

Perspectives of Human Capital Core Specialization for Digital Transformation in Romania

Adriana Grigorescu¹, Cristina Lincaru² and Speranța Pîrciog³

¹⁾ National University of Political Studies and Public Administration (SNSPA), Bucharest, Romania; Academy of Romanian Scientists; Romanian Academy - National Institute for Economic Research "Costin C. Kiritescu", Bucharest, Romania

²⁾³⁾ National Scientific Research Institute for Labour and Social Protection, INCSMPS, Bucharest, Romania

E-mail: adriana.grigorescu@snsa.ro; E-mail: cristina.lincaru@yahoo.de

E-mail: speranta.pirciog@incsmips.ro

Please cite this paper as:

Grigorescu, A., Lincaru, C., Pîrciog, S., 2023. Perspectives of Human Capital Core Specialization for Digital Transformation in Romania. In: R. Pamfilie, V. Dinu, C. Vasiliu, D. Pleșea, L. Tăchiciu eds. 2023. 9th BASIQ International Conference on New Trends in Sustainable Business and Consumption. Constanța, Romania, 8-10 June 2023. Bucharest: ASE, pp. 104-112

DOI: [10.24818/BASIQ/2023/09/067](https://doi.org/10.24818/BASIQ/2023/09/067)

Abstract

The actual challenge is the digital transformation and the higher education holds the leading role to digital adoption and new skills providing. Based on the challenges highlighted by COVID19 pandemic, the new business models are shaped considering the digital transformation and the future jobs creation. They are requiring human resources with specific new skills and knowledge, educated in new teaching programs. The purpose of the study was to explore the Romanian higher education system capacity to create human capital core specialization for digital transformation in view to design a sustainable occupational mobility. It used the theory based analysis as a logic model, particularly in terms of the causal linkages between outputs and the different levels of outcome. Higher education spatial and temporal analysis were conducted with focus on study programs with relevant content for digital transformation creation in the framework the unified matriculation register. The specialized study programs are the intervention that should make the difference in digital transformation. Interdisciplinarity is the core of the new digital occupations formalization which request to develop and update an appropriate taxonomy based on a common scientific framework. The study offers practical inputs to design new tools for interdisciplinary management in creation of new occupational standards, to design study programs adequate for the new digitalized economy. A second finding refers to the domains that are faster moving forward to the new dimensions of digital adoption and futures jobs, the labor mobility, flexibility and hybrid or remote opportunities being part of the new business paradigm.

Keywords:

Human capital, Study Programs, Digital transformation, Interdisciplinary, New Occupations

DOI: [10.24818/BASIQ/2023/09/067](https://doi.org/10.24818/BASIQ/2023/09/067)

Introduction

The digital transformation is a global concern nowadays, accelerated by the effects of the COVID-19 pandemic and it is stated as a strategic objective by the European Union. Human capital need to adapt rapidly to the irreversible radical economies changes driven by digital transformation. This process generates creation for new economic sectors as well as destruction of old ones. New digitally transformed sectors request long term investment in human capital (Ulas, 2019). This has to be able to generate new occupations in the same time with labour force reallocation from the old sectors (Berman, 2012). Even if these new sectors profiles have not very clear profiles, there are some characteristics already emphasized for new occupations:

- the need to adopt new radical disruptive digital technologies for a knowledge economy, an economy based on science;

- the novelty character is generated especially by its interdisciplinary interaction of fundamental scientific fields of knowledge.

All these processes demand for creation of labor mobility mechanisms that are able to create new jobs in new sectors and to reallocate labour force from old sectors to this new sectors in a sustainable manner (Solberg et al., 2020.).

The mobility mechanism has to fully exploit the new digital opportunities and need to develop new digital tools that allow interconnectivity of Educational Systems (Levels of Education and Certification) and labour Market System (Occupation and Qualifications) especially by specialization domains in a scientific common framework. Among these new tools we mention the RMU. It is also important to formalize the new occupations generated by digital transformation using a scientific common framework. Here we point towards the comprehensive, holistic and strategically understanding of occupational content to be in studies programs using appropriated and updated taxonomies.

The nowadays transformations generated by the challenges that started with the COVID-19 pandemic are being reflected in digital transformation, remote working, hybrid working, trade and transport restructuring etc., the energy crisis with impact on economic growth, transport and energy consume, military conflicts with multiple and unexpected effects and other turbulations, clearly demonstrated that the education will be hit by the need of new specialization required on the labour market (Beylis et al., 2020). The present study is a preview of the education system development and needs to change (Kopp et al., 2019).

1. Literature review

Digital transformation in Higher Education Institutions (HEIs) is not only a priority for the decision makers but it also represents a research area explored by a lot of specialists in the last years (Benavides, 2020). That is because the importance of the academics in developing new programs aimed to offer the skilled personnel needed on the labour market and in accordance to the social changes. The content of the education, in line with the innovation and digital adoption and the managing aspects, has to be considered to faster the transition (Jackson, 2019). Aditya et al (2021) analyzed the barriers to the digital transformation in HEIs. Usually the transformation should be driven by the education, but from time to time the economic life pushes the education reshape (Pirciog et al., 2023).

