# The RDI System in Romania as Compared to Other Member States of The European Union

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*Abstract: Research, technological development and innovation contribute directly to Europe's prosperity and well-being of citizens and society. The European Union has a leading role in the international science and technology. In terms of innovation, Romania belongs to the group of emerging innovative countries in the European Union. Its RDI system has interrelated shortcomings, being at a considerable distance even from the countries in the group of emerging innovators. Against this background, this paper analyses key factors that hinder innovative activities in Romania, as well as the position occupied in the European rankings as compared to the group of innovative leader countries, but also with the group of emerging innovative countries. The methodology used in the research topic is qualitative, with specific methods (document analysis, comparative analysis), but also quantitative. The objective of the paper is to identify, present and analyse innovation barriers in Romania compared to other member states of the European Union. The work also has certain limitations, and the most important one is that the data available at this moment in the European databases are up to the level of the years 2020-2021.*

*Keywords: research, development, innovation, PhD graduates, "knowledge intensive" activities, economic forecast.*

*JEL Classification: C53, D80, O30, O31.*

## 1. Introduction

Investing in research, development and innovation (RDI) means investing in Europe's future. These investments help EU to compete globally while preserving its unique social model. They have a large contribution to well-being in Europe and around the world, helping to solve some of the major societal challenges. It is important to prioritize investments in RDI to create more and better jobs in Europe, to improve the quality of life and to increase the competitiveness of the EU economy. The EU is one of the global leaders in this regard, as almost two-thirds of its economic growth in recent decades has been generated by innovation. In addition, the EU has a share of almost 20% of global RDI investment and wants to increase its spending on research and development. According to Grassano et al. (2022), the technology race intensified in 2021 with EU companies showing a recovery, US and Chinese companies continuing to increase sharply their R&D investments and Japanese companies following behind. As a result, the share in global R&D investment of EU companies decreased to 17.6% while that of US companies reached 40.2% in 2021. Chinese companies continued to increase their R&D share sharply, reaching 17.9%. In contrast, Japanese companies' share of global Scoreboard R&D continued to shrink (10.4%).

Innovation has become the symbol of modern society, a solution for solving many problems and a phenomenon that must be studied. Innovation gained real importance in the 20th century. Innovation does not represent just the implementation of new ideas or methods, but it can be defined as a process involving multiple activities to discover new ways of doing things. For this reason, innovation is so important in the socio-economic development of a country.

This paper analyses the indicators regarding the RDI system in Romania and have been forecasted the trends of these indicators until the year 2030. Ranga (2018) emphasized the important role that smart specialization has in catalysing the development of regional innovation systems at an early stage in less advanced regions, by facilitating the emergence of some defining elements that were missing or by accelerating the

development of existing ones. Ranga (2018) and Scutaru, Prelipcean & Cozorici (2019) studied the opportunities for exploitation of Romania's competitive advantages by small and medium-sized enterprises (SMEs), through the development of innovative clusters, which stimulate the performance of research and development activities and increase the competitiveness of companies (Scutaru, Prelipcean & Cozorici, 2019). Şerbănica examined territorial innovation patterns in Romania, a country labelled as a "modest innovator" (Șerbănică, 2021).

## 2. Presentation of indicators

According to the European Innovation Scoreboard 2022, in terms of performance of the innovation system, Romania falls into the group of emerging innovative countries. With performance "well below the EU average" of 70%, Romania lags behind the innovation's leaders, strong innovators and moderate innovators, but also behind all the other EU member states included in the same group, namely: Hungary, Croatia, Slovakia, Poland, Latvia and Bulgaria (European Commission, 2022a). It is important to mention the over-fragmentation of the system of public organizations performing RDI. This 'system' is not a system, but a constellation of institutions of various types and origins, which are the product of historical developments (European Commission, 2022b).

Performance is measured through a set of indicators classified in the following categories: human resources, attractive research systems, digitalisation, finance and support, firm investments, use of information technologies, innovators, linkages, intellectual assets, employment impact, sales impact and environmental sustainability. In this paper are taken into account the following four indicators, these being the ones that raise the most significant problems in the field of RDI in Romania.

