priority areas for smart specialisation. Second, the analysis of identified preliminary priority areas was implemented through topic modelling of patents, publicly funded R&D projects and scientific publications to provide more detailed information on the selected areas and to identify emerging specialisation topics. Third, inter-institutional and participative entrepreneurial discovery workshops were organised at national/regional level to build on the collected evidence and to identify main smart specialisation niches.

Moreover, it took into account the relevant policy setting in the preliminary priority areas and, within it, the area of VET and continuous education, and the institutional arrangements for engaging representatives of non-state actors in education and training, i.e. sectoral committees or similar collaborative formats. The analysis relied on existing ETF tools and methodologies, e.g. labour market analysis, skills mismatch analyses, skills needs anticipation, Small Business Act (SBA) and holistic analyses of VET systems, such as the ETF's Torino Process.

As presented in Figure 2.1, the main goal was to analyse the implications for human capital development of innovation, growth and competitiveness in two priority areas chosen from those selected for smart specialisation. The analysis included the assessment of skills supply and demand; analysis of skills trends and gaps; relatedness of skills; mapping of training offer; and analysis of training providers' capacity to respond to emerging trends or new skills requirements.

FIGURE 2.1 KEY ELEMENTS IN THE METHODOLOGICAL DEVELOPMENT

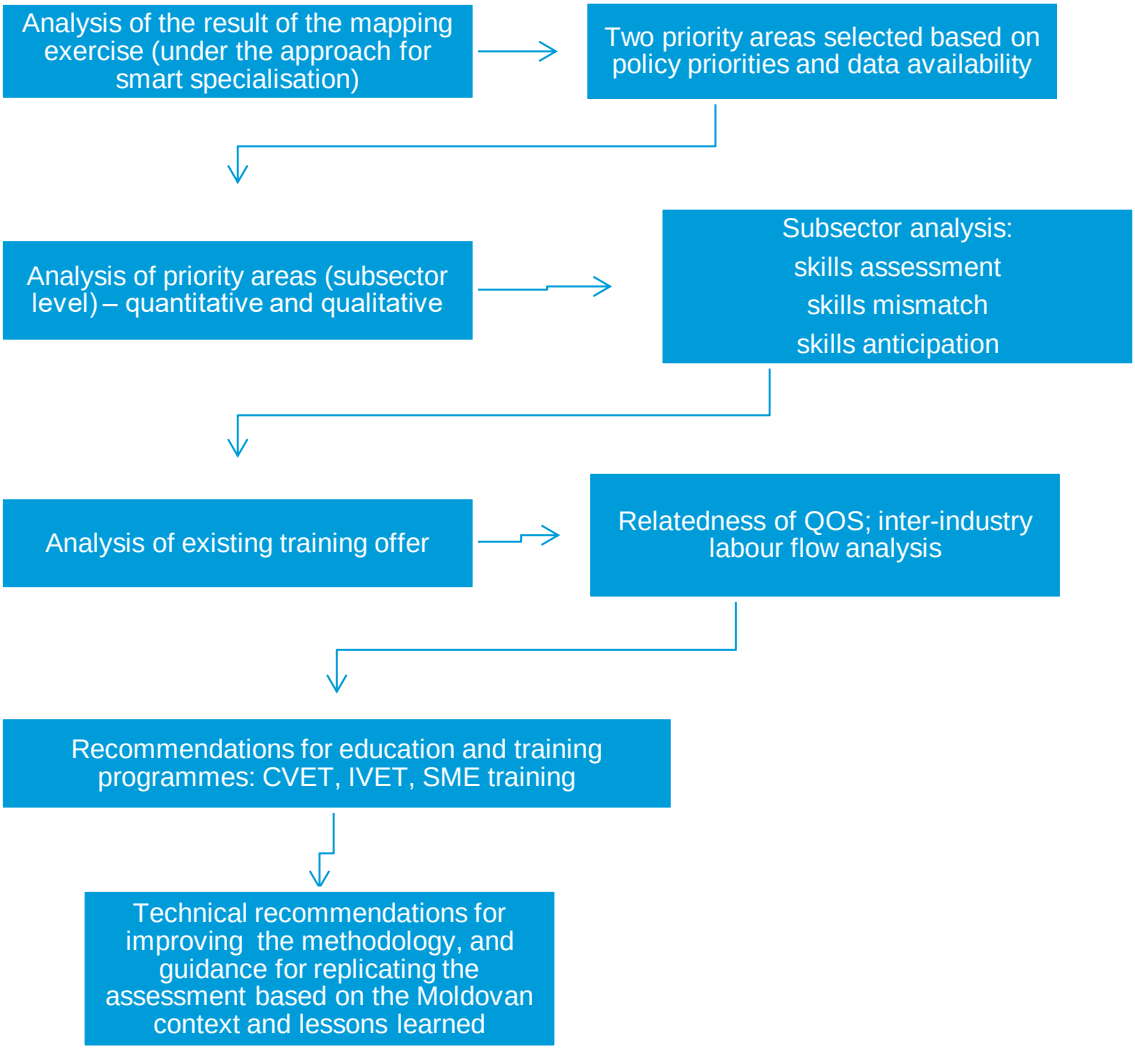


The methodological approach tested has three modules (see also Figure 2.2):

1. analysis of two priority areas identified in the (draft) smart specialisation strategy or other relevant analysis (specifically in terms of employment, occupational and education profile);
2. analysis of the relatedness of QOS in the priority areas; and
3. assessment of existing training offer and content, including the potential to respond to newer skill sets generated by the economic prioritisation.

The analysis combined secondary data analysis, qualitative interviews with relevant stakeholders and desk research of existing studies in the country or internationally. The primary aim of the analysis was to use existing data sources and to test to what extent they enable the key research objectives to be achieved and what the limitations that need to be taken into account are. The targeted data included both survey and administrative sources, managed by different institutions, such as the statistical office, ministries or agencies in charge of employment, education and other relevant fields.

FIGURE 2.2 SUMMARY OF THE METHODOLOGICAL APPROACH



In Moldova, the methodology was tested in two preliminary priority areas for smart specialisation: energy, and agriculture and food processing. The choice was mainly driven by the policy priorities of the MECR as well as data availability initially assessed by the country experts.

As already specified above, the following choices were made to narrow the scope of the analysis. First, when assessing the preliminary priority area of energy, the focus is on renewable energy. This is particularly the case when the skills implications are discussed. Second, based on the agreement with the MECR, the analysis of the second preliminary priority area was limited to food processing.

The following sections present the objectives, data collection methods, data needs and limitations of the three modules tested in Moldova.

2.1 Module 1. Skills assessment for the two priority areas

Objective: to analyse the characteristics of the priority areas in terms of occupations, level of education and skills profiles, mismatch incidence and wages.

The main goal of this module is to analyse the characteristics of the two preliminary priority areas for smart specialisation, based on occupation, qualification and skills profiles, the available data and stakeholder interviews. A skills supply and demand analysis for two priority areas is undertaken, as well as anticipation of skills trends and identification of skills gaps. Quantitative and qualitative data collection tools are used in this first module.

The assessment is carried out at subsectoral level. This requires data at level 3 of the four-level NACE classification of economic activities. However, the preliminary priority areas for smart specialisation do not necessarily follow the NACE classification. Smart specialisation often addresses new areas and specialisations; the preliminary priority areas are usually presented at a more aggregate level and may thus consist of several other sectors or subsectors. Subsectoral approaches to skills anticipation are crucial to economic and skills anticipation, as various subsectors have very different skills needs due to the characteristics of different economic activities they pursue and the technologies associated with them.

This requirement related to skills data in the context of smart specialisation presents a challenge as the regularly collected data in countries, in particular data on employment and skills profiles, is often not available at such a disaggregated level or has limited reliability. This is also the case in Moldova. Thus, the analysis combines different data sources that allow for a higher or lower level of data disaggregation. In addition, secondary data analysis is combined with qualitative interviews with selected representatives of the preliminary priority areas and desk research to provide additional evidence, which is not possible to obtain through quantitative data.

Considering the specific context and limitations, the analysis of each preliminary priority area was focused on:

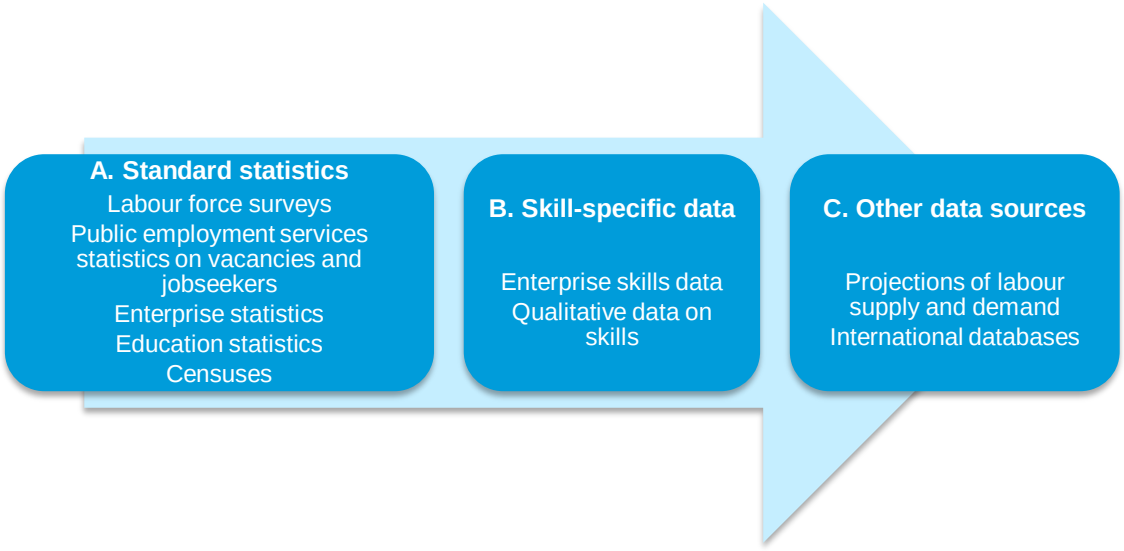
- gaining a sound understanding of the subsector(s) of interest, the key drivers of change, and interlinkages with other parts of the economy; and
- developing a profile of occupations, jobs and human capital, with a focus on skills aspects.

Key data and information sources

A combination of quantitative and qualitative techniques is used: interviews with key actors and stakeholders; descriptive analysis of relevant data related to employment, skills and education; and desk research using existing data, studies and reports. This combination is necessary to overcome limitations in data availability at subsectoral level, which is crucial for this type of study.

Figure 2.3 gives a general overview of the data sources considered for this study.

FIGURE 2.3 DATA SOURCES FOR ANALYSIS OF SKILLS SUPPLY AND DEMAND



Quantitative analysis

The main quantitative data used for the analysis was LFS (e.g. data disaggregated by sectors and International Standard Classification of Occupations (ISCO) groups), survey and administrative data on companies, wages/revenues and vacancies.

Depending on data availability, the analysis is focused on (i) socio-demographic variables (gender, age); (ii) variables which denote status in the labour market (employed, unemployed, inactive); (iii) occupation (by standard classification) and industry (sectors) for the employed; (iv) level and field of education; (v) wage level; (vi) participation in formal and informal education; and (vii) industry and size of the company, place of work, required qualifications, and number of vacancies per position.

The following data collected in Moldova was considered in the preliminary stage of the analysis:

- administrative data related to employment, registered unemployment and vacancies from the National Employment Agency (NEA) (see Table 2.1); and
- survey and administrative data, such as LFS data, from the National Bureau of Statistics of the Republic of Moldova (NBS) (see Table 2.2).

TABLE 2.1 OVERVIEW OF DATA AND DATA SOURCES FOR SECTORAL/SUBSECTORAL APPROACH PROVIDED BY NEA

Indicator	Disaggregation
Job vacancies	Monthly, by locality and occupation
Unemployment structure	Registered unemployed people according to education, age, reasons for being unemployed, duration of unemployment
Active measures to stimulate employment	Number of participants in the following measures: labour mediation services, management of vacancies, professional information and advisory services, and vocational training

Indicator	Disaggregation
Passive measures for the social protection of unemployed people	Structure and number of unemployment benefit beneficiaries; structure of beneficiaries of professional integration or reintegration allowance; duration of receipt of unemployment benefits and professional integration or reintegration allowance
Of which:	
Number of registered unemployed people receiving employment services	Individuals: by age, sex, level of education, prior work experience, benefit receipt, disability, unemployment spell, migrant status, other disadvantage
Number of registered unemployed people participating in active labour market programmes	Individuals: as above Service/programme: labour market training, recruitment subsidy, self-employment schemes, internships, public works/local employment initiatives
Coverage of the target population	Individuals: as above Service/programme: as above
Average cost per participant	Service/programme: as above
Employment rates (gross)	Individuals: as above Service/programme: as above Employment: type (waged employment, self-employment), contract duration, occupation, average earnings, skills matching, social protection entitlements, usefulness of service/programme
Average cost per placement	Service/programme: as above
Percentage of job vacancies filled	Vacancy: occupation, size of enterprise, economic sector

TABLE 2.2 OVERVIEW OF DATA AND DATA SOURCES FOR SECTORAL/SUBSECTORAL APPROACH PROVIDED BY NBS

Performance indicator	Disaggregation
Employment	By status in employment, economic activities, occupations, forms of ownership of the unit/enterprise, level of education, age groups, sex, area, working hours
Inactive population	By level of education, main reason for not working, marital status, age groups, sex and area
Informal sector	By age groups, economic activities, status in employment, type of unit/enterprise, type of job, sex and area
Labour force migration	Population aged 15 years and over, working or looking for work abroad by level of education, country of destination, statistical regions, age groups, sex, area
Unemployment	By sex, area, level of education, unemployment duration, age groups
Labour cost	Labour force expenditure by economic activities and per employee
Mobility of employees and number of jobs	The number of job vacancies and mobility of employees by economic activities
Number of employees	Number of employees by economic activities, forms of ownership, sex, region
Vocational training	The number of employees participating in CVET by economic activities
Other relevant indicators	Population aged 15 years and over by statistical regions, labour status, level of education, age groups, sex and regions

As previously mentioned, it was not always possible to access the disaggregated data at subsectoral level. For example, the existing LFS data does not allow for disaggregation at level 3 or 4 of the NACE classification. Therefore, where needed, data at sectoral level was used, which is of course a compromise between the existing data and the ideal level of accuracy. In addition, NEA and NBS data sets are not compatible when it comes to the classification of economic activities and occupations.

Qualitative analysis

To complement the quantitative data, additional qualitative evidence was collected. The reason was the insufficiency of existing quantitative data in terms of availability and reliability. Data collected through qualitative tools helped explain the context and add value to the numbers, but the primary aim was not to obtain statistically representative evidence.

The qualitative analysis was carried out through in-depth interviews and/or consultations (done face-to-face, by phone or online) with relevant stakeholders, using a clear set of guiding questions and/or questionnaires. Interview guides for the three main target groups (see below) were developed and tested.

The main topics covered in Moldova were skills needs; skills gaps; vacancies; training activities (or human resource development strategies more generally); strategies to attract and retain specialised workforce; bottlenecks in company development; and sectoral development priorities.

Three main target groups were identified for gathering such insights:

- companies active in the respective priority areas and business/employers' associations;
- employees of the respective companies; and
- representatives of central and local public administration and professional associations relevant for the respective priority areas.

In addition to interviews, the qualitative analysis includes (i) analysis and overview of the relevant strategic framework, (ii) review of relevant national reports and studies, and (iii) global trends and skills needs.

2.2 Module 2. Relatedness of qualifications, occupations and skills

Objective: to assess the relatedness of QOS in the selected priority areas for growth and smart specialisation (sectors/subsectors) with similar/compatible QOS in shrinking economic areas, with the aim to identify possible alternative uses of skills.

This module seeks to answer the following questions: How mobile are workers across industries? Which industries can easily exchange labour? Such questions matter, because on the one hand, shocks to an economy's industrial structure require the transfer of productive capacity, and thus of workers, from shrinking to growing industries. On the other hand, labour mobility transfers the know-how of workers across firms, industries and locations. This makes labour mobility an important factor in organisational learning (Simon, 1991) and regional and national growth (Saxenian, 2006).

The module also seeks to provide answers to other important questions: How large is the set of industries a worker chooses from when he or she changes jobs? Do different types of workers switch within the same industry, i.e. do they follow the same industrial transition matrix? To what extent do the mobility constraints expressed in this network prevent an economy from reallocating labour from shrinking to growing industries? While these questions are relevant for studying skill relatedness, data limitations in many countries restrict the analysis.

The conceptual starting point is that, if jobs require industry-specific human capital, the mobility of workers across industries will be constrained, and inter-industry labour flows will be shaped by those constraints.

Analyses of inter-industry labour flows should answer several questions that are important for understanding QOS relatedness.

- Do workers often switch jobs between industries that belong to different sections of the industrial classification system?
- Which developing/growing industries mainly absorb labour flows from shrinking industries?
- Does the structure of inter-industry transitions change over time?

The final aim of QOS analysis should then be to derive several stylised facts using the data described on:

- the general structure of the labour flows in terms of the amount of job switches;
- the degree to which labour flows concentrate in relatively few industry pairs;
- the general structure underlying these flows by plotting the skill-relatedness network and comparing the skill-relatedness matrices for different labour market segments;
- how skill relatedness affects local labour markets by estimating local industry growth regressions; and
- the extent to which the limited mobility of workers across industries could potentially hinder efficient reallocation of workers from shrinking to growing industries.

Analysis of the inter-industry labour flows should reveal how industries are connected to one another in terms of their human capital requirements. QOS analyses focus on cross-industry labour flow patterns; flexibility (ability of an industry to absorb workers who leave another industry); the skill-relatedness structure of labour flow matrices, where the size of labour flow will depend on the size and flow rates (the fraction of employees switching jobs) of the industries involved; comparing skill relatedness across labour market segments; skill relatedness and the growth of local industries; and skill relatedness and reallocation frictions.

Key data and information sources

To study labour flows, ideally the administrative or survey data would be used to follow individual trajectories of workers in terms of their job switches, employment characteristics, economic sectors or specific businesses.

Unfortunately, such data does not exist in Moldova. Therefore, the element of relatedness could only be discussed to a very limited extent, using the existing literature and qualitative interviews. The related analysis is thus only an indication of the potential of related sectors to provide skills supply to the priority areas and further research should be done to analyse more comprehensively this specific area.

2.3 Module 3. Assessment and anticipation of the training offer and training needs for selected subsectors

Objective: to map the existing education and training offer, both initial and continuous, relevant to the selected priority areas and understand to what extent it can respond to skills gaps and identified needs.

The review and assessment of existing training offer covers IVET, CVET, tertiary education and other types of skills (e.g. transversal and managerial) in the priority areas for smart specialisation. In addition, the aim is to map the existing training provided to businesses.

The following information was gathered: IVET, CVET and tertiary education providers; students enrolled on and graduates of education programmes relevant for the sectors/subsectors in question; existing qualifications in these sectors; and offered education and training programmes. Sources for such data are administrative and managed by different institutions.

The information on availability and quality of education and training offer was matched with the outcomes of skills needs assessment and anticipation, done in the first and second modules. Such comparison determines existing or emerging gaps, and eventual requirements for review of the content of qualifications, curricula or modalities of training provision in the priority areas.

Key data and information sources

The analysis relied on the data published by the MECR as well as the NBS. The following information was gathered: a list of accredited IVET and CVET providers; the number of students per sector in IVET; and a list of training programmes or number of graduates per programme.

The information related to existing programmes in both IVET and CVET was incomplete. Therefore, additional information had to be collected directly from the education and training providers. In addition, the structured data on training provided at the workplace was missing. Finally, we were not able to collect information on training provided to businesses. In such cases, evidence gathered through qualitative interviews and existing studies was used.

2.4 Limitations and considerations revealed by testing in Moldova

The study aimed to analyse the two selected preliminary priority areas in terms of skills needs and gaps and the potential of existing education and training to match the skills demand, reflecting the economic prioritisation and the ideal set of skills needed for the development of the selected priority areas. To do so, disaggregated data at subsector level was needed to be able to analyse employment, wage and education patterns. The analysis aimed to rely primarily on existing data sources that are regularly collected in the country and to test the feasibility of the theoretical methodological approach in the country context.