The strategies of the digital transformation must be revised upon the actual need and the disruptions that are taking place on socio-economic life since the beginning of 2020 (Wilms et al., 2017; Xiao, 2019; Seres et al., 2018; Kopp et al., 2019). One of the most important issues is the content of the programs, it should fit with the skills evolution and the expectations of the employers (Alenezi, 2021; Marks & Al-Ali, 2022; Gupta et al., 2022; Neborsky, 2020; Grigorescu et al., 2022). This briefly screening of the literature, but not only if we have understood how the new educational programs are generated to be efficient and effective.

Research Hypothesis we will explore in current study is: The creation of a new sector is consistent when there is mass specialization for those economic activities. We understand through mass specialization the existence of at least a bunch of study programs with specific and dedicated content at first educational level of university programs, bachelor degree, respectively ISCED 6. The question that has to be posted is: Is the actual Educational system able to provide the Human Capital Core Specialization for Digital Transformation in Romania in content, volume and dynamics? The figure no.1 is presenting the research framework proposed for the study.

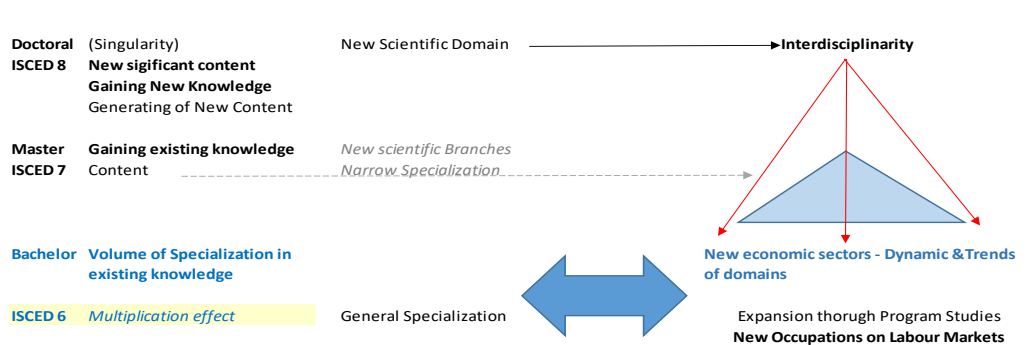


Figure no.1 Research framework

Source: authors' concept

The proposed framework is reflecting the process of a new specialization appearing at bachelor degree level as a reflection of the new scientific domain created as a result of the society evolutions and challenges.

2. Digital transformation educational context in Romania

The bachelor education programs expanded during 1990-2007 with negative effects on quality. In 1990, the number of students enrolled in the undergraduate program was 192.8 thousand and reached a level of more than 4 times higher in 2007. Figure no. 1 indicates that Romania's access into the EU, there is a rapid decrease of the students enrolled in the undergraduate university program from 907.3 thousand in 2007 to 411.2 thousand by 2014, due to the new regulation. Once the regulations about the accreditation and the quality control on the higher education programs, were implemented, in accordance with the European regulations, the number of students has stabilized, with small variations. The phenomenon of programs creation and academic unit without quality standards, made the education process questionable from a quality perspective (Romania Court of Accounts, 2015, p 6).

The experts from the Romania Court of Accounts (2015) stated in their reports that from the perspective of content and quality of the educational process there is no correlation with the labor market needs. Their comments showed that less performing universities, improper programs content are driving to a large number of graduation diplomas, but less skilled professionals and finally to a low competitiveness on the European market. We can note that there is a decoupling of the educational system from the labor market, a fact illustrated by a low performance in various sectors. The quality assurance of the higher education programs and units covers two components (Jordan, 2021, p18): provisional authorization and respectively accreditation and the ranking of study programs and the classification of universities.

The paradigm shift is found in the new approach to education public policies highlighted in QAFIN project (Improving public policies in higher education and enhancing the quality of regulations by updating quality standards) funded by European Social Fund (ESF).

From the perspective of the digital transformation there are levels of digital tools implementation. There are six digital platforms active at educational management level (Jordan, 2021, p26). The Integrated Educational Register (Registrul Educațional Integrat - REI), actually hosting and managing the Unique Matriculation Register (Registrul Matricol Unic -RMU) aims to integrate all the platforms with data about education units, students, programs, teaching staff, research activity, etc. One of the most important platforms that creates the link between programs and qualifications is the National Register of Higher Education Qualifications (Registrul Național al Calificărilor din Învățământul Superior - RNCIS). The fact that it links the Students, Graduates and the Labour Market Platform (Studenți, Absolvenți și Piața Muncii - SAPM) will give a complete picture of the compatibility between the skills needed on the labor market and the skills provided by the HEIs.