*First, the number of PhD graduates* is far below the target set by the Romanian authorities (3.000 per year) (Ministry of Research, Innovation and Digitization, Framework document regarding National Research Strategy, Innovation and Smart Specialisation 2021-2027, 2021). One of the main reasons is the low attractiveness of doctoral studies because the amount of money for those who get a scholarship is very small and the doctoral students have too little time left to complete their studies (they have to work as research assistants or in other fields to earn a living). This lack of coherence between ambition and the will to invest sufficiently in Romania's next generation of advanced human capital results in a very low graduation rate from doctoral schools in the country and a limited number of well-trained young researchers available for the Romanian research-innovation system. On the other hand, the labour market in Romania has difficulties in absorbing PhD graduates because most companies are SMEs without research or innovation departments (UEFISCDI, 2022a).

Most PhD graduates are purely academically oriented, and the current supply of PhD holders does not match the demand and absorptive capacity of the RDI labour market. In addition, the number of PhD graduates per capita followed a positive trend until 2013 (due to funding of PhD programmes through the European Regional Development Fund). However, since then it has steadily declined. Moreover, even the increased number of new PhD holders in the past has not been reflected in the increase in the number of researchers in science and technology.

Second, *RDI expenditure (both in the public and business sector)* is at a very low level in Romania, being only 0.47% of GDP the expenses made by the Romanian state even falling marginally. Currently, a package of financial facilities for research and development activities in Romania includes an additional deduction of 50% of the total expenses incurred for this purpose, accelerated depreciation of assets used for research and development purposes and an exemption from tax on employee incomes. It is worth noting that in Lithuania, Slovakia, Hungary, Poland and Croatia, additional deductions reach significant values (of up to 300% of total expenses).

The new target assumed by the authorities through the National Plan for Research, Development and Innovation in the period 2022-2027 is 2% of GDP. This target has the potential to create the conditions for the structural convergence of the national RDI system with the systems of the other European Union countries, with increased visibility, sustainability and impact. The public investment in RDI will also support the training of innovation in the private sector, contributing to Romania's innovation-based competitiveness and social cohesion (UEFISCDI, 2022a).

Third, there are few *companies in Romania that provide information and communications technology (ICT) training to their own staff*. To increase their productivity, it is necessary for companies, especially SMEs, to invest in the training of personnel in the ICT sector. One of the main benefits of training employees in ICT is the increase in business opportunities.

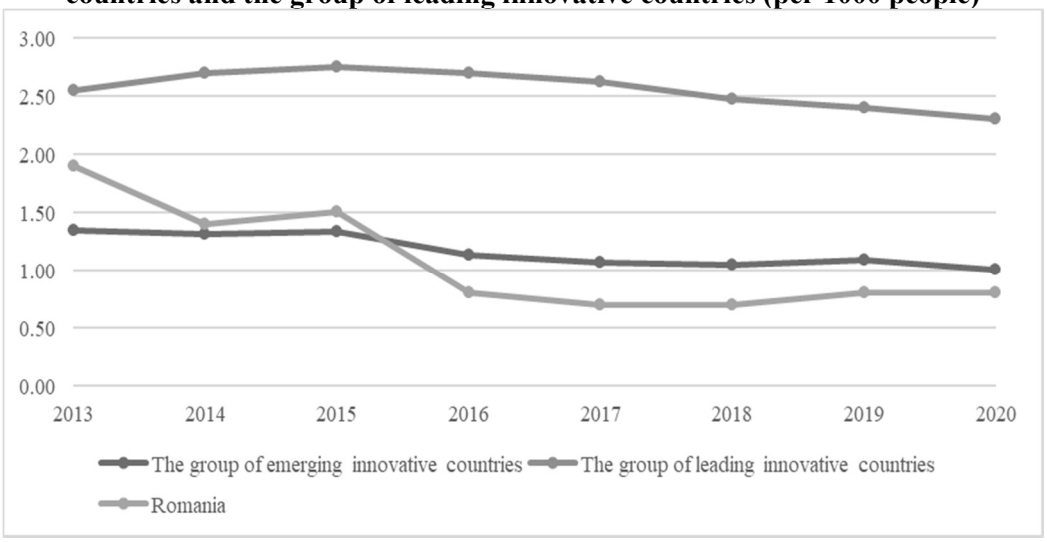
*Fourth, employment in "knowledge intensive" activities* in our country has a low share, although the number of employees of the largest "knowledge intensive" firms has seen a constant increase in the last decade. It is worth underlining that "knowledge intensive" services include activities carried out for the purpose of creating, acquiring and disseminating knowledge. The "knowledge intensive" service sector is at a high level in developed countries, in contrast to Romania.

