Shifting Landscapes: Structural transformations that shape the VET workforce across European regions

Skills2Capabilities (Technical Report)

April 2025

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ABSTRACT

In this technical report, we identify five dimensions of structural transformation that are relevant to individuals with a VET-level qualification and vary across regions. These are: economic and labour market transformation; technological and digital transformation; demographic transformation; environmental transformation; and normative transformation. The technical report accompanies an interactive tool of regional maps across the European countries that are in the focus of the Skills2Capabilities project, i.e. Austria, Bulgaria, Estonia, Finland, Germany, Italy, the Netherlands, Norway and UK. The maps can be found here and will be embedded on the Skills2Capabilities website. The map data can be used to carry out regonalised analyses is applied in other deliverables of the Skills2Capabilities project.

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Skills2Capabilities, a Horizon Europe study, is about understanding how skills systems need to develop if they are to assist people to make labour market transitions – i.e. between jobs, employers or sectors – and thereby reduce the level of skill mismatch which might otherwise arise.

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Introduction

Structural transformations refer to processes of economic and societal change that reshape the composition of industries, employment structures and individuals' development trajectories. The vocational education and training system (VET) along with workers in VET occupations are particularly challenged by these transformations at various levels. Reasons and drivers of these challenges are:

Changing skill demand. Automation and artificial intelligence (AI) are reshaping the labour market (Fierro et al., 2022; Goldin & Katz, 2010), particularly in sectors that rely on routine-based tasks such as manufacturing, logistics and administration. Many jobs that require manual labour or consist mostly of repetitive processes are being replaced or adapted in their tasks by machines and by AI in particular. This leads to fundamental changes in job contents and ultimately to job displacement and an increased uncertainty particularly for VET-trained workers in occupations that rely on routine-based and manual tasks.

Digital Competency and Technological Adaptation. Simultaneously, new job opportunities emerge. However, these opportunities demand advanced technical skills that may not always be found in traditional VET curricula (Arntz et al., 2016; Goos et al., 2014). The challenge lies in keeping vocational training programs up to date with the rapidly changing demands of the labour market. In particular, the development of digital tools is an increasing part of the workplace. Thus, workers in VET-level occupations need to develop digital literacy skills. However, not all workers have access to the necessary (re-)training or are willing or able to engage in it. The digital and technological divide particularly affects older workers and those with limited access to digital infrastructure.

Declining willingness to train and increasing mismatches on the training market. Declining birth rates and an increasing orientation towards higher education have led to fewer young people entering vocational education and training programs (Ollikainen & Karhunen, 2021), exacerbating shortages in skilled labour. At the same time, technological advancements and digitalisation have created a growing mismatch between traditional training curricula and the evolving needs of firms. Many businesses struggle to find suitable apprentices or VET-trained workers, while young people face difficulties in securing training positions that align with future job prospects. Additionally, regional disparities, with rural areas often experiencing a lack of training opportunities, further contribute to imbalances in the training market. Moreover, rising training costs and bureaucratic hurdles reduce firms' willingness to invest in training. Especially small and medium-sized enterprises (SMEs) struggle with these costs, particularly during economic downturns, as the risk of training apprentices leaving for higher-paying jobs after completing their training makes the investment risky (OECD, 2023).

As highlighted, these challenges are discussed in relation to processes such as skill-biased technological change, digitisation and demographic shifts. While these challenges are often viewed as global or national phenomena, their implementation and impact are inherently regional. Persistent – and in some European countries even widening – disparities between regions, such as the urban and rural divide, are increasingly relevant. Strong regional disparities limit the explanatory power of national or international analyses and underscore the need for regionalised perspectives in both research and policy discussions (Detemple et al., 2024).

A critical question in this context is how structural transformations on various levels affect individuals with intermediate qualifications, particularly those with a VET degree, as they form a crucial part of the European workforce. VET occupations, as opposed to occupations that require higher education qualifications, are generally more affected by regional developments because individuals with intermediate and lower qualifications are known to be less mobile because VET occupations are more equally scattered across regions (Hartung & Weßling, 2024; Schuster & Margarian, 2021).

Dimensions of Structural Transformation at the Regional Level

In this technical report, we identify five key dimensions of structural transformation that are of high relevance to individuals with an intermediate qualification, i.e. VET-level and vary across regions, which are: economic and labour market transformation; technological and digital transformation; demographic transformation; environmental transformation; and normative transformation.

The aim of this technical report is to accompany an interactive tool of regional maps across the European countries that are in the focus of the Skills2Capabilities project, i.e. Austria, Bulgaria, Estonia, Finland, Germany, Italy, the Netherlands, Norway and UK. The maps can be found here and will be embedded on the Skills2Capabilities website.

