The Impact of Sustainability in Research-Development-Innovation Activity

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Abstract

In our scientific approach, we aimed to emphasize the significance of sustainability in the research-development-innovation (RDI) activity. This activity should align with other economic activities and prioritize the utilization of renewable resources whenever feasible. In cases where renewable resources are not available, the use of non-renewable resources should be extended over a longer timeframe, allowing for the identification and exploration of renewable alternatives. The transfer of scientific knowledge (TSK) was also addressed, which should lead to an implementation of the results of scientific research in the economy, and the ratification of this transfer can be done both through qualitative and quantitative measures, with a greater emphasis on qualitative measures. This transfer of knowledge must constantly adapt, especially when there are external factors, such as the COVID-19 pandemic and the war in Ukraine in recent years.

Key words: RDI activity, sustainability, non-renewable resources, renewable resources, TSK
J.E.L. classification: D24, G32, M41

1. Introduction

In 1980 Mrs. Gro Harlem Brundtland, Prime Minister of Norway, defined sustainability as the means of "meeting the needs of today without compromising the needs of future generations". A few years later, in 1987, the United Nations established the definition of sustainable development, because sustainability starts from the idea that natural resources are limited and that our role is to protect them, to use them carefully and to ensure that they are sufficient for those who will come after us. This means that a sustainable society knows how to be responsible, focused on protecting the environment and the balance between its various (eco)systems.

Sustainability is a process through which the current needs of the population can be met, without affecting the resources that future generations will need. This means nothing more than the fact that sustainability can be considered a real goal, but it cannot be achieved if it does not take into account a sustainable development, made up of three main pillars: economic, environmental and social, that is, it must take into account profit, planet and people (Zaman and Geamănu, 2014, p. 63).

To make a profit a business must be solid, produce an income that generates as little expenses as possible and, as far as possible, this business has a continuity in the future. If it is the simplest form of sustainability, its challenge lies in achieving a balance – that of generating profit taking into account the other two principles of sustainability above. Which means focusing on more complex goals, not just making money by any means.

2. Theoretical background

Sustainability science emerged as a distinct field of scientific research during the "Challenges for a Changing Earth 2001" World Congress held in Amsterdam. This event, organized by the International Council for Science, International Geosphere-Biosphere Program, International Human Dimensions Program on Global Environment Change, and World Climate Research Program, marked the official launch of sustainability science in 2001 (Zaman and Geamănu, 2014, p. 64).

Sustainability science focuses on the advancement, integration, and practical application of knowledge related to Earth Systems. This knowledge is obtained through comprehensive and historical approaches to disciplines such as geology, ecology, climatology, earth physics, and oceanography, among others. The field of sustainability science recognizes the interconnectedness and interdependence of this scientific knowledge with social and human knowledge, promoting a holistic understanding of sustainable development.

The overarching aim of sustainability science is to evaluate, mitigate, and minimize the effects of human activities on planetary systems at various scales, ranging from local to global, and their impact on society. This encompasses both present and future generations. The goal is to enable humanity to adopt a responsible role as stewards of the Earth, protecting and managing its diverse forms of life in a sustainable manner (Zaman and Geamănu, 2014, p. 65).

A real structuring of knowledge within the science of sustainability is a complex and, at the same time, open, adaptable problem, as well as a major challenge for the main actors of the economy, governments, industrial sectors, Research- Development-Innovation (RDI) sector, as well as universities. All these actors must contribute, within the framework of the science of sustainability, to combat pollution and channel the economy towards sustainable development, which requires the development of systems of indicators and a metric of Sustainable Development, an outline of the transition paths towards sustainable development based on the implementation of sustainable governmental straits, a setting of methodological instructions for the development and implementation of Sustainable Development Strategies and, most importantly, an inventory of sustainability problems.

In the digital age we live in, advances in technology and innovation are constant, and research and development plays a key role in directing and shaping these developments. However, the impact that this rapid and expansive innovation has on the environment has become a growing concern. It is against this background that the concept of sustainable research, development and innovation (RDI) has emerged, integrating the principles of sustainable development into all aspects of RDI. This approach aims to steer technological progress in a way that protects and improves the environment and society.

The effects of sustainability in RDI can be seen in many areas, from the digital economy to tourism. Micu et al. (2021, p. 133) point out that sustainability has become a new challenge in the digital economy, especially in neuromarketing applications on social networks. New technologies and massive data generate huge opportunities for research and innovation, but also imply significant challenges in terms of data and environmental protection. In tourism, the relevance of sustainability impacts is even greater. Stan et al. (2021a, p. 628) analyse stakeholder perceptions of the environmental impact of coastal tourism in the Black Sea coastal area of Romania. They show that while tourism generates significant economic benefits, it can also have negative environmental impacts, thus requiring innovative approaches to ensure sustainable development.

