

# Educational Mismatch in Romania: A Dynamic Analysis of Overeducation and Undereducation (2015–2024)

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## Abstract

This paper examines the qualitative imbalances affecting the Romanian labour market, with a particular focus on the relationship between structural economic change and skill mismatch. While labour market tensions are often assessed through quantitative indicators such as unemployment or vacancy rates, persistent inefficiencies may also arise from the inadequate alignment between workers' qualifications and employers' needs. In this context, the study investigates the vertical skill mismatch in Romania, reflected in overeducation and undereducation. The empirical analysis relies on data provided by Eurostat for the period 2015–2024 and uses descriptive, comparative and dynamic methods based on the ISCO-08 occupational classification. Key indicators include educational match rates, overqualification, underqualification, and employment distribution across occupations. The findings reveal a dual labour market structure in Romania. Overqualification is concentrated in elementary, clerical and technical occupations, indicating an inefficient use of human capital, while underqualification remains particularly pronounced in agriculture and managerial positions, suggesting shortages of formally certified skills. At the same time, labour demand has shifted towards highly qualified professionals, skilled trades and service workers, while demand for elementary occupations has gradually declined. The paper concludes that Romania's labour market challenges are not limited to labour shortages in quantitative terms, but are increasingly shaped by structural mismatches in competencies. These results highlight the need for better coordination between education systems, vocational training policies and labour market demand.

## Keywords

Skill mismatch; rightly educated; overeducated; undereducated; occupational groups; labour market

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## Introduction

The efficient functioning of the labour market is one of the fundamental prerequisites for sustainable economic growth, competitiveness, and the optimal use of human capital. Beyond traditional quantitative indicators, such as the unemployment rate or the number of job vacancies, labour market equilibrium depends crucially on the degree of alignment between the skills available in the economy and those demanded by employers. In the academic literature, this issue is commonly examined through the concept of *skill mismatch*, defined as the discrepancy between labour supply characteristics and the requirements of available jobs (CEDEFOP, 2015; OECD, 2019). The phenomenon may arise even when a sufficient number of workers is available, if the educational structure, qualifications, or fields of specialization of individuals do not correspond to the needs of the economy. Its consequences are wide-ranging and affect individuals, firms, and the economy as a whole, including lower productivity, earnings below potential, recruitment difficulties, high employee turnover, and the inefficient use of educational resources (McGuinness, Pouliakas & Redmond, 2018). At the same time, persistent mismatch may slow down

innovation processes and structural adjustment, particularly in emerging economies. In the case of Romania, this issue is especially relevant in the context of recent structural transformations, including the expansion of the services sector, shortages of qualified workers in certain occupations, labour migration, demographic changes, and the digitalisation of the economy. Taken together, these developments have intensified tensions between the demand for and supply of skills, while increasing the need for public policies focused on training, reskilling, and anticipating labour market needs. This paper aims to examine the scale and characteristics of the *skill mismatch* phenomenon in the Romanian labour market, with particular emphasis on its vertical dimension (*vertical mismatch*). Vertical mismatch refers to the discrepancy between the employee's level of education and that required by the occupation, resulting in either overqualification or underqualification (Montt, 2017; Robst, 2007). The overall objective of the research is to assess the efficiency of human capital allocation in the Romanian economy and to identify the main structural imbalances affecting labour market performance. More specifically, the study seeks to identify the main forms of educational mismatch across occupational groups; analyse the incidence of overqualification and underqualification; highlight the evolution of these imbalances during the period 2015–2024; examine the relationship between mismatch and the structure of employment.

The paper is structured as follows. The first section reviews the main findings of the literature on *skill mismatch*. The second section presents the conceptual and methodological framework of the research, including the definition of key concepts and the description of data sources. The third section is dedicated to the empirical analysis of vertical mismatch, focusing on its distribution across occupational groups, its evolution over time, and recent occupational changes. The final section summarises the main conclusions of the study and outlines the implications for public policies in the fields of education, vocational training, and employment.