The experience in Moldova highlighted the following limitations that need to be accounted for during the revision of the methodological approach.

Accessibility and reliability of data at subsector and local level is limited

Moldova has a solid labour market information system, i.e. the key data sources, such as the LFS, annual survey of enterprises or the monitor of vacancies, are conducted regularly and are accessible

in the forms of tables and reports. However, the range of information collected[2] or the level of disaggregation is limited. For example, the LFS data, which should theoretically allow us to analyse the employment profile of the subsector(s), only provides information at the aggregated sectoral level, which limits the precision of analysis that we aimed for.

Combination of different data sources and data source types (administrative and survey data) requires attention to data comparability and consistency during the data interpretation process

In the context of limited data availability as well as the complexity of the topic studied, there is a need to explore different data sources. Each data source has its limitations that need to be taken into account and which necessarily influence the comparability of the data obtained. This is, in particular, the case of administrative versus survey data. In addition, the use of different classifications, for example in the case of occupations, further influences the consistency of the results.

Systematic data on CVET training as well as training provided to enterprises is limited

The analysis aimed at mapping the training provision relevant to the selected priority areas. Given the assumed importance of CVET and training provided to businesses (SMEs in particular), it was important to map this type of provision. Yet, relevant and systematically collected evidence is absent. The information was thus gathered directly from training providers as well as through qualitative interviews. Consequently, the obtained evidence does not necessarily provide a comprehensive picture.

Data allowing study of labour flows is not available

To study the labour flows and, consequently, the relatedness, there is a need for very specific data (e.g. administrative or panel data) that would allow trajectories of individual workers to be followed. In this way, we could identify sectors that could be potential 'suppliers' to the preliminary priority areas. As this data is not available in the country, the relatedness analysis could not be performed.

Absence of smart specialisation strategy and clear indications on specific niches within the priority areas influences the level of detail provided when assessing the potential response of the education and training provision

The analysis of skills implications was done when the smart specialisation process in Moldova was underway. This meant that we made assumptions with respect to the innovation niches that the country would eventually decide on and drew more general conclusions regarding the education and training provision.

The revised methodology needs to account for the identified challenges and find ways to overcome them. At the same time, it needs to reflect the real capacity of the country if the aim is to offer a user-friendly toolkit that can be replicated within the remaining priority areas. One of the opportunities could be to strengthen the data collection for qualitative research to compensate for quantitative data limitations. Another way forward is to systematise the analysis of existing research for the selected priority areas and strengthen the structured dialogue and exchange of good practices between the respective country or region involved in the smart specialisation process and innovation leaders, including employers and training providers.

[2] For example, the information collected through the enterprise survey focused primarily on gathering information concerning the number of employees by economic activities, sector, sex, territory and wage distribution. However, detailed data on skills needs and gaps is missing.

3. ECONOMIC CONTEXT AND THE ROLE OF SMES IN MOLDOVA

This chapter provides key contextual information on the socio-economic development in Moldova. Also, it looks at the structure of the employed population in terms of education and occupational profile.

3.1 Socio-economic context

Moldova is a lower-middle-income country that has experienced positive economic growth in recent years. Remittances play an important role: in 2018, they accounted for 16% of gross domestic product (GDP) (World Bank, WDI).

In 2015, Moldova's economy suffered greatly when a banking scandal erupted, triggering high inflation and a market crisis. However, it recovered relatively quickly and the economy grew by 4% in 2018. The recovery was driven mostly by the favourable economic conditions of Moldova's major trading partners and increasing disposable income supported by tax cuts, wage increases and remittances. In 2019, GDP growth was estimated at 3.6%. However, it declined sharply in the last quarter to 0.2% as a result of decreased exports and investments. The projected medium-term outlook for the economy was negative even before the Covid-19 crisis. The current crisis is expected to have additional negative impact on economic growth and further widen the fiscal deficit as well as public debt (World Bank, 2020).

Moldova is heavily dependent on Russia due to its importance in regional trade flows. However, exports are increasingly redirected towards the EU. This trend was likely amplified by the Deep and Comprehensive Free Trade Area (DCFTA) which Moldova entered with the EU in July 2016.

In the beginning of 2019, the inflation rate was 5.8%, compared to the inflation rate of 0% recorded in the same period the previous year. The annual inflation rate, when comparing October 2019 and October 2018, reached 6.8%, which exceeded the upper limit of the inflation target variation range established by the National Bank of Moldova, set at 5% (+/-1.5%).

The volume of industrial production increased by 2.7% between January and September 2019. The main factors that kept the industrial sector growing were the development of the automotive branch and positive developments in the construction sector. Manufacturing is driven largely by its traditionally strong food processing sector, which accounts for 37% of manufacturing production (OECD et al., 2020a). The inflow of direct foreign investments in 2018 amounted to USD 189.2 million, including 24.8% in the processing industry and 13.2% in energy (INCE, 2018).

According to the NBS, the gross monthly average earning per employee was MDL 7 204 (EUR 369) between January and September 2019. It was an increase of 15% in nominal terms if compared to a similar period in 2018. In real terms, the salary increased by 10.5%. Within the budgetary sector, the average monthly salary was MDL 6 660 (EUR 341); in the real sector (in nominal terms), it was MDL 7 408 (EUR 379).

In 2018, the economically active population of Moldova consisted of 1.2 million people, a 2.5% increase compared to 2017. The activity rate for the population aged 15+ was low at 43.3% in 2018, while more men were active than women. In 2018, the employment rate of the population aged 15+ was 42.0%, a slight increase compared to 2017 when the employment rate was 40.5%. The 2018 distribution of employed people showed that 36.1% of employed people worked in agriculture, 16.5%

in industry and construction and 47.4% in services. The number of unemployed people was estimated at 38 000 in 2018, showing a decrease in comparison to 2017. Unemployment particularly affected men and people in urban areas. In 2018, the unemployment rate was 3.0% for the adult population aged 15+. Among young people aged 15 to 24, the unemployment rate was 7.4%, and 5.6% for those aged 15 to 29. In 2018, the share of young people not in employment, education or training was 27.1% of the total number of young people aged 15 to 29 (NBS).

Although the National Development Strategy Moldova 2020 is the main strategic economic policy document, the EU–Moldova Association Agreement, the DCFTA provisionally applied since 2014, and the International Monetary Fund programme that followed the banking crisis in 2015 have been important in shaping policy developments in Moldova, stimulating the speed and depth of economic and financial policy reforms (OECD et al., 2020a).

Moldova has recently developed a new National Development Strategy, Moldova 2030, which is aligned with both the EU Association Agreement and the United Nations' 2030 Agenda for Sustainable Development. This document will contribute to the strategic allocation of budgetary resources, according to the objectives set for its four basic pillars: (i) sustainable and inclusive economy, (ii) strong human and social capital, (iii) fair and efficient institutions, and (iv) healthy environment. Although the strategy does not have specific targets for SME development, many of the priority actions highlighted in the document aim to support entrepreneurship (OECD, 2020). Once finalised, the smart specialisation strategy will contribute to achieving the goals set in Moldova 2030.

3.2 Innovation context

In 2016, the Horizon 2020 Policy Support Facility conducted a review of the research and innovation system in Moldova. As per the recommendations that resulted, the government empowered the MECR to develop public policies in the field of R&D, and, in 2018, the National Agency for Research and Development (NARD) was established.

NARD is a central administrative authority under the Government of the Republic of Moldova, founded by Government Decision No 196 of 28 February 2018. NARD is the legal successor of the Centre of International Projects, Agency for Innovation and Transfer Technology and Agency for Research and Development, all public institutions under the Academy of Sciences of Moldova. It is responsible for the implementation and funding of the research, innovation and development of national policy, the EU Framework Programme for Research and Innovation: Horizon 2020, and other European programmes and coordination of the Moldovan Office for Science and Technology in Brussels. NARD also offers grants and tax incentives to SMEs to support innovative projects.

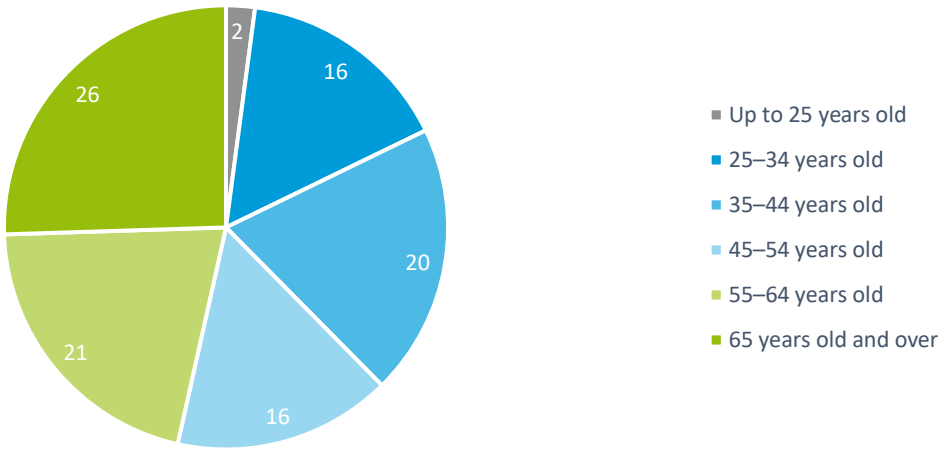
The new National Programme for Research and Innovation 2020–2023 aims to address the recommendations of the Horizon 2020 Policy Support Facility and to adopt and transpose the principles of smart specialisation. The programme has a comprehensive vision on research and innovation and addresses the fragmentation created by the existence of two sectoral strategies: Research and Development Strategy of the Republic of Moldova until 2020, approved by Government Decision No 920/2014, and the Innovations for Competitiveness 2013–2020 Innovation Strategy of the Republic of Moldova, approved by Government Decision No 952/2013. The programme complies with the provisions of the Code on Science and Innovation of the Republic of Moldova No 259/2004 with further amendments. At the same time, its actions are congruent with the activities stipulated in the 2019–2021 Roadmap for the Integration of the Republic of Moldova into the European Research Area, approved by Government Decision No 1081/2018, building the capacity necessary for the research and innovation system to explore the opportunities resulting from the status of being a country

associated with EU research and innovation framework programmes and promoting the national priority of integration in the European Research Area.

As of early 2019, there was one scientific-technological park and eight innovation incubators present in Moldova.

A career in research is not at the top of young people's preferences: in 2018, there were 1 569 PhD students, about 50 and 100 fewer people than in 2017 and 2016 respectively. The number of researchers per million inhabitants is 4.5 times lower in Moldova than the European average. Other negative phenomena affecting the quality of staff involved in research are emigration and increasing average age (in 2019, about 26% of researchers were aged 65 and over) (NARD, 2019).

FIGURE 3.1 AVERAGE SHARE OF RESEARCHERS BY AGE GROUP, 2019



Source: NBS (2019)

According to a survey by the NBS, in the period 2017–18, there were 605 innovative enterprises (18% of the total number of enterprises included in the research). This number is 10% lower compared to 2015–16. Of the total number of innovative enterprises, 378 (62%) are small enterprises with 10–49 employees; 163 (27%) are medium-sized enterprises with 50–249 employees; and 64 (11%) are large enterprises with 250 employees or more. Thus, in total there were 541 SMEs with innovation activity, or 89% of the total number of innovative enterprises. Overall, 317 innovative enterprises were active in industry, of which 271 were SMEs (85%), and 288 innovative enterprises were active in services, of which 270 were SMEs (94%).

TABLE 3.1 NUMBER OF INNOVATIVE ENTERPRISES BY SIZE AND DEVELOPMENT REGIONS, 2017–18

	Total	Chișinău	North	Centre	South	Găgăuzia
Total	605	389	87	69	39	21
Small: 10–49 employees	378	257	42	47	19	13
Medium: 50–249 employees	163	89	30	18	18	8
Large: 250+ employees	64	43	15	4	2	–
Industry – total	317	168	58	52	25	14
Small: 10–49 employees	168	94	21	35	9	9
Medium: 50–249 employees	103	48	22	14	14	5
Large: 250+ employees	46	26	15	3	2	–
Services – total	288	221	29	17	14	7
Small: 10–49 employees	210	163	21	12	10	4
Medium: 50–249 employees	60	41	8	4	4	3
Large: 250+ employees	18	17	–	1	–	–

Source: NBS (2019)

TABLE 3.2 INNOVATION BY TYPE

	2015–16		2017–18	
	Number of enterprises (units)	Structure of innovative enterprises (%)	Number of enterprises (units)	Structure of innovative enterprises (%)
Total enterprises included in the research	3 233	–	3 326	–
Innovative enterprises – total, of which:	**673**	**100.0**	**605**	**100.0**
Enterprises that have made several types of innovations (product, process, methods of organisation and marketing)	276	41.0	244	40.3
Innovative product and/or process companies, from which	155	23.0	119	19.7
■ innovative product-only enterprises	57	8.5	51	8.4
■ innovative process-only enterprises	56	8.3	37	6.1
■ innovative product and process enterprises	42	6.2	31	5.1
Innovative enterprises of organisation and/or marketing methods, from which	242	36.0	242	40.0
■ innovative enterprises only of organisational methods	72	10.7	81	13.4
■ innovative enterprises only of marketing methods	99	14.7	91	15.0
■ innovative enterprises of organisational methods and marketing methods	71	10.5	70	11.6

Source: NBS (2019)

Out of the total number of innovative enterprises, 40% achieved several types of innovations at the same time (of products, processes, methods of organisation and marketing), 20% achieved product and/or process innovations, and 40% achieved innovations in organisation and/or marketing.

Moldova performs relatively well with regard to the policy framework for non-technological innovation and diffusion of innovation. However, at the regional (subnational) level, few actions to support science exist. There are large differences between the capital and the rest of the country, especially for economic development as well as the scope of research activities. According to the National Strategy for Regional Development, the structures for regional development have been created and a financial instrument has been established. At the same time, these support tools are not used for R&D funding.

The law on public procurement introduces the concept of 'innovation partnerships', whereby contracting authorities effectively create incentives to invest in innovation by committing to acquiring goods or a service that is not yet available in the market. However, a constant vulnerability of the scientific activities' relevance is related to the weak connection between the scientific community and the business environment.

The result of the lack of dialogue between representatives of the two spheres at the national level is that the business environment insufficiently implements results from research in practice and fails to absorb new technologies (including from outside). According to data from the 2015–16 Innovation Activity of Enterprises in Moldova study by the NBS, regarding cooperation on the innovation of products and processes, only 13% of the innovative enterprises considered universities and research institutions to be cooperation partners, 28% considered equipment, materials, components or software providers to be cooperation partners, 26% considered other enterprises to be cooperation partners and 25% considered clients or buyers to be cooperation partners (NARD, 2019).

3.3 The role of SMEs

SMEs are the backbone of the Moldovan economy and represent 98.6% of all enterprises. SMEs are also an essential driver of job creation by employing 61.1% of the labour force (IRENA, 2019).

While SMEs played a significant role in the upswing of the Moldovan nonfinancial business economy, in 2016–17, SME value added increased by 30.0%. However, SME employment stagnated. At the same time, the value added growth of large firms rose by only 3.1%. From 2014 to 2017, the most important growth driver for SME value added was wholesale and retail trade, which generated a cumulative rise in value added of 65.1%, contributing an average of one-third (34.2%) of total SME value added. This increase in overall SME value added was accompanied by strong SME productivity growth of 50.7% but a rise of just 0.3% in SME employment (European Commission, 2019a).

The new definition of SMEs adopted in 2016 is in line with EU and international good practices. It uses employment, turnover and balance sheet criteria to determine whether a company is a micro, small or medium enterprise. While the employment criteria are consistent with the EU definition, thresholds for turnover and assets are lower in Moldova, reflecting Moldova's lower per capita incomes. Table 3.3 shows these thresholds and definitions, and these are the parameters used when referring to MSMEs in the file.

TABLE 3.3 DEFINITION OF MSMES IN MOLDOVA

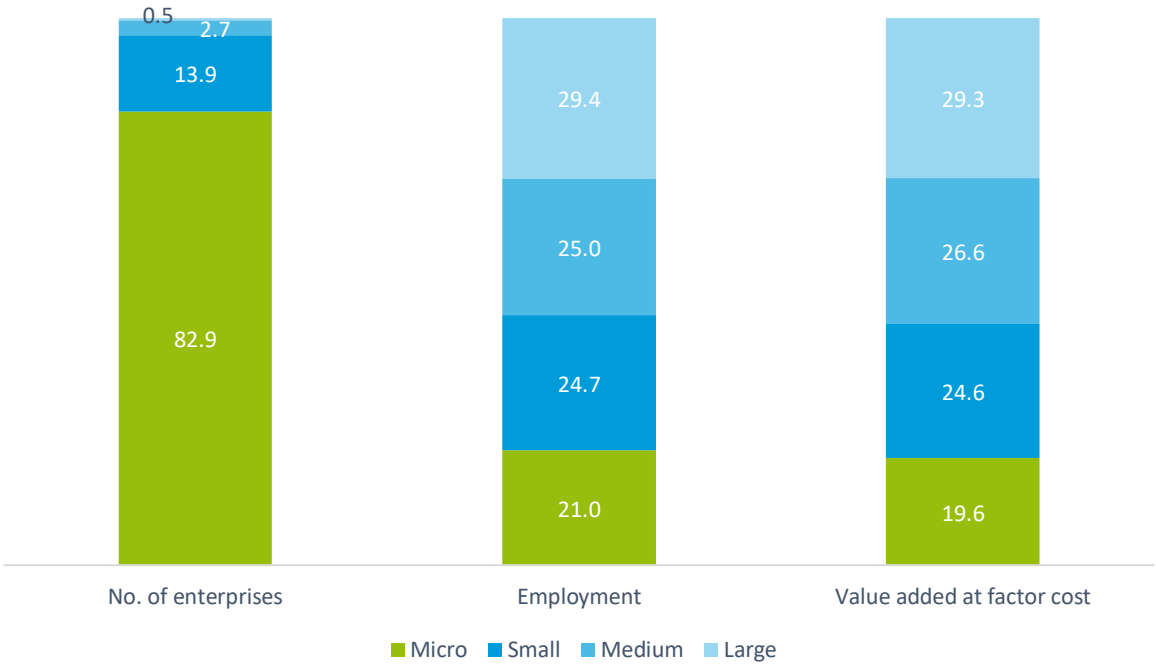
	Micro	Small	Medium
Employment	< 10 employees	< 50 employees	< 250 employees
Annual turnover	< MDL 9 million (EUR 0.46 million)	< MDL 25 million (EUR 1.28 million)	< MDL 50 million (EUR 2.56 million)
Total assets	< MDL 9 million (EUR 0.46 million)	< MDL 25 million (EUR 1.28 million)	< MDL 50 million (EUR 2.56 million)

Note: Exchange rates as of October 2019 (www1.oanda.com/lang/it/currency/converter)
Source: Law No 179 of July 2016: 'With regard to small and medium-sized enterprises'

According to the European Commission's 2019 SBA factsheet, in 2017 there were 33 554 SMEs in Moldova (of which 27 950 were micro, 4 680 were small and 924 were medium-sized companies) and 164 large companies. During the same period, SMEs employed 262 697 people (of which 78 051 were employed by micro, 91 740 by small and 92 906 by medium-sized companies). The share of value added of SMEs was 70.7%, compared with 29.3% for large companies – a far larger share than in the EU28 (European Commission, 2019a).

