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Science Communication in Transition Countries: The Thin Line between Trust and Distrust in Science

Introduction

The last wave of globalisation accelerated at the beginning of the twenty-first century and significantly changed global communication. The development of new technologies and digitalisation impacted the world of science, encouraging researchers, universities, and scientific institutions to put greater effort into the presentation and communication of scientific work and its results to the broader public. The complex and multifaceted process of mediatisation – in which media technologies, practices, and values became deeply integrated into social structures and impacted the behaviour of individuals – facilitated communication, access to information, and opportunities for self-expression. In addition, internationalisation, which became increasingly important, began to play an integral role in institutional strategies, encouraging and fostering the connecting and networking of researchers worldwide. In this new context, continuous communication of scientific results outside the academic environment has become an urgent necessity. Because of this, various scientific communities, institutions, and individuals have developed and implemented a range of different science communication models and practices.

During the second decade of the twenty-first century as the need for the development of new strategies for science communication and the transfer of scientific knowledge to the public began to grow, the trend of increasing doubt in science also became evident. This trend grew covertly at first, mostly related to topics such as vaccination, genetically modified organisms (GMOs), climate change, and global warming, but its peak was experienced during the COVID-19 pandemic. The Internet and the emergence of social networks and their rapid development created a new virtual debate space for questioning science and scientific results in the international community. As a result, individuals around the globe were able to share online posts and opinions that often contradicted established scientific knowledge.

In this perspective paper, we address the issue of science communication using the example of the COVID-19 pandemic. We base our conclusions on publicly available data. By using descriptive statistical analysis, we indicate several social factors that may have increased distrust in science during the pandemic, looking specifically at four transition

countries (Croatia, Bulgaria, Hungary, and Romania), regardless of the level of education or previous experience of their populations.

Our analysis relies on two premises: (1) Continuous scientific communication and the presence and popularisation of science in the media and among the broader public leads to its demystification and contributes to a better understanding of scientific topics in the population at large; (2) These activities consequently cause the growth of trust in science in general. In contrast, rare or non-existent communication of science and research achievements in the media and among the public prior to the pandemic, as well as several other socio-political characteristics of transition countries, might correlate with the level of distrust in science and how the public responds to recommendations based on scientific knowledge during acute situations such as the COVID-19 crisis.

In the first section, we briefly address science communication definitions and models based on a review of the literature. In the next section, we present our observations of science communication in the context of European higher education, research, and mediatisation. In the third section, we focus on science communication in transition countries. In particular, we observe the effects of four socio-economic factors that might have an important impact on people's attitudes about science and the level of trust in science in various national contexts (level of education, economic growth and percentage of GDP, security and economic stability of the country, and the presence of corruption). After presenting the observed phenomena related to (dis)trust in science in the context of the COVID-19 pandemic, based on descriptive statistical analysis, we offer some thoughts on the future of science communication and the relevance of its more robust development in transition countries.

Science communication – definition and models

Science communication, as well as more recent models that began to be developed in the last few decades, is understood differently within the academic community than the professional public. As a result, there is a gap in defining science communication and other related concepts (e.g. Public Awareness of Science – PAS, Public Understanding

of Science – PUS, Scientific Literacy – SL, Scientific Culture – SC, Public Engagement with Science – PES, etc.) in the literature and in practice.

The importance of science communication significantly increased in 1985 when the Royal Society in London established an ad hoc group chaired by Walter Bodmer that created a report titled "The Public Understanding of Science" (López Pérez & Olvera-Lobo, 2017). The aim of the report was to provide recommendation to help governments, schools, universities, the media, and scientists promote science and scientific phenomena through joint actions and activities, thus facilitating the creation of a "scientifically literate" population. The Royal Society initiative become a milestone for the accelerated development of science communication, which has become increasingly relevant in recent years.

There are different approaches to defining science communication in the literature (e.g. Bryant, 2003; Treise & Weigold, 2002; Trench & Bucchi, 2010; Metcalfe, 2019; etc.). In this paper, we follow the widely recognised AEIOU definition by Burns at al. (2003), according to which:

science communication (SciCom) might be defined as the use of appropriate skills, media, activities, and dialogue to produce one or more of the following personal responses to science (the vowel analogy):

- Awareness, including familiarity with new aspects of science,
- Enjoyment or other affective responses, e.g. appreciating science as entertainment or art,
- Interest, as evidenced by voluntary involvement with science or its communication,
- Opinions, the forming, reforming, or confirming of science-related attitudes,
- Understanding of science, its content, processes, and social factors (p. 191).