## 1. Review of the scientific literature

In contemporary economic literature, the concept of *skill mismatch* has evolved from a simple discrepancy between labour supply and demand into a multidimensional phenomenon analysed through the lens of resource allocation efficiency in the labour market. At its most fundamental level, *skill mismatch* refers to a structural imbalance between the skills and qualifications available within the labour force (supply) and those required by the occupational structure of the economy (demand). This phenomenon manifests itself in a dual manner: at the aggregate level, through sectoral or regional imbalances, and at the individual level, through a mismatch between a worker's skill profile and the specific requirements of the job held (CEDEFOP, 2010). From an economic perspective, this imbalance is highly relevant because it affects how human resources are allocated within the economy. Adalet McGowan & Andrews (2017), in an empirical study based on PIAAC data (Programme for the International Assessment of Adult Competencies) covering several advanced economies, show that *skill mismatch* is associated with lower productivity levels and inefficient labour utilisation. They conceptualise the phenomenon as an underuse of human capital with direct implications for Total Factor Productivity (TFP). The authors emphasise that, in a perfectly functioning labour market, human resources should be allocated to those jobs where their marginal productivity is highest, whereas *skill mismatch* signals a failure of this mechanism, reducing the economy's ability to operate on its production frontier. CEDEFOP (2015) refines the operational definition by identifying two dimensions of the phenomenon: situations in which available skills do not correspond to job requirements, and situations in which existing skills are not utilised to their full potential. This approach highlights the two main facets of mismatch: skill gaps and overqualification or skill underutilisation (*overskilling*).

An important contribution to terminological clarification is provided by Shah & Burke (2003), who, in a working paper devoted to the conceptualisation and measurement of the phenomenon, warn against the frequent confusion between *skill mismatch* and an absolute shortage of skills. They argue that mismatch often reflects institutional rigidities, informational asymmetries in the labour market, or the slow adjustment cycles of education systems to structural economic change. Consequently, the phenomenon should not be explained solely through individual behaviour, but rather analysed in relation to the interaction between education systems, institutions, and labour demand. This idea is further developed by McGuinness, Pouliakas & Redmond (2018), who, in a comprehensive review article, propose a clear conceptual framework for analysing *skill mismatch*. They show that the concept should be treated as multidimensional, encompassing both mismatches between education and occupation—through comparisons between formal education levels (ISCED) and standardised occupational requirements such as ISCO—and discrepancies between actual skills and job requirements. In addition, the authors stress that the choice of measurement method directly influences the results obtained. To ensure data comparability at the European level, Eurostat (2024) operationalises the concept through the harmonisation of ISCED (education) and ISCO

(occupation) classifications, thereby enabling the statistical quantification of these discrepancies. An important contribution in this direction is made by Guvenen et al. (2020), who analyse the phenomenon using a dynamic model applied to U.S. panel data. Their study introduces the concept of multidimensional *skill mismatch* and shows that the effects of mismatch are not only immediate but also persistent over time, affecting both current wages and subsequent human capital accumulation. However, the authors also implicitly acknowledge an important limitation: their results are calibrated to the U.S. economy and cannot be automatically generalised to other contexts. In more recent literature, the focus has increasingly shifted from formal education to actual competencies. Coraggio et al. (2024), in a theoretical review, argue that a skills-based mismatch approach provides a more realistic picture of labour market dynamics, especially in the context of rapid technological change. Their study is not an empirical application to a specific economy, but rather offers a broader perspective on the evolution of the concept.

Overall, the literature shows that *skill mismatch* should be understood as a complex phenomenon resulting from the interaction between the education system, institutions, and labour market dynamics, rather than as a simple discrepancy between education and occupation.

## 2. Research methodology

The analysis is based on secondary statistical data obtained from the database of Eurostat. The information was extracted for Romania over the period 2015–2024, allowing both an assessment of the current situation and the identification of structural labour market trends over the past decade.

In order to measure vertical educational mismatch, the analysis combines occupational data classified according to the ISCO-08 with educational attainment grouped following the ISCED 2011 aggregation used by Eurostat: ISCED 0–2 (low), ISCED 3–4 (medium), and ISCED 5–8 (high education). A normative correspondence is established between ISCO-08 major groups and educational levels: ISCO 1–2 are associated with high education (ISCED 5–8), ISCO 3–8 with medium education (ISCED 3–4), and ISCO 9 with low education (ISCED 0–2). Although some studies assign ISCO 3 (technicians and associate professionals) to tertiary education, this study includes it in the medium category, reflecting the Romanian labour market structure and avoiding the overestimation of overeducation. Based on this mapping, individuals are classified as undereducated, rightly educated, or overeducated by comparing their attained education level with the level required by their occupation. The educational match rate (*rightly educated*) measures the share of individuals whose level of education corresponds to occupational requirements; the overeducation rate reflects the proportion of employees whose educational attainment exceeds the level required for their job; the undereducation rate captures deficits in formal education relative to occupational requirements; the employed population by major occupational groups according to the ISCO-08 classification. This framework enables a comparative analysis of the main occupational categories: managers, professionals, technicians, clerical support workers, service and sales workers, skilled trades workers, machine operators, and elementary occupations.

