BRIDGING NEET STATUS AND EMPLOYABILITY THROUGH DIGITAL LITERACY: IMPLICATIONS FOR TVET POLICIES IN THE DIGITAL AGE

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In the digital age, the employability, quality of life and social inclusion of young people, particularly those classified as NEET (Not in Education, Employment, or Training), is increasingly linked to their digital literacy. This study examines the relationship between digital skills and NEET rates across European Union countries, emphasizing the role of Technical and Vocational Education and Training (TVET) policies in addressing digital exclusion. By analyzing Eurostat data for 2023, the research investigates disparities in digital competencies among NEET populations based on gender, age, and regional differences. The primary aim is to assess how digital skills impact employability and to propose policy recommendations for integrating digital literacy into TVET curricula.

To achieve this, the study employs hierarchical clustering analysis to categorize EU countries based on their NEET rates and digital skills distribution. The dataset comprises Eurostat statistics from 32 European countries. The key variables analyzed include employment status and digital skill levels categorized as high, basic, low, or none. The clustering results highlight critical gaps in digital education and underscore the need for tailored TVET policies that equip NEET youth with relevant digital competencies. This study provides evidence-based policy recommendations to bridge the digital divide, enhance labor market integration, and align vocational training with the evolving demands of the digital economy. The findings contribute to the broader discourse on digital inclusion and workforce preparedness in the modern labor market.

***Keywords*:** *NEET; TVET; digital skills; Eurostat; policy recommendations; digital inclusion.*

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INTRODUCTION

The primary objective of this study is to examine the role of digital literacy in addressing the challenges faced by NEET (Not in Education, Employment, or Training) youth and to explore its implications for developing targeted TVET (Technical and Vocational Education and Training) policies. The interest in analyzing the relationship between TVET and NEETs stems from the fact that many young people at risk (young people from disadvantaged backgrounds, young people with lower educational performance) choose this form of education due to the shorter duration of schooling, the possibility of rapid integration into the labor market, etc. In recent years, significant efforts have been made to change the perception of this level of education and to transform it into an attractive one for as many categories of young people as possible, to increase its efficiency and effectiveness.

Using Eurostat data on digital skills acquisition from 2021 to 2023, the study aims to analyze trends and disparities in digital skills among NEET populations across European Union countries, focusing on variations by gender, age, and region. We will take these variables into account − gender, age, and region − because the premise we are starting from is that women, the population aged 16−29, or young people living in rural areas have the highest risk of marginalization. By identifying critical gaps in digital competency, the research seeks to provide evidence-based insights that can inform the design of TVET policies aimed at equipping NEET youth with the necessary skills to enhance their employability and social inclusion. Additionally, the study offers actionable recommendations for policymakers to leverage digital skill-building to re-engage NEET youth and align their abilities with the digital economy's demands.

Our article is organized into the following chapters: in the first part we will analyze the relationship between the NEETs situation (rate, categories of NEETs, etc.) and digitalization; in the second part we will focus on the characteristics of education systems with an emphasis on TVET; the research methodology (data, analysis methods) will be presented in the third part of the article; the last two chapters will be devoted to the data analysis and the discussions and conclusions resulting from these analyses.

THE NEET CHALLENGE

In 2010 the EU adopted a new indicator – NEETs – which measures the degree of social, occupational, educational, etc. vulnerability of young people. The origin of the concept was established in the early 1980s when the United Kingdom set out to analyze the problems that people aged 16−18 were facing in entering the labor market and for which it needed an indicator to differentiate it from other vulnerable categories. Later, the term was taken over and improved by researchers and international organizations. (Quintini and Martin 2006; Eurofound 2012; Eurofound

2016). At the EU level, the European Commission considers it a key indicator and not only uses it in strategy documents and programs addressed to the youth population − "Youth in Action", "Europe 2020" − but also asks the Member States and European organizations to develop and understand this concept.

The NEETs concept highlights in particular the situations of vulnerability in which young people may be (Nudzor and Finlay, 2017), disadvantaged family environment (Furlong 2006), lack of interest in civic and political activities (Volonte 2012) as off-register (Bently and Gurumurphy 1999).