Decision no. 42/2021, within the Government Program 2021-2024, also reveals the strategic importance of using the inter-connectable digital tools by assuming the implementation of the integrated computer system of education in Romania (SIIR) and the creation of the Unique National Reporting Platform in Higher Education in July 2022. The link with the National Institute of Statistics is set up within this unique platform.

3. Research methodology

The digital transformation is a highly complex process that could be evaluated under the theory of Change. It is important for social funds design (Carvalho and White, 2004). The method we apply for this study is the Theory-based approaches to evaluation starting from the change theory. The intervention is very complex and represents comprehensive cross-sector community-based interventions designed to improve the programs offers considering Weiss (2011).

Theory-based approaches to evaluation represent a logical enquiry based on the observed fact and results through the theories. It can be combined with evaluation methods. This theory is mainly an evaluation of the research object, a theory supporting the structuring analysis in an evaluation process. The theory of change gives the possibility to evaluate the expected results produced by an intervention. The most common mechanism is the logic model that starts with the inventory of the existing facts, acts and results (Shadish et al., 1995; Alkin, 2013). The six principles to a successful application of the approach of change were identified by White (2009). Another way of evaluating the change is question-based approach to evaluation practice by Vedung (1997, 2020) applied by Mickwits et al (2021) to evaluate the

transition to sustainability. The theory of change can be analyzed as a logic model using the causal link-ages between inputs and outputs, considering intermediate outcomes.

For this study we will consider the data from the RMU about the HEIs for 2020-2021 academic year and select the domains we are considering vital for digital transformation, for a brief analysis (Rodrigues, 2017). The administrative database provides an exhaustive picture regarding the description of the state of higher education in the year 2020-2021. The data set is publicly offered in Open Source format on the data.gov.ro platform in the Invatamant-Superior-2020.xlsx file.

4. Results and Discussions

Nomenclature for the classification of the Specialization Programs by the official statistics is done upon the INCED codes, in our case ISCED 6 education level is allocated to bachelor's degree. The evolution of the bachelor students enrolled in Romania between 1990 and 2021 is presented in figure no. 2 and reconfirm the abnormal growth up to 2007, the decrease and the level of constancy from 2014 up to now.

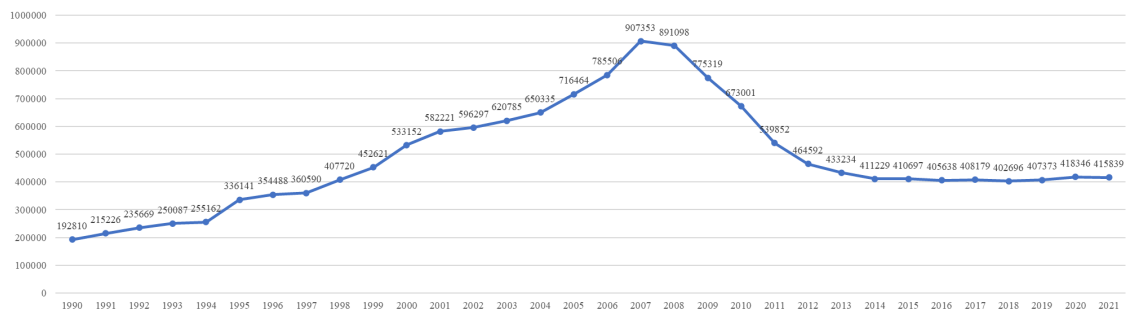


Figure no. 2 Students enrolled in bachelor programs during 1990-2021 (Number of persons)
Source: Authors representation based on data from INS TEMPO TEMPO_SCL103L_10_4_2023

To evaluate the digital transformation we will explore the evolution of the programs that are generating proper skills. At first sight, we are presenting the evolution of the total programs and on levels INCED 6,7 and 8, for 2014-2021 and particularly for the programs specialized in information and computer technology (ICT).