The maps display each of the five key dimensions of structural transformation. To provide this, we collected regionalised variables from: Eurostat, the World Bank, national statistic offices (Istat, INKAR, Statistics Netherlands, Statistics Finland (Tilastokeskus), Statistics Italy (Istituto Nazionale di Statistica), Office for National Statistics, Statistics Estonia, National Electoral Committee of Estonia (Vabariigi Valimiskomisjon), Valgdirektoratet (Norwegian Directorate of Elections), Central Election Commission of Bulgaria (Централна избирателна комисия). All maps and underlying data are sourced from official repositories or can be provided upon request.

The goal of this interactive maps tool is twofold: First, the tool raises awareness among policy makers and researchers of the fact that structural transformations are frequently located on the regional level and should be analysed there. Second, we aim to foster further research that applies the regionalised data we collected. The data can be used for analytical purposes, and it is already applied in the Skills2Capabilities project. A key application of the tool is to link the regional administrative data to other data sources, such as survey data on the European or national level. This enables region-specific analyses on how dimensions of transformation in isolation or

combination affect outcomes such as individuals, labour-market outcomes, employers' hiring strategies, inequalities, mobility behaviour and individual decision-making.

The map tool provides indicators on the levels of NUTS1, 2 or 3, on the national level or electoral districts level – depending on the available sources. The NUTS (Nomenclature of Territorial Units for Statistics) regions are a hierarchical system for systematically dividing the territory of the European Union (EU) and the UK for statistical and analytical purposes. Established by Eurostat, the classification was implemented to enable regional comparisons and policy evaluations. The NUTS classification is structured into three main levels: NUTS 1 refers to major socio-economic or administrative regions (e.g. Germany's federal states like Bavaria); NUTS 2 represents central regions that are larger than city policies (e.g. German Regierungsbezirke, Spanish autonomous communities, Italian regions); NUTS 3 are smaller regions that refer to cities or larger rural entities (e.g. German Landkreise/Kreisfreie Städte, French départements, UK unitary authorities).

Structural transformation is a multi-dimensional phenomenon that can be analysed through several lenses. We propose five key dimensions, not claiming that they are exhaustive, but that they are particularly important with regard to VET-workers and that they manifest differently across regions.

Economic and labour market restructuring. One of the most visible aspects of structural transformation is the shift in economic activities across sectors. Many European regions have transitioned from manufacturing-based economies to service-oriented ones, driven by globalisation, automation and digitalisation. The decline of traditional industries in some regions and the rise of high-tech and knowledge-intensive sectors in others create varying regional economic landscapes. In Addition, changes in the employment structures are another dimension of structural transformation. The demand for highly skilled workers has increased, while some low-skilled jobs have been automated or offshored. Intermediate-skilled jobs, including those held by VET graduates, are transforming, requiring adaptability and continuous skill upgrading.

Technological and Digital Transformation. The increasing use of digital technologies, artificial intelligence, and automation is reshaping how work is organised. Regions with strong digital infrastructures and innovation ecosystems are better positioned to benefit from these changes, while lagging regions face risks of economic stagnation and job displacement.

Demographic Transformation. Migration, ageing populations, and increased urbanisation play crucial roles in structural transformation. Some regions experience labour shortages, while others struggle with brain drain and depopulation, affecting their economic viability and social cohesion.

Environmental Transformation. The extent to which regions can adapt to structural transformation depends on their institutional capacities, governance structures, and the effectiveness of regional and EU policies in supporting transition processes. Policies such as the European Regional Development Fund (ERDF) and Smart Specialisation Strategies (S3) play a crucial role in shaping regional adaptation.

Normative transformation. This refers to a change in widely accepted social, cultural, or institutional expectations that guide behaviour, attitudes, and decision-making within a society or specific group. Changes can be driven by factors such as technological advancements, economic shifts, policy reforms, demographic changes, and evolving societal values. Norm transformations often unfold over time and may be influenced by public debates, generational shifts, social movements, or external pressures such as crises.

Table 1 provides an overview of the dimensions, the indicators by which we measure the dimension, the countries and regional levels for which the indicators are available, as well as the sources from which the data were derived.