The analysis of the concept reveals a first and important challenge: delimiting the "borders" and content of this category of populations characterized primarily by a high level of heterogeneity: women and men, young people with a high level of education and young people lacking education or with a very low level of schooling, young people who come from different socio-economic backgrounds (disadvantaged backgrounds versus favored backgrounds, immigrants-non-immigrants, ethnic, religious, sexual minorities versus the majority, etc.), young people who have different values, lifestyles, etc. Also, under this broad hat called NEETs there are young people for whom social and professional achievement does not mean having a job and an income, young people who for objective reasons (health status, socio-family situation) cannot attend school, obtain a job and an income, or young people for whom repeated failures to integrate socially and professional discouraged them and distanced them from school, the labor market or any other form of integration. Moreover, some researchers (Fourlong 2006) believe that this population category is not sufficiently analyzed and some young people are not included in NEETs, which means that they are excluded from certain support actions. Thus, an important but rarely analyzed aspect is that the indicator and its definition refer to a static situation and assume that a young person belongs to this category forever, which is unrealistic (Zanardelli 2015): young people are the age group with the greatest educational, professional, and social mobility, etc. This means that the share of NEETs in society is fluctuating, young people can enter and exit − often the same youth − this category frequently. In this case, the causes why a young person returns to the NEETs category and the identification of solutions that can avoid this failure are very important. Other opinions (Maguire and Thompson 2007) draw attention to the fact that the period of youth has been prolonged (in some countries up to 34 years), the time people spend in school has expanded, and educational and professional trajectories have long been no longer linear. Considering that the age category for which this indicator is calculated is 15−16−29 years old, young people over this age are not considered people who need socio-professional integration programs or support to exit the NEETs category. There are also opinions (Hamdan *et al.* 2024) on which socio-cultural factors cause the increase in the NEET rate: in some cultures, women have limited access to education, work, and socio-economic independence. However, due to socio-cultural customs, these people are not considered NEETs, therefore excluded from support programs.

Given that the NEET population is heterogeneous, in order to facilitate the analysis of needs and public policy measures aimed at this category, Eurofound (2012) developed a classification into 5 sub-categories. The first and most numerous is made up of unemployed young people (including traditional unemployed people) who are actively looking for a job. The second category is made up of unavailable young people, i.e. those young people who are taking care of their family or are sick. The third category is made up of young people with a very low level of education, young people who are not looking for a job. The fourth category is made up of opportunists, those who are looking for a job or a form of schooling that they consider suitable for their skills. Finally, the fifth sub-category is represented by NEETs-volunteers, i.e. those people who have consciously chosen to be in this situation because they want to travel, take care of certain hobbies, etc.

In conclusion, it is important to note that NEETs are a highly heterogeneous group which make it rather difficult to attempt to reach out to this group by "one size fits all policies" (Shore and Tosun 2019). It is generally considered that the education system has the greatest responsibility to help young people avoid entering the NEETs category by offering them the opportunity to acquire social, cultural, and professional skills that will facilitate their socio-professional integration. To achieve this objective, educational systems have diversified their training offer and have become much more open to the labor market: development of vocational education, digitalization, partnerships with employers, and development of support programs for vulnerable young people (scholarships, job subsidizing), etc.

The difficulty of establishing the "borders" and content of this category of youth populations overlaps with the accelerated changes and transformations in society and the economy generated mainly by digitalization and technology. In most countries (economies), digital skills have already become an eliminatory criterion in the selection of job candidates. For young people, especially those from disadvantaged categories − e.g. NEETs − who do not have such skills, ICT represents a barrier to their active participation in the labor market. Thus, although born in the era of digitalization in which people frequently speak of digital natives, this category of the population is marginalized socio-economically and culturally precisely because they lack these skills.

The concept of digital skills is no less complex than that of NEETs. One of the most frequently used definitions belongs to the European Commission: "the confident, critical and responsible use of digital technologies, as well as their use for learning, the workplace and participation in society". (Council Recommendation of 22.05.2018 on key competences for lifelong learning). Another definition is proposed by Ferarri (2012): 'the set of knowledge, skills, attitudes, abilities, strategies and awareness that are required when using ICT and digital media to perform tasks; solve problems; communicate; manage information; collaborate; create and share content; and build knowledge effectively, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure,

participation, learning and socializing'. (Ferrari 2012, 30). Ferrari's definition reveals the complexity of the digital skills required by today's society and economy and the future: in some situations we are talking about basic skills such as communication, collaboration while others target information management or content creation. The more such skills a young person possesses, the higher their chances of meeting the demands of the job market.

But, analyzing Eurostat data, the research seeks to uncover which aspects of digital literacy − such as information literacy, communication skills, or problem-solving − are most critical for improving employability and reducing NEET rates. This aligns with the broader objective of understanding how digital competency can serve as a foundational element in addressing the challenges faced by NEET populations.

That of the digital skills often follows the concept of digital divide. Recent studies (Neagu *et al.* 2022) have shown that young NEETs are the most exposed to this digital divide phenomenon.

The digital divide creates significant problems especially for NEET youth and deepens the problems of this group, such as finding a job, adapting to social life, and career planning, which are becoming more difficult every day. (Van Deursen and Helsper 2015; Matli and Engoepe 2022; Hamdan *et al.* 2024). NEETs are increasing the technological gap by staying away from digital environments where they can develop their skills and create opportunities for employment (Neagu *et al.* 2021).