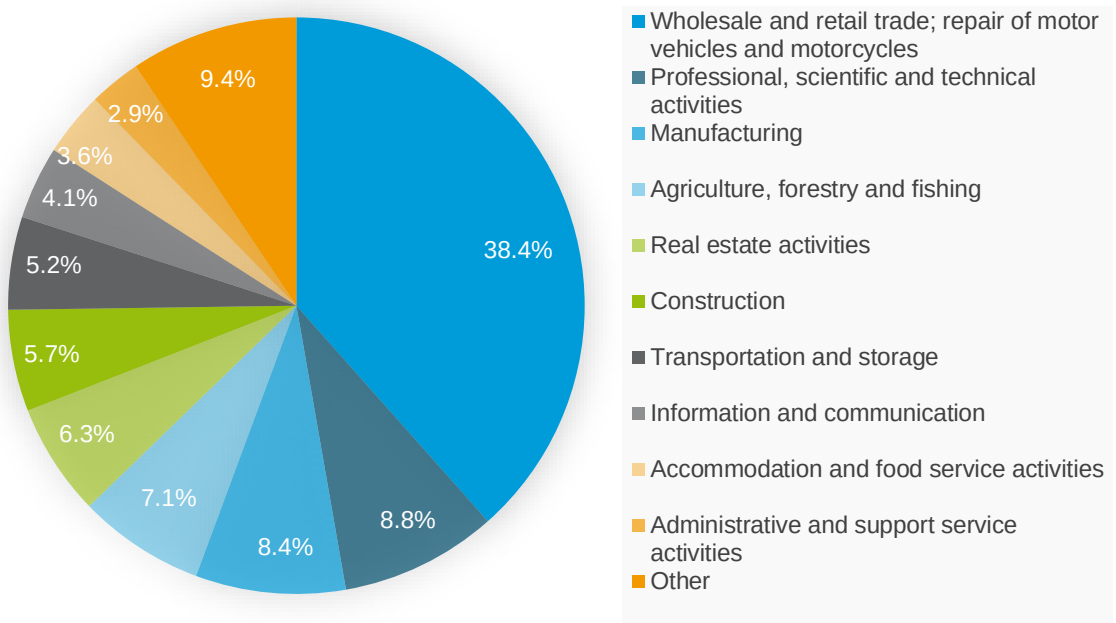
Moreover, Moldovan SMEs employed an average of 7.8 people, double the EU SME average of 3.9. SME productivity in Moldova, measured as value added per person employed, amounts to EUR 7 932, less than one-fifth of the EU SME average of EUR 43 604. SMEs in wholesale and retail trade generate the highest share of employment in Moldova, at 34.7%, with manufacturing coming second, at 20.9%. Value added follows the same trend: SMEs in wholesale and retail trade are responsible for the highest share, at 36.8%, followed by manufacturing, at 18.3% (European Commission, 2019a).

FIGURE 3.2 OVERVIEW OF THE BUSINESS SECTOR IN MOLDOVA, 2017



Source: OECD (2020)

FIGURE 3.3 SECTORAL DISTRIBUTION OF SMES IN MOLDOVA, 2017



Source: OECD (2020)

The majority of the goods exported from Moldova to the EU are from large-scale sector categories and industries (around EUR 5.5 billion between 2009 and 2016). The remaining EUR 500 million consisted of exports from smaller sectors that are more likely to see higher levels of active SMEs. For the most part (97%), these smaller trade categories are potential growth categories, specifically for SMEs when they gain full access to the European internal market.

The Ministry of Economy is in charge of SME policy and supervises the overall implementation of the strategy, while the Organisation for Small and Medium Enterprises Sector Development (ODIMM, the national SME development agency) is responsible for the implementation of most of the planned actions, according to bi-annual action plans. The SME Development Strategy 2012–2020 and the Investment Attraction and Export Promotion Strategy 2016–2020 are the main strategic documents guiding policy developments in the area of SME internationalisation in Moldova.

The recently restructured Moldovan Investment Agency (formerly MIEPO) is responsible for a wide range of export support services although in practice its activities have been mostly limited to supporting the participation of Moldovan companies in international trade fairs. Despite its broad mandate, limited capacity and staffing have prevented the agency from expanding its range of services to encompass more complex advisory services for exporting SMEs, such as training, market intelligence and consultancy services.

ODIMM, with the help of the Enterprise Europe Network, currently provides informational advice for SMEs that are interested in exporting, and the Ready to Trade project (financed by the EU and implemented by the International Trade Centre seeks to improve the international competitiveness of SMEs in the apparel sector.

Partial data and interviews with the private sector suggest that Moldovan SMEs have not fully exploited the opportunities arising from the Association Agreement and the DCFTA. Moreover, sanctions imposed by Russia in 2014 have had a negative impact on the internationalisation of SMEs.

According to the 2020 World Bank Doing Business report, Moldova ranks 38th on trading across borders, up from 152nd in 2015 (World Bank, 2019).

In general, there is a lack of systematic effort to better integrate local SMEs into global value chains. Nonetheless, in 2018, ODIMM, with the help of the Technical Assistance and Information Exchange instrument of the European Commission, launched two clusters focusing on the textile and creative sectors. In cooperation with the Organisation for Economic Cooperation and Development (OECD), the agency is designing a pilot programme to stimulate the creation of supply chain linkages between local food producers and food retail chains operating in Moldova.

Significant challenges remain as to how the public education system can respond to the skills demands of businesses. With some 46% of businesses having difficulty in engaging staff with the skills required, and a third of employers considering skills gaps and mismatches as a significant constraint on business, the business community is 'extraordinarily critical' of the workforce skills base (World Bank, 2018). Despite the importance afforded to education within the country's National Development Strategy – Moldova 2020 – more efforts are necessary to ensure that both vocational and higher education are more responsive to the evolving economy. In particular, while reforms to vocational education are ongoing, significant structural reforms across the higher education system are paramount to Moldova's wider drive for innovation, productivity and growth (World Bank, 2019).

In terms of entrepreneurial learning, the overall policy framework has been reinforced through the 2030 National Development Plan, backing up the 2020 education and SME strategies that give particular attention to entrepreneurial learning. The entrepreneurship key competence in primary, secondary and vocational education is embedded within specific subjects or optional courses (e.g. career design and development of entrepreneurial spirit). The greater part of non-formal entrepreneurial learning is provided by ODIMM with the National Youth Council raising young people's awareness about entrepreneurship potential. Entrepreneurship in higher education remains confined to individual champions within a number of universities (e.g. Technical University of Moldova (UTM), Academy of Economic Studies), and university–business cooperation is limited. Universities and the wider higher education community, in particular teaching and research staff, are not well integrated into the country's wider economic drive.

As there are few business associations beyond the national Chamber of Commerce and Industry, ODIMM is important for voicing SMEs' needs.

Several online portals exist for SMEs to get support (EU4Business, 2020).

- The Trade Information Portal of the Republic of Moldova: the newly created portal is a national information tool for businesses engaged in international trade, for authorities, as well as for other stakeholders that will be able to access first-hand reliable information with respect to customs legislation; customs regimes and destinations; declaration, classification and origin of goods; permits; and the rules for border crossings concerning goods and transportation units.
- DFCTA Adaptation Programme: business advisory projects with local consultants and international advisers under the programme strengthen the competitiveness of SMEs, facilitate exports, adopt new standards, raise awareness of the DCFTA, provide better access to finance, and increase the use and improve the quality of local business advisory services.
- The Chamber of Commerce and Industry provides training/seminars and consulting services for the business environment and information on regulations in the field of economic activity, commercial and banking usage, and trade opportunities.

- European Business Association Moldova: information regarding practical workshops and coaching sessions as well as networking events are offered, thus contributing to enhanced technical skills and more open and qualitative business communication by sharing knowledge and expertise.
- Entrepreneurial Business Training Centre of the Chamber of Commerce and Industry: information is provided on modern international trends in entrepreneurial development and how to implement them.
- ODIMM: programmes and projects are offered for the development of the SME sector, consulting, training and mentoring.
- Business Advice and Assistance Centre: personalised consulting options are adapted to individual business models and each entrepreneur on how to set up a business, access grants, identify new markets and build business partnerships.
- Women in Business Programme: help is offered for women-led SMEs on how to access the finance and know-how they need to grow.
- Association Agreement/DCFTA in Moldova: this site includes a list of active links to programmes that provide assistance (credit schemes, grants or subsidies) to entrepreneurs.
- Alliance of Small Enterprises from Moldova: this covers the latest business news, expert consultation offerings and details of events in the economic environment.
- Know-how – advice for SME programme: this programme supports SMEs with business advice to improve their performance and growth.

3.4 Employment by occupation and level of education[3]

The distribution of the employed population by level of education shows that about one-fifth of employed people have completed higher education, 36% have completed VET education, 19% have completed secondary general and the remaining 22% have completed basic or primary education. The numbers for the different education groups remained relatively stable between 2014 and 2018, although the share of those with secondary education decreased slightly while workers with low education levels slightly increased. Education is also positively correlated with the probability of being employed and this is valid for both men and women.

TABLE 3.4 STRUCTURE OF EMPLOYMENT BY OCCUPATION (%, 15+)

	2014	2015	2016	2017	2018
Total	100	100	100	100	100
Legislators, senior officials and managers	7	7	7	7	6
Professionals	13	14	14	14	14
Technicians and associate professionals	8	7	6	7	6
Clerks	2	2	2	2	2
Service workers and shop and market sales workers	14	14	14	14	13
Skilled agricultural and fishery workers	15	24	26	25	30
Craft and related trades workers	11	11	11	11	11
Elementary occupations	22	13	12	12	10
Other	8	7	7	7	6

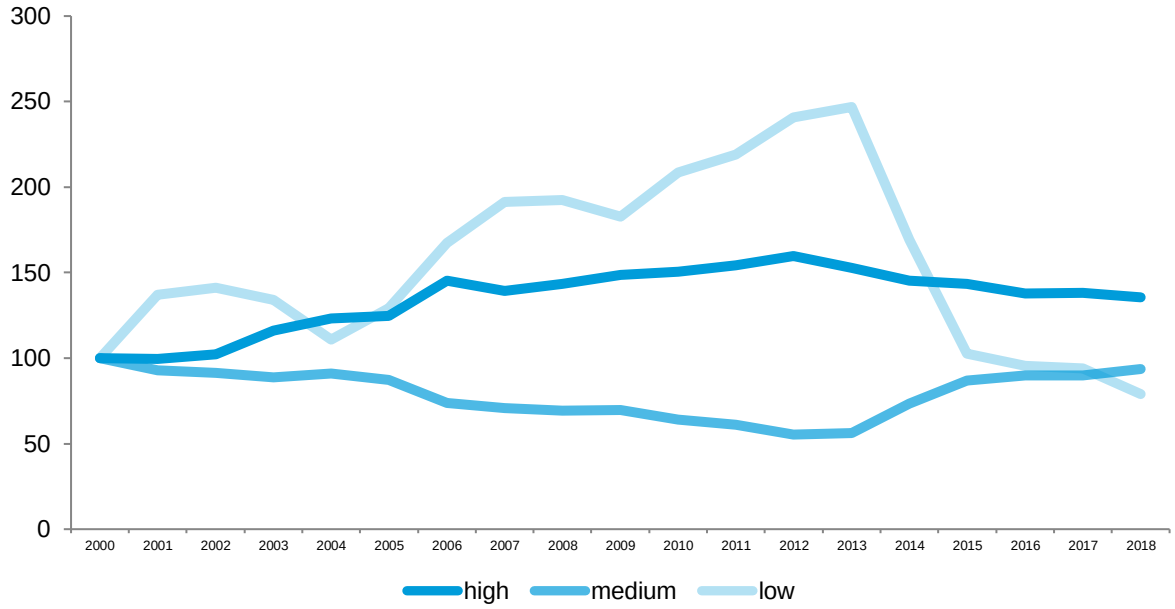
Source: Authors' calculation based on NBS data

[3] Calculations made using LFS data from NBS are based on resident population.

The data related to the occupational profile of employed people shows that about 26% work in occupations requiring a high level[4] of skills, including managers, professionals and associate professionals, and 10% work in elementary professions, leaving significant space for middle-skilled occupations (see Table 3.4). In terms of recent trends, we can point to the increase of skilled workers in agriculture and fishery and the drop in the number of elementary occupations between 2014 and 2018.

The decreasing trend when looking at the share of low-skilled workers is shown in Figure 3.4. Interestingly, up to 2013, labour market polarisation[5] can be detected, showing the increase in both high- and low-skilled occupations in contrast to middle-skilled ones. This trend has reversed in recent years, pointing to the increasing importance of middle-skilled occupations compared to elementary ones.

FIGURE 3.4 CHANGE IN SHARES OF LOW-, MIDDLE- AND HIGH-SKILLED JOBS (%, 2000=100)



Note: Low refers to ISCO 08 group 9; medium refers to ISCO 08 groups 4–8; high refers to ISCO 08 groups 1–3.
Source: Authors' calculation based on NBS data

Education has a positive impact on the occupations held, i.e. having higher education leads to higher probability of working in occupations requiring a high level of skills (see Table 3.5). On the other hand, those with basic education are more likely to work as unskilled labour.

[4] Typically tertiary education.

[5] 'Polarisation can be defined as the process whereby a specific group tends to be divided into two opposing sub-groups, with members remaining neutral or holding an intermediate position decreasing progressively' (Cedefop, 2011).

TABLE 3.5 STRUCTURE OF EMPLOYMENT BY OCCUPATION AND EDUCATION, 2018 (%, 15+)

	Total	Higher	Secondary specialised	Secondary professional	Secondary school	Gymnasium and below
Total	100	100	100	100	100	100
Legislators, senior officials and managers	6	19	8	2	2	0
Professionals	14	52	10	0	1	0
Technicians and associate professionals	6	6	27	2	2	0
Clerks	2	4	5	1	2	1
Service workers and shop and market sales workers	13	7	14	16	19	9
Skilled agricultural and fishery workers	30	5	21	32	40	54
Craft and related trades workers	11	3	8	22	10	11
Elementary occupations	10	1	4	12	15	19
Other	6	2	4	13	8	4

Source: Authors' calculation based on NBS data

In terms of the vertical mismatch for data between 2014 and 2018, the share of overqualified workers[6] aged 15+ was around 20%, though it reached 22.3% in 2018 (NBS).

The share of women working in occupations requiring a high level of skills is much higher than the share of men. By contrast, men are more likely to work in elementary professions. The occupational profile differs also among economic sectors (which will be partially discussed below) and by regions (see Table 3.6). It is clear that the capital city offers more high-skilled occupations and attracts high-skilled workers. About 48% of employed people in Chișinău have an occupation requiring high-level skills in contrast to approximately 20% in the other three regions, where the majority of employed people have middle-skilled occupations.

In general, the labour market in Moldova is characterised by skills shortages, caused mainly by emigration. At the same time, the activity level of the working-age population is very low in comparison to other countries in Eastern Europe[7]. In addition, a large share of employed people have only a basic level of education, which restricts their chances on the labour market. This is especially problematic taking into account the continuous drop in the share of elementary occupations.

[6] Overqualified workers are defined as employed persons who have attained tertiary education (ISCED 2011 levels 5 to 8) and who work in occupations for which a tertiary education level is not required, equivalent to the major groups 4 to 9 of the ISCO 2008 classification (Eurostat, 2020).

[7] This is partially caused by the definition of inactive population, which covers people who are (temporarily) abroad (i.e. labour migrants are included in the calculation of labour market indicators and categorised as inactive).

TABLE 3.6 STRUCTURE OF EMPLOYMENT BY OCCUPATION, REGION AND SEX, 2018 (%, 15+)

	Total	Chișinău	North	Centre	South
Total					
Legislators, senior officials and managers	6	13	4	4	5
Professionals	14	27	10	9	12
Technicians and associate professionals	6	8	5	5	5
Clerks	2	5	2	2	2
Service workers and shop and market sales workers	13	18	11	11	12
Skilled agricultural and fishery workers	30	1	41	43	34
Craft and related trades workers	11	13	11	11	9
Other (operators, assemblers, unskilled workers etc.)	17	15	17	16	21
Male					
Legislators, senior officials and managers	8	16	5	5	5
Professionals	9	20	6	5	7
Technicians and associate professionals	5	7	3	5	4
Clerks	1	3	0	0	0
Service workers and shop and market sales workers	7	11	6	5	5
Skilled agricultural and fishery workers	31	0	42	45	36
Craft and related trades workers	15	20	14	15	13
Other (operators, assemblers, unskilled workers etc.)	24	23	24	21	31
Female					
Legislators, senior officials and managers	5	9	4	3	4
Professionals	19	36	13	13	17
Technicians and associate professionals	7	9	7	6	8
Clerks	4	7	3	3	0
Service workers and shop and market sales workers	19	26	15	17	19
Skilled agricultural and fishery workers	30	0	40	41	34
Craft and related trades workers	7	7	8	7	5
Other (operators, assemblers, unskilled workers etc.)	10	6	11	11	12

Note: The autonomous territorial unit of Găgăuzia is part of the South region data.
Source: Authors' calculation based on NBS data

4. SKILLS ANALYSIS IN THE PRELIMINARY PRIORITY AREA OF ENERGY

4.1 Overview[8]

4.1.1 Energy priorities mapped under the smart specialisation framework

The Mapping of Economic, Innovative and Scientific Potential in the Republic of Moldova report mapped the preliminary priority areas of specialisation for Moldova and its regions. The report exploits several national and international data sources to map specialisation potential and selected preliminary economic priority areas based on economic, scientific and innovation potential. Energy is one of four preliminary priority domains based on scientific potential. The report also identifies additional domains of specialisation, of which one is renewable energy.

This analysis was followed up by mapping of Moldovan science and innovation ecosystems with the aim to provide a more detailed description of the identified preliminary priority areas. This was done through topic modelling of patents, publicly funded R&D projects and scientific publications. The results of such modelling are summarised below.

ENERGY

The emergent topics found for the energy preliminary priority are almost fully aligned with either publications or patents; the overall contribution from those datasets is almost equivalent, with roughly four topics per source.

The four patent-intense topics focus on electrotechnical equipment, biofuels, electricity generation and electronics. The four publication-intense topics focus on quantum and nanotechnology, spectrometry, biomass-based energy production and electric motors.

Source: JRC (2018b)

In energy, there is significant R&D activity focused on biofuels. The priority is connected to research in electrical and electronic equipment. Overall, the entire ecosystem shows interesting potential for green energy technology development.

ELECTRICAL AND ELECTRONIC TECHNOLGIES

Electrical and electronic technologies is a slightly science-oriented topic.

Two of the topics are patent-intense, focusing on devices for solar energy production and storage and on instrumentation for signal amplification and conversion. Four topics are publication-intense, focusing on nanoparticle manipulation and deposition, electronic circuitry, advanced optics and voltage regulation.

Source: JRC (2018b)

[8] The energy priority area covers electric power generation, transmission and distribution; manufacture of gas; distribution of gaseous fuels through mains; and steam and air conditioning supply.

Following the mapping process, the entrepreneurial discovery process resulted in the identification of three sub-areas related to energy that represent potential for smart specialisation: heating solutions, alternative energy sources, and efficient technologies (see Table 4.1).

TABLE 4.1 MAIN DEVELOPMENT FACTORS BY SUBSECTOR OF THE ENERGY AREA

Heating solutions	Alternative energy sources	Efficient technologies
■ Well-developed infrastructure of natural gas and electricity networks ■ Research potential ■ The existence of SMEs that are involved in the development of heating solutions and have growth potential ■ The existence of the retail market mainly in the district centres ■ Weak investments in the development of innovative district heating systems ■ Lack of diversification of sources of natural gas supply ■ High level of risk for foreign investors as a result of political instability ■ Lack of qualified personnel to carry out the heating projects ■ Lack of decentralised demonstration projects (missing focus on hybrid district heating systems)	■ Existence of institutions in the field empowered with obligations to promote and support the development of renewable sources (e.g. Agency for Energy Efficiency) ■ R&D potential, although currently with low funding ■ There is a retail market with guaranteed access ■ Potential for creation of new companies specialised in alternative energy technologies as well as job creation potential ■ Research on alternative sources is increasing and the cost decreasing ■ Need for energy security, also through alternative sources ■ Reduced ability to pay by consumers ■ Poor state support for innovation and technology transfer ■ Lack of state subsidies ■ Political instability in the country ■ Incorrect and non-transparent formation of prices of energy sources	■ Existence of standards (over 1 000 standards) in the energy field ■ Existence of research projects and scientific potential ■ Accessibility to energy efficiency technologies ■ Existence of market potential for the implementation of efficient technologies ■ Increased awareness of the importance of efficient technologies for business ■ Lack of funding programmes/ financing instruments ■ Lack of stimulation mechanisms from the state ■ Low payment capacity of the consumers ■ Barriers created by the monopolistic organisations in the field

Source: MECR (2019a)

4.1.2 Overview of the energy priority sector

Three-quarters of Moldova's energy needs are covered by imports, and economic growth is further increasing the demand. In 2017, of the 3.7 billion kilowatt-hours (kWh) of electricity consumption, only 18% was generated domestically, mainly by local combined heat and power plants, a non-pumped hydropower plant, and other small-scale renewable energy installations (IRENA, 2019). With imported fossil fuels accounting for more than two-thirds of primary energy supply, increasing domestic supply would reduce the country's vulnerability due to fluctuating fuel costs and potential supply disruption. Therefore, the country's energy policies are now aimed at enhancing energy security and security of supply, reduction of CO_2 emissions, and sustainable development of the economy (Ibid.). The

mapping for smart specialisation identifies 'renewable energy'[9], later expanded and relabelled 'energy', as having vast potential that remains largely untapped.