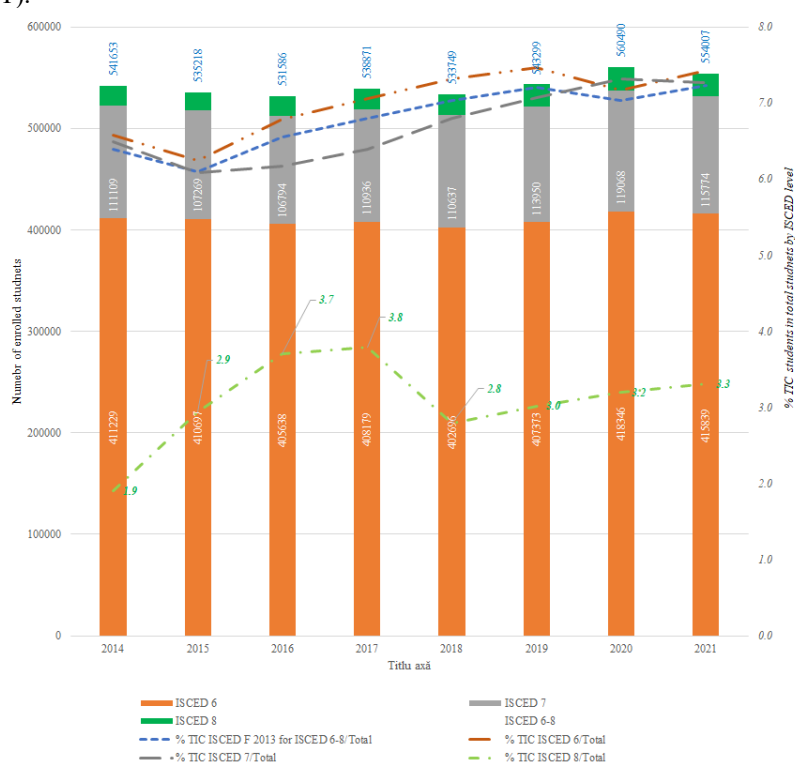


Figure no. 3 Students enrolled in tertiary education and ICT specialization during 2014-2021 (Number of persons, %)

Source: Authors representation based on data from INS TEMPO TEMPO_SCL103L_10_4_2023

In figure no.3 it can be seen that the number of total students enrolled in academic programs is roughly constant, with slightly changes between changes. The percentage of the students in ICT programs knows an increase of 0.84 ppt, but the level is placed at 7.2% for 2021. The higher increase was done for INCED 8 (1.40 ppt) that demonstrates a tendency of new scientific domains appearance. The number of students enrolled in ITC doctoral and post-doctoral programs is doubled in 2021 compared to 2014. Overall, in our opinion, the number of students generally studying ITC is very small to signal a consistent digital transformation and new specialization.

The science branches with more than 1% share in students number is presented in Figure no. 4 and it can be seen that the Economics & Business administration is the first (16.13%) followed by Medicine (10.30). The digital transformation branches: Electrical, Electronics and Telecommunication Engineering and Systems Engineering, Computers and Information Technology are having only 4.65% respectively 4.51%.

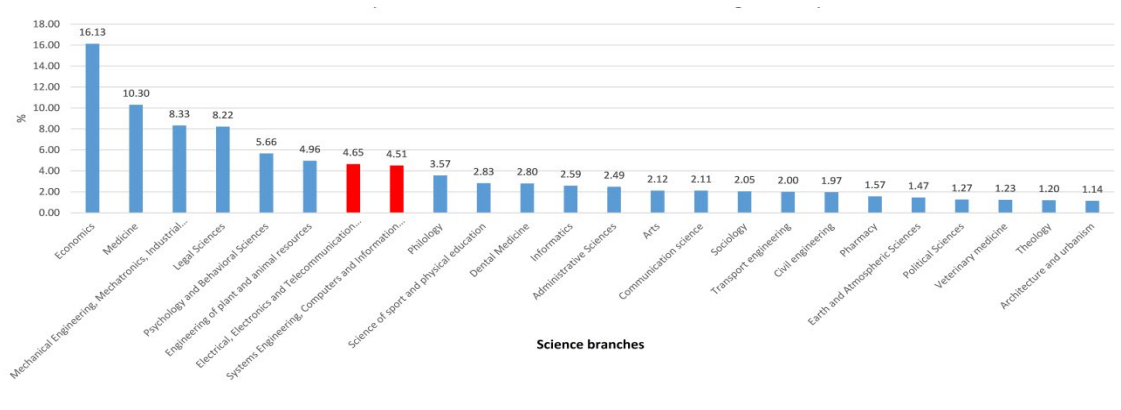


Figure no. 4 Science branches ranking for 2020/2021, INCED 6

Source: Authors representation based on data from <https://data.gov.ro/dataset/reteaua-unitatilor-de-invataman-t-universitar-2020-2021>

For figure no.4 we used data from the RMU platform and we found a rate of data recording of 96%, compared to the national statistics. This is relevant for the data accuracy and the integrated platform REI.