From a methodological perspective, the paper adopts a descriptive-comparative approach. In the first stage, a cross-sectional analysis of indicator values for the year 2024 is carried out in order to identify the sectors with the highest levels of imbalance. In the second stage, a dynamic analysis is conducted for the period 2015–2024 by examining the evolution of educational match, overeducation, and undereducation rates over time. In addition, a multidimensional graphical analysis using a *bubble chart* is employed to assess the relationship between mismatch rates and the size of the employed population, with the aim of highlighting the economic impact of these imbalances.

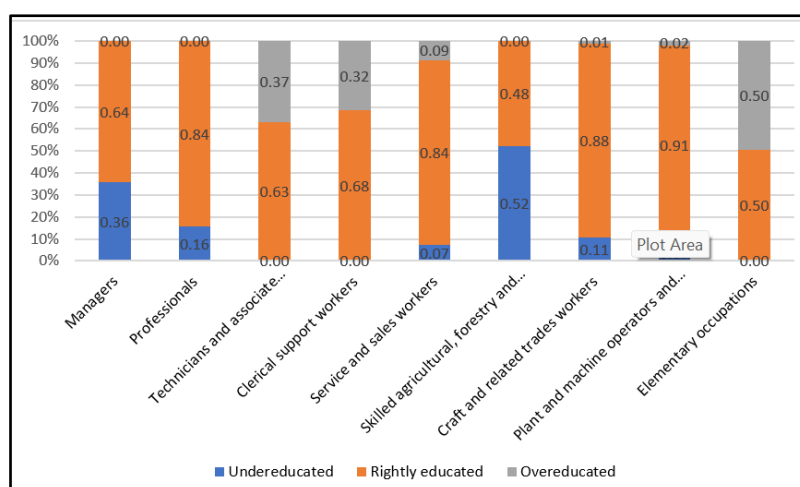
## 3. Results and discussion

Assessing labour market equilibrium cannot be limited exclusively to quantitative indicators. Even in the absence of a numerical shortage of candidates, the economy may face significant functional difficulties generated by qualitative labour shortages. These arise when, despite the availability of labour supply, the profile of workers' skills and qualifications does not correspond to the specific requirements of vacant positions, reflecting the inability of labour supply to adjust rapidly to the structural dynamics of demand.

This study examines the depth of this phenomenon in Romania by decomposing mismatch into its structural components: vertical mismatch, defined as the discrepancy between an employee's level of education and that required by the occupation, resulting in either overqualification or underqualification; and horizontal mismatch, which captures the incongruence between the field of completed studies and the actual field of employment. Investigating these dimensions, together with the analysis of structural changes across

economic activities, is essential for understanding the inefficiencies in human capital allocation that persist beyond unemployment figures or vacancy statistics. A key component of qualitative labour market imbalances is vertical mismatch, on which the present research is focused. It is defined as the discrepancy between employees' formal educational attainment and the occupational requirements of their jobs. This form of mismatch is bidirectional: it appears as overeducation, indicating a waste of human capital, and as undereducation, signaling a deficit of formal skills.

To diagnose the scale of this phenomenon in the Romanian economy, the analysis begins with a “snapshot” of the current situation in 2024, broken down by major occupational groups according to the ISCO-08 classification (Figure no. 1). The data presented in Figure 1 reveal a strong polarisation in the type of mismatch according to occupational complexity. In 2024, overqualification is predominantly concentrated in technical and support occupations. Specifically, technicians and associate professionals, clerical support workers, and employees in elementary occupations record the highest overeducation rates, ranging between 32% and 50%. The case of elementary occupations is the most critical, with half of all employees holding an educational level above the minimum requirements of their jobs. This indicates a substantial underutilisation of productive potential and an inefficient allocation of human capital.