In the following sections will be analysed the indicators mentioned above. The forecasts have been realized with special software.

## 3. Graduates of doctoral programs

The total number of PhD graduates in Romania has declined significantly over the past decade. If in 2013 Romania was above the European Union average in terms of the number of graduates of doctoral programs per thousand people, in 2020 our country was at a considerable distance below the EU average, standing at half of it (Chart 1). On the one hand, a significant decrease in doctoral graduates was registered in Romania in 2016 due to some legislative provisions (application of Government Decision 681/2011, in force since March 10, 2016) regarding the approval of the Code of doctoral university studies, by which were limited both the age of doctoral supervisors and the maximum number of doctoral students which could be coordinated simultaneously by a doctoral supervisor. On the other hand, in recent years, funding instruments for high-performing young researchers have been reduced, causing them to go abroad, to work in RDI in other European countries, or even to migrate to other economic sectors more attractive from a financial point of view. Recent research underscores the brain drain phenomenon, with its negative effects on the Romanian RDI system (European Commission, 2022b).

**Chart 1: Graduates of doctoral programs in Romania, as compared to the group of emerging innovative countries and the group of leading innovative countries (per 1000 people)**

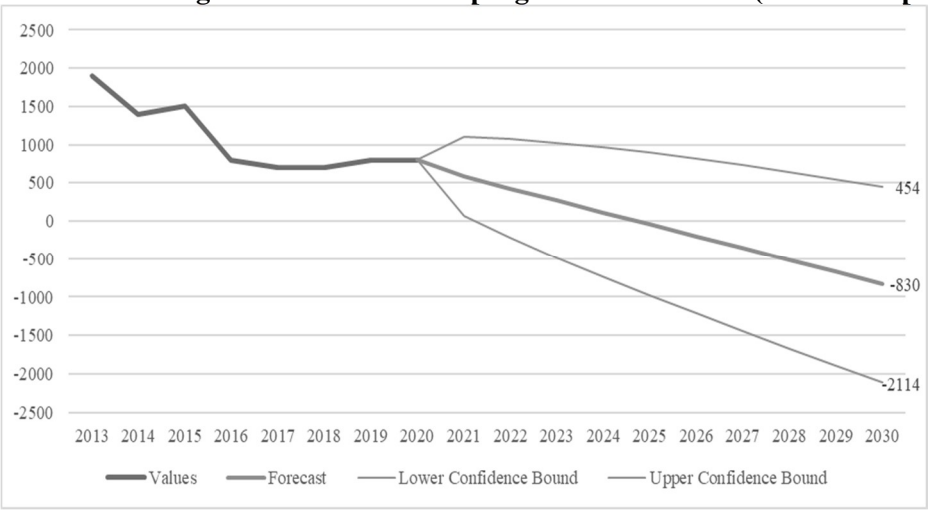



Source: Own representation based on
https://ec.europa.eu/eurostat/databrowser/view/educ_uoe_grad06/default/table?lang=en

During the analysed period, one can observe the unfavourable evolution of doctoral graduates per 1000 people in our country compared to the group of emerging innovative countries. If between the years 2013-2015 Romania recorded a higher level compared to the countries in its group, during the period 2016-2020 our country constantly recorded levels of doctoral graduates below the average of the group of emerging innovative countries.