When these problems are combined with gender equality, rural areas, and inadequate infrastructure, solving problems and finding appropriate solutions becomes even more difficult. NEETs' inability to use digital resources effectively and not having sufficient access opportunities cause them to not be able to evaluate the opportunities they encounter (Areas and Life 2022). Today, there is congestion in many professions and the need for labor in vocational and technical education is increasing. Directing NEETs to vocational and technical education and reducing the digital divide will both help deal with the problems of NEETs and provide the human resources needed by the workforce and the sector (Köiv *et al.* 2024).

Given the heterogeneity of NEETs but also the complexity of education systems and the way in which each of them manages the transmission of digital skills, in this article we will focus only on the level of TVET and the relationship between certain socio-demographic characteristics of NEETs and digital skills.

TVET AND DIGITALIZATION

The educational system is the best framework for the transmission and formation of digital competence among the population: it has a trained staff, it has the capacity to develop educational programs adequate to every level of individual psycho-intellectual development, it has the authority to issue documents (diplomas/certificates) which guarantee the level of digital competence of the

graduates, etc. The last years, marked by the COVID-19 crisis, have further strengthened education systems' position as leaders in forming digital competencies.

TVET has become a priority of educational and employment policies in recent years because decision-makers have understood that this form of education can contribute to achieving the objectives set in European development strategies: Europe 2020, Sustainable Development Goals, etc. TVET proves important because it can contribute to:

− Smart growth − through the digitalization and modernization of this level of education, young people can acquire skills appropriate to the current and prospective needs of the economy;

− Sustainable growth − TVET can establish itself as an efficient and competitive resource on the educational market but also on the labor market and become attractive to young people;

− Inclusive growth − by developing digital competencies, by facilitating the professional and social integration of young people, TVET becomes a measure to combat and reduce poverty among the young population.

Also, the researchers are of the opinion that considers that "Vocational Education and Training Systems are important elements of countries' economic development strategies. Improving the skills and knowledge of the workforce is crucial for achieving or maintaining economic competitiveness, especially in a context of progressing globalization" (Mouzakitis 2010, 3916). He and other specialists believe that VET must be adapted not only to global trends—technologization and digitalization—but also to the current and prospective needs of national economies and those of the population. TVET is essential for a country's economic development because it can develop skills and competencies needed by the labor market (Boutsiouki 2014), especially since each such sector collaborates directly with employers. Connecting TVET to the economy also means increasing the degree of technology and digitalization to achieve faster placement of graduates in the labor market. The fact that young people who attend TVET acquire digital skills is all the more important as this allows them to continue their training after graduating from this level of education (they can take online training courses, for example), and this helps them remain occupationally active.

The development of TVET so as to truly become a path to the socio-economic and professional integration of young people also means a change in the perception of the population on this level of education.

Currently, in most approaches to the organization of education systems, its relationship with the organization of the labor market in manual and non-manual occupations is emphasized.

Educational trajectories − general and vocational − have always been at the center of socio-economic theories. The central idea of these theories − traditional but also modern (Baudelot and Establet 1971; Althusser 1971; Bowles and Gintis 1976; 2002; Lucas 2001; Raftery 1993; Delès 2018) is that young people who follow

vocational paths − TVET − are prepared for manual occupations, and general education prepares young people for non-manual occupations. The disadvantaged category of the population orients their children towards a future that they consider accessible (Claes and Comeau 1996) will opt to a greater extent for short forms of schooling convinced that this requires lower costs with education and earning income by entering work early. According to Furlong (2006), young people from disadvantaged families are more likely to regard vocational paths as a 'safer' option, which leads them to invest less in their education and ultimately increases their risk of becoming NEETs.

This perception of TVET distances young people from the vocational path and demotivates those who have chosen it to achieve educational and professional performance. Data (OECD 2023) show that young people from socio-economically disadvantaged families (young people from rural areas whose parents have a low level of education, large families) are in most countries overrepresented in vocational education, while young people are favored (parents with a high level of education, families with a low level of education) are overrepresented in general education. Young people who are oriented or are oriented towards path considered less important or less prestigious (vocational education) are prepared for manual occupations because they are exposed to educational content less complex, more distant from the academic character, in which emphasis is placed on the formation of skills, practical competencies, execution and will have low chances to overcome their socio-economic origin. On the contrary, in the case of prestigious educational fields (theoretical education) the preparation of young people is done for non-manual occupations by transmitting a content in which the emphasis is on the formation of critical thinking, creativity, ability and decision-making skills.

Different studies have shown that certain educational pathways (TVET) remain undervalued and underfunded in an unequal and stratified education system. (Raffe 2011; Valiente *et al.* 2020). Young people who choose these educational pathways are not always sufficiently supported by the school to understand the importance of education for their socio-economic future. Moreover, these young people who do not receive support from their families because their parents have a low level of education, and lack digital skills are even more exposed to educational and subsequent socio-professional failure. Changing the population's perception of this training trajectory, but also increasing young people's chances of professional integration, can be brought about by the technologization and digitalization of TVET.