Science communication developed under the auspices of the academic discipline of communication. Over the decades, it passed through significant transformations. Although the literature offers various approaches to different models of science communication (e.g. Trench & Junker, 2001; Trench, 2008; Höppner, 2009; Kurath & Gisler, 2009;

Horst & Michael, 2011; Stocklmayer, 2013; Metcalfe, 2019; etc.), the direction of communication in the process has changed. One-way communication involving the active role of the sender has been substituted with two-way communication between the sender and the receiver. A dialogue model, implying the active role of both sender and receiver, is predominant today.

In the European context, the dialogue model was upgraded to include the active participation and involvement of various target groups in the process of science communication. This change has been the result of various policies and programmes created at the supranational level, such as *Horizon 2020*. Based on the idea of two-way communication and participation in which "researchers and other stakeholders engage and listen to different target groups… including them in shaping research outcomes for mutual benefit…" (SiS.net, 2020), the new dialogue fostered various activities and initiatives that aimed to rebuild public trust in science, scientific institutions, and scientists in general.

Science communication in European higher education and research

Science, research, technology transfer, and innovation have never been so important to society as during the last few decades. In general, globalisation brought the rise of competitiveness and commercialisation, strengthened the importance of the connection between higher education (HE) and research and the global labour market, and put an increased emphasis on the concepts of the knowledge society and the knowledge-based economy. Together with the growing expansion of communication technologies, which enabled the development of new international collaboration models, these developments had a tremendous influence on the world and its societies, and particularly universities, HE and research institutions in all countries, including those in transition. In the last two decades, the mission and purpose of universities, HE and research institutions had to change in societies, and these institutions underwent processes of transformation (with various outcomes and levels of success) in order to be prepared for their new roles, which included new modes of closer cooperation with society.

Many documents, programmes, and initiatives have been introduced in the last two decades at the supranational European level. These documents mainly reflect the political arena and provide a framework for the activities that might be developed in various policy areas at the national and institutional levels. Because of this, various countries and institutions progress in the field at different speeds. Unfortunately, in transition countries, many initiatives are not being implemented, as they are perceived as a "dead letter" or as "cosmetic change" to actual reality. Science communication is only one example of policies that are not implemented. Finally, thinking of science communication only through the lens of the popularisation of science, even though it is one part of the whole concept, makes real progress in this area difficult.

Education, and especially HE, is not fully recognised as a driver of societal development in many transition countries. On the contrary, it is seen primarily as an expenditure and not an investment. A shortfall of funds or economic hardship is frequently presented as a legitimate reason for insufficient public funding and reduced numbers of investors willing to put money into HE and research. Moreover, the number of highly educated people in transition countries is lower, which might have a negative impact on society as a whole. In such an environment, knowledge and research remains mostly in academic milieus, and very often without obvious significance for the general public. Because of this, authorities and policy makers have a certain justification for less investment in these areas and allocating funds to other sectors. Moving forward, comparative data on the percentage of public investment in HE in transition countries and financially more stable countries speaks directly to the strength, potential, and status of research and HE in each individual country (Dagen & Kovačević, 2022). In such circumstances, science communication is rarely viewed as a high priority. As a result, there are fewer initiatives and activities in this area, leading to science communication being generally less developed.

The term mediatisation emerged among scholars during the 1990s (Krotz, 2017), mostly in the analysis of the media's impact on political communication and politics in general (Hjarvard, 2008). It began to develop in parallel with the transformation of the media, which "changed the human communication environment in a fundamental way" (Kro-

tz, 2017, p. 105). During recent decades, mediatisation became "a systematic concept for understanding and theorising the transformation of everyday life, culture and society" (Krotz, 2017, p. 103). Nie et al. (2014, p. 364) define mediatisation as "the process of increasing dependency of society upon media and its logic". Through mediatisation, the media (television, radio, print media, and the Internet with its various platforms) today constitute the central forces in the shaping of public opinion, the dissemination of information, and the construction of social reality. Mediatisation plays an important role in making science more accessible to the general public. While the media enhances the accessibility of scientific knowledge to the general public through the dissemination of information, it also shapes public opinion and perceptions about science and influences cultural norms and values.

Unfavourable economic conditions, unstable governments, and ineffective public policies that are not based on long-term strategies and are often not even implemented, are only some of the elements that make up the national contexts of transition countries. These elements encourage mistrust in institutions in general, and consequently have a negative effect on science and science communication as they result in disinterest in science among the general population. In addition to the fact that science communication is not well understood by stakeholders, the question of responsibility for science communication initiatives also remains unclear. What's more, negative content related to research, research institutions, and researchers themselves in the media and especially on social network platforms – e.g. topics related to research integrity, the appearance of fake diplomas and doctorates, plagiarism, etc. – all serve to devalue research.

Finally, increased mistrust in institutions and authorities has become a problem that extends far beyond researchers and their work. As a consequence, some part of the population finds it very difficult to accept authority in any form, and in particular the authority of scientists whose prominent social role is based on knowledge and research achievements.