It is worth mentioning that during the analysed period the gap between Romania and the group of leading innovative countries deepened, the level of doctoral graduates in our country being one third compared to the average level of doctoral graduates from the group of leading innovative countries in 2020.

**Chart 2: Forecast of graduates of doctoral programs in Romania (number of people)**




Source: author own processing based on https://ec.europa.eu/eurostat/databrowser/view/educ_uoe_grad06/default/table?lang=en

Following the forecast made, it can be observed that in the current decade the downward trend of doctoral graduates is maintained, being able to appreciate that Romania will not reach the target of increasing the average number of doctoral graduates to 3000 per year in 2030, in the case of a natural evolution of the indicator (Chart 2).

## 4. Research-development-innovation expenses

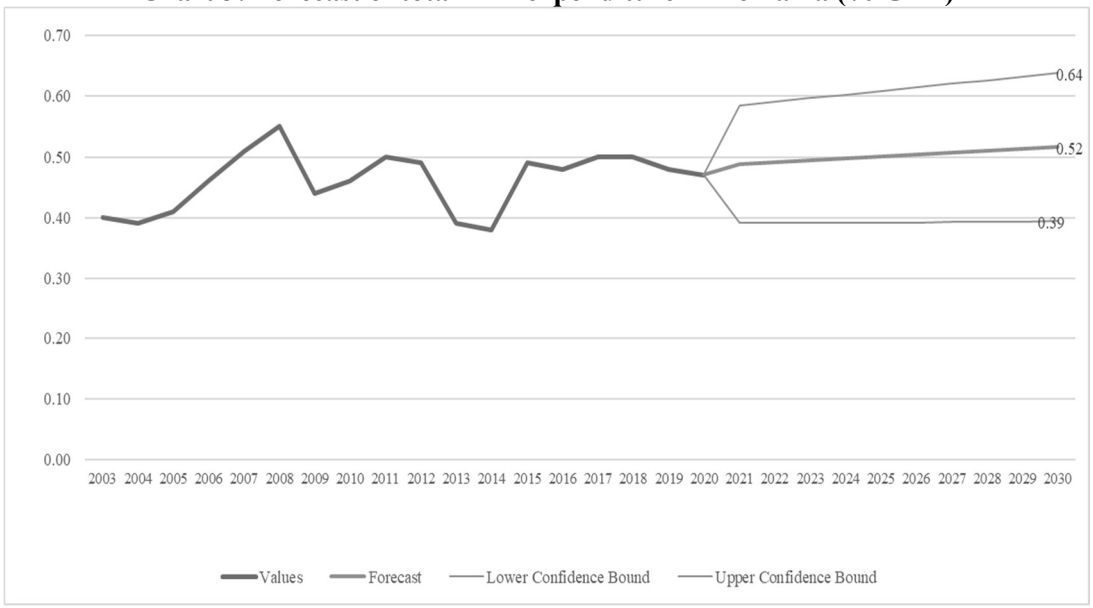
In a competitive society, RDI expenses must be looked at more carefully, their impact on the future development of the economy being essential. The most important premise for the development of the research-development-innovation sector is the investment intended for various relevant activities. According to the OECD, expenditure committed to RDI activities is an indicator of a country's efforts to drive innovation. These activities mainly cover three areas: basic research, applied research and experimental development. The indicator used to measure the intensity of specific activities is the total expenditure on research and development activity as a percentage of GDP. They represent, according to the definition of the National Institute of Statistics, a percentage of the expenses made by all sectors of a country for the research and development activity, in relation to the GDP, and provide the level of financial resources allocated to the development of the research activity. The indicator has the advantage of also allowing comparisons to be made between countries, a particularly important aspect in the context of highlighting the role that RDI plays in the economy (Eurostat, 2023).

In the specialized literature there are extended studies and investigations regarding the RDI sector in Romania. In order to bring elements of novelty, this research focuses on the own forecasts to analyse the achievement of the targets that our country proposed through the National Strategy for Research, Innovation and Intelligent Specialization 2022-2027 (UEFISCDI, 2022b).