Moldova has insignificant reserves of solid fuels, petroleum and gas, and low hydroelectric potential. This has led to a high dependency on energy imports, mainly from Russia and Ukraine. Almost 70% of the primary energy supply – around 2 012 kilotons of oil equivalent (ktoe) of the total 2 939 ktoe – comes from imports. This is not only a huge economic burden, but also affects the country's energy security, making it vulnerable to risks related to fuel supply disruption. Indeed, domestic power production typically covers less than 20% of demand, with this mostly provided by local, gas-fuelled combined heat and power stations (330 MW) and renewables-based capacity (53 MW). In addition, gas infrastructure is underdeveloped with limited gas storage facilities which makes the country very vulnerable to unplanned shortages of gas supply. The existing energy mix favours natural gas, which is now largely supplied through the gas interconnector between Romania and Moldova, the full capacity of which is expected to be reached in 2020. In the case of electricity, 80% of the market is dependent on one power station (EU4Energy, 2020).

In 2018 the energy sector gross value added was 2.9%, with 1.7% of all employees working in the sector[10]. The sector is dominated by large companies which generate 99% of turnover (see Table 4.2).

TABLE 4.2 STRUCTURE OF BUSINESSES IN THE SECTOR OF ELECTRICITY, GAS, STEAM AND AIR CONDITIONING SUPPLY BY SIZE (%)

	2015	2016	2017	2018
Structure of businesses by size (%)				
Large	23	21	21	20
Medium	1	2	3	1
Small	13	10	11	9
Micro	63	67	65	70
Structure of businesses by their contribution to turnover (%)				
Large	99	99	99	99
Medium	0	0	1	0
Small	0	0	1	1
Micro	0	0	0	0

Source: Authors' calculation based on NBS data

The institutional framework was established with the adoption of the Energy Strategy until 2020, the Law on Renewable Energy (2007), the Law on Energy Efficiency (2010), the National Energy Efficiency Programme 2011–2020 and the Energy Efficiency Agency. Work is underway to bring the national legislation in line with the relevant EU acquis. Moldova plans to fully synchronise its electricity network with the European Network of Transmission System Operators for Electricity (ENTSO-E) and to connect to the European electricity market (EU4Energy, 2020). This is in line with the 2015 Riga Summit, which concluded that cooperation within the Eastern Partnership should in future focus on four main areas, of which ensuring energy security and improving energy and transport

[9] Renewable energy relabelled as energy since it includes 'D352 manufacture of gas' and it can accommodate the oil industry.

[10] NBS data refers to the economic sector of electricity, gas, steam and air conditioning supply.

interconnections is one and coordinated through Platform 3 (connectivity, energy efficiency, environment and climate change) (SBA).

4.1.3 Overview of the renewable energy sub-priority

Despite abundant resources, deployment of renewable energy in Moldova is limited, though its share in gross final energy consumption has been growing in recent years and reached 27.8% in 2017. Approximately 98% of this relates to biomass (IRENA, 2019). Within biomass, over the last decade, the solid biofuel sector has been developed, with coal- and gas-fired boilers, as well as basic stoves, being replaced with biomass heating units which burn straw, pellets, briquettes and firewood. The government is further strengthening the solid biofuel production industry (briquettes and pellets), which has created about 400 new jobs in rural areas and had an assessed turnover of USD 6 million to USD 8 million in 2017 (Ibid.).

At present, Moldova is only beginning to harness the potential of renewable resources. The state has developed different support schemes to support the development of renewable energy, targeting at least 100 MW being installed by 2020[11]. The state is also attracting external funding to increase energy efficiency; for example, the European Bank for Reconstruction and Development funded the Moldovan Sustainable Energy Finance Facility project, which has allocated EUR 42 million for more than 300 projects (European Portal for Energy Efficiency in Buildings, n.d.). The Moldova Agency for Energy Efficiency oversees the national programme to improve energy efficiency.

BOX 4.1 BIOMASS AS DEFINED BY IRENA

Biomass is part of bioenergy which falls into two main categories: 'traditional' and 'modern'. Traditional use refers to the combustion of biomass in such forms as wood, animal waste and traditional charcoal. Modern bioenergy technologies include liquid biofuels produced from bagasse and other plants; bio-refineries; biogas produced through anaerobic digestion of residues; wood pellet heating systems; and other technologies. 'About three-quarters of the world's renewable energy use involves bioenergy, with more than half of that consisting of traditional biomass use. There is rising demand for biomass. It can be directly burned for heating or power generation, or it can be converted into oil or gas substitutes. Liquid biofuels, a convenient renewable substitute for gasoline, are mostly used in the transport sector. Renewable energy technologies provide employment along the entire supply chain, including manufacturing, trade and installation.'

Source: International Renewable Energy Agency

The importance of biomass, in the form of agricultural residues and wood, stems from the strong agricultural sector. As shown in Table 4.3, in Moldova, biomass is predominantly consumed by the residential sector and used for heating. With respect to other sources, there is only one operational hydropower plant and two industrial wind installations. For solar energy, Decision No 321 on the tariff methodology was finalised in 2009, and a limited number of generating units have been built on the roofs of both private and public buildings since then (EU4Energy, 2020).

[11] Law No 10 of 26 February 2016: Promotion of the use of energy from renewable sources.

TABLE 4.3 ENERGY BALANCE BY SUPPLY, CONSUMPTION AND TYPE OF ENERGY PRODUCTS, 2018 (KTOE)

	Total	Coal	Natural gas	Oil products	Biofuels and waste	Electricity	Heat
Primary production	798	–	0	5	787	6	–
From other sources	219	–	–	–	–	219	–
Imports	2 109	85	913	1 026	3	82	–
Exports	27	–	–	27	–	0	–
Stock changes	12	5	2	2	3	-	–
Gross consumption	**3 087**	**80**	**911**	**1 002**	**787**	**307**	–
Transformation, input	430	1	381	19	23	6	–
Transformation, output	345	–	–	8	0	82	255
Energy sector	16	–	0	0	–	14	2
Losses	124	0	44	3	0	38	39
Final consumption	**2 862**	**79**	**486**	**988**	**764**	**331**	**214**
Industry	251	24	76	37	1	67	46
Transport	758	–	25	727	–	6	–
Residential sector	1 385	36	286	62	737	142	122
Trade and public services	283	18	96	1	12	110	46

Note: – = not applicable
Source: NBS

4.2 SMEs

Although the role of large enterprises is significant in the energy sector, it is likely that the importance of SMEs will continue to grow, in particular in the field of renewable energy. Between 2015 and 2018 (see Table 4.2), the share of large enterprises in the energy sector declined from 23% to 20% of all enterprises in the sector. At the same time, the share of micro enterprises increased from 63% to 70% of all enterprises in the energy sector.

Despite limited research and data on SME engagement in the energy supply chain in Moldova, global experience shows that SMEs are often the largest drivers in developing and producing energy technologies (see Box 4.2 for examples). For instance, in European countries such as Finland, where bioenergy is a significant sector, SMEs dominate in its production and in the whole supply chain from planting and provision of biomass fuel to operation of small power stations and distribution to customers. This includes equipment and instrumentation for conventional energy generation as well as the technology for clean power production such as boilers, stoves, wood pellet technology, and photovoltaic and wind technology.

BOX 4.2 PRODUCT AND SERVICE INNOVATIONS FOR SMES IN THE RENEWABLE ENERGY SECTOR

- New renewable energy, energy storage and infrastructure solutions, such as:
  - small-scale combined heat and power production plant,
  - mobile anaerobic digestion solutions,
  - hybrid energy solutions (bio-solar),
  - new type of vanadium-redox flow battery,
  - small-scale vertical-axis wind power solutions– electric vehicle charging,
  - energy-efficient/healthy building structures,
  - manufacturing of recycling equipment (refuse-derived fuel machine construction),
  - feeders, augers and components,
  - forest/bioenergy machinery.
- Product modulation: by designing the production, the same structures can be utilised in several products and thus lead to efficiency and material savings. This is applicable in manufacturing industries.
- Industrial design of existing products to make them more user-friendly and attractive; design and brand-building for companies in the renewables sector.
- Digital services for monitoring and controlling of energy systems.

Source: Okkonen and Pasanen, Karelia University of Applied Sciences (2017)

The sunk costs related to the preparatory phase, such as feasibility studies and getting permits, together with the level of development of the local financial sector, limit entry to larger enterprises with sufficient financial resources to initiate project development. SMEs with scarce financial resources are exposed to a high risk of failure in the completion of a project. Some support is provided by the Energy Efficiency Fund and international financial institutions, but this is often insufficient to increase the participation of those entities in the renewable energy market (IRENA, 2019).

In Moldova, to raise the interest of the private sector in renewable electricity, the government has adopted support schemes. In 2012, in its National Renewable Energy Action Plan 2013–2020, the government committed to achieving a 17% share of renewables in gross final energy consumption. The Renewable Energy Law (No 160-XVI of 12 July 2007) introduced tariffs for 15 years, under the 'cost-plus' principle, with these based on the actual eligible costs incurred. However, the framework did not attract sufficient investment in the sector (Ibid.).

The capacity of local banks to facilitate the financing of renewable energy projects needs to be enhanced, because although large-scale renewable power plants can access the necessary financial resources from abroad, small-scale projects are limited to funding opportunities from the local financial market and this depends on local lenders understanding and appraising projects. The continuous involvement of international players, however, is expected to advance the uptake of renewable energy sources and to ensure that all investors, including small ones, that are interested in the new support mechanisms will be in a position to prove their financial credibility (Ibid.).

Several initiatives are in place to support SMEs. Launched in 2012, the Moldova Eco Energy Competition aims to support initiatives in the production, transmission, distribution and efficient consumption of energy, in the implementation, development and promotion of modern technologies,

as well as innovations in the field. In 2019, five start-up ideas were awarded and took part in a four-month intensive training scheme at a start-up accelerator in Europe (Eco Energetică, 2020).

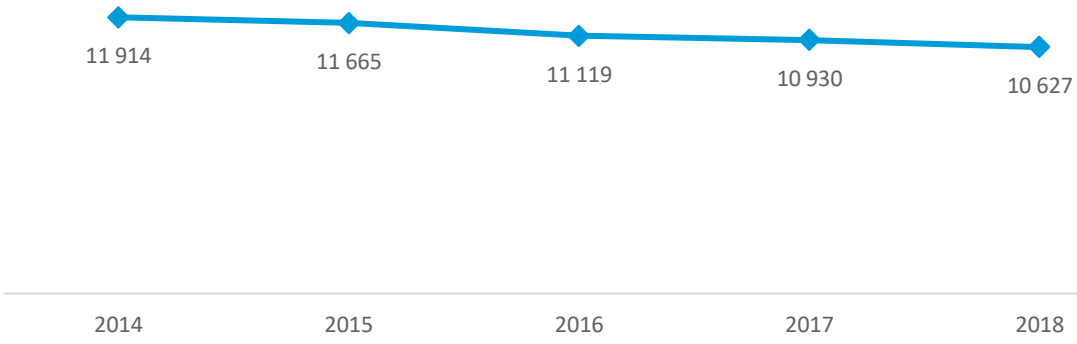
In March 2017, as part of an EU-funded and United Nations Development Programme implemented support programme, a cluster organisation was established with a mission to connect representatives of the economic environment with support organisations, research, universities and public administration in order to strengthen cooperation to stimulate innovation and disseminate knowledge of biomass. The activities of the cluster organisation are still limited. The cluster organisation includes five large companies, two SMEs, ten research organisations and universities and seven other actors.

4.3 Employment

This section aims to combine the existing quantitative data with evidence collected through qualitative interviews to provide indications on the characteristics of employment, current skills gaps and demand in energy[12]. As detailed, reliable quantitative data is often not available; where necessary, more aggregated data was used, which limits the precision of the findings. Thus, the primary focus is on data related to the sector of electricity, gas, steam and air conditioning supply[13]. However, in the case of some data sources, such as LFS data, the focus is on a more aggregated category of industry.

The number of employees in the energy sector has been declining over the past years, which mirrors the overall trend on the labour market during the observed period (see Figure 4.1)[14].

FIGURE 4.1 NUMBER OF EMPLOYEES IN ELECTRICITY, GAS, STEAM AND AIR CONDITIONING SUPPLY (PERSONS)



Source: NBS, statistical survey – M3 annually 'Salary earnings and labour force cost'

[12] It needs to be acknowledged that this section focuses on the sector related directly to energy, although jobs related to energy and renewable energy or technologies encompass jobs across different sectors, such as construction and manufacturing.

[13] As already mentioned, the delineation of smart specialisation priority areas does not necessarily follow the categorisation used within, for example, NACE. Therefore, the choice of data and respective subsectors tries to identify the most relevant subsectors/sectors for the chosen priority area. In the case of Moldova, the smart specialisation priority area actually reflects the 'sectoral' categorisation, which makes the choice of sectors and subsectors more straightforward.

[14] Data used in this report does not cover data on districts from the left side of the river Nistru and municipality of Bender.

Staff turnover in the energy sector is low in comparison to the overall level for all economic activities. At the same time, the number of people dismissed exceeds the number of people hired, which points to potential skills mismatches (see Table 4.4).

TABLE 4.4 STAFF TURNOVER, 2015 AND 2018

	2015				2018			
	Hired		Dismissed		Hired		Dismissed	
	Total (persons)	% of vacancies	Total (persons)	% of vacancies	Total (persons)	% of vacancies	Total (persons)	% of vacancies
All economic activities	160 737	21.9	169 283	23.1	227 966	28.6	212 705	26.7
Electricity, gas, steam and air conditioning supply	1 298	10.1	1 848	14.4	1 286	10.8	1 434	12.0

Note: Data is presented for social and economic units with four or more employees and all budgetary institutions regardless of the number of employees; Statistical survey 'Mobility of employees and jobs'.
Source: NBS

TABLE 4.5 EMPLOYMENT BY OCCUPATION (%, 15+)

	2014	2015	2016	2017	2018
All economic activities					
Total	100	100	100	100	100
Legislators, senior officials and managers	7	7	7	7	6
Professionals	13	14	14	14	14
Technicians and associate professionals	8	7	6	7	6
Clerks	2	2	2	2	2
Service workers and shop and market sales workers	14	14	14	14	13
Skilled agricultural and fishery workers	15	24	26	25	30
Craft and related trades workers	11	11	11	11	11
Elementary occupations	22	13	12	12	10
Other	8	7	7	7	6
Industry					
Total	100	100	100	100	100
Legislators, senior officials and managers	7	8	9	9	9
Professionals	10	9	8	9	9
Technicians and associate professionals	7	7	6	5	5
Clerks	1	2	2	2	2
Service workers and shop and market sales workers	2	1	1	0	0
Skilled agricultural and fishery workers	0	0	0	0	0
Craft and related trades workers	40	44	45	46	46
Elementary occupations	17	15	15	14	12
Other	16	14	14	14	16

Source: Authors' calculation based on NBS and LFS data

Looking at the occupational and education structure of employment in the energy sector, the existing LFS data allows us to look only at the broad category of industry. The occupational distribution shows that, in comparison to the overall distribution across all economic activities, the share of middle-skilled occupations is higher (see Table 4.5). At the same time, the data is influenced largely by the manufacturing sector and it is not possible to assess to what extent the data is valid for the energy sector.

Comparing the education distribution of employed people across all economic activities and in the category of industry, it is evident that workers with a vocational education profile are more likely to find job opportunities in this sector (see Table 4.6). By contrast, the share of workers with a low level of education is lower than in the overall employed population. This suggests, as expected, the need for a skilled workforce.

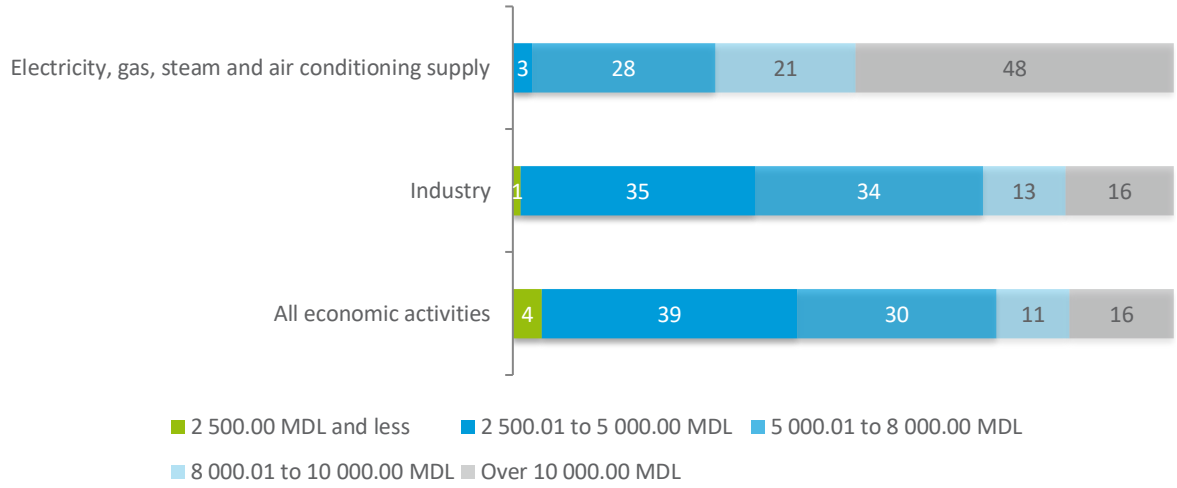
TABLE 4.6 EMPLOYMENT BY LEVEL OF EDUCATION (%, 15+)

	2014	2015	2016	2017	2018
All economic activities					
Total	100	100	100	100	100
Higher	24	24	24	25	24
Secondary specialised/ professional	37	36	35	36	36
Secondary school	19	20	20	19	19
Gymnasium and lower	19	19	20	20	21
Industry					
Total	100	100	100	100	100
Higher	21	20	20	22	22
Secondary specialised/ professional	45	46	47	44	45
Secondary school	20	19	19	19	16
Gymnasium and lower	14	14	14	15	17

Source: Authors' calculation based on NBS and LFS data

Again, looking at the broad category of industry limits the conclusions that can be made regarding the specific sector. Yet, assuming the positive correlation between skills (qualification) and salary, Figure 4.2 shows that employment in the energy sector is significantly skewed towards high-skilled workers.

FIGURE 4.2 DISTRIBUTION OF EMPLOYEES BY SALARY, SEPTEMBER 2019 (%)



Note: Data includes real sector economic units with four or more employees and all institutions in the budgetary sector.
Source: Authors' calculation based on NBS data, including the statistical survey 'Distribution of employees by earning size in September'

The monthly net salary is higher in the energy sector than the average salary for all economic activities (see Table 4.7). From 2013 to 2018, the average salary in production and supply of electricity, heat, gas, hot water and air conditioning increased for both women and men from MDL 5 004/5 296 to MDL 8 195/8 873 respectively.

TABLE 4.7 AVERAGE MONTHLY NET SALARY IN ENERGY SECTOR IN THE REAL SECTOR (IN MDL)

	2013		2014		2015		2016		2017		2018	
	W	M	W	M	W	M	W	M	W	M	W	M
Production and supply of electricity, heat, gas, hot water and air conditioning	5 004	5 296	5 545	5 929	6 497	6 550	6 767	7 201	7 701	8 126	8 195	8 873
Total	2 902	3 262	3 190	3 631	3 507	4 029	3 808	4 438	4 268	4 896	4 764	5 555

Note: Data includes real sector economic units with one or more employees and all institutions in the budgetary sector. W – women; M – men.
Source: NBS, statistical survey – M3 annually 'Salary earnings and labour force cost'

When it comes to demand for workers in the energy sector, the number of vacancies has been stable recently. According to the NBS data, the number of vacancies within the sector of electricity, gas, steam and air conditioning supply was 475 at the end of 2015 and 470 at the end of 2019.

Finally, it is important to stress that in the energy sector, large companies dominate when it comes to the share of employees (see Table 4.8).