Table 1. Dimensions and indicators of transformation across European Regions

DIMEN-SION	INDICA-TOR	DE, NUTS	FI, NUTS	UK, NUTS	NL, NUTS	IT, NUTS	EE, NUTS	AT, NUTS	BG, NUTS	NO, NUTS	SOURCE
Digital Transfor mation	Household s with broadband access	2006-2021 (NUTS2)	2006-2021 (NUTS2)		2006-2021 (NUTS2)	2008-2021 (NUTS2)	2006-2021 (NUTS2)	2008-2021 (NUTS2)	2006-2021 (NUTS2)	2006-2021 (NUTS2)	Eurostat (https://doi.org/10.2908/demo_r_pjanind3)
Demogra phic transform ation	Proportion of population older than 65 (%)	2015-2024 (NUTS3)	2015-2024 (NUTS3)	2015-2019 (NUTS3)	2015-2024 (NUTS3)	2015-2024 (NUTS3)	2015-2024 (NUTS3)	2015-2024 (NUTS3)	2015-2024 (NUTS3)	2015-2024 (NUTS3)	Eurostat (https://doi.org/10.2908/DEMO_R_PJANIND3)
	Median Age	2014-2024 (NUTS3)	2014-2024 (NUTS3)	2014-2019 (NUTS3)	2014-2024 (NUTS3)	2014-2024 (NUTS3)	2014-2024 (NUTS3)	2014-2024 (NUTS3)	2014-2024 (NUTS3)	2014-2024 (NUTS3)	Eurostat (https://doi.org/10.2908/EQ_POP04)
	Internal migration		2005-2016 (NUTS3)	2012-2020 (NUTS2)	2000-2023 (NUTS2)	2002-2023 (NUTS3)	2015-2023 (NUTS3)	2002-2023 (NUTS2)			Statistics Austria, ISTAT, Office for National Statistics, Statistics Netherlands (CBS), Statistics Estonia (Eesti Statistika), Statistics Finland
	Total migration	2002-2022 (NUTS3)			2000-2023 (NUTS2)	2002-2023 (NUTS3)	2015-2023 (NUTS3)	2002-2023 (NUTS2)			INKAR BBSR, Statistics Austria, ISTAT, Statistics Netherlands (CBS), Estonia (Eesti Statistika)
	External migration				2000-2023 (NUTS2)	2002-2023 (NUTS3)	2015-2023 (NUTS3)	2002-2023 (NUTS2)			Statistics Austria, ISTAT, Statistics Netherlands (CBS), Estonia (Eesti Statistika)
Economi c transform ation	Unemploy ment rate	2000-2021 (NUTS3)	2000-2023 (NUTS2)	2000-2019 (NUTS2)	2000-2023 (NUTS2)	1999 – 2024 (NUTS2)	2000-2023 (NUTS2)	2000-2023 (NUTS2)	2000-2021 (NUTS3)	2000-2023 (NUTS2)	BG: Institute for market economics, Eurostat (https://doi.org/10.2908/LFST_R_LFU3RT)

	Patents	2001-2024 (NUTS2)	2004-2023 (NUTS0)		2004-2023 (NUTS0)	2004-2023 (NUTS0)	2004-2023 (NUTS0)	2004-2023 (NUTS0)	2004-2023 (NUTS0)	2009-2023 (NUTS0)	Eurostat (https://doi.org/10.2908/PAT_EP_TOT)
	Industry Share of GDP	2000 – 2023 (NUTS0)	2000 – 2023 (NUTS0)	2000 – 2023 (NUTS0)	2000 – 2023 (NUTS0)	2000 – 2023 (NUTS0)	2000 – 2023 (NUTS0)	2000 – 2023 (NUTS0)	2000 – 2023 (NUTS0)	2000 – 2023 (NUTS0)	World Bank and OECD National Accounts (indicator code: NV.IND.TOTL.ZS)
Environmental transformation	Just Transition Fund (EU)	NUTS3, eligible territories	NUTS3, eligible territories	/	NUTS3, eligible territories	NUTS3, eligible territories	NUTS3, eligible territories	NUTS3, eligible territories	NUTS3, eligible territories	/	European Commission (2020)
	Renewable Energy in... Transport Electricity Heating & Cooling	2004-2023 (NUTS0)	2004-2023 (NUTS0)		2004-2023 (NUTS0)	2004-2023 (NUTS0)	2004-2023 (NUTS0)	2004-2023 (NUTS0)	2004-2023 (NUTS0)	2004-2023 (NUTS0)	Eurostat (https://doi.org/10.2908/SDG_07_40)
Normative transformation	National Elections	2005-2021 (NUTS3)	2005-2024	2010-2024 (electoral districts)	2005-2024 (NUTS3)	2013, 2022 (NUTS2)	2011-2024	2004-2025	2014-2024	2009-2024 (electoral districts)	Valgdirektoratet, Централна избирателна комисия (Central Election Commission of Bulgaria), Office for National Statistics UK, Vabariigi Valimiskomisjon, Istituto Nazionale di Statistica, INKAR

Conclusion

Structural transformations take place on various, interconnected levels and are reshaping European regions in complex ways. They are strongly driven by economic and technological change, population developments and policy frameworks. While some regions in Europe are more successful in adapting to these changes, others struggle with stagnation, socio-economic challenges and shrinking populations.

For individuals with intermediate qualifications, particularly VET graduates and workers, these structural transformations present both risks and opportunities. Ensuring that these workers can transition into new and evolving job markets requires targeted policies, lifelong learning initiatives, and proactive regional development strategies.

Our multidimensional web tool, accompanied by this technical report, is designed to serve as a data basis for regionalised analyses across European countries and regions with the aim of fostering successful strategies to manage transformational changes.

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