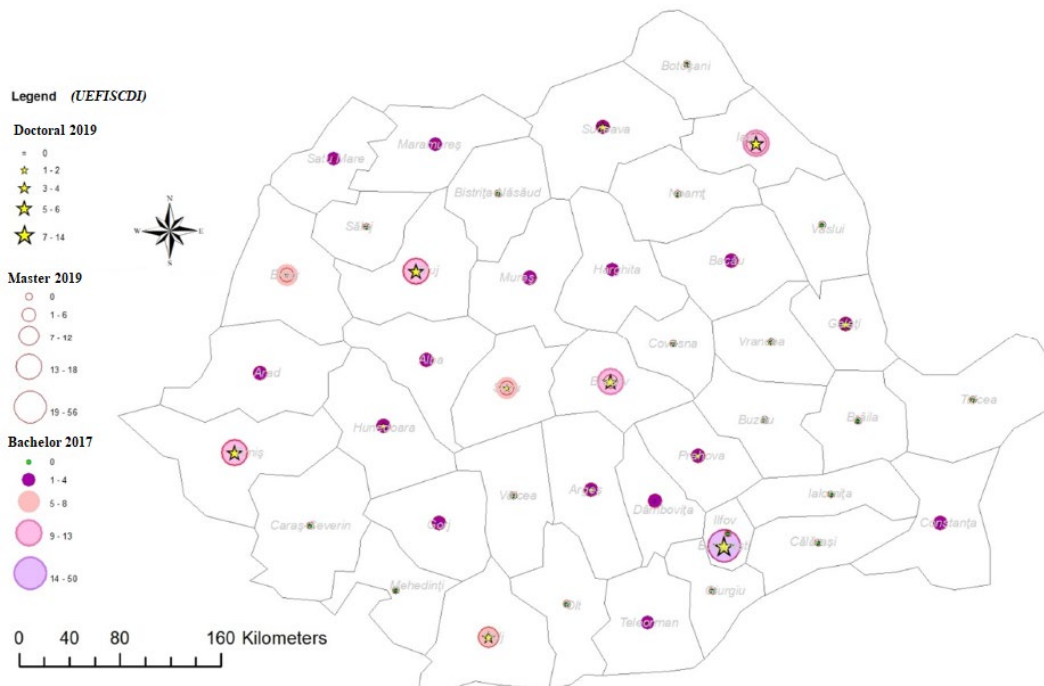


Figure no. 5. Spatial distribution of study program specializations by level of education in 2020

Source: Authors representation; RMU data.gov.ro

Figure no. 5 presents the geographic distribution of the educational programs for bachelor, master and doctoral levels. It is obvious that there is a concentration in few centers: Bucharest, Brasov, Cluj, Iasi, Timisoara, Craiova. The concern is the East and South areas have the most uncovered counties.

A selection of study programs with potential in digital transformation in Romania were done with their correspondence to the fundamental domain and science branch. The data reveals the fact that the highest consistent growth for digital transformation is in engineering, followed by military science and economics. At first sight, the conclusion is that the technical domains are acting on the program renew for digital transformation and new specializations. The ranking of the specializations in 2020 places the Modern languages on top with 14.89%, compared to Economic informatics (place 34, 0.57%), Applied Electronics (place 36, 0.54%), Computers (place 38, 0.51%) and Technologies and Telecommunication Systems (place 59, 0.40%). This volume of core program studies specialization for digital transformation in Romania at bachelor degree level reveal the relatively low amplification power of the process.

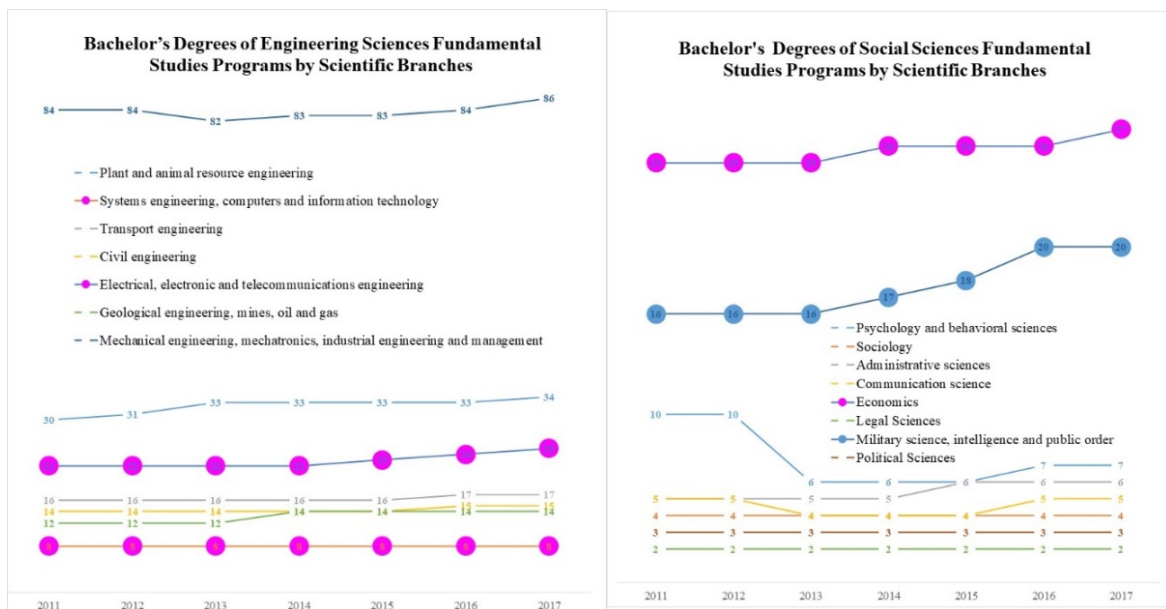


Figure no. 6. Bachelor's degrees studies programs evolution and comparison

Source: Authors representation; RMU data.gov.ro

If we are comparing the evolution of the study programs in Engineering Sciences and Social Sciences, there is an increase of programs for Electrical, Electronics and Telecommunication Engineering and a stagnation for Systems Engineering, Computers and Information Technology. For military sciences and Economics there is a more consistent growth.