TABLE 4.8 DISTRIBUTION OF EMPLOYEES BY SIZE OF BUSINESS IN THE SECTOR OF ELECTRICITY, GAS, STEAM AND AIR CONDITIONING SUPPLY (%)

	2015	2016	2017	2018
Large	95	94	92	95
Medium	1	3	5	1
Small	2	2	2	2
Micro	1	1	1	1

Source: Authors' calculation based on NBS data

Skills from the employers' perspective

As specified in the methodological section, the assessment combines secondary data analysis of existing statistics with qualitative interviews of employers and representatives of professional associations and public administration.

In general, the energy sector suffers from a lack of investment, lack of state support for innovation and technology transfer, and a lack of qualified workforce. At the same time, the offered salaries, although above the national average, are not competitive enough to attract high-skilled specialists. Moreover, cooperation with research institutions, universities and vocational education is limited.

Overall, the sector requires high-skilled and/or specialised personnel. This means that employees are usually required to have tertiary education, typically related to the field of engineering. SMEs in the energy sector usually employ experienced people in the field of engineering. In large companies, both fresh graduates and experienced specialists are hired.

Similarly to other sectors, the industry suffers from skills shortages due to emigration of the working-age population and the specificities of skills needed. Employers report that demand for workers, both skilled and less skilled, currently exceeds supply. In particular, the replacement of highly skilled workers is a major issue for this sector.

Companies often need to invest in training of their employees. Examples of training sessions frequently provided by employers include training related to computer skills or foreign languages, English in particular.

In general, the competences relevant for this priority area as identified during the interviews are as follows:

- Technical competences – general understanding of the field, with emphasis on engineering skills. The specialists are expected to install, maintain, test and monitor the energy generation systems.
- Language competences – knowledge of foreign languages, especially English, is crucial. This includes the ability to understand and communicate.
- Digital competences – the required skills range from basic ICT literacy and the ability to manage and analyse data to the management of IT systems and operational technology.
- Generic competences – this includes analytical and problem-solving skills, critical and innovative thinking, motivation/desire to learn, working with others and resilience.

Finally, the main skills gaps identified are characterised by scarce knowledge of foreign languages, especially among highly skilled workers, and poor analytical and problem-solving skills as well as low motivation to learn new things in the case of middle-skilled workers. In addition, (advanced) ICT skills are required due to increasing use of new technologies.

4.4 Provision of education and training

The Moldovan education system is structured in levels and cycles in accordance with the International Standard Classification of Education (ISCED) 2011 as illustrated in Table 4.9.

TABLE 4.9 MOLDOVAN EDUCATION SYSTEM BY ISCED AND NATIONAL QUALIFICATIONS FRAMEWORK (NQF)/EU CLASSIFICATION

ISCED level	NQF level	Education programme
8	8	Higher education, III cycle – Doctoral level
7	7	Higher education, II cycle – Master's level
6	6	Higher education, I cycle – Bachelor level
5	5	Non-tertiary post-secondary technical vocational education
4	4	Post-secondary technical vocational education
3	3	Secondary technical vocational education II cycle, upper secondary education (lyceum)
2	2	I cycle, lower secondary education (gymnasium)
1	1	Primary education
0		Early education

Source: Developed by authors on the basis of the Education Code of the Republic of Moldova (Law No 152 on Education Code, adopted on 17 July 2014)

The VET system includes all educational institutions offering programmes that:

- train qualified workers, technicians and other categories of specialists in accordance with the NQF, the Nomenclature of Professional Training and Trades/Professions and the Nomenclature of Professional Training, Specialities and Qualifications, approved by the government, as well as ISCED levels 3, 4 and 5;
- retrain workers and specialists in various fields of vocational training; and
- strengthen the professional competences of skilled workers, in line with the requirements of the economy and the labour market.

Since 2014, the VET sector has provided programmes for dual VET, which is organised in both VET institutions and companies.

There are three main types of VET providers, which include a total of 89 educational institutions: 13 centres of excellence[15] (including 2 private ones), 34 colleges (including 4 private institutions) and 42 professional schools.

At present, in Moldova, VET institutions, particularly VET centres of excellence, have good potential and are more oriented towards technology dissemination than universities. VET schools and centres of excellence have a more practical and incremental focus on work-based learning or learning by doing. They also have a more local focus and mainly cooperate with SMEs. Still, the education system, in particular the VET sector, lacks drive for innovation, growth and competitiveness. As a

[15] VET partnership-based institutions provide high-quality IVET and CVET programmes with strong focus on technological and/or innovative sectoral or multi-sectoral training and competence solutions, reflecting the needs of the labour market.

result, the VET system is limited to the provision of formal education programmes only and is not considered to be on a par with higher education in regional innovation systems.

In addition, there is no system for recognition of informal and non-formal learning. Yet, some steps in this direction have been made; in January 2019, the MECR approved the Regulation on Validation of Non-formal and Informal Education. According to the regulation, VET institutions are to provide validation of prior learning. Four VET institutions were commissioned by the MECR to pilot the mechanism between 1 March and 1 October 2019.

Diplomas are recognised for academic purposes by a large number of international institutions, including EU countries; for professional purposes, for employment, Moldovan diplomas are recognised by a small number of countries, such as Romania and countries of the former Soviet Union.

The recognition of diplomas at international level is based on agreements between states. The Government of Moldova through the MECR/ Ministry of Health, Labour and Social Protection (MHLSP) is responsible for concluding and acceding to such conventions, treaties and international agreements.

The country is part of several international conventions and agreements that facilitate the procedure for recognising Moldovan diplomas abroad. For example, in 2004, Moldova signed the Agreement on Mutual Recognition and Equivalence of Study Documents in general secondary education, secondary and post-secondary VET to facilitate the recognition of education and qualifications, as well as to stimulate academic and professional mobility in the Commonwealth of Independent States (CIS). In 2012, an Intergovernmental Framework Agreement on the Recognition of Diplomas, Academic Qualifications, Qualifications and Competences was proposed in 23 European countries, including those where Moldovan migrants go (Italy, France, United Kingdom, Ireland, Denmark, Germany, Poland, Hungary, Sweden, Norway, Finland, the Czech Republic, Slovenia, Slovakia, Bulgaria, Portugal, Greece, Turkey, Israel, Cyprus and the Baltic states).

The general framework for the recognition of study certificates is the Convention on the Recognition of Higher Education Certificates in European Regions, signed in Lisbon. Moldova agreed to this convention in 1999. Moldova has also signed agreements for mutual recognition of study documents with Romania, Bulgaria, Ukraine, Russia and Lithuania.

Finally, the country's accession to the Bologna Process, the issuance of the diploma supplement to all graduates and implementation of the Transferable Academic Credit System also facilitate the procedures for recognising qualifications abroad.

4.4.1 Education and training offer relevant to the priority area of energy

Education in the field of electricity and energy is mainly provided by universities, colleges, centres of excellence and vocational schools.

Higher education

Moldova State University (USM), UTM and State Agrarian University of Moldova (UASM) provide higher education programmes (ISCED 5–8) in energy (see Table 4.10). When it comes to the field of renewable energy, the UTM offers a module on renewable energy sources in the fourth year. In addition, UTM hosts the Centre of Electrical Energy Systems, the mission of which is to provide innovative R&D solutions. The centre is currently undertaking research projects in various areas of energy sustainability. In addition, it offers PhD and Master's-level engineering programmes in the fields of renewable energy, electrical energy markets and generation studies, power quality engineering, energy efficiency and demand-side management power system engineering. USM has

also introduced a new speciality of renewable energy systems engineering within the Physics and Engineering faculty.

TABLE 4.10 HIGHER EDUCATION PROGRAMMES IN THE FIELD OF ENERGY (ISCED 6)

General field of study	Speciality/study programme at cycle I – Bachelor level	Chișinău			
		Code	USM	UTM	UASM
44	Electrical power engineering	523.1		+	
	Thermoenergetics	523.2		+	
	Non-traditional energetics	523.3	+		
	Electromechanics	524.1		+	
	Electrification of agriculture	524.2			+
	Engineering of heating, gas supply and ventilation for buildings	582.7		+	

Source: Compiled by authors

VET

The Centre of Excellence in Energy and Electronics from Chișinău and five professional schools are the main suppliers of VET programmes in the field of energy, both upper secondary and post-secondary VET programmes (ISCED 3 and 4). The number of students at both post-secondary and secondary levels has declined in recent years. It is worth noting that males dominate in the sector of electrotechnics and energy; in academic year 2018/19, 98% of the students at both post-secondary and secondary VET were males (see Tables 4.11 and 4.12).

TABLE 4.11 NUMBER OF STUDENTS, ENROLLED AND GRADUATES, IN POST-SECONDARY VET IN THE FIELD OF ELECTROTECHNICS AND ENERGY, BY YEARS OF STUDY AND SEX

	2016/17			2017/18			2018/19		
	Total	Female	Male	Total	Female	Male	Total	Female	Male
Students	1 333	132	1 201	1 158	32	1 126	1 058	24	1 034
Enrolled	339	m.d.	m.d.	299	m.d.	m.d.	312	m.d.	m.d.
Graduates	299	33	266	298	5	293	313	11	302

Note: m.d. = missing data

Source: Compiled by authors using NBS data

TABLE 4.12 NUMBER OF STUDENTS, ENROLLED AND GRADUATES, IN SECONDARY VET IN THE FIELD OF ELECTRICITY AND ENERGY, BY YEARS OF STUDY AND SEX

	2016/17			2017/18			2018/19		
	Total	Female	Male	Total	Female	Male	Total	Female	Male
Students	1 195	11	1 184	1 047	18	1 029	901	16	885
Enrolled	509	9	500	409	8	401	332	5	327
Graduates	260	0	260	433	0	433	340	3	337

Source: Compiled by authors using NBS data

There are currently 14 VET programmes, including dual training, offered in the field of electricity and energy (see Table 4.13). Ten VET programmes are at ISCED (2011) level 3, covering training of

qualified workers in trades such as electrician/locksmith in construction, electrician in construction, maintenance and repair electrician, electrician, locksmith/electrician in the repair and maintenance of electrical equipment, electrician for repairing and installing cable lines, installer of heating installations and solar thermal equipment, installer of ventilation and air conditioning systems, appliances and equipment, and electrician installer of lighting networks. Furthermore, the mapping identified three VET programmes at ISCED (2011) level 4 in electrification of agriculture, household electrical machines and appliances, and power systems/electro-energetics. The number of programmes may vary each year. The programme for installers of heating installations and solar thermal equipment takes into account the aspect of renewables, and is a new programme offered by the Centre of Excellence in Construction.

TABLE 4.13 VET INSTITUTIONS OFFERING PROGRAMMES IN ELECTRICITY AND ENERGY

No	VET programme / VET institution	Professional School from Ungheni	Professional School No 5 from Bălți	Professional School No 7 from Chișinău	Professional School from Alexăndreni	Professional School No 9 from Chișinău	Professional School from Comrat	Professional School No 3 from Chișinău	Professional School No 6 from Chișinău	Centre of Excellence in Construction	Centre of Excellence in Energy & Electronics	Agricultural Technical College from Soroca	Agricultural Technical College from Svetlîi
1	Electrification of agriculture											+	+
2	Household electrical machines and appliances											+	
3	Electroenergetics										+		
4	Electrician/locksmith in construction	+		+			+						
5	Electrician in construction	+		+			+						
6	Electrician in construction – electrician installer of lighting networks	+		+			+		+				
7	Electrician for repair and maintenance of electrical equipment				+	+							
8	Electrician		+										
9	Locksmith/electrician in the repair and maintenance of electrical equipment		+										
10	Electrician for repairing and installing cable lines								+				
11	Installer of heating installations and solar thermal equipment									+			
12	Installer of ventilation and air conditioning systems, appliances and equipment									+			
13	Electrician installer of lighting networks	+		+			+	+					
14	Electromechanic for electrical machinery and equipment										+		

Source: Compiled by authors using reports from VET institutions, NBS data, MECR data and government decisions on annual training plans

Twelve VET institutions provide VET programmes in the field of energy and electricity: two centres of excellence, two agro-technical colleges and eight professional schools (see Table 4.14). The VET institutions are distributed across different regions of the country. Two of them are situated in the north, two in the south and eight in the centre. All the institutions are public.

TABLE 4.14 PROVIDERS OF VET PROGRAMMES IN THE FIELD OF ELECTRICITY AND ENERGY BY THEIR GEOGRAPHICAL LOCATION AND MODE OF OWNERSHIP

No	VET institution	Geographical area	Mode of ownership
1	Professional School No 5 from Bălți	North	Public
2	Agricultural Technical College from Soroca	North	Public
3	Professional School from Alexăndreni	Northern central	Public
4	Professional School No 9 from Chișinău	Central/capital	Public
5	Professional School No 7 from Chișinău	Central/capital	Public
6	Professional School No 3 from Chișinău	Central/capital	Public
7	Professional School No 6 from Chișinău	Central/capital	Public
8	Centre of Excellence in Construction from Chișinău	Central/capital	Public
9	Centre of Excellence in Energy & Electronics from Chișinău	Central/capital	Public
10	Professional School from Ungheni	Western central	Public
11	Agricultural Technical College from Svetlîi	South	Public
12	Professional School from Comrat	South	Public

Source: Compiled by authors

CVET is sporadically provided by some professional schools and some private institutions on request (see Table 4.15). The short courses usually range from one to two weeks up to six months and focus on the development of professional skills in some trades at ISCED level 3.

TABLE 4.15 CVET PROVIDERS IN THE FIELD OF ELECTRICITY AND ENERGY BY OWNERSHIP AND GEOGRAPHICAL LOCATION

	CVET provider	Mode of ownership	City	Geographical location
Electricity and energy	Premier energy LLC	Private	Chișinău	Central/capital
	Eneada LLC	Private	Ialoveni	Central/capital
	Moldelectrica	State-owned company	Chișinău	Central/capital
	C.D.T.-Agro LLC	Private	Hîncești	Central/capital
	Centrul de instruire şi producţie	State-owned company	Chișinău	Central/capital

Source: Compiled by authors

Some companies provide training, mostly for their own needs, when hiring new workers or when they need to upgrade the qualifications of their own employees. Although there is no comprehensive and detailed information on the extent and types of training, we refer here to the data collected by NBS. Such data shows that 67% of employees within the electricity, gas, steam and air conditioning supply received training organised by enterprises in 2018 (see Table 4.16). Thus, we may assume that the training organised and paid by enterprises in this particular priority area is very common. This may be

driven by the constant development in this field as well as the business structure of this sector: the majority of employees work in large companies, which are more likely to spend resources on further training of their workers.

TABLE 4.16 SHARE OF EMPLOYEES (FROM CORRESPONDING ACTIVITY) PARTICIPATING IN CVET IN THE FIELD OF ELECTRICITY, GAS, STEAM AND AIR CONDITIONING SUPPLY (%)

	2014	2015	2016	2017	2018
All economic activities	15	15	15	16	18
Electricity, gas, steam and air conditioning supply	48	49	45	53	67

Note: The data includes economic and social units and budgetary institutions with 10 or more employees; CVET represents all training measures or activities (courses or other forms of vocational training) which are organised and financed by the enterprises totally or partly, for their employees. In order to include an activity in the continuing vocational training category, it should be planned in advance, financed at least partly by the enterprise or from external assistance granted to the unit (grants, sponsorships etc.) and have as their objectives the acquisition of new competences or the development and improvement of existing ones.
Source: NBS, statistical survey 'Vocational training of employees'

Thus, CVET in the field of electricity and energy is still scarcely developed, and is not provided systematically and systemically. Moreover, there is no coordination between the providers and applicants, and there is no mechanism to measure and evaluate the impact of such training.

4.4.2 Legal framework for curriculum design in the field of electricity and energy

The professional training of skilled workers, technologists, technicians and other categories of specialists in the field of electricity and energy is done according to the NQF, the Nomenclature of the Vocational Training Fields and of the Trades/Professions and the Nomenclature of the Vocational Training Fields of the Specialities and Qualifications, approved by the government, and are in line with levels 3 and 4 of ISCED 2011[16].

With reference to the curricula:
In the last four years, all the curricula for existing VET programmes in the field of electricity and energy have been developed. The curricula are modular.

All trades/professions/specialities are included in the Nomenclature of Vocational Training Fields, Specialities and Qualifications for Post-secondary and Non-tertiary Post-secondary VET, approved by Government Decision No 853/2015, and the Nomenclature of Vocational Training Fields of the Trades/Professions, approved by Government Decision No 425/2015. The curricula are in line with the frame curriculum (MECR, 2019b) and include the study plan.

Secondary VET lasting for three years provides vocational training in two trades and includes 80% of the disciplines within the high school component for grades X and XI. This allows the graduates to continue their studies in the 12th grade of high school or access post-secondary VET in the same field of training. Most curricula in the specialities and professions analysed offer modular training.

The structure of the disciplinary/modular curriculum includes: preliminaries, motivation, usefulness of the module for professional development; professional skills specific to the module; module administration; learning units; indicative distribution of hours by learning units; individual study guided

[16] Education Code of the Republic of Moldova, No 152/2014.

by the teacher; recommended practical work; methodological suggestions; suggestions for evaluating professional competences; the resources needed to carry out the study process; and teaching resources recommended to students.

The curricula reveal that the process of training starts with the theoretical training. In the later stages, the theoretical training and the practical training/work-based learning are done in a cyclical way. Internships are compulsory and practical training is mandatory each year during the study period. The distribution between the number of theoretical hours and the number of hours of practical training varies between 40% and 60%.

With reference to the occupational standards:

The competences of the graduates of the VET programmes in the field of electricity and energy are formulated in the NQF in accordance with the occupational standards. Currently there are five occupational standards in the field of electricity and energy for occupations/working professions at ISCED level 3. There are no occupational standards for occupations at ISCED levels 4 and 5 (see Table 4.17).

TABLE 4.17 ANALYSIS OF THE EDUCATIONAL OFFER FOR VET PROGRAMMES IN THE SPECIALITIES AND TRADES WITHIN THE FIELD OF ELECTRICITY AND ENERGY

No	Speciality/trade	Qualification	ISCED 2011 level	Duration/years	Curriculum/year of approval	Qualification standard/year of approval	Nomenclature code*	Qualification is in National Register of Qualifications	Occupational standard	Frame curriculum/year of approval	Study plan/year of approval	Study materials
1	Electrification of agriculture	Energy technician/ Electrician technician	IV	4	2019	2016	71330	absent	absent	2015	2016	absent
2	Household electrical machines and appliances	Energy technician	IV	4	2016	absent	71340	absent	absent	2015	2016	absent
3	Electro-energetics	Energy technician	IV	4	2017	2015	71310	absent	absent	2015	2016	absent
4	Electrician/ locksmith in construction		III	2	2017	2015	732019	absent	2014	2015	2016	absent
5	Electrician in construction		III	2	2017	2015	732008	absent	2014	2015	2015	absent
6	Electrician in construction – electrician installer of lighting networks		III	3	2017	2015	732008 732009	absent	2014 2016	2015	2015	absent
7	Electrician for repair and maintenance of electrical equipment		III	2	2016	absent	713007	absent	2014	2015	2016	absent

No	Speciality/trade	Qualification	ISCED 2011 level	Duration/years	Curriculum/year of approval	Qualification standard/year of approval	Nomenclature code*	Qualification is in National Register of Qualifications	Occupational standard	Frame curriculum/year of approval	Study plan/year of approval	Study materials
8	Electrician for repair and maintenance of electrical equipment Electrician/ locksmith for repairing electrical equipment		III	3	2016	2015	713007 – 713009	absent	2014	2015	2016	absent
9	Locksmith/ electrician to repair electrical equipment		III	2	2016	absent	713009	absent	absent	2015	2016	absent
10	Electrician for repairing and installing cable lines		III	2	2016	absent	713013	absent	absent	2015	2015	absent
11	Installer of heating installations and solar thermal equipment		III	2	2016	absent	732040	absent	2016	2015	2017	absent
12	Installer of ventilation and air conditioning systems, appliances and equipment		III	3	2016	absent	732040 732041	absent	2016	2015	2016	absent
13	Electrician installer of lighting networks		III	2	2019	absent	732009	absent	2016	2015	2017	absent
14	Electromechanic for electrical machinery and equipment		III	2	2019	absent	713004	absent	absent	2015	2017	absent

* Qualification is registered as an occupation/position in the classification of occupations for Moldova.
Source: Compiled by authors using reports from VET institutions, MECR and government decisions on annual training plans (www.legis.md/cautare/getResults?doc_id=115385&lang=ro (accessed 10 September 2019))

With reference to the qualification standard:

According to the Education Code of the Republic of Moldova, qualifications in VET are assigned according to the NQF, elaborated on the basis of occupational standards for each level of VET, in accordance with the European Qualifications Framework and reflecting the need for qualifications in the labour market. However, up to now, only four qualification standards in the field of electricity and energy have been developed, two of which are derived from the occupational standards.