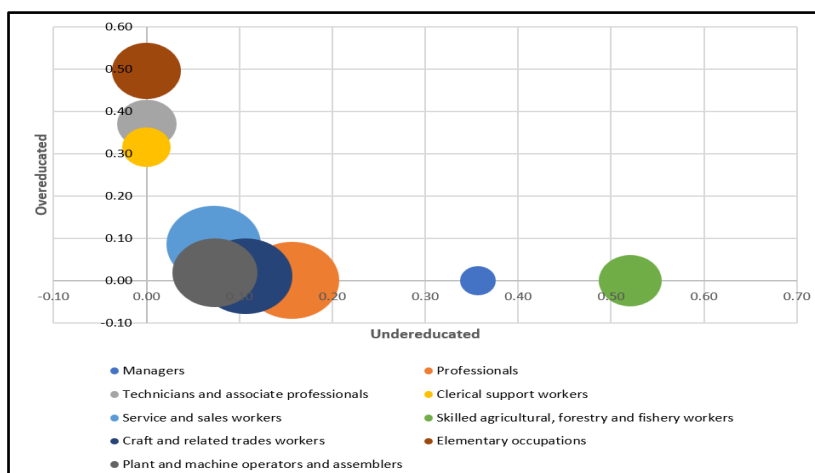


**Figure no. 1. Structure of Educational Mismatch by Occupational Groups in Romania, in 2024**

*Source: Own contribution, based on Eurostat data (Eurostat, 2024)*

At the opposite end, underqualification is concentrated in occupations located at the extremes of the occupational hierarchy: management and agriculture, forestry, and fisheries. Managers display an undereducation rate of 36%, while skilled agricultural, forestry, and fishery workers record a rate of 52%. These figures suggest that a significant share of workers in these sectors occupy positions for which they do not possess the standard formal educational level, likely compensating through practical experience or non-formal competencies. At the same time, the stable core of the labour force—represented by professionals, service and sales workers, and plant and machine operators—shows the highest rates of educational match (*rightly educated*), with values ranging from 84% to 91%. Overall, the structure of mismatch confirms a well-documented pattern: less specialised occupations, such as elementary and clerical jobs, as well as technical support occupations, tend to attract overqualification, whereas managerial and agricultural occupations are more strongly associated with underqualification.

To better understand the real economic impact of these percentages, mismatch rates were correlated with the actual size of the workforce in each occupational category (Figure no. 2). The *bubble chart* presented in Figure no. 2 provides a multidimensional view of the labour market, showing that the main “engines” of the Romanian economy operate relatively efficiently in terms of human capital allocation. The three largest occupational categories, each employing approximately 1.4 million people—professionals, service and sales workers, and skilled trades workers—are positioned in the area of balance or high educational match. For example, skilled trades workers record a match rate of 88%, while professionals reach 84%. Major structural imbalances, however, emerge in medium-sized and smaller sectors. A distinct “overqualification cluster” can be identified, consisting of elementary occupations (747.8 thousand persons), technicians (559.3 thousand persons), and clerical support workers (375 thousand persons). This grouping demonstrates that, regardless of qualification level—from low-skilled labour to technical office positions—a considerable share of workers are employed below their educational potential.



**Figure no. 2. Relationship between Workforce Size and Type of Educational Mismatch (2024)**

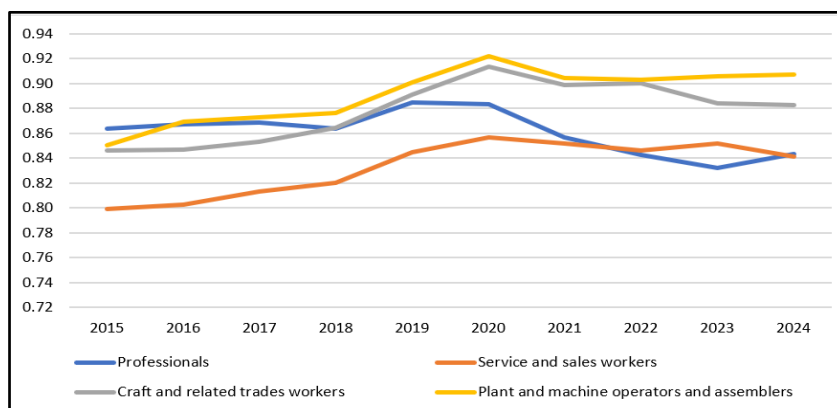
*Source: Own contribution, based on Eurostat data (Eurostat, 2024)*