METHODOLOGY

Country clusters with similar NEET and digital skills profiles.

The study aims to cluster countries with similar NEET rates and digital skills profiles to reveal patterns and regional disparities. The research groups EU countries based on shared characteristics in NEET status and digital literacy by employing clustering techniques, such as K-Means or Hierarchical Clustering. This outcome aligns with the study's objective to provide a comparative perspective, helping policymakers identify common challenges and tailor regional strategies to address the needs of NEET populations effectively.

Actionable recommendations for TVET-oriented digital literacy programs.

The study aims to provide actionable recommendations for integrating digital literacy into Technical and Vocational Education and Training (TVET) programs. By analyzing the relationship between digital skills and NEET status, the research identifies key areas where targeted digital skill-building initiatives can enhance employability and re-engagement of NEET youth. This aligns with the broader goal of designing evidence-based policies that leverage TVET as a tool for addressing skill gaps and fostering socio-economic inclusion in the digital age.

Dataset

The study utilized NEET and Digital Skills data from the EUROSTAT database. The dataset contains the distribution rates of 32 countries for 2023. The dataset for Iceland, United Kingdom, Montenegro and North Macedonia was not included in the analysis because there was missing data. The data for each country's total population, female and male aged 15−29, and the variables specified in *Table no. 1* were included in the analysis. All data are proportional.

Table no. 1

Information on the data used in the analysis

Variable name (EUROSTAT)	Variable name (Coded)
Not employed persons	Not employed persons
Individuals with above basic overall digital skills (all five component indicators are at above basic level)	High_dig_skills
Individuals with basic overall digital skills (all five component indicators are at basic or above basic level, without being all above basic)	Basic_dig_skills
Individuals with low overall digital skills (four out of five	Low_dig_skills

component indicators are at basic or above basic level)	
Individuals with no overall digital skills	No_dig_skills

Statistical Analyses

Hierarchical clustering analyses were conducted to identify patterns by considering the three different NEET rates (total, females, and males) and the Digital Skills rates of the countries together. Open-source statistical software JASP was used for the analysis (JASP Team 2025). The Euclidean distance metric was employed to calculate the distances for the analysis, and the Average linkage method, which is frequently used in the literature, was applied to merge the clusters. The final number of clusters was determined by considering Information Criteria (AIC and BIC) and Silhouette scores of the models together.

As shown in the accompanying visual analysis generated using JASP, the optimal number of clusters was determined by optimizing the Bayesian Information Criterion (BIC) in hierarchical clustering. This graph highlights the selection of the optimal cluster number based on the lowest BIC value, further supporting the data-driven choice of clusters (Chen and Gopalakrishnan 1998). This approach ensures the robustness of the clustering results by combining multiple validation metrics.

FINDINGS

Cluster Analysis Results for Discovering Patterns in Total NEET Rates

In this study, the performance of the two-cluster solution (k=2) obtained from hierarchical clustering analysis was comprehensively evaluated based on various statistical metrics (see Everitt, Landau, Leese, and Stahl 2011; Jain 2010). The model's $R^2 = 0.440$ indicates that approximately 44% of the total variance in the dataset was explained, while AIC = 106.780 and BIC = 121.440 suggest that the two-cluster solution is the most appropriate model, especially according to the BIC criterion (Schwarz 1978). Furthermore, the Silhouette score = 0.460 (Rousseeuw 1987) suggests a moderate separation, indicating that the clusters overlap partially but are still reasonably distinguishable.

When examining cluster sizes, Cluster 1 consisted of 26 observations, while Cluster 2 contained 6 observations. The within-cluster sum of squares values was found to be 62.868 and 23.915, respectively, with intra-cluster heterogeneity calculated as 0.724 for Cluster 1 and 0.276 for Cluster 2. Other performance metrics related to the model (Everitt *et al.* 2011) were also examined, with the Maximum Cluster Diameter calculated as 4.743 and the Minimum Cluster Separation as 1.628. Pearson's $\gamma = 0.711$ indicated a strong correlation between intra-cluster ranking and distances, while the Dunn index = 0.343 reflected limited but satisfactory separation

between clusters. Entropy = 0.483 suggested moderate intra-cluster diversity, and the Calinski-Harabasz index = 23.582 indicated a reasonable level of overall clustering quality.

Finally, the standardized mean values of the variables revealed that Cluster 1 was characterized by lower youth unemployment rates and higher or basic digital skills, while Cluster 2 exhibited higher youth unemployment rates and generally lower digital skills. All these findings suggest that the two-cluster solution explains a significant portion of the variance in the data and provides a satisfactory clustering model according to the BIC criterion.