The professional competences in the qualification standards, as per the methodology (MECR, 2019c), are described in terms of skills and knowledge. In the analysed qualification standards, the abilities are formulated similar to the work tasks of the occupational standard, and the theoretical content of the training modules is derived from these.

Given that there are just two qualification standards in the field of electricity and energy, developed on the basis of occupational standards, and bearing in mind that the working group for the elaboration of the qualification standard includes three to five people, of whom only one or two are representatives of trade unions/employers/companies that offer jobs/provide services in the field, it can be concluded that the labour market is represented to a very limited extent.

This restricted representation and consideration of labour market needs within the process of the development of educational programmes may influence the relevancy and compliance with the situation on the labour market and may be one of the reasons why employers continue to be dissatisfied with the quality of the educational offer.

4.5 Development prospects and skills implications

This section discusses the skills implications of smart specialisation in the dnergy sector. It combines research and evidence gathered from the interviews with employers and stakeholders representing public administration and professional associations. Given that the area is broad and the smart specialisation strategy is still to be finalised, the analysis will focus on the area of renewable energy, one of the key sub-areas identified during the entrepreneurial discovery process.

Most of the interviewees consider the following to be essential to the development of the sector:

- increase energy security;
- increase use of energy from alternative sources;
- research new alternative sources;
- create new companies specialised in the realisation and commissioning of alternative energy sources;
- attract external financing;
- provide incentives for SMEs; and
- develop a more supportive legislative framework.

Concerning the innovation process, the biggest challenge is the lack of financial resources and limited investments in innovation from both the government and the private sector. Additional barriers identified are initial high capital investments (sunk costs); the lack of state subsidies; poor state support for innovation and technology transfer; and the lack of laboratories. Companies in the Energy sector also suffer from recruitment difficulties.

From the existing national labour market and education data as well as interviews with employers, it can be concluded that the energy sector suffers from both skills shortages and skills gaps. Besides the technical skills, the gaps seem to also be in the knowledge of foreign languages and ICT skills.

Relevant education programmes exist at secondary, post-secondary and tertiary levels. However, the growing renewable energy sector is accelerating the change in skills demand and raising new expectations from VET and higher education providers. These processes change the skills requirements within existing occupations and give rise to new qualification and skills needs. Currently, the education offer related to renewable energy is very limited and concentrated mainly at the tertiary level. When it comes to vocational secondary or post-secondary education, the offer is almost non-existent in terms of scope and the number of providers. The training for adults is underdeveloped and companies are likely to provide (ad hoc) training themselves.

BOX 4.3 SUPPLY OF WORKERS FROM RELATED SECTORS

As specified in the methodology, the supply of workers in the energy sector could be theoretically provided from other – related – sectors or through immigration. To study this, one would need to understand what areas or sectors have the potential to become such 'suppliers'. Good administrative data or panel data would be needed to study the individual trajectories of workers and labour movements. This is not currently possible in Moldova.

From the interviews it seems that given the need for specific knowledge in the energy sector, there is no easy and straightforward link with other sectors. Therefore, mobility is likely to be limited. However, shifting the focus from traditional to renewable sources would mean the labour shifts within the sector, which would need to be supported by targeted training.

However, further research is needed to assess the potential of using the existing labour to supply the priority area.

From international experience, it is evident that the skills needed for the area of renewable energy call for new specialised profiles as well as supplementary targeted knowledge and skills, building on 'traditional' competences. This means that there is a need for responses from the formal education sector, adult education providers and employers.

The required skills generally cover different production steps, such as manufacture and distribution of equipment, project development, construction and installation, operation and maintenance, biomass production and cross-cutting occupations. Focusing, for example, on solar energy, three typical groups of jobs would cover workers responsible for building and maintaining solar installations, jobs related to sales, and high-skilled software and electrical engineers. Typical jobs would therefore be solar installer, sales consultant, electrician, project manager, electrical engineer, field service technician, maintenance technician, construction manager, project engineer or software engineer.

In general, the emerging profiles are connected with planning, manufacturing and operating renewable energy technologies. Thus, for example, there is a need for design engineers of wind/solar power, resource assessment specialists and technicians. On the other hand, additional competences related to the existing jobs are required, for example for electricians and plumbers who install small-scale renewable technologies (EU Skills Panorama, 2014). Among generic skills, teamworking and communication skills are key. In addition, people in technical roles are also expected to have good problem-solving and decision-making skills, as they are required to assess, monitor, diagnose and provide solutions (Baruah et al., 2018).

From the collected evidence in Moldova, the following preliminary profiles were identified as the most important if renewables are to be focused on within the smart specialisation strategy and which should be reflected in the education and training offer:

Tertiary education qualification:

- wind/solar power design engineers;
- wind/solar resource assessment specialists; and
- biomass production managers.

Secondary/post-secondary education qualification:

- wind/solar service mechatronics technicians; and
- electricians, plumbers, roofers and construction workers specialising in solar, wind and bioenergy.

Thus, there is a need for specific profiles to be integrated into the existing education and training offer. Moreover, there is an opportunity for the development of continuous professional training, which would offer short-term training for specific profiles, such as electricians or construction workers. An important role can be played by the Centre of Excellence in Energy and Electronics from Chișinău, which could be responsible for the implementation of innovation support services and the facilitation of technological transfer. In addition, there is a need to strengthen environmental awareness within the education and training system as a strategy to support the green transition of the economy and society.

Besides shaping the skills supply to support the development of the energy sector, training also needs to be provided to businesses, SMEs in particular. As SMEs are likely to be an important component of renewable energy and likely to be started by young entrepreneurs, entrepreneurial learning will play an important role. The recent SBA assessment in Moldova noted important work by the Centre for Entrepreneurial Education and Business Support in vocational education, including development and assessment of entrepreneurship competences. It also noted continued promotion of entrepreneurship skills of pupils in post-secondary vocational education. This should be widened to include more developed entrepreneurial experience through work placements where pupils not only have the opportunity to develop occupational skills but also learn how a business works. However, at the level of higher education, little strategic progress has been made to promote entrepreneurship. Entrepreneurship in higher education remains confined to individual champions within a number of universities (e.g. UTM, Academy of Economic Studies). University–business cooperation remains underdeveloped. Universities and the wider higher education community, in particular teaching and research staff, should be better integrated into the country's wider economic drive, including the SBA monitoring framework (ETF, 2020).

5. SKILLS ANALYSIS IN THE PRELIMINARY PRIORITY AREA OF FOOD PROCESSING

5.1 Overview[17]

5.1.1 Food processing priorities mapped under the smart specialisation framework

The Mapping of Economic, Innovative and Scientific Potential in the Republic of Moldova report mapped preliminary priority areas of specialisation for Moldova and its regions. The report exploits several national and international data sources to map specialisation potential and selected preliminary economic priority areas based on economic, scientific and innovation potential. Agriculture and food processing is one of three preliminary priority domains based on innovation potential.

This analysis was followed up by mapping of Moldovan science and innovation ecosystems with the aim of providing a more detailed description of the identified preliminary priority areas. This was done through topic modelling of patents, publicly funded R&D projects and scientific publications. The results of such modelling are summarised below.

FOOD PROCESSING

Agriculture and food processing is a technological- and innovation-oriented area, featuring an important contribution from patents but also significant publication records. It must be noted that the share of patents focused on technological innovation is growing.

The following topics are patent-intense, focusing on farming, food processing, alcohol production and food industry machinery. Two of the topics are publication-intensive, focusing on biotechnology and genetics. European projects are mostly connected to the latter field.

Source: SIRIS Academic (2018)

Building on the analysis of technological innovation and scientific potential, the identified sub-areas for smart specialisation related to agriculture and food processing through the entrepreneurial discovery process (organised by the MECR) are shown in Table 5.1.

[17] Food processing involves the change of raw materials into edible products. It also includes scientific and technological processes to preserve food or to change the food qualities.

TABLE 5.1 SITUATION OF THE AGRICULTURAL SUBSECTORS

Agricultural biotechnologies, horticulture and field crops	Animal husbandry and veterinary medicine	Processing of agricultural raw materials
■ Varieties of plants with high productive potential that are not fully exploited ■ Sub-domain branches (fruit, vegetable, ornamental plants, nuciferous, genetics and breeding, agro-technical and protection technologies, organic farming) are not fully exploited due to the lack of financial resources ■ Lack of communication between producers and researchers, and lack of interest in new technologies	■ Favourable climatic conditions ■ The experience (tradition) of raising animals ■ The existence of processing infrastructure ■ Existence of the gene pool of wild animals, but with a low level of manifestation ■ Existence of innovative potential	■ Scientific potential ■ Functional products elaborated but are not capitalised by the private sector ■ Domestic raw material ■ Poor orientation towards the technological process based on end products with weight in the value chain ■ Non-performing infrastructure for product quality testing

Source: USARB (2019)

5.1.2 Overview of the food processing subsector

The agriculture and food processing sector is an important part of Moldova's economy, international trade and export. The sector accounts for 18% of GDP, 50% of total exports (IFAD, n.d.) and employs more than 30% of the labour force (OECD, 2020), of which 25% (80 700) are directly employed by agri-enterprises, while the other 75% (242 300) are classified as self-employed. The share of household income coming from agricultural activities has been decreasing and represents up to 45% in the case of farmers and 50% to 60% for the employers in agriculture. The contribution to the revenue of the rural population is up to 20% (FAO, n.d.).

The agriculture and food processing industry focuses largely on production and processing of fruits, vegetables, grains and livestock. The food processing sector accounts for 37% of manufacturing production (OECD, 2020b). Food production is led by the processing and preserving of meat products (24% of value added), then equally distributed between fruit and vegetables, fish and seafood products, and preparation of vegetable and animal oils and fats (15% to 16% of value added) (SBA). Wine and spirits and fruit and vegetables, both fresh and processed, are the main exported products. Together these two categories account for circa 40% of exports. Exports to the EU and CIS account for 85% of foreign trade. Agri-food exports to the EU constituted EUR 589 million while imports constituted EUR 325 million (DGARD, 2021). Enhancing Moldova's agricultural competitiveness is a key element in improving the access of Moldovan agri-food products to the EU market and capitalising on the potential benefits from the Association Agreement (including the DCFTA).

Moldova is largely self-sufficient in terms of food production as the majority of the population's food requirements are met domestically. The sector also supplies raw materials for other sectors dependent on agriculture. However, to achieve stable growth in agri-food exports, there is a need to diversify exports and increase access to high value markets (World Bank, 2016). Challenges include emigration and an ageing labour force; the lack of product testing units in industrial quantities; and limited exploitation of functional products by the private sector.

The majority of existing businesses in food processing are MSMEs (see Table 5.2).

TABLE 5.2 STRUCTURE OF BUSINESSES IN THE SECTOR OF MANUFACTURING FOOD PRODUCTS AND BEVERAGES BY SIZE (%)

	2015	2016	2017	2018
Structure of businesses by size (%)				
Large	7	6	7	7
Medium	7	7	6	7
Small	22	21	21	19
Micro	65	65	66	67
Structure of businesses by their contribution to turnover (%)				
Large	77	78	79	78
Medium	12	12	10	11
Small	9	8	9	9
Micro	2	2	2	2

Source: Authors' calculation based on NBS data

The organic sector does not have a long history, but combined efforts by non-governmental organisations, private investors and the government have resulted in Moldova exporting over 75 000 tonnes of organic products to the EU, making it the market leader in the Eastern Europe, Caucasus and Central Asia region (Invest Moldova, 2018/2019). Turning further production to organic products has the potential to revitalise the food processing sector. Producers of organic products benefit from a price premium as organic foods are marketed up to 150% higher than the price of comparable conventionally produced goods (European Commission, 2019b). A basic national regulatory framework is in place for organic foods. Law No 115-XVI of 9 June 2005, regarding organic agriculture products, and regulations for using the 'Organic Agriculture – Moldova' mark are also in force: Law No 1078, 22 September 2008. Standards are based on EU regulation 2092/91 (now 834/2007 and 889/2008). Regulations include ecological principles and methods of processing organic food production, an inspection and certification system in the field, and import and export of organic food products. Each organic farm and processor has to be registered by the Moldovan authorities (Global Organic Trade Guide, n.d.).

5.2 SMEs

The Moldovan agricultural private sector is composed of a corporate sector with large companies and an individual sector that includes peasant farms and household land on private property. Small agricultural farms, especially subsistence and semi-subsistence farms, generate a limited surplus of high value added crops (fruits, nuts, grapes, vegetables, potatoes) that are mostly sold in open-air agricultural markets. Large-scale agricultural companies specialise in the production of low value added crops (such as cereals, oilseeds and sugar beet), and employ limited labour force due to the high level of mechanised operations. This specialisation has been driven by a number of factors, such as the relatively low production cost of these crops, the availability of agricultural machinery allowing the rapid cultivation over large areas, relatively simple and cheap post-harvest facilities, and assured markets for these commodities (Vittuari et al., 2020).

There is a large degree of heterogeneity in the characteristics and performance of agriculture producers. There are about 900 000 farms in Moldova, with an average size of 2.5 hectares (ha) (see Table 5.3). Overall, 88% of producers engaged in fruit production (nearly 400 000) have holdings of

less than 0.1 ha. Another 9% (just over 40 000) have holdings between 0.1 and 0.5 ha. At the larger end of the spectrum, fewer than 1 000 farmers have holdings of 10 ha or more. Of these, 115 farmers have holdings of more than 100 ha.

TABLE 5.3 AGRICULTURE HOLDINGS BY SIZE

	Area (ha)	Number of agricultural holdings
> 50 ha	24 568	638
100 < 200 ha	89 859	621
200 < 500 ha	314 416	965
500 < 1 000 ha	378 418	550
1 000 < 2 500 ha	338 692	229
> 2 500 ha	187 953	49
Total	2 243 540	902 214

Source: Invest Moldova (2018/2019)

Each year, approximately 20% of all vegetables and 55% of all fruits are processed – approximately 300 000 to 350 000 tonnes per year. Fruit and vegetable processors consist of a small number of large firms, focused on export markets and producing about 80% of the total sector output, and about 80 small and medium canneries, mainly serving the domestic market. Canned fruits and vegetables have the most significant export volumes, including peas, corn and whole tomatoes. Additional processed items are tomato pastes and ketchups, purees for babies, jams, preserves and speciality items, while more than 90% of production is for export. Only one-third of the potential of the fruit and vegetable processing industry is currently utilised.

It is important that the SME food processing sector, in the domestic as well as the international trade areas, grasps a share of the export market. For this, SME producers need up-to-date pricing strategies, marketing, labelling, supply chain management, technology and operational innovations, such as packaging and sustainable processing, to stay competitive. At present, there are eight primary exporters: Orhei-Vit, Alfa-Nistru, Ecovit, Natur Bravo, Fortuna Plus, Covali & Co, VMPlumCom, and Monsterax-GSG (Invest Moldova, 2018/2019).

Moldova's meat processing industry is highly consolidated. According to official statistical data, in 2016 there were 90 meat processing enterprises and production units in Moldova. Carmez in Chișinău and Basarabia Nord in Bălți dominate the domestic market, together representing about two-thirds of the local market. Along with Carmez International (a Belgian joint venture separate from Carmez), these companies dominate the export market and have strong brands. All three companies import about 85% to 95% of their meat and offal raw material, and nearly all of their ingredients are used to manufacture sausages and ham. A handful of smaller manufacturers supply sausages and smoked meats to the supermarket and small shop outlets in cities and towns. Meat companies operate their abattoirs on an intermittent basis because domestic stock is more expensive than imported frozen meat. The products from the processing industry are exported mainly to the CIS. Animal products exported from Moldova to the EU are currently restricted to honey, egg powder and animal by-products. In 2019, Moldova produced approximately 7 630 tonnes of cattle meat, 65 000 tonnes of pork, and 43 200 tonnes of poultry (FAOSTAT, 2020).

The dairy industry is based primarily on the supply of raw milk from small producers, company-owned collection centres and dairy cooperatives with collection centres financed by the dairy companies or

through donor programmes. Further investments in milk processing facilities will lead to an increase in the subsector's efficiency, both related to productivity and quality of the milk (FAO, 2020).

There is a small segment of the horticulture processing industry that adds value by producing shelled walnuts in retail-sized packages (EU market); apple juice, preserved vegetables and jams (niche markets in Germany); and tomatoes (Russia, Belarus, Kazakhstan and supermarkets in Moldova). However, the size of the processing sector (excluding wine) is relatively small (World Bank, 2016).

Agribusinesses tend to compete more on price than on innovation and quality. Penetration rate of business development services provided by the government is low and do not play a substantial role in developing managerial skills (OECD, 2020b). According to a study (OECD, 2016), almost 50% of SMEs were not aware of services provided by Moldova's Organisation for Small and Medium-Sized Enterprises Sector Development (ODIMM), and less than 14% had benefited from its services in the last three years. The penetration rate of the services of the Moldovan Chamber of Commerce and Industry stand out with 45% of companies having benefited from their services in the last three years. Reasons for limited usage of government support services could be the result of SMEs lack of awareness of their own training needs, awareness of available of training offer, or perceived value of offer in advisory services.

SMEs in the food processing sector are finding it difficult to build linkages with large retailers selling in Moldova and less than half of SMEs are selling directly to at least one of the seven major retailers while nearly 80% would like to do more business with them (OECD, 2020b).

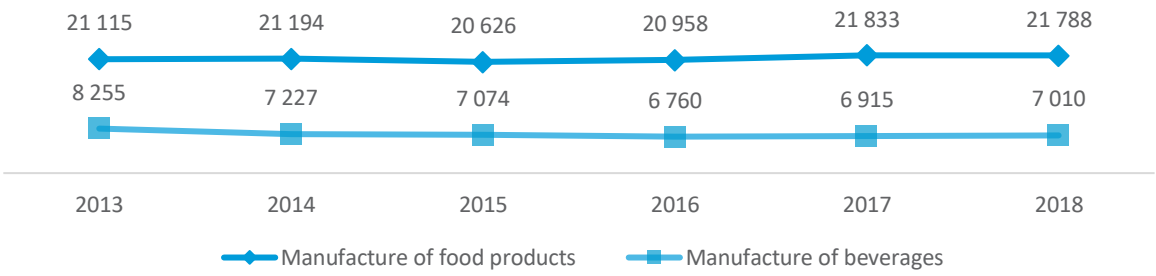
5.3 Employment

This section compiles available data on the food processing priority area and provides evidence gathered through qualitative interviews. As in the case of the first priority area, the availability of data is an issue and detailed reliable data is missing to a large extent. This also means that, where necessary, more aggregated data is used, which limits the precision of the analysis. Therefore, the primary focus is on data related to the subsector of manufacture of food products and beverages[18]. However, in the case of some data sources, such as LFS data, the focus is only on a more aggregated category of manufacturing or even industry.

The number of employees in food processing has been stable recently, with a slight increase since 2016 (see Figure 5.1). Staff turnover cannot be observed at the level of food processing, but only for manufacturing in general. Such data shows that staff turnover is high and has increased over time. Interestingly, the number of hired workers exceeded the number of those dismissed in 2018 (see Table 5.4).

[18] As already mentioned, the delineation of smart specialisation priority areas does not necessarily follow the categorisation used under, for example, NACE. Therefore, the choice of data and respective subsectors tries to identify the most relevant subsectors/sectors for the chosen priority area. In the case of Moldova, the smart specialisation priority area actually reflects the 'sectoral' categorisation, which makes the choice of sectors and subsectors more straightforward.