By contrast, the “underqualification cluster” is represented by agriculture (615.3 thousand persons) and management (201.8 thousand persons). Agriculture faces the most severe educational deficit, with an undereducation rate of 52%, indicating a shortage of formal skills in a sector that still employs a significant share of the active population. The chart therefore shows that the size of a sector does not protect it from structural imbalances. While large employment sectors such as services, production, and professional occupations are relatively well aligned educationally, technical and support sectors (elementary and clerical occupations) waste human capital through overqualification, whereas strategic sectors (management) and primary sectors (agriculture) operate with substantial deficits in formal qualifications.

The temporal evolution of the phenomenon provides valuable insights into the structural trends shaping the labour market.

Figure no. 3 illustrates the evolution of the share of correctly matched workers (*rightly educated*) across ISCO occupational groups in which the proportion of properly matched employees exceeds 80%. As shown in the figure, the labour market experienced a period of improvement in educational matching between 2015 and 2020, particularly visible among service and sales workers, skilled trades workers, and plant and machine operators. However, following the pandemic shock of 2020, the overall trend shifted towards stagnation with a slight downward trajectory. A divergent pattern can be observed in the case of professionals, who, after a temporary recovery in 2019–2020, entered a declining trend and reached in 2024 a matching rate below the level recorded in 2015. Overall, although the proportion of correctly matched employees remains relatively high (above 80%), the post-2020 trajectory points to a mild deterioration in matching efficiency.

A detailed analysis of the components of mismatch highlights the persistence of structural problems.

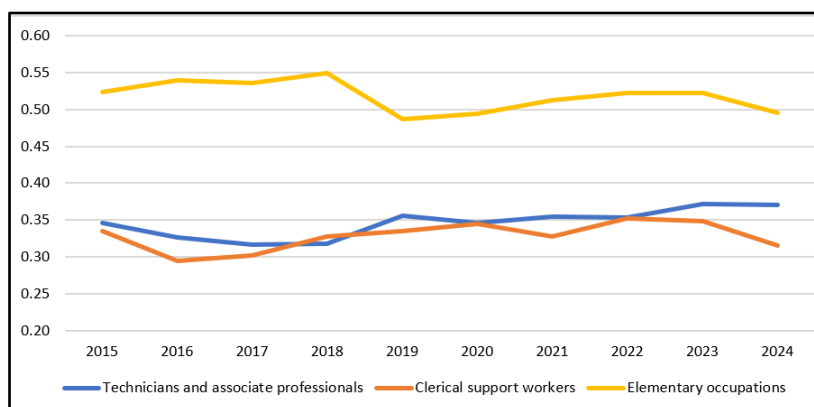


**Figure no. 3. Evolution of the Educational Match Rate (Rightly Educated), 2015–2024**

*Source: Own contribution, based on Eurostat data (Eurostat, 2024)*

Figure no. 4 illustrates the evolution of the share of overqualified workers across the ISCO occupational groups where overeducation is most prevalent. Overqualification proves to be a persistent phenomenon,

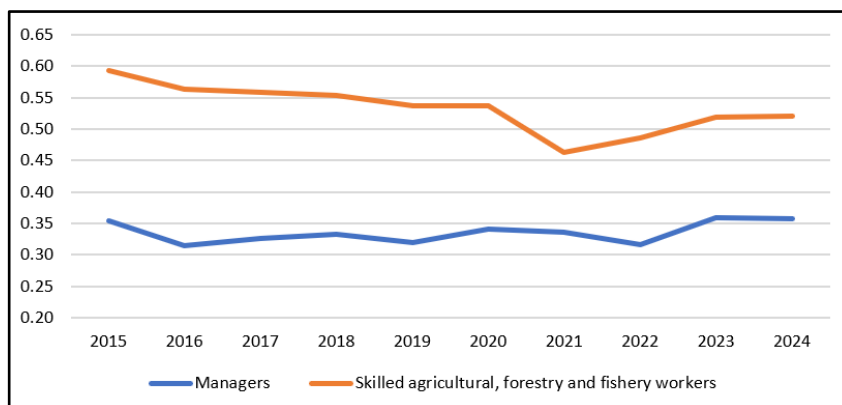
although with varying intensity across occupations. Elementary occupations recorded a gradual increase during the period 2015–2018, followed by a sharp decline in 2019. Subsequently, the share rose again moderately until 2023, before entering a downward trend in 2024. Nevertheless, it remained consistently high throughout the period, suggesting a chronic inability of the economy to absorb educated labour into higher value-added jobs. In the case of technicians, the rate appears to stabilise after the sharp increase observed in 2019, while for clerical support workers the trend is more volatile, marked by cyclical fluctuations. Overall, the analysis shows that overqualification is a persistent feature of the labour market, manifested with different levels of intensity depending on the occupation.