In figure no.7 is presented a synthesis of the study programs distribution and consistency for Engineering and Social Science, as an example of structural integrated analysis framework. The theory based change analyze offers a brief image of the past seven years evolution of the higher education system and the germs of the digital transformations. The lack of data about the content of the study programs is a barrier in having a transversal content analysis. We can appreciate that not significant changes took place in the structure of domains, branches and field of specialization in view of the digital transformation. A deep analysis will be needed for new education areas or for the content reshaping of the existing.

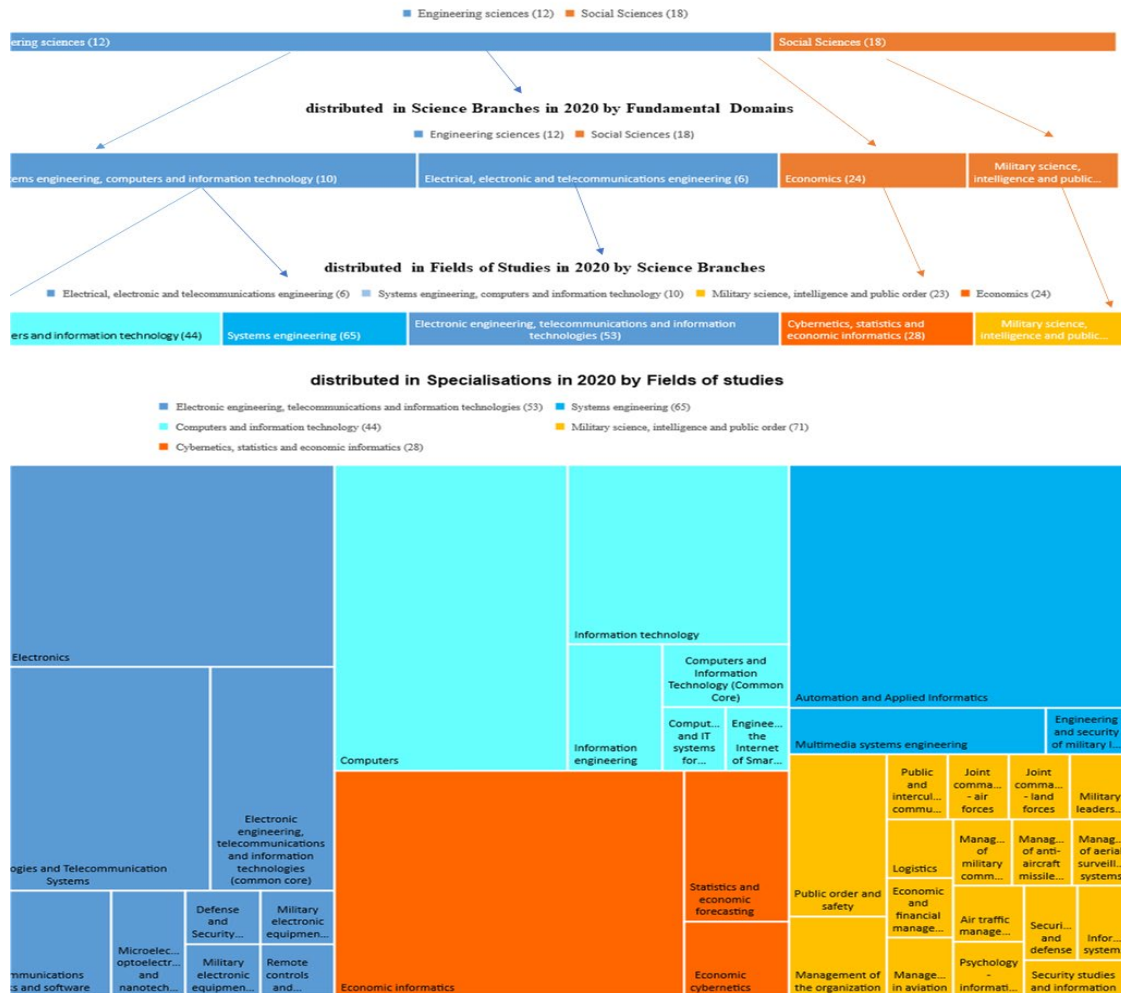


Figure no. 7. Bachelor study programs distribution in Romania for 2020
Source: Authors representation

Conclusions

Our main contribution is statistical analysis of the perspectives of human capital core specialization for digital transformation in Romania. The present educational system is not able to provide the human capital core specialization for digital transformation in Romania in volume, dynamic and tendency. Even if the content is present, it is spatially isolated and does not provide mechanisms for interdisciplinary programs.