The total expenditure on RDI in our country is below the average of emerging innovative countries, 2007-2008 being the only period in which Romania came close to the average of this group. Regarding the average RDI allocations in the leading innovative countries, we can appreciate that this is almost seven times higher than Romania's financial allocation.

The accelerated growth of investments in research-development-innovation opens opportunities for the structural integration of national RDI systems with other national systems of European countries to increase visibility, sustainability and impact. That is why we consider it important to analyse whether our country will reach the target of 2% of the Gross Domestic Product spent on research-development-innovation, a target assumed by the National Strategy for Research, Innovation and Intelligent Specialization 2022-2027.

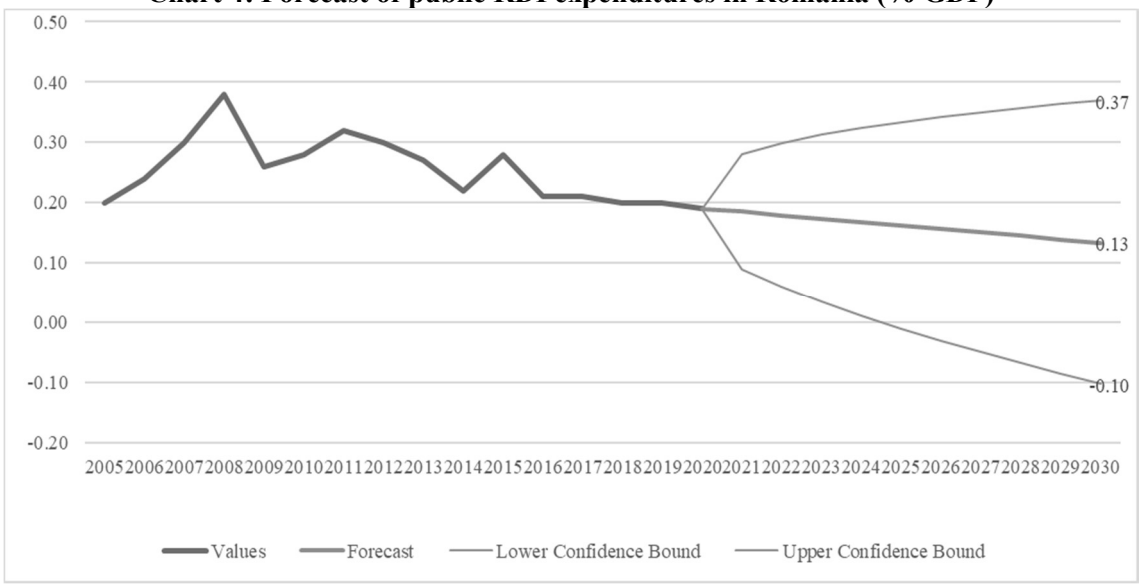
**Chart 3: Forecast of total RDI expenditure in Romania (% GDP)**




Source: author own processing based on https://ec.europa.eu/eurostat/databrowser/view/rd_e_gerdsc/default/table?lang=en

According to the forecast, the share of research-development-innovation expenses in Romania will be in the year 2030, with a probability of 95%, in the range of 0.39% - 0.64%, if the current evolution continues (Chart 3). The average forecasted value is 0.52%, thus resulting in a gap of 1.48% compared to the 2030 target. Thus, we can appreciate that our country will not be able to reach the 2030 target (2%) only through the simple natural evolution of the indicator.