Table no. 2

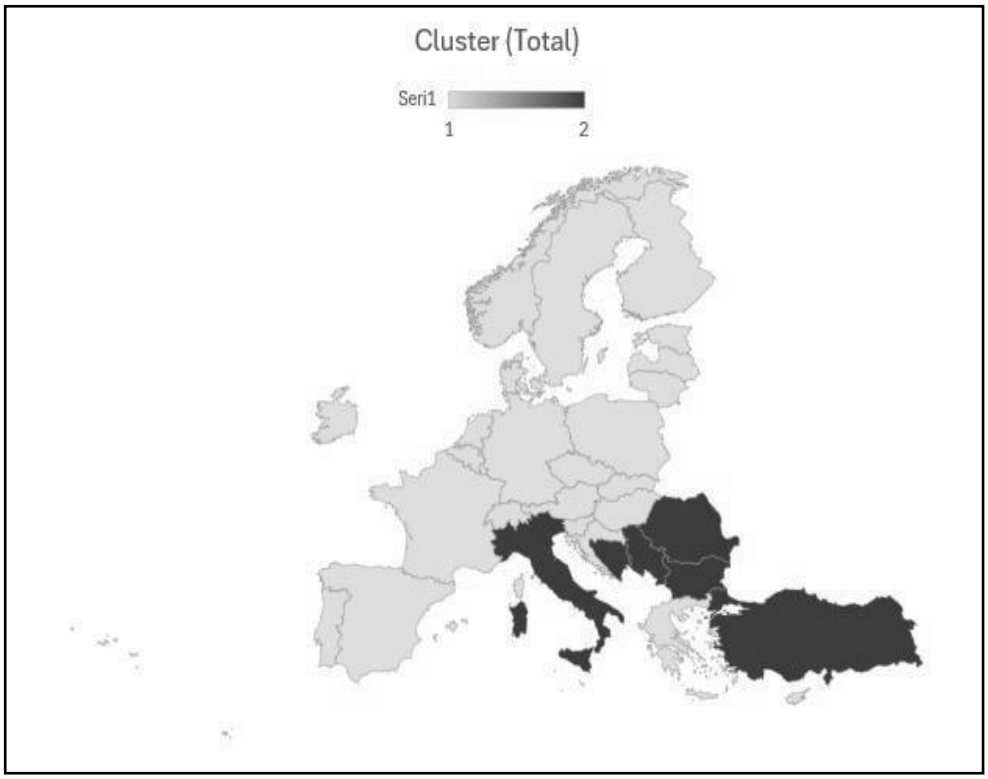
Cluster means for Total NEET Data

Cluster	Not employed persons	High_dig_skills	Basic_dig_skills	Low_dig_skills	No_dig_skills
1	-0.365	0.321	0.303	-0.354	-0.196
2	1.581	-1.392	-1.315	1.532	0.849

Table no. 2 displays the standardized means of clusters for specific variables (e.g., "Total Unemployed Persons aged 15–29" and "Digital Skills" categories). Cluster 1 included observations with relatively lower youth unemployment (-0.365) and relatively higher or basic digital skills (0.321 and 0.303). Conversely, Cluster 2 was characterized by higher unemployment (1.581) and lower advanced/basic skills (-1.392; -1.315), with higher average values in the "no_dig_skills" and "low_dig_skills" components (0.849 and 1.532).

Figure 1

Clusters of Total NEETs Rates



These findings reveal the relationship between digital skill levels and youth unemployment, indicating that the two-cluster solution provides sufficient insight to explain significant differences in the data, meeting the criteria of the BIC. While the moderate Silhouette value indicates "satisfactory but limited" separation between clusters, this two-cluster structure offers valuable insights for data-driven decision-making processes.

Cluster Analysis Results for Discovering Patterns in Male NEET Rates

The performance of the two-cluster solution (k=2) obtained from the analysis of the male population NEET rates was evaluated in detail based on various statistical metrics (see Everitt, Landau, Leese, and Stahl 2011; Jain 2010). The model's $R^2 = 0.427$ indicates that approximately 42.7% of the total variance in the dataset was explained through clustering. Additionally, AIC = 108.750 and BIC =

123.410 suggest that the two-cluster solution is the most appropriate model according to the BIC criterion (Schwarz 1978). Furthermore, the Silhouette score = 0.420 (Rousseeuw 1987) indicates reasonable separation between clusters, though with some overlap.

Cluster sizes showed that Cluster 1 consisted of 25 observations, while Cluster 2 contained 7 observations. The within-cluster sum of squares values were calculated as 63.801 and 24.951, with intra-cluster heterogeneity found to be 0.719 for Cluster 1 and 0.281 for Cluster 2. Other performance metrics (Everitt *et al.* 2011) revealed a Maximum Cluster Diameter of 4.660 and a Minimum Cluster Separation of 1.580. Pearson's $\gamma = 0.665$ indicated relatively strong correlation between intra-cluster ranking and distances, while the Dunn index = 0.339 reflected moderate separation between clusters. Entropy = 0.525 suggested moderate intra-cluster diversity, and the Calinski-Harabasz index = 22.393 demonstrated satisfactory overall clustering quality.