Aivaz (2021a, p. 8) explores the impact of information and communication technologies (ICT) on education and living standards in Constanta County, Romania. The author highlights the potential of ICTs to contribute to sustainable development, but also stresses the need for continued research to understand and address issues of accessibility and the digital divide. The same author, in another paper, studies the correlations between infrastructure, health workforce and financial indicators of companies operating in health and social services in Constanta County, Romania (Aivaz, 2021b, p. 22), showing the importance of investments in infrastructure and education as a way to promote sustainability in the health sector. A whole series of studies discuss the interaction between tourism, underwater cultural heritage and environmental protection, and highlight the potential of sustainable maritime spatial planning to harmonise these interests and promote

sustainable development (Aivaz, Stan and Ioniţiu, 2021, p.4; Stan et al. 2021b, p.139) and analyse the dynamics of the impact of labour expenditure on the profitability of HORECA companies in the Romanian coastal area. They stress the importance of a sustainable approach, balancing economic needs with social and environmental needs (Aivaz et al., 2021, p.24).

All these studies are clear examples of how integrating sustainability principles into RDI can lead to more sustainable and efficient solutions that protect and improve the environment and society. However, it is clear that there is much more to be done to fully embed sustainability in all aspects of RDI, and it is essential to continue research and innovation in this direction. This is a long and challenging road, but it also offers huge opportunities for a better and more sustenabile future.

3. Research methodology

Our scientific inquiry employed the analytical research method, which aims to uncover pertinent information regarding a given topic The initial step involved collecting the existing data on the subject, which was subsequently examined to either test a hypothesis or substantiate a particular concept.

The analytical method played a significant role in our research by collecting evidence that strengthens the validity of ongoing investigations, encouraging their credibility, and fostering the development of fresh ideas related to the subject matter.

As part of this research methodology, we conducted a comprehensive literature review on the topic, which involved analyzing previously gathered data related to the subject under investigation.

One crucial aspect to acknowledge regarding the analytical research method is its inherent susceptibility to change as new data is acquired or when data forms the foundation of further research. This characteristic applies to varying degrees across all scientific methods, but it is particularly prominent within the analytical approach.

The challenge lies in the fact that unlike other methodologies like the experimental method, which can establish causality and provide robust evidence on the factors causing a phenomenon, the analytical method does not afford such certainty. Regardless of the abundance of data available on the subject of study, it will inevitably remain incomplete.

4. Findings

As mentioned earlier, sustainability encompasses, in fact, all aspects of human life, establishing according to them, a metric and a series of specific indicators, giving great importance to the notions of eco-efficiency and social efficiency based on specific knowledge. Therefore, sustainability only shows us the need to combine economic efficiency and profitability with solidarity, equity and social justice, at micro and macroeconomic levels, in the short, medium and long term.

The two factors, eco-efficiency, and social efficiency, depend very much on the pace and mode of consumption of non-renewable and renewable natural resources, that is, on the complexity of technical progress on the environment.

If for non-renewable sources the advice of specialists is that their use should be as small as possible to none, in the case of renewable sources a correlation must be established between their use and the pace of their recovery, that is, their consumption should be consistent with their restoration. This can be traced in Table no. 1.

Table no. 1 The ratio of the consumption of renewable resources, the state of the environment and sustainability

Consumption of renewable resources	State of the environment	Sustainability
Over the possibility of nature to recover	Environmental degradation	Unsustainable
Equal to the possibility of nature to recover	Ambient balance	Economy in stable condition
Less than nature's ability to recover	Environmental renewal	Sustainable development

Source: (Zaman and Geamănu, 2014, p. 71)

The science of sustainability highlights the fact that a substitution between natural capital, social and economy can be made within certain limits because beyond these limits the economic system, as well as the social one, faces a major risk, which can push it towards generalized collapse. Setting these limits is not easy, it is a difficult job that involves research in multi and interdisciplinary teams, which aim to affect testing and hypothesis verification over relatively long periods.

Research development innovation (RDI) in the field of sustainability and sustainable development can only take place thanks to the efforts of professionals in several fields, as different as possible, and scientific disciplines, due to the increasing complexity of current economic and social processes and phenomena, as well as due to the need to respond to new and more complex challenges.