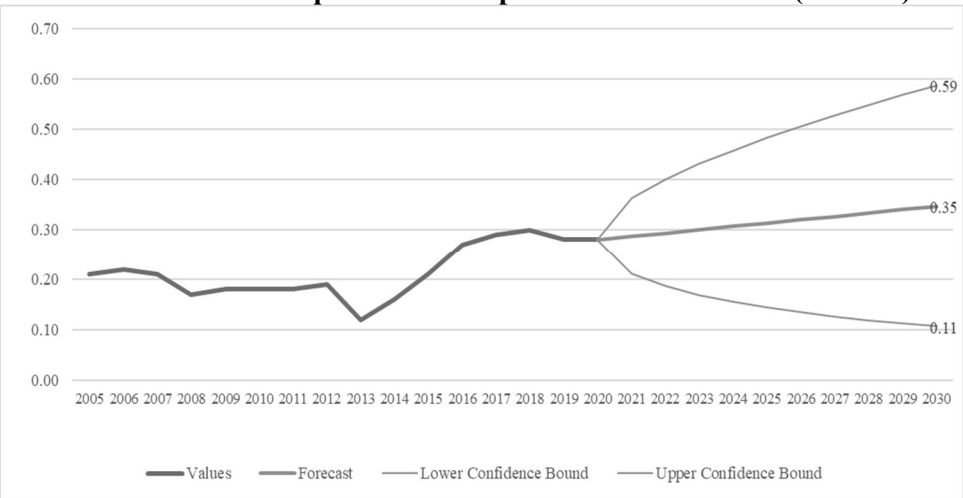
**Chart 4: Forecast of public RDI expenditures in Romania (% GDP)**




Source: author own processing based on https://ec.europa.eu/eurostat/databrowser/product/view/rd_e_berdcostr2?lang=en

Following the forecast, it turned out that the share of public expenditure on research-development-innovation in Romania will be in the year 2030, with a probability of 95%, in the range -0.10% - 0.37%, if a natural evolution will occur (Chart 4). The average forecast value is 0.13%, thus resulting in a gap of 0.87% compared to the 2030 target. Thus, we can appreciate not only that our country will not be able to reach the 2030 target (1%) only through the simple natural evolution of indicator, but the share of public RDI expenditures in the Gross Domestic Product will decrease by 0.06 percent.

**Chart 5: Forecast of private RDI expenditures in Romania (% GDP)**



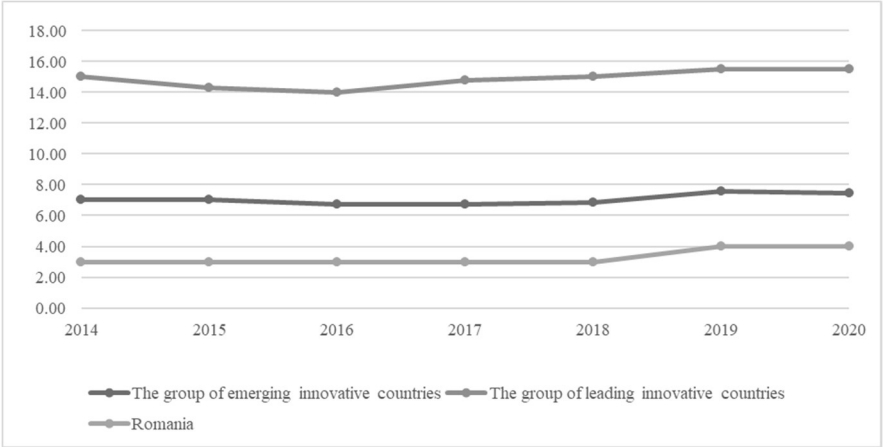

Source: author own processing Source: author own processing based on https://ec.europa.eu/eurostat/databrowser/product/view/rd_e_berdcostr2?lang=en

The forecast shows that the share of private expenditure on research-development-innovation in Romania will be in the year 2030, with a probability of 95%, in the range of 0.11% - 0.59%, if there is a natural evolution (Chart 5). The average forecast value is 0.35%, thus resulting in a gap of 0.65% compared to the 2030 target. Thus, we note that the share of private spending will increase slightly (by 0.07%), but we estimate that our country will not reach the 2030 target (1%) only through the simple natural evolution of the indicator.

## 5. Companies that provide ICT training to their own staff

In recent years, only 4 percent of Romanian enterprises provided their employees with ICT training (a slight increase compared to the period 2014-2018) (Chart 6). In comparison, the European average was 10 percent. It is evident that a coherent intervention regarding this dimension would greatly improve Romania's score in the European Innovation Index, but it must be done constantly and consistently in order to increase the degree of digitization of SMEs.