Table no. 3

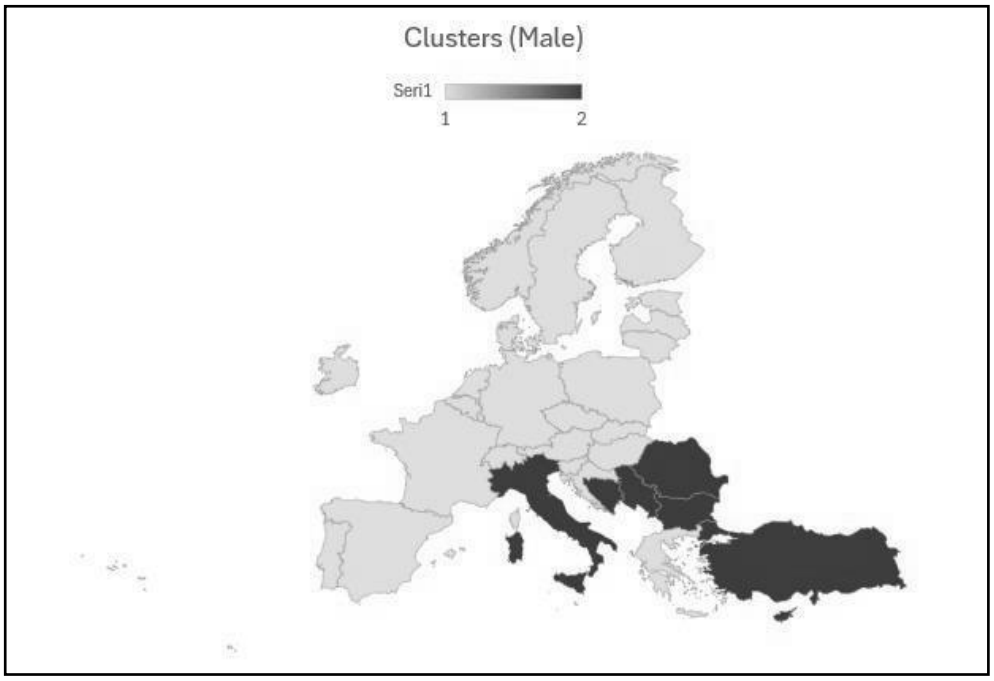
Cluster means for Male NEET Data

Cluster	Not employed persons	High_dig_skills	Basic_dig_skills	Low_dig_skills	No_dig_skills
1	-0.369	0.374	0.326	-0.259	-0.361
2	1.317	-1.336	-1.164	0.925	1.290

Table no. 3 shows that Cluster 1 exhibited relatively lower unemployment (-0.369) and higher digital skills (0.374; 0.326), whereas Cluster 2 was characterized by higher unemployment (1.317) and lower advanced/basic digital skills (-1.336; -1.164). Additionally, Cluster 2 stood out with significantly higher averages in "low_dig_skills" (0.925) and "no_dig_skills" (1.290).

Figure 2

Clusters of Male NEETs Rates



These findings underscore the relationship between digital skill levels and youth unemployment, with the two-cluster solution providing adequate insight to explain differences in the data. The Silhouette score of 0.420 reflects moderate separation, suggesting that while clusters are reasonably distinct, some overlap exists.

Cluster Analysis Results for Discovering Patterns in Female NEET Rates

The analysis of female NEET rates yielded a four-cluster solution (k=4), which was evaluated based on various statistical metrics (see Everitt, Landau, Leese, and Stahl 2011; Jain 2010). The model's $R^2 = 0.640$ indicates that approximately 64% of the total variance in the dataset was explained, with AIC = 95.870 and BIC = 125.190 suggesting that the four-cluster solution provides a reasonable model according to the BIC criterion (Schwarz 1978). Furthermore, the Silhouette score = 0.290 (Rousseeuw 1987) indicated some separation between clusters, though certain inter-cluster interactions were partially observed.

Cluster sizes revealed that Cluster 1 included 23 observations, Cluster 2 had 5 observations, Cluster 3 comprised 3 observations, and Cluster 4 consisted of only 1 observation. The within-cluster sum of squares values were calculated as 45.352, 3.862, 6.661, and 0.000, respectively, with intra-cluster heterogeneity found to be 0.812 for Cluster 1, 0.069 for Cluster 2, 0.119 for Cluster 3, and 0.000 for Cluster 4. Other performance metrics (Everitt *et al.* 2011) revealed a Maximum Cluster Diameter of 3.771 and a Minimum Cluster Separation of 1.363. Pearson's $\gamma = 0.669$ indicated strong correlation between intra-cluster ranking and distances, while the Dunn index = 0.361 reflected moderate separation between clusters. Entropy = 0.858 suggested high intra-cluster diversity, and the Calinski-Harabasz index = 16.558 demonstrated reasonable overall clustering quality.