Science communication in transition countries: the example of the COVID-19 pandemic

As presented in the previous section of the paper, there are many differences in the areas of HE and research in European countries, especially transition countries. Those differences may be related to the impact of various factors in specific national contexts. Since it is difficult to deal with all of these factors simultaneously, in our analysis we have focused on two that we believe have a decisive impact on the perception of science in the general public, and on the level of public trust in scientific results in various countries: (1) the socio-political environment, and (2) the general public's attitude toward science and education. We took the case of the COVID-19 pandemic, which fortunately has become a less burning issue today, but nevertheless serves as a good example for examining the role of science communication and its impact on society.

Our observations showed the complex interaction of various factors in different countries. A general lack of science communication in transition countries was observed. Less reporting on scientific topics in recent years was observed as well, and this coincides with an increased distrust in science and scientists among the broader public. Furthermore, it was indicated that reduced trust in science might be correlated with citizens' distrust in public institutions and the state in general. In addition, while for many generations vaccination was taken for granted, in particular the vaccination of children, as the COVID-19 crisis came to a head, the issue of vaccination suddenly became extremely present in the public and the media, and particularly on social networks.

Analysis of data on the percentage of people vaccinated against COVID-19 in selected EU member states showed a disparity between western and transition European countries. As presented in Table 1, there are substantial differences among various countries, although the vaccine within the EU was more or less equally available to everyone. Science communication during the COVID-19 crisis was shown to be insufficient in some countries, with accurate information about the virus and its impact not reaching certain parts of the population.

Table 1: Data on the percentage of vaccination against COVID-19 in selected EU member states

Country	Uptake of at least one dose (%)				Uptake of the primary course (%)				Uptake of first booster (%)				Uptake of second booster (%)			
	TP	A18+	A60+	C<18	TP	A18+	A60+	C<18	TP	A18+	A60+	C<18	TP	A18+	A60+	C<18
Finland	82.1%	91.1%	95.8%	43.4%	78.7%	88.8%	95.3%	35.3%	55.2%	67.5%	89.6%	-	16.9%	20.8%	53.5%	-
France	79.7%	92.7%	93.1%	31.7%	77.5%	91.0%	91.0%	27.9%	60.1%	74.7%	83.7%	-	9.5%	12.0%	30.9%	-
Germany	77.9%	93.3%	92.1%	-	78.0%	93.5%	91.2%	-	62.2%	74.5%	86.0%	-	9.7%	11.6%	27.1%	-
Hungary	65.3%	73.7%	83.2%	25.6%	63.2%	71.4%	81.8%	24.4%	39.7%	47.4%	67.3%	-	3.6%	4.3%	10.8%	-
Croatia	57.4%	68.2%	78.6%	5.1%	55.6%	66.2%	77.2%	4.5%	23.2%	28.1%	49.2%	-	0.0%	0.0%	0.0%	-
Romania	42.6%	50.9%	47.0%	7.4%	42.4%	50.7%	46.8%	7.1%	9.2%	11.2%	13.6%	-	0.1%	0.1%	0.3%	-
Bulgaria	30.4%	36.2%	38.9%	2.4%	30.0%	35.7%	38.4%	2.3%	11.7%	14.1%	22.8%	-	1.1%	1.3%	3.1%	-

Source: European Centre for Disease Prevention and Control (retrieved October 6, 2022, from https://www.ecdc.europa.eu/en)

TP = Total population
A18+ = Adults 18+
A60+ = Adults 60+
C<18 = Children below 18

The analytical data collected by the European Centre for Disease Prevention and Control presented in Table 1 indicates substantial differences in the level of vaccination, especially in transition countries, which might correlate with insufficient communication of scientific data related to the pandemic. Furthermore, the data shows there are certain subgroups of citizens within each country that differ from the mainstream in terms of their acceptance and preference for vaccination. The reason for such polarisation might be partially found in insufficient science communication, as people in some milieus were not provided with enough information to understand the risks, prevent the spread of the disease, and make informed decisions about their health and well-being. Our observations recognised that a substantial amount of different, and often contradictory, types of information about the COVID-19 pandemic coming from various sources, including the media, social media posts, and the academic community, as well as official statements and guidance from health organizations and governments, created a level of communication noise which made it difficult for people to separate fact from fiction. This opened up space for misinformation, especially as various conspiracy theories spread rapidly, particularly on social media.

It must be asked who or what contributed to this situation and particularly to the great variety in public perceptions and attitudes. The common assumption that it is easier to influence or even manipulate less educated people seems to have been disproved in the case of the COVID-19 crisis. On the contrary, resistance to vaccination and other attitudes that are connected with doubts in science and scientists often came from the least expected individuals and groups. As a matter of fact, the denial of research- based truths, knowledge, and professional experience even came from prominent individuals in society, which had a significant negative impact on the general population.