**Chart 6: Enterprises that provide ICT training to their own staff in Romania as compared to the group of emerging innovative countries and the group of leading innovative** countries (% of total)



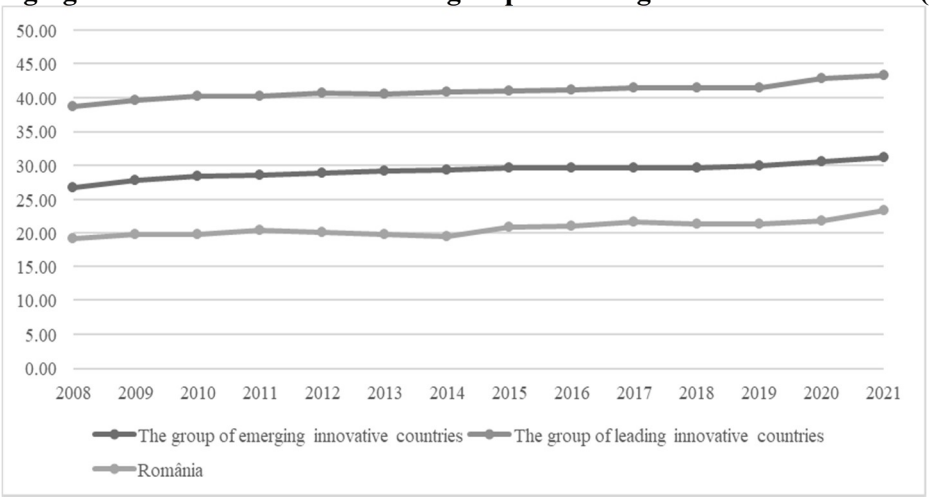

Source: author own processing based on https://ec.europa.eu/eurostat/databrowser/product/view/isoc_ske_ittn2?lang=en

Regarding this indicator, Romania's level is half compared to the average of the group of emerging innovative countries and a quarter compared to the average of the group of leading innovative countries. Therefore, it is very important for our country to advance rapidly and sustainably on this component both for digital convergence with European countries, but also to contribute to the unitary economic development of the EU.

## 6. Employment in "knowledge intensive" activities

"Knowledge intensive" activities have a specific contribution to economic development, creating the main added value. Although the trend followed by Romania in terms of employment in "knowledge intensive" activities is a slightly increasing one, our country is still 13.6% away from the average level of the European Union countries (Chart 7).

**Chart 7: Employment in "knowledge intensive" activities in Romania as compared to the group of emerging innovative countries and the group of leading innovative countries (%)**




Source: author own processing based on https://ec.europa.eu/eurostat/databrowser/view/isoc_ske_ittn2/default/table?lang=en

Regarding this indicator, Romania is below the average of the group of emerging innovative countries and at a considerable distance from the group of leading innovative countries. The most jobs were created in IT, and the fewest in creative professions. Compared to the rest of Europe, Romania has several relative strengths. The main strength is represented by telecommunications, followed by high-tech manufacturing and IT services. On the other hand, Romania's weaknesses are in the field of the pharmaceutical industry, design and other creative activities, but also in the field of management.

## 7. Conclusions

Our first finding is that the existing research-development-innovation system in Romania is not able to ensure a sustainable catching up within the EU. This is due to some of its weaknesses, among which the most important are: extremely small expenses for RDI as compared to the leading innovative countries and even to the average of the European Union, the excessive priority given by some institutes to fundamental research to the detriment of applied research, the lack of adequate incentives in favour of RDI, the lack of a periodic analysis of the real correlation between the needs of society Romanian and priority programs as research direction within the national programs.

Our second finding shows that, in line with research by the European Commission, a series of necessary actions can be taken in order to stimulate innovation in Romania. Among these can be mentioned: higher result-oriented allocations for research-development-innovation activity from both public and private funds; improved performance of doctoral education; increased public-private collaboration for involvement in innovation projects and capitalizing on the results; increased innovation entrepreneurship through balanced public-private funding; broader participation in European Union programs in the field of RDI on the basis of long-term partnerships.

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