This multidisciplinary is nothing more than a combination of scientific disciplines, but in this multidisciplinary each discipline must maintain its own methodologies and working hypotheses that can interfere with the methodologies of the other fields.

Multidisciplinarity and interdisciplinarity diverge in how the relationship between scientific disciplines is manifested, particularly in terms of the utilization or adoption of theories, methods, or hypotheses. In multidisciplinary interactions, cooperation between disciplines can be reciprocal and summative but lacks true interactivity (Augsburg,2005).

Nowadays, in the contemporary society and, implicitly, in the contemporary economy, there is an unprecedented increase in the importance and role of RDI in the process of accelerating the transition of humanity to a sustainable development, that is, it represents one of the primary production factors of well-being from the point of view of sustainability.

According to strict "conventional" classifications in the literature, the national or socio-human economies, in terms of generation and application (dissemination) of scientific knowledge and results of RDI, are divided into science generators (science makers) and beneficiaries, science users (science takers). The specialized institutions of the European Commission (EUROSTAT) groups the EU member countries, from the perspective of global indicators of RDI, into innovators-leaders, innovators-followers (followers) and modest innovators, previously calling them "catching-up". Undeniably, these classifications, rather mainly Scholastic, are invalidated by the fact that, at the present, all countries, clearly, in various proportions, are simultaneously both generators and beneficiaries (users) of scientific production within RDI systems (Cohen, Winn, 2007, p.45).

Therefore, RDI's activity within the science of sustainability leads to a transfer of scientific and technological knowledge (TCS) at both national and international levels and this represents a main factor of economic growth and, implicitly, profit.

The transfer of scientific knowledge can be measured both quantitatively and qualitatively as can be seen from Table no. 2.

Table no. 2 Framework scheme of the transfer of scientific knowledge

TSK mechanism	Quantitative measurement	Qualitative measurement
Networks	Number of people who meet at events that generate other TSK activities	Share in total scientific events of those that led to TSK activities
Continuing professional development, continuing education	Revenues from courses held to raise the professional level and the number of people and companies participating	Share of returning companies and customer feedback
Consulting	Value / revenues from contracts as a share in total revenues from RDI, share in the market, duration of the relationship with the client	The share of returning firms, customer feedback of the company, the importance of customers for the company
Collaborative research	Value of contracts, market share, share of revenues from collaborations in total revenues, duration of the relationship with the client	Share of returning companies, customer feedback, share of successful products
Research contracts	Value of contracts, market share, share of revenues from collaborations in total revenues, duration of the relationship with the client	Share of returning companies, customer feedback, share of successful products
Licensing	License revenues, products created through licenses	Customer Feedback, the quality of the firm that bought the license, the share of licenses that generate revenues
Spin-outs	Number of spin-outs, revenue generated, external investment induced, market value at IET (IPO or commercial sale)	Survival rate, investor quality, investor or customer satisfaction, growth rate
Teaching courses	Share of graduates in total students, student occupancy rate	Student satisfaction(after employment), employer satisfaction with the quality of the student employed
Other measures	Migration of students to industry, publications as a measure of research	

Source: (Zaman and Geamănu, 2014, p. 91)

This framework scheme for the transfer of scientific knowledge must be constantly adapted, especially according to external factors, such as the COVID-19 pandemic or now the war in Ukraine.

The effectiveness of TSK depends on several factors, such as the inability of the market to internalize positive and negative externalities, the complexity of intellectual property law, information asymmetry, which can be mitigated, in particular, by public interventions, and last but not least, the inability of market mechanisms to have an overall view, leading to a practical implementation of research results in all areas, especially since important steps are being taken in areas that were affected by the Ukrainian war (Vac *et al*., 2023).

Making a brief analysis of TSK, we note that more attention should be paid to the qualitative measures of evaluation of TSK as it is useless to pursue only the profit, which lies in the quantitative measures, if the final result leads us to the exhaustion of resources that can no longer be regenerated (Stanley *et al*. 2006, p. 335).

5. Conclusions

If a certain number of years ago there was more and more talk about stimulating the research-development-innovation activity for economic development, in the current situation this activity should be related to sustainability and sustainable development (Rus, 2016, p. 189).

There is a particular emphasis on renewable resources and, we must admit, in the field of energy the results are seen. Thus, renewable energy is increasingly taking the place of conventional energy, through the use of solar energy, energy generated by wind, water, natural springs, etc.

We need to get used to the science of sustainability being part of our lives, be more careful with the use of resources, protect the environment and try to use the circular economy as much as possible. A future study will address more on the concept of circular economy.

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