**Figure no. 4. Evolution of the Overeducation Rate, 2015–2024**

*Source: Own contribution, based on Eurostat data (Eurostat, 2024)*

With regard to underqualification (*undereducation*), the data presented in Figure no. 5 indicate a critical situation in agriculture. After a period of gradual improvement up to 2020 and a sharp decline in 2021, the trend turned upward again, remaining at high levels in 2023–2024. In the case of managers, underqualification is lower but persistent, with a slight upward tendency in recent years. These results confirm that underqualification is not a temporary phenomenon, but a structural one, concentrated primarily in traditional or weakly formalised sectors of the economy.



**Figure no. 5. Evolution of the Undereducation Rate, 2015–2024**

*Source: Own contribution, based on Eurostat data (Eurostat, 2024)*

Synthesising the results of the multidimensional analysis of vertical mismatch, a picture emerges of a dual labour market characterised by structural inefficiencies in the allocation of human capital. On the one hand, persistent overqualification can be observed in administrative support functions and elementary occupations, where educational resources are underutilised, generating a waste of skills. On the other hand, strategic or traditional sectors, such as management and agriculture, operate with a chronic deficit of formal certification, reflected in underqualification. The temporal dynamics confirm that these imbalances are structural rather than cyclical. The slight deterioration in educational match indicators (*rightly educated*) during the post-pandemic period (after 2020) suggests a degree of rigidity in the education and training system in responding rapidly to shifts in labour demand. Therefore, the fundamental problem of the Romanian labour market is not only one of quantity (a shortage of workers), but also one of inefficient qualitative distribution along the occupational hierarchy. This perspective on the inefficient allocation of human resources should be complemented by an analysis of horizontal mismatch, in order to determine the

extent to which employees work in fields for which they were specifically trained, beyond the formal level of education attained.

## Conclusions

The analysis highlights that the main vulnerabilities of the Romanian labour market do not stem exclusively from quantitative labour shortages, but also from the persistence of qualitative imbalances in the allocation of human capital. The results confirm the existence of a vertical mismatch phenomenon, reflected in the coexistence of overqualification and underqualification across different occupational categories. This situation indicates that a significant share of available educational resources is not being used efficiently, while certain sectors continue to operate with insufficient levels of formal training. The study shows that overqualification is particularly concentrated in elementary, administrative, and technical support occupations, where many employees possess educational levels above the requirements of the jobs they occupy. This phenomenon suggests a suboptimal use of human capital and the existence of barriers preventing educated workers from being absorbed into higher-productivity occupations. At the same time, underqualification remains high in agriculture and in certain managerial positions, pointing to persistent deficiencies in access to formal training and skills certification. The dynamic analysis for the period 2015–2024 reveals that these imbalances are structural rather than cyclical. Although some labour market segments recorded temporary improvements, the post-pandemic period has been characterised by stagnation or a slight deterioration in educational match indicators.

These findings have direct implications for public policy. First, a stronger alignment is needed between the education system and the real needs of the economy, through curriculum updates, expanded partnerships between universities, vocational schools, and employers, as well as the development of mechanisms for anticipating future skill needs. Second, lifelong learning and continuing vocational training policies should be strengthened through reskilling and upskilling programmes targeted at adults and sectors undergoing technological transformation. Third, active labour market policies should focus on improving job placement and career guidance services, so that occupational mobility becomes faster and more efficient.

In conclusion, the major challenge facing the Romanian labour market lies not only in labour shortages, but also in the inefficient distribution of available skills. Reducing vertical mismatch is an essential condition for increasing productivity, making better use of human capital, and supporting long-term economic convergence.

## Generative Artificial Intelligence (GenAI) usage statement:

No GenAI tool was used in the development of this paper

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