In our opinion, the science fundamental domains and science branches need an interdisciplinary management tool development. On this purpose, there is a request to develop and update an appropriate taxonomy based on a common scientific framework as a tool for managing interdisciplinarity as the source for the new digital occupations. RMU is a digital tool that could be improved to better reflect the link between the study programs and the adoption of digital transformation. Based on a clear taxonomy, the evolution of the students flow, specialization, qualification (skills), professions and jobs will reflect the shift to the new occupations needed on the labour market. The identification of the qualitative and quantitative items of study programs evaluation in accordance with the content and appropriateness for the business environment are amongst other measures to be implemented. From the perspectives of data - it needs a better, relevant and consistent of the records collection, real time and access, all integrated in a framework easy to be linked with other data bases at national, European or international level (Jordan, 2021) and this will increase the visibility of the digital transformation process and that is not the only plus side.

This work is of a tremendous importance to properly evaluate the education system capacity to support digital transition in a sustainable manner in Romania. The detailed image of the network of HEIs includes the data of public and private units operating in the 2020-2021.

The results do not 100% reflect the changes to the digital transformation because the most important limit of the study consists in having little information about the content of the study programs,

Among the possible applications of this research, we mention the new occupation generation based on new occupational standards to be linked to the new educational programs and to assure fully connection with labour market demand.

Further extend of the study are: exploration of the studies programs matching with the labour market specialization demand across economic sectors in the digital transformation framework; interoperability of educational systems with labour market systems; forecasting for digital transformation implementing in Romania based on regional smart specialization strategies.

Acknowledgement(s):



This work was supported by a grant from the Romanian Ministry of Research and Innovation, Programme NUCLEU, 2022–2026, Spatio-temporal forecasting of local labour markets through GIS modelling [P5]/ Previzțiuni spațio-temporale pentru piețele muncii locale prin modelare în GIS [P5] PN 22_10_0105.

This publication was realised with the EEA Financial Mechanism 2014-2021 financial support through the Project Moving towards the new normal in digital learning – new dimension of human capital in higher education, contract number 20-COP-0043. Its content does not reflect the official opinion of the Programme Operator, the National Contact Point and the Financial Mechanism Office. Responsibility for the information and views expressed therein lies entirely with the authors.

References

- Aditya, B. R., Ferdiana, R., and Kusumawardani, S.S., 2021. Barriers to digital transformation in higher education: An interpretive structural modeling approach. *International Journal of Innovation and Technology Management*, 18(05), 2150024.
- Alenezi, M., 2021. Deep dive into digital transformation in higher education institutions. *Education Sciences*, 11(12), p.770.
- Alkin, M., 2013. *Evaluation Roots: A Wider Perspective of Theorists' Views and Influences*, 2nd edn. London: SAGE
- Beylis, G., Jaef, R.F., Morris, M., Sebastian, A.R. and Sinha, R., 2020. *Economic transformation, skills, and the future of work*.
- Berman, S.J., 2012. Digital transformation: opportunities to create new business models. *Strategy & Leadership*, 40(2), pp.16-24.
- Benavides, L.M.C., Tamayo Arias, J.A., Arango Serna, M.D., Branch Bedoya, J.W., and Burgos, D., 2020. Digital transformation in higher education institutions: A systematic literature review. *Sensors*, 20(11), p.3291.
- Carvalho, S. and White, H., 2004. Theory-Based Evaluation: The Case of Social Funds. *American Journal of Evaluation*, 25(2), pp.141–160. <https://doi.org/10.1177/109821400402500202>.
- Grigorescu, A., Zamfir, A.-M., Sigurdarson, H.T. and Lazarczyk Carlson, E., 2022. *Skill Needs among European Workers in Knowledge Production and Transfer Occupations*. *Electronics*, [online] 11(18), p.2927. <https://doi.org/10.3390/electronics11182927>.
- Jordan, P., 2021. *Manualul de proceduri cu privire la rolul și competențele med și ale consiliilor subordonate, respectiv aracis, în procesul de asigurare a calității și de ierarhizare și clasificare*. [pdf] Available at: <<https://www.aracis.ro/wp-content/uploads/2021/03/5.2-PARTEA-III-Procedura-roluri-Ierarhizare-martie.pdf>.> [Accessed November 2022]
- Jackson, N.C., 2019. Managing for competency with innovation change in higher education: Examining the pitfalls and pivots of digital transformation. *Business Horizons*, 62(6), 761-772.
- Kaputa, V., Loučanová, E., and Tejerina-Gaite, F.A., 2022. Digital transformation in higher education institutions as a driver of social oriented innovations. *Social innovation in higher education*, pp.61-85.
- Kopp, M., Gröblinger, O., and Adams, S., 2019. Five common assumptions that prevent digital transformation at higher education institutions. In *Inted2019 Proceedings*, pp. 1448-1457.
- Marks, A. and AL-Ali, M., 2020. Digital Transformation in Higher Education: A Framework for Maturity Assessment. *International Journal of Advanced Computer Science and Applications*, 11(12).