FIGURE 5.1 NUMBER OF EMPLOYEES IN MANUFACTURING OF FOOD PRODUCTS AND BEVERAGES (PERSONS, YEARLY AVERAGE)



Source: NBS, statistical survey – M3 annually 'Salary earnings and labour force cost'

TABLE 5.4 STAFF TURNOVER IN MANUFACTURING, 2015 AND 2018

	2015				2018			
	Hired		Dismissed		Hired		Dismissed	
	Total (persons)	% of vacancies	Total (persons)	% of vacancies	Total (persons)	% of vacancies	Total (persons)	% of vacancies
All economic activities	160 737	21.9	169 283	23.1	227 966	28.6	212 705	26.7
Manufacturing	29 702	29.1	30 599	29.9	50 171	43.2	46 617	40.1

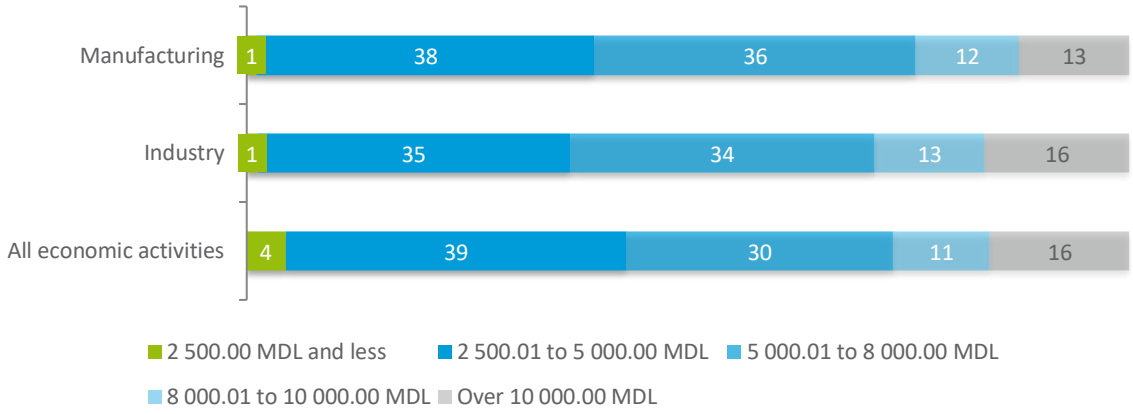
Note: Data is presented for social and economic units with four or more employees and all budgetary institutions regardless of the number of employees; statistical survey 'Mobility of employees and jobs'.
Source: NBS

When it comes to the education and occupational structure of the workforce in food processing, we rely on the aggregated data from the LFS, which only provides information at the industry level. Referring to Tables 4.3 and 4.4, the structure of employment in the industry sector pointed to a high share of middle-skilled workers, representing about half of all employed people in the sector. Moreover, a large share of employed people had general secondary or a low level of education, at around 33% in 2018. Although no strong conclusions relevant to food processing can be drawn, given the nature of jobs, it can be assumed that the requirements in terms of skills needs are lower than in the energy sector[19]. In terms of the occupation structure, the industry sector is characterised by a large share of occupations requiring mid-level skills, such as craft and related trades workers or operators. Again, given the data aggregation, such findings need to be considered as indicative.

As in the case of energy, the earnings structure can be used as a proxy to indicate the level of skills required (see Figure 5.2). Although the available data only looks at the structure of manufacturing, the earnings distribution is clearly skewed more towards low and middle levels of earnings and, thus, we may assume that the available jobs require a lower level of skills in comparison to energy.

[19] This is also confirmed by the evidence collected through the interviews with employers.

FIGURE 5.2 DISTRIBUTION OF EMPLOYEES BY SALARY, SEPTEMBER 2019 (%)



Note: Data includes real sector economic units with four or more employees and all institutions in the budgetary sector.
Source: Authors' calculation based on NBS data and statistical survey – 'Distribution of employees by earning size in September'

Additional data on the average monthly net salary in the subsectors of manufacture of food products and beverages show that the average salary is lower than the overall level for all economic activities (see Table 5.5). Again, assuming that salaries are positively correlated with qualification, this indicates the use of low-skilled labour within this subsector.

TABLE 5.5 AVERAGE MONTHLY NET SALARY IN MANUFACTURE OF FOOD PRODUCTS IN THE REAL SECTOR (IN MDL)

	2013		2014		2015		2016		2017		2018	
	W	M	W	M	W	M	W	M	W	M	W	M
Manufacture of food products	2 724	3 017	3 122	3 349	3 267	3 689	3 437	3 994	3 934	4 325	4 181	5 004
Manufacture of beverages	2 677	3 588	2 868	3 582	3 195	3 884	3 566	4 373	3 915	4 879	4 394	5 390
Total	2 902	3 262	3 190	3 631	3 507	4 029	3 808	4 438	4 268	4 896	4 764	5 555

Note: Data includes real sector economic units with one or more employees and all institutions in the budgetary sector. W – women; M – men.
Source: NBS, statistical survey – M3 annually 'Salary earnings and labour force cost'

The NBS data related to the vacancies in manufacturing shows increasing demand for workers: 5 148 vacancies were recorded at the end of 2015 and 7 499 vacancies at the end of 2019. Using additional data from the NEA database showing registered vacancies, a snapshot of the situation at the end of 2017 can be obtained (see Table 5.6). The registered vacancies in food processing point to the need for operators in production as well as bakers and sweet-makers.

TABLE 5.6 REGISTERED VACANCIES RELEVANT TO FOOD PROCESSING, 31 DECEMBER 2017 (PERSONS)*

	Total	Rural	Urban
Workers – Total	291	22	269
Technician in making bread (panification)	2	0	2
Laboratory technician	1	0	1
Public food technology	1	0	1
Quality control of grains and grain products	6	0	6
Food preparation	2	0	2
Baker	53	8	45
Sweet-maker	63	9	54
Pastry chef	1	0	1
Operator of apparatus for pasteurisation and cooling of milk	1	0	1
Baker in a production line	3	3	0
Operator in the production sector	135	2	133
Online operator in the food industry	10	0	10
Assembler of industrial, construction and agricultural equipment	2	0	2
Other	11	0	11

Note: *It is important to note here that the data reflects only the vacancies reported by companies to the public employment service, so it does not reflect the entire labour market.

Workers (not including unskilled employees): trade professionals, service workers, operators of machinery, sales clerks, hairdressers, dressmakers, electricians, welders, mechanics, etc.

Source: Compiled by authors based on NEA administrative data

Finally, although the majority of employees in manufacturing of food products and beverages work in large companies, 39% of them worked in MSMEs in 2018 (see Table 5.7).

TABLE 5.7 DISTRIBUTION OF EMPLOYEES BY SIZE OF BUSINESSES IN THE MANUFACTURING OF FOOD PRODUCTS AND BEVERAGES (%)

	2015	2016	2017	2018
Large	57	57	61	61
Medium	21	21	18	18
Small	16	16	15	14
Micro	6	6	6	6

Source: Authors' calculation based on NBS data

Skills from the employers' perspective

Interviews with selected representatives of businesses active in food processing were carried out to complement the existing quantitative data and provide an indication on the *current* skills gaps and needs.

In general, the interviewed companies recognise the potential in food processing, building on the existence of raw materials and a favourable country position. Food processing companies in Moldova

seek to follow global trends and new technologies. The key challenges for their development are access to finance and human resources. Businesses also suffer from limited cooperation with the research community.

The workforce employed in the interviewed businesses is made up of a mix of skilled and unskilled workers, the latter hired especially during the growing season. The companies tend to hire (young) workers for simple operations related mainly to processing raw materials. For more advanced technological operations, skilled workers are used. The lack of qualified workforce was also recognised. Companies often face difficulties in recruiting qualified staff and need to dedicate resources to training their workers.

In general, the current (both technical and generic) competences needed in food processing are connected with the ability to handle relevant equipment, be able to effectively manage time and information, work in teams, and be resilient or motivated to learn. However, employers report a lack of technical skills, work ethic and motivation, which negatively influences the performance of companies. In addition, employees lack a mix of personal attributes and professional/vocational skills. In particular, this covers interest in personal development, responsibility, ability to cope with change, positive work ethic and general interest in the job. Required professional/specific skills include food hygiene, understanding quality, dexterity, machinery/technology operation and maintenance skills, and health and safety.

Apart from personal and job-specific skills, SMEs in particular mentioned the need for multi-skilling. In SMEs it is common for employees to be able to operate machinery, carry out maintenance or work in the processing/production section and, in addition, to have a customer service role, as processing, production and sales are often integrated.

The interviewed employers recognise that traditional manual skills are now less required, while skills in machine and technology operation have become more important. The rising level of mechanisation, automation or computerisation of the food processing operations requires specific professional skills to operate, regulate and maintain these technologies. The use of modern equipment and machinery requires a high level of technical and ICT skills and there is currently a lack of experienced technologists. Also, given the increased use of automation for production processes, there is a perceived need to develop skills related to mechatronic engineering.

Finally, when it comes to the management level, there seems to be a lack of knowledge related to management and administration. The employees responsible for administration or management often have technical backgrounds but no economic or business management knowledge.

5.4 Provision of education and training

As in the case of energy, the analysis of the training offer focuses on the legal framework as well as the programmes and providers active in the area of food processing. As was the case for the priority area of energy, the education programmes on offer in Moldova have remained largely unchanged in the last seven years. The connection between professional competences included in the educational standards and the professional competences within learning outcomes in the curricula are superficial or missing. In addition, the lack of occupational standards and qualification standards for a number of occupations in the studied area indicates that curricula may not reflect real labour market needs in terms of skills.

5.4.1 Education and training offer relevant to the priority area of food processing

The programmes in the field of food processing are mainly provided by universities, colleges, centres of excellence and vocational schools.

Higher education

Higher education with an agri-food profile can be found at UASM. Some specialities and specialisations are also provided by UTM, USM, State University Alecu Russo from Bălți, Comrat State University, and State University B.P. Hasdeu from Cahul.

VET

There are twelve VET institutions providing VET programmes in the field of food processing: three centres of excellence, two agro-industrial colleges and seven vocational schools (see Table 5.8). The VET institutions are located in different regions of the country. Six of the VET institutions are in the north, four in the centre and two in the southern part of Moldova. All institutions are public.

TABLE 5.8 PROVIDERS OF VET PROGRAMMES IN THE FIELD OF FOOD PROCESSING BY GEOGRAPHICAL LOCATION AND MODE OF OWNERSHIP

No	VET institutions	Geographical area	Mode of ownership
1	Agro-industrial College from Grinauti	North	Public
2	Professional School from Cupcini, Edineț	North	Public
3	Centre of Excellence in Horticulture and Agricultural Technologies from Țaul	North	Public
4	Professional School from Soroca	North	Public
5	Centre of Excellence in Food Processing and Services from Bălți	North	Public
6	Agro-industrial College from Rîșcani	North-west	Public
7	Centre of Excellence in Viticulture and Winemaking in Chișinău	Central/capital	Public
8	Professional School No 2 from Chișinău	Central/capital	Public
9	Professional School No 5 from Chișinău	Central/capital	Public
10	Professional School from Ungheni	Western central	Public
11	Professional School from Cimișlia	South	Public
12	Professional School No 1 from Cahul	South-west	Public

Source: Compiled by authors using MECR data (https://mecc.gov.md/ro/content/institutii-de-invatamant-0 (accessed 10 September 2019))

The number of students at both secondary and post-secondary VET has remained stable. More female students than male students are enrolled in the food processing programmes at secondary level: during academic year 2018/19, 73% of the students were female. The opposite is true for the post-secondary VET level: only 39% of students were female in academic year 2018/19 (see Tables 5.9 and 5.10).

TABLE 5.9 NUMBER OF STUDENTS, ENROLLED AND GRADUATES, IN SECONDARY VET IN THE FIELD OF FOOD PROCESSING BY SEX

	2016/17			2017/18			2018/19		
	Total	Female	Male	Total	Female	Male	Total	Female	Male
Students	1 136	825	311	1 140	794	346	1 141	832	309
Enrolled	552	400	152	561	395	166	623	453	170
Graduates	156	98	58	472	326	146	489	362	127

Source: Compiled by authors using NBS data

TABLE 5.10 NUMBER OF STUDENTS, ENROLLED AND GRADUATES, IN POST-SECONDARY VET IN THE FIELD OF FOOD PROCESSING BY SEX

	2016/17			2017/18			2018/19		
	Total	Female	Male	Total	Female	Male	Total	Female	Male
Students	1 129	676	453	1 130	451	679	1 127	440	687
Enrolled	339	m.d.	m.d.	320	m.d.	m.d.	323	m.d.	m.d.
Graduates	223	128	95	244	146	98	231	88	143

Note: m.d. = missing data
Source: Compiled by authors using NBS data

There are 14 VET programmes offered in the field of food processing, out of which 8 are at ISCED level 3. Such training for qualified workers covers trades such as baker, food controller, line operator in the food industry, sweet-maker, confectioner/pastry chef, deboner and meat slicer, sausage food processor, and operator on an automatic dairy production line. In addition, there are six VET programmes at ISCED level 4 in technology of vegetable products, safety of agri-food products, baking technology, technology of animal products, technology of public food, and technology of fermentation products (see Table 5.11). The number of programmes may vary from year to year.

TABLE 5.11 VET INSTITUTIONS OFFERING PROGRAMMES IN FOOD PROCESSING

No	VET programme \ VET institution	Agro-industrial College from Grinauti	Agro-industrial College from Rîșcani	Centre of Excellence in Viticulture & Winemaking in Chișinău	Centre of Excellence in Horticulture & Agricultural Technologies from Țaul	Centre of Excellence in Food Processing & Services from Bălți	Professional School No 2 from Chișinău	Professional School No 5 from Chișinău	Professional School No 1 from Cahul	Professional School from Cupcini, Edineț	Professional School from Ungheni	Professional School from Cimișlia	Professional School from Soroca
1	Technology of vegetable products	+		+	+								
2	Safety of agri-food products				+								
3	Baking technology		+										
4	Technology of animal products	+											
5	Technology of public food products	+											
6	Technology of fermentation products			+									
7	Sweet-maker							+					
8	Confectioner/pastry chef							+	+	+	+	+	
9	Baker					+	+	+					
10	Baker – confectioner					+	+	+					
11	Deboner and meat slicer							+					
12	Food controller						+		+				
13	Operator on an automatic dairy production line							+					
14	Sausage food processor							+					

Source: Compiled by authors using reports of VET institutions, NBS data, MECR and government decisions on annual training plans (www.legis.md/cautare/getResults?doc_id=115385&lang=ro (accessed 10 September 2019))

Some professional schools and private institutions provide continuing vocational training (see Table 5.12). They offer short courses that range from one to two weeks up to six months and aim for the development of professional skills in some trades at ISCED level 3. The training is, however, not regular and is often only organised on request.

TABLE 5.12 CVET PROVIDERS IN THE FIELD OF FOOD PROCESSING BY OWNERSHIP AND GEOGRAPHICAL LOCATION

	CVET provider	Ownership	Trade	Location	Geographical location
Food processing	BACO LLC	Private	Confectioner	Chișinău	Centre
	Insula Speranțelor	Private	Confectioner	Chișinău	Centre
	Viitorul Meu LLC	Private	Confectioner	Chișinău	Centre
	MBS LLC	Private	Confectioner	Chișinău	Centre
	Actual Prof	Private	Confectioner	Chișinău	Centre
	Miracol LLC	Private	Confectioner	Bălți	North

Source: Compiled by authors

Some companies provide short courses, mostly when hiring new workers or when they need to upgrade the qualifications of their own employees. Again, the detailed data regarding such training is missing. However, referring to the data on manufacturing collected by NBS (see Table 5.13), we can see that this type of training is not so common (compared to the level for all economic activities), as only 11% of employees in the field participated in training organised by the enterprises.

TABLE 5.13 SHARE OF EMPLOYEES (FROM CORRESPONDING ACTIVITY) PARTICIPATING IN CONTINUING VOCATIONAL TRAINING IN THE FIELD OF MANUFACTURING (%)

	2014	2015	2016	2017	2018
All economic activities	15	15	15	16	18
Manufacturing	8	10	8	11	11

Note: The data includes economic and social units and budgetary institutions with 10 or more employees; continuing vocational training represents all training measures or activities (courses or other forms of vocational training) which are organised and financed by the enterprises totally or partly, for their employees. In order to include an activity in the continuing vocational training category, it should be planned in advance, financed at least partly by the enterprise or from external assistance granted to the unit (grants, sponsorships etc.), and have as their objectives the acquisition of new competences or the development and improvement of existing ones.

Source: NBS, statistical survey 'Vocational training of employees'

CVET in the field of food processing is underexploited. Similarly to other sectors, it is not provided systematically and systemically.

Specific training is provided through different donor projects, for example the United States Agency for International Development's Performance Agriculture project, the EU's Development of Rural Areas project and the European Investment Bank's Livada Moldovei project.

Furthermore, the Ministry of Agriculture, Regional Development and Environment offers annual subsidies to service providers for the provision of consultancy and training services in the field of agriculture. For example, in 2019, under the Măsura 5 regulation on the granting of the National Fund for the Development of Agriculture and Rural Environment, subsidies were awarded to 18 service providers, including the National Federation of Farmers of Moldova, the Federation of Farmers of Moldova, ProConsulting LLC, and the Employers' Association of the Value Chain Alliance in Organic Agriculture in Moldova.

5.4.2 Legal framework for curriculum design in the food processing subsector

The professional training of skilled workers, technologists, technicians and other categories of specialists in the field of food processing is done according to the NQF, the Nomenclature of the Vocational Training Fields and of the Trades/Professions and the Nomenclature of the Vocational Training Fields of the Specialities and Qualifications, approved by the government, and are in line with ISCED 2011 levels 3 and 4[20].

With reference to the curricula:
Currently, all VET programmes in the field of food processing have set curricula, which are modular in design. However, the textbooks and other didactic materials are still to be elaborated and are lacking at the moment. Consequently, this hinders the teaching and learning process. In the absence of primary didactic sources, the quality of the teaching process is dependent on the quality and motivation of teachers.

With reference to the occupational standards:
The competences of the graduates of VET programmes in the field of food processing are formulated in the NQF in accordance with the occupational standards. Currently there are five occupational standards for occupations/working professions at ISCED level 3. There are no occupational standards for occupations at ISCED levels 4 and 5 (see also Table 5.14).

With reference to the qualification standard:
To date, seven qualification standards in the field of food processing have been developed. Only three of the qualification standards have been prepared based on occupational standards as requested by the methodology on the development of qualification standards (see Table 5.14 for more details).

As mentioned above, the professional competences in the qualification standards, as requested by the methodology, are described in terms of skills and knowledge. In the analysed qualification standards, the abilities are formulated similarly to the work tasks within the occupational standards, and the theoretical content of the training modules is derived from these. The qualification standard also covers the methods for assessing professional competences for both knowledge and skills.

In the absence of occupational standards, the existing qualification standards (four in the field of food processing), provided for the elaboration of the occupational profile of the speciality/trade, serve as the basis for specifying the professional skills of the VET graduates that are required by the labour market.

As in the case of the first priority area, the working group responsible for the elaboration of the professional qualification includes three to five people, with very limited representation of trade unions and employers. Consequently, the reflection of labour market needs within the development of relevant education programmes is very limited.

[20] Education Code of the Republic of Moldova, No 152/2014.