Table no. 4

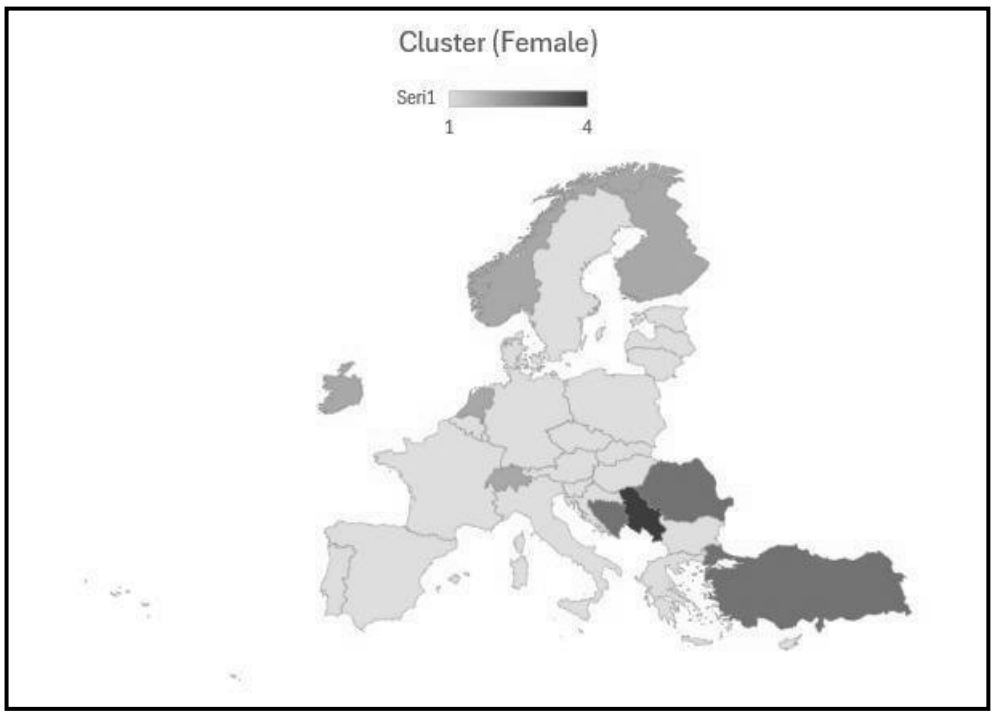
Cluster means for Female NEET Data

Cluster	Not employed persons	High_dig_skills	Basic_dig_skills	Low_dig_skills	No_dig_skills
1	-0.175	0.198	-0.097	0.051	-0.065
2	-0.829	0.479	1.611	-1.346	-0.986
3	2.528	-1.791	-1.506	0.814	2.140
4	0.588	-1.582	-1.312	3.125	0.004

Table no. 4 highlights the standardized mean values of Females_15_29__Not employed persons and various digital skills categories (e.g., high_dig_skills, basic_dig_skills, low_dig_skills, no_dig_skills) across clusters. Cluster 1 exhibited moderate unemployment and digital skills levels, while Cluster 2 stood out with low female unemployment and high basic digital skills. Cluster 3 was characterized by high female unemployment and low advanced/basic digital skills, while Cluster 4 displayed a unique profile with significantly high "low_dig_skills" due to its single observation.

Figure 3

Clusters of Female NEETs Rates



These findings illustrate the relationship between female unemployment and digital skill levels, with the four-cluster solution explaining a significant portion of the variance in the data. Although the relatively low Silhouette value (0.290) suggests "satisfactory but limited" separation between clusters, this four-cluster structure offers important insights for data-driven decision-making processes.

DISCUSSION, RESULTS AND CONCLUSION

The challenges faced by NEET youth in the digital age and the important role of digital literacy, together with the importance of the contributions this combination will make to VET, are particularly emphasized in the literature (Köiv *et al*. 2024; Eichhorst *et al*. 2015). Using Eurostat data, this study aimed to reveal significant inequalities in digital competence across European Union countries and found that countries with higher levels of digital literacy exhibit lower NEET rates. This analysis was conducted on a country basis and in the perspective of the clusters created. The importance of TVET in the process of socio-professional integration of

NEETs is all the higher as researchers (Acemoglu and Restrepo 2019; Dauth *et al.* 2017) have concluded that companies that adopt ICT do not tend to create new jobs, especially for young people at the beginning of their careers, young people with low levels of education and qualifications. This means that the responsibility of TVET for the development of digital skills becomes all the higher. The data obtained highlight the critical need for comprehensive TVET policies that prioritize digital skills as a key component of employability, and that Technical and Vocational Education and Training curricula should be aligned with the needs of the sector and the era. Similar to the findings of these studies in the literature, the digital divide disproportionately affects disadvantaged groups such as women, rural youth, individuals from low-income households, NEETs, and exacerbates chronic educational, social, and economic inequalities. (Eruchalu *et al.* 2021; Litchfield *et al.* 2021; Kinney 2010) These and similar situations complicate the solution-finding proposals and processes of policy makers, educators, and youth workers. In order to find solutions to the obstacles inclusively created by inadequate digital literacy, education policies and curriculum development studies that are in line with the demands of the labor market and society can offer opportunities to develop deep and effective solutions to the problems (Resources). Similarly, the cluster analysis conducted in this study shows that countries with better digital skills have lower NEET rates, and are less exposed to problems such as the digital divide, inequality among disadvantaged groups, and employability.