- Mickwitz, P., Neij, L., Johansson, M., Benner, M., and Sandin, S., 2021. A theory-based approach to evaluations intended to inform transitions toward sustainability. *Evaluation*, 27(3), 281-306.
- Neborsky, E.V., Boguslavsky, M.V., Ladyzhets, N.S. and Naumova, T.A., 2020. Digital Transformation of Higher Education: International Trends. In: *Proceedings of the International Scientific Conference "Digitalization of Education: History, Trends and Prospects" (DETP 2020)*. Yekaterinburg, Russia: Atlantis Press.
- Pirciog, S.C., Grigorescu, A., Lincaru, C., Popa, F.M., Lazarczyk Carlson, E. and Sigurdarson, H.T., 2023. Mapping European high-digital intensive sectors—regional growth accelerator for the circular economy. *Frontiers in Environmental Science*, [online] 10, p.1061128. <https://doi.org/10.3389/fenvs.2022.1061128>.
- Rodrigues, L. S., 2017. Challenges of digital transformation in higher education institutions: A brief discussion. In *Proceedings of 30th IBIMA Conference*.
- Romanian Court of Accounts, 2015. *Sinteza: Raport de Audit alPeformanței: Perioada auditată: 1.01.2011-30.06.2015, Perioada de efectuare a acțiunii: 07.09-18.12.2015*. [online] Available at: <<https://www.curteadeconturi.ro/uploads/34b38f42/285eb1a6/e769d38f/944b1397/a951b66e/98cdea70/87f3734f/85d7dd1c/SINTEZAAPInvsup.pdf>. > [Accessed 5 November 2022]
- Shadish W.R., Cook T.D., and Leviton L.C., 1995. *Foundations of Program Evaluation: Theories of Practice*. Newbury Park, CA: SAGE
- Solberg, E., Traavik, L.E. and Wong, S.I., 2020. Digital mindsets: Recognizing and leveraging individual beliefs for digital transformation. *California Management Review*, 62(4), pp.105-124.
- Seres, L., Pavlicevic, V., and Tumbas, P., 2018. Digital transformation of higher education: Competing on analytics. In *INTED2018 Proceedings* (pp. 9491-9497). IATED.
- Treasury Board of Canada Secretariat, 2015. *Theory-Based Approaches to Evaluation: Concepts and Practices*. [online] Available at: < <https://www.canada.ca/en/treasury-board-secretariat/services/audit-evaluation/evaluation-government-canada/theory-based-approaches-evaluation-concepts-practices.html>. > [Accessed 12 August 2022]
- UEFISCDI, 2023. *Registrul Educational Integrat și Registrul Matricol Unic*. [online] Available at: < <https://rei.gov.ro/informatii-generale-14>. <https://data.gov.ro/dataset/reteaua-unitatilor-de-invataman-universitar-2020-2021> > [Accessed 12 August 2022]
- Ulas, D., 2019. Digital transformation process and SMEs. *Procedia Computer Science*, 158, pp.662-671.
- Vedung, E., 1997. *Public Policy and Program Evaluation*. New Brunswick: Transaction Publishers.
- Vedung, E., 2010. Four waves of evaluation diffusion. *Evaluation*, 16(3), pp. 263–77.
- Weiss, C.H., 2011. *Nothing as Practical as Good Theory: Exploring Theory-Based Evaluation for Comprehensive Community Initiatives for Children and Families*. [online] Available at: < <https://www.semanticscholar.org/paper/Nothing-as-Practical-as-Good-Theory-%3A-Exploring-for-Weiss/ed98a1ac4b7b54ef4854b7b7a802db7b3e46ae02>. > [Accessed 5 September 2022].
- White, H. (2009) 'Theory-based impact evaluation: principles and practice', *Journal of Development Effectiveness*, 1(3), pp. 271–284. Available at: <https://doi.org/10.1080/19439340903114628>.
- Wilms, K. L., Meske, C., Stieglitz, S., Decker, H., Fröhlich, L., Jendrosch, N., and Rudolph, D., 2017. Digital transformation in Higher Education—new cohorts, new requirements?
- Xiao, J., 2019. Digital transformation in higher education: critiquing the five-year development plans (2016-2020) of 75 Chinese universities. *Distance Education*, 40(4), 515-533.