TABLE 5.14 ANALYSIS OF THE EDUCATIONAL OFFER FOR VET PROGRAMMES IN THE SPECIALITIES AND TRADES WITHIN THE FIELD OF FOOD PROCESSING

No	Speciality/trade	Qualification	ISCED 2011 level	Duration/years	Curriculum/year of approval	Qualification standard/year of approval	Nomenclature code*	Qualification is in National Register of Qualifications	Occupational standard	Frame curriculum/ year of approval	Study plan/year of approval	Study materials
1	Technology of vegetable products	Food industry technician	IV	4	2017	2016	72150	absent	absent	2015	2017	absent
2	Safety of agri-food products	Quality assurance technician	IV	4	2017	2015	72110	absent	absent	2015	2016	absent
3	Baking technology	Baking technician	IV	4	2017	2015	72130	absent	absent	2015	2016	absent
4	Technology of animal products	Food industry technician	IV	4	2017	2015	72140	absent	absent	2018	2018	absent
5	Technology of fermentation products	Food industry technician	IV	4	2017	2015	72160	absent	absent	2018	2018	absent
6	Sweet-maker	Sweet-maker	III	2	2017	absent	721002	absent	absent	2015	2017	absent
7	Confectioner/ pastry chef	Confectioner/ pastry chef	III	2	2016	2015	721008	absent	2013	2015	2015	absent
8	Baker	Baker	III	2	2016	2015	721004	absent	2014	2015	2015	m.d.
9	Baker – confectioner	Baker – confectioner	III	3	2016	2015	721004 – 721008	absent	2014 2013	2015	2015	absent
10	Deboner and meat slicer	Deboner and meat slicer	III	2	2017	absent	721007	absent	absent	2015	2017	absent
11	Food controller	Food controller	III	2	2017	m.d.	721009	absent	2016	2015	2017	absent
12	Operator on an automatic dairy production line	Operator on an automatic dairy production line	III	2	2017	m.d.	721018	absent	absent	2015	2017	absent
13	Food controller – line operator in the food industry	Food controller – line operator in the food industry	III	3	2017	absent	721009 – 721019	absent	2016– absent	2015	2017	absent
14	Sausage food processor	Sausage food processor	III	2	2017	absent	721024	absent	2016	2015	2017	absent

Note: Qualification is registered as an occupation/position in the classification of occupations for Moldova and the nomenclature of specialities/trades; m.d. = missing data

Source: Compiled by authors using reports from VET institutions, MECR data and government decisions on annual training plans (www.legis.md/cautare/getResults?doc_id=115385&lang=ro (accessed 10 September 2019))

5.5 Development prospects and skills implications

This section examines the potential skills implications of smart specialisation in food processing. The analysis combines research and the evidence gathered from interviews with employers and stakeholders representing the public administration and professional associations.

The analysis of the current situation in terms of skills demand and training provision in the field of food processing reveals that, despite the wide range of education and training providers, there is still a lack of specialists to satisfy the existing needs. The lack of resources is also connected with inefficient human resources practices, uncompetitive job offers, poor working conditions, low salaries and geographical barriers. This is especially problematic for SMEs.

Aspirations for EU membership have resulted in a series of market-oriented reforms providing access to the EU single market and facilitating the export of goods. These dynamics have led to emerging skills needs; for example, marketing and management skills are essential for technicians in order to understand consumer needs, to ensure good quality of products and to adapt to the requirements of different markets.

The legislative framework in the field of food processing is becoming more complex. This requires additional knowledge of the application of environmentally friendly practices, as well as compliance with the requirements in the field of trade and consumer protection. There is also a need to learn the procedures for quality assurance, to verify the process of organising and carrying out the work, to modernise the equipment involved in the processing of food, and to improve quality control.

In general, the number and variety of schools and centres that offer educational and training programmes in food processing suggests that there is potential to satisfy the demand for skills. However, the available continuing education and training is still rather underdeveloped. In response to the changing demand for skills, it is essential that the education system adjusts the offer and reforms the content of curricula to integrate the formation of new skills, such as marketing and management skills and high-level technical and ICT skills, to respond to automation and the pace of technological development. Higher priority should be given to job-specific skills (including food hygiene, understanding quality, dexterity, machinery/technology operation and maintenance skills, and health and safety) and transferable and integrated/multi-skills. In addition, one of the potential growth areas is organic foods, which is not supported by any of the existing programmes.

The VET institutions, especially the VET centres of excellence, have the potential to become important actors in regional innovation systems. This is due to their focus on work-based learning and cooperation with companies, particularly SMEs.

It is expected that the integration of new technologies will be intensified, for example with processing and preservation of food products. In addition, there will be a need for education and training related to new occupations in organic food production and processing. The rising level of mechanisation/automation/computerisation of food processing operations requires specific professional skills to operate, regulate and maintain the modern technologies. Moreover, awareness of environmental issues is becoming very important. For example, most countries require the processed food to be prepared with high-quality water. In Moldova, there is a concern about the contamination of aquifer horizons. Many food processing companies use water extracted from wells, from deep aquifers, to avoid problems with surface water. Yet, the quality of such water is influenced by geochemical conditions, such as the levels of fluoride, strontium and selenium. Therefore, the water from wells needs to be further treated by most processing companies.

These tendencies are in line with the existing research. In general, to boost and innovate the field of food processing, there is a need to respond to the increasing use of (digital) technology and to higher requirements for safety and environmental issues, which are becoming more important for both local and international consumers. Moreover, there is a need for strong communication/marketing skills. Despite the continuous need for (seasonal) unskilled labour, the existing occupational profiles need to change in terms of their content. Moreover, it is expected that new occupation profiles will emerge (Akyazi et al., 2020; OECD, 2019).

Based on the evidence gathered in Moldova, the following technical and generic skills and knowledge were identified as key to supporting the growth and innovation of the food processing area:

- advanced mechanical operations, including manufacturing practices, work measurements and process controls;
- ability to operate and maintain machines;
- extensive knowledge of safety-related issues, which implies skills and knowledge in biotechnology, supply chain communication and safety training;
- environment-related issues related to, among other things, sustainable plant design, waste reduction and water protection;
- computation skills that may range from basic knowledge that workers need to have to operate the technology to advanced programming skills to manage data or interface with consumers online; and
- communication skills, used in different contexts and with different interlocutors, such as employees, supply chain partners and clients. Such interactions can be face-to-face but also online, which points to the need to learn to use online communication tools. In view of strengthened exports, cultural awareness is also important.

The future trends point to the stronger role of researchers in the field of food technology, data analysts, information system management and maintenance specialists, marketing specialists and sustainable food systems specialists.

BOX 5.1 SUPPLY OF WORKERS FROM RELATED SECTORS

Can the supply of workers be channelled from other related sectors, in particular those currently facing economic decline? As in the case of energy, the missing data prevents us from analysing labour flows and, consequently, from identification of the related sectors.

Based on the interviews, there are opportunities for movement of workers, if supported by additional targeted training. For example, for occupations in the field of sales, marketing, data analysis or communication, there is potential in the (broad) sector of services. For the production process, people from the agriculture sector can potentially move to the area of food processing.

Yet, as in the case of the first priority area, further research is needed to assess the relatedness and potential for shifting labour from one sector to another, while bearing in mind that Moldova suffers from major labour shortages and has difficulties retaining labour in the country.

The future skills needs connected with the development and support of the priority area of food processing can primarily be addressed through formal education programmes as well as short-term workplace training. The current education and training provision exists at different qualification levels. However, it is relatively narrow. There is a need to promote broader profiles, combining technical skills and knowledge focusing on ICT skills, sustainable food technology and marketing skills. This is especially important given the existing business structure with a significant role of SMEs, where multi-skilling is needed. In addition, if the organic food industry is to be promoted, there is a need to develop profiles such as organic food scientists, organic food handlers, quality and safety supervisors, and marketing and salespeople.

Finally, there is a need to support regular workplace training, mainly connected with handling of machines, safety and environment-related regulations. This leads to the need to support businesses with targeted training, SMEs in particular, and improve their awareness of regulations related (primarily) to safety and protection of the environment, which are crucial, especially for exports.

6. CONCLUSIONS AND RECOMMENDATIONS

This study aimed to analyse the skills implications for preliminary priority areas for smart specialisation and to test to what extent the existing evidence allows for a meaningful analysis. More specifically, it aimed to assess the current potential of the existing workforce, as well as education and training provision. It also assessed the skills gaps, reflecting the strategic priorities set by the country.

A new VET Development Strategy is in the process of being developed. In order to drive the smart specialisation, both the renewable and the food processing priority areas would require specific skills strategies. To strengthen the strategic orientation in reforming the vocational education and training, the following recommendations can be made to leverage the innovation potential in the context of smart specialisation.

VET in the skills ecosystems for innovation and regional development

Moldova performs relatively well with regard to the policy framework for non-technological innovation and diffusion of innovation. However, important differences between the capital and regions persist. VET institutions, particularly VET centres of excellence, have potential in expanding innovation. They are more oriented towards technology dissemination than universities and, due to their regional and local focus, cooperate mainly with SMEs. Despite evidence on the role and contribution of the vocationally trained workforce and vocational training system, a number of impediments are preventing VET practitioners from full contribution to innovation.

In moving forward, the role of VET in innovation could be strengthened by including the VET system in the national innovation policy, programmes and advisory structures. The National Programme for Research and Innovation, 2020–2023, when reviewed, could be strengthened by engaging the VET system in policy discussion. Moreover, engaging VET practitioners (directors, teachers, project coordinators, etc.) in inter-organisational networks and related learning with local, regional, national, European or international research and innovation networks, would foster innovative practices and contribution of VET to applied innovation and innovation diffusion.

There are currently no centres of vocational excellence in the renewable energy or food processing sub-sectors in Moldova. Developing VET excellence in the priority areas for smart specialisation would enable VET to better meet the demand for skills of both learners and employers. Centres of excellence, could play an important role in connecting VET to the broader drive for innovation by both deepening and extending their relationship with employers, in particular SMEs, and by cooperating and coordinating with other skills providers (schools, companies, universities, research organisations and specialist development agencies). In addition, collaboration with stakeholders (e.g. economic development agencies, local authorities, National Employment Agency, regional employment services, incubators, key companies in the field, social partners and economic sector representatives) responsible for economic development, innovation and competitiveness policies is needed. This would push VET institutions to go beyond the provision of VET qualifications.

Skills shortages and gaps

Demand for workers, both skilled and less skilled, exceeds supply in both renewable energy and food processing. Many of the most serious recruitment difficulties are caused by real shortages of available people with appropriate skills and qualifications. As new technologies are introduced by employers, new demand in terms of skills and profession are emerging at the boundary of disciplines.

Renewable and biomass energy

Despite the promising outlook, renewable and biomass energy are still in their infancy. With the government planning to increase its energy generation, biomass energy offers a means to do so while mitigating climate change, facilitating job creation and rural development. However, the renewable energy sector suffers from skills shortages due to emigration of the working-age population and the specificities of skills needed. Employers report that demand for workers currently exceeds supply.

The renewable and biomass energy sector is a relatively new sector with important job creation potential. Basic training for occupational fields in renewable energy still lack in practical relevance and often fail to meet the requirements of companies. Emerging profiles are connected with planning, manufacturing and operating renewable energy technologies and additional competences are required in existing jobs. Curricula is not defined in partnership with industry. Teacher training is in need of updating in terms of pedagogical knowledge, practical relevance and training expertise. Women are clearly under-represented in technical training courses. The rapid growth of the renewable energy market has caused a problem of a shortage of skilled professionals to design, install, and maintain ecologically sound bioenergy systems.

To reduce skills shortages in producing and harvesting biomass energy, the European Commission funded a pilot educational module on 'Energy and Biomass Project 2', in 2015–17. Building on the pilot, a vocational training structure on biomass energy and relevant technical specialisation programmes in VET could be developed. Raising young professionals' and students' awareness of career paths in renewable energy and bioenergy in particular could help curb skills shortages. In addition, because of the complexity of biomass energy involved with land use, food production, energy, natural resources, and climate change, this topic ought to be embraced by both agricultural education and environmental education programmes. Training programmes should be made available at national, regional and local levels. An important role in applied research skills, the implementation of innovation support services and the facilitation of renewable energy technological transfer could be played by the Centre of Excellence in Energy and Electronics from Chișinău.

Food processing

Skills shortages and gaps are recognised by employers, SMEs in particular, as a challenge in the food processing priority area. In addition, occupations in this field are often not seen as attractive due to low salaries and poor working conditions. The priority area is impacted by the trends of automation and computerisation of food processing operations which require advanced professional skills to be able to manage, regulate and maintain modern technologies. The demanded skills are also influenced by the EU-oriented export strategies. Moreover, opportunities in the food processing with high value added include organic foods, which call for specialisations in quality and safety, organic food handling or sales.

A mix of technical and generic skills is required by companies in food processing to support growth and innovation. There is a clear tendency in the increased demand for both basic and advanced digital skills, marketing and management skills as well as knowledge on processing and preservation of food products, safety-related and environment-related issues. In line with the increased focus on sustainable production, emerging trends point also to the need for researchers in food technology or sustainable systems specialists. In addition, given the prominent role of SMEs, there is a demand for multi-skilled professionals with a broad range of skills, including technical, marketing and communication skills.

This calls for revisiting the existing training offer and development of occupational standards, with a more active involvement of the industry and a more prominent role given to the continuing professional

education and training. While relevant VET programmes exist, they offer rather narrow specialisations instead of promoting broader profiles integrating skills in marketing, digital technologies as well as environmental awareness. In moving forward, cooperation between the Ministry of Education, the Ministry of Economy, ODIMM, representatives of sector associations, and vocational and higher education groups would be required to review occupational standards and improving curricula to ensure relevance of education and training provision.

SME skills

Renewable and biomass energy

The importance of micro enterprises and SMEs in producing renewable energy is growing and the trend is expected to continue – in particular in biomass energy. However, small companies, in addition to struggling with skills shortages, are lacking in expertise for suitable business models and appropriate financing options. The Energy and Biomass Cluster, established in 2017, aims to connect companies with support organisations, research, public administration and higher education – but not vocational education, in order to strengthen cooperation to stimulate innovation and disseminate knowledge of biomass.

Micro enterprises and SMEs are likely to be a major contributor of renewable energy, including biomass energy. Many small companies in the sector are likely to be started by young entrepreneurs. Entrepreneurship education and entrepreneurial learning, such as knowledge, skills and attitudes involved in entrepreneurship, and guidance on entrepreneurship as a career option will play an important role. The recent SBA assessment in Moldova noted important work by the Centre for Entrepreneurial Education and Business Support in vocational education, including development and assessment of entrepreneurship competences. It also noted continued promotion of entrepreneurship skills of pupils in post-secondary vocational education. This could be widened to include more developed entrepreneurial experiences through work placements in renewable energy companies.

Food processing

SME's in the food processing sector are held back by limited managerial skills and tend to compete more on price than on innovation and quality. Increasing access to business development services and promoting cluster development could boost innovation and SME growth in the food processing industry. The Ministry of Economy, ODIMM, the Moldovan Investment Agency and, in particular, business incubators in the regions could play an important role in broading the availability of tailored support to SMEs in the food processing sector.

SMEs in the sector would benefit from business development services in food safety, traceability, and packaging to, on the one hand, help reduce the food waste by improving product shelf life, while, on the other hand, moving towards more sustainable and circular design of packaging (reduce-reuse-recycle). In terms of digitalisation, SMEs would benefit from support in digitisation of production and sales processes, integrating management procedures based on ICT, big data, and artificial intelligence technologies. In the domestic retail market (retail outlets as well as traditional groceries, food service industries such as restaurants and cafeteria), SMEs would benefit from training on connecting with and meeting retailer demands and requirements. In terms of internationalisation, business development services could be strengthened, e.g. in obtaining internationally recognised quality certificates to gain access to global value chains, accessing the European market, identifying buyers online, and meeting the quality and pricing requirements of European importers.

Fostering cluster development in food processing would be conducive to collective knowledge creation, innovation driven growth and strengthen regional innovation performance, highly skewed

across regions. Cluster development could increase the innovation activity of local producers, enhance cooperation among primary producers, food processors and research institutions, and ultimately increase the competitiveness of the food sector. Strengthening cooperation with VET providers and research and innovation networks, would foster innovative practices and improve innovation diffusion in the food processing sector.

Encourage and enable employer engagement

Strengthening sectoral coordination mechanisms on education business cooperation would help increase employers investment in work-based learning, including apprenticeships and internships. Cooperation could be strengthened, for example through joint projects with VET institutions, creating partnerships with educational institutions, or getting actively involved in education/labour policy formulation and implementation (e.g. participating in the elaboration of occupational standards, qualification standards and curricula). In particular, focusing on skills needs and development for SMEs is important.

The role of CVET

VET is mostly supply-driven and focused largely on initial training. A growing demand for continuing training due to mass emigration of the workforce, especially young people, which encourages older workers to remain active, has become very important. The offer of CVET in energy and food processing is very scarce, fragmented and uncoordinated, being delivered by a few providers (VET institutions/agencies) using different models and methodologies for delivery.

Given the importance that CVET may play in responding to the demand brought by economic prioritisation, a clear strategy is required on how to develop and increase access to such training, including financial support and stimulus measures.

Human capital-related statistics

Despite the existence of a solid labour market information system with regular labour market/enterprise surveys, several limitations can still be observed. First, current data does not allow for a reliable and comprehensive analysis at subsector level. In addition, there is a lack of valid mechanisms for anticipating the skills demanded by the labour market, which requires analytical and forecasting tools that would allow for medium- and long-term projections.

In moving forward, improving the availability of detailed and reliable data would allow for a more comprehensive analysis of the current situation, future needs and potential skills gaps, which would then provide a better evidence basis for planning and management of human capital within the smart specialisation strategies.

Replication of similar analyses for other priority areas

This analysis is limited to energy and food processing only. However, this type of analysis is beneficial for all priority areas for smart specialisation. The analysis of skills needs for the development of smart specialisation priority areas as well as mapping of current potential should be part of related planning and strategies.

ANNEXES

Annex 1. Methodological guidance for the implementation of qualitative interviews

A limited number of qualitative interviews were carried out to complement the quantitative analysis. The aim was to collect additional evidence focusing on elements such as current skills demand and skills gaps assessment, emerging skills needs and expected changes in the respective priority areas.

Three target groups from the energy and food processing priority areas were selected: (i) representatives of relevant institutions for both priority areas, (ii) employees working in selected areas, and (iii) representatives of businesses operating in the targeted priority areas. The selection was primarily focused on the identified stakeholders during the entrepreneurial discovery process.

To implement the interviews, a structured interview guide was developed, both in Romanian and in Russian. Given time constraints, the interviews were done face-to-face or by telephone[21]. In total, 16 interviews were carried out between the end of November and December 2019. Before conducting the interviews, interviewees were provided with information about the project and goals of the interview. This was important given the low awareness of the smart specialisation process.

One of the challenges for the fieldwork was the availability of interviewees due to the holiday season and change of administration. Therefore, some flexibility in terms of data collection strategies was required.

In the future, it is advised to strengthen the evidence collected through qualitative research. This is especially crucial in case of significant limitations of existing quantitative data.

Annex 2. List of consulted stakeholders

- Institute of Power Engineering
- Agenția Națională pentru Reglementare în Energetică
- BOT Eugen, SA EnergoCom
- Centre for Energy Efficiency
- Î.C.S. Premier Energy Distribution SA
- Termoelectrica SA
- INCE (National Institute for Economic research)
- Association of Lavender Growers in Moldova
- Orhei-Vit SRL
- MoBerry
- Biofruct Moldova SRL
- Castel Mimi SRL
- Kvin Com SRL
- Bukdoors SRL

[21] In a few cases, a self-administered questionnaire sent by email was used.

ABBREVIATIONS AND CRONYMS

CIS	Commonwealth of Independent States
CVET	Continuing vocational education and training
DCFTA	Deep and Comprehensive Free Trade Area
ETF	European Training Foundation
EU	European Union
EUR	Euro (currency)
GDP	Gross domestic product
ha	Hectare
ICT	Information and communications technology
ISCED	International Standard Classification of Education
ISCO	International Standard Classification of Occupations
IVET	Initial vocational education and training
KTOE	Kiloton of oil equivalent
LFS	Labour force survey
MDL	Moldovan leu (currency)
MECR	Ministry of Education, Culture and Research
MSMEs	Micro, small and medium enterprises
NACE	Nomenclature statistique des activités économiques dans la Communauté européenne (Statistical classification of economic activities in the European Community)
NARD	National Agency for Research and Development
NBS	National Bureau of Statistics of the Republic of Moldova
NEA	National Employment Agency
NQF	National qualifications framework
ODIMM	Organisation for Small and Medium Enterprises Sector Development (the national SME development agency)
OECD	Organisation for Economic Cooperation and Development
QOS	Qualifications, occupations and skills
R&D	Research and development
SBA	Small Business Act
SMEs	Small and medium-sized enterprises

UASM	Universitatea Agrară de Stat din Moldova (State Agrarian University of Moldova)
USD	United States dollar (currency)
USM	Universitatea de Stat din Moldova (Moldova State University)
UTM	Universitatea Tehnică a Moldovei (Technical University of Moldova)
VET	Vocational education and training

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International Renewable Energy Agency: www.irena.org/bioenergy

ODIMM: www.odimm.md/en/

Trade Information Portal of the Republic of Moldova: https://trade.gov.md/en

Women in Business: http://ebrdwomeninbusiness.com/?s=home&country=MD&language=en&language=ro&language=en

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