Despite the studies and important findings, there are still significant uncertainties and unclear points in current TVET policies. Mouzakitis (2010) mentioned the importance of TVET systems for economic development in his study, and stated that it is necessary to adapt to global trends and the new world order with digitalization, innovation and technological developments. The results of this study, as in the study conducted by Furlong (2006), are consistent with the result that disadvantaged young people perceive the career they can obtain through vocational education as less prestigious, and reveal that there are gaps and problems in the compatibility of TVET curricula with labor market demands. In addition, the heterogeneity of NEET populations and differences in different factors and indicators reveal the need for multifaceted strategies for solutions. Inclusiveness should be given priority in the TVET curricula and programs to be developed, and disadvantageous situations such as gender, geographical area, social opportunities and disability should be eliminated and equality should be ensured. The findings of the study reveal that cooperation between governments, educational institutions and private sectors should be increased to integrate digital competencies into TVET programmes and that dissemination of good practice examples will accelerate the process. Additionally, the findings align with the Sustainable Development Goals (SDGs), particularly SDG 8 on decent work and economic growth and SDG 4 on quality education (Transforming our world: The 2030 Agenda for Sustainable Development).

Policymakers need to pay attention to the balance between the development of new technologies and the absorption capacity of the labor market: if the modernization of the economy is not accompanied by an increase in the number of decent jobs for young people preparing to enter the labor market, and not only that, then ICT may become a problem and not a solution. SDGs (9) recommend considering both macro and sectoral policies so that countries avoid shocks and crises generated by the transition from one industrial revolution to another.

This study recommends integrating comprehensive, future-proof digital literacy modules as a core component of Technical and Vocational Education and Training (TVET) curricula to align with the demands of the digital age, society and business, and to enhance employability. These modules should cover core digital skills tailored to the specific needs of businesses and different industries, advanced competencies such as data analysis, emerging technologies such as Artificial Intelligence and the Internet of Things (AI), and to enable students to develop lifelong learning skills. The new curricula should also combine digital skills with soft skills such as problem-solving, analytical thinking, communication and adaptability. Stronger collaborations with business, society and other stakeholders will ensure that education is aligned with labor market demands and that more effective and flexible learning pathways are integrated into the curricula. This will create inclusivity and ensure that disadvantaged groups such as NEET populations are reached equitably.

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În era digitală, capacitatea de angajare, calitatea vieții și incluziunea socială a tinerilor, în special a celor clasificați ca NEET (nici în educație, nici în muncă, nici în formare), sunt din ce în ce mai strâns legate de alfabetizarea lor digitală. Acest studiu analizează relația dintre competențele digitale și ratele NEET în țările Uniunii Europene, subliniind rolul politicilor de Educație și Formare Profesională (TVET) în combaterea excluziunii digitale. Prin analiza datelor Eurostat pentru anul 2023, cercetarea examinează disparitățile în competențele digitale ale

populațiilor NEET în funcție de gen, vârstă și diferențele regionale. Scopul principal este de a evalua modul în care competențele digitale influențează capacitatea de angajare și de a propune recomandări de politici pentru integrarea alfabetizării digitale în curricula TVET.

Pentru a realiza acest lucru, studiul utilizează analiza de cluster ierarhic pentru a categoriza țările UE în funcție de ratele NEET și de distribuția competențelor digitale. Setul de date include statistici Eurostat din 32 de țări europene. Principalele variabile analizate includ statutul de angajare și nivelurile competențelor digitale, clasificate ca ridicate, de bază, scăzute sau inexistente. Rezultatele analizei cluster evidențiază lacune critice în educația digitală și subliniază necesitatea unor politici TVET adaptate, care să echipeze tinerii NEET cu competențe digitale relevante. Studiul oferă recomandări de politici bazate pe dovezi pentru a reduce decalajul digital, a îmbunătăți integrarea pe piața muncii și a alinia formarea profesională la cerințele în continuă evoluție ale economiei digitale. Concluziile contribuie la discursul mai larg despre incluziunea digitală și pregătirea forței de muncă pentru piața muncii modernă.

***Cuvinte cheie*:** *NEET; TVET; competențe digitale; Eurostat; recomandări de politici; incluziune digitală.*

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