The role of the media

The media have exerted enormous changes over institutions (Nie et al., 365). To observe the media's role in the conception of science communication, it is necessary to consider mediatisation's influence on society, which has both positive and negative aspects.

Mediatisation, in general, has expanded the formats and channels through which science communication takes place and allows more interactive and engaged science communication, including direct interaction between scientists and the public. While the media plays a vital role in framing and shaping public perceptions of science and scientific issues, science journalists act as intermediaries between scientists and the public, translating complex scientific concepts into accessible language and making them easier for non-experts to understand. In this sense, science journalists can bridge the gap between the scientific community and the media, and ensure that accurate and reliable information is communicated to the public.

Nevertheless, mediatisation has also brought challenges related to privacy, authenticity, and the quality of public discourse. While it has offered numerous opportunities, it has also introduced challenges and risks to science communication. Oversimplification, sensationalism, and the spread of misinformation or misconceptions about scientific topics are only some of these challenges. In addition, the desire for sensationalism and the pressure to produce attention-grabbing headlines and to gain "clicks" often leads to the misinterpretation or oversimplification of scientific findings in the media, and consequently, among the general public. Dissemination of conflicting narratives in the media, as well as "opening the floor" to science sceptics who either do not understand how science works or are ignorant of the existence of a consensus based on research, has in some cases undermined the careful and rigorous nature of scientific research and its public perception.

The decisions of journalists, editors, and media organisations as to which scientific topics to cover, how to frame them, and which aspects to emphasise influence public understanding, interest, and opinions regarding science-related topics. By focusing on controversial or contradictory scientific research, cherry-picking studies that support particular viewpoints, or amplifying minority opinions, the media can inadvertently sow seeds of distrust among the public and create a false sense of scientific disagreement or debate. In today's digital age, misinformation and disinformation can spread rapidly through social media and online platforms, and the media's coverage of controversial topics, such as climate change or vaccines, often becomes polarised, creating

an "us versus them" mentality that further erodes trust. As a consequence, the general public often has little accurate information about research that is being carried out, and is not aware of the role that research has in everyday life. The perception of science and everything around it is often unsatisfactory to both scientists who dedicate their lives to research activities and to the general public.

Without going into all the aspects of specific social contexts, we observed whether the media could have contributed to a better understanding of the COVID-19 pandemic, and how in the framework of science communication the general population might have received relevant, prompt, and accurate information about how to fight the pandemic and its impact on their lives. Finally, we raised the question of whether science communication failed in some countries.

As a first step, it was necessary to look at the role of the media and to observe it both at the time of the pandemic and during the period before the crisis broke out. Our analysis indicated several important differences between countries with long democratic traditions and transition countries. While in the "old democracies" there was the significant presence of scientific topics in the media both during the pandemic and prior to the crisis, less media coverage (if any) in public newspapers was observed in transition countries during both periods. Furthermore, newspapers in countries with long democratic traditions had special sections dealing exclusively with scientific topics even in recent decades during a period when print media was already facing a crisis as a result of the growing influence of television and online platforms (e.g. YouTube channels and social media platforms). In contrast, special sections for science coverage had been reduced or abolished in the public newspapers of transition countries.

Likewise, there are differences in the way that print media reported on scientific topics in the various countries. While in the "old democracies" topics related to science were in most cases covered by journalists who were well-acquainted with a specific area, this was relatively rare in transition countries. Due to the rarity or non-existence of specialised science sections in the print media, topics related to research were not generally covered by journalists specialised in science education reporting. As the publishing of news and stories on other situations tends

to attract more readers, editors often did not pay sufficient attention to scientific topics and limited reporting on controversial issues related to HE and research areas. In general, bringing scientific research closer to the readers was a practice more present in public newspapers in countries with long democratic tradition than in transition countries.

Nevertheless, the issue of education is of significant importance, both in the media and the area of science communication. While some universities in western Europe have developed specific multidisciplinary study programmes in science communication in order to educate skilled professionals in this area (for example, the UK, the Netherlands, Italy, Finland, Germany, France), such initiatives are missing in transition countries. What's more, little is done to in transition countries to develop even single study courses dedicated to science communication at universities, which would be a great benefit to further the scientific education of journalists. As a result, journalists in transition countries report much less on scientific topics, and what they do write is usually less affirmative. The tendency to report on scandals and failures of ethical criteria in scientific milieus negatively impacts the amount and quality of media coverage dedicated to science.

Finally, our research extended to the audience and the question of the readership of specific newspapers. As discussed above, changes affecting society have led to a shift in public behaviour, and consequently to the changing expectations of the public. At the same time, transformations in political context, regardless of whether they take have taken place in countries with a long democratic tradition or countries in transition, have tended in recent years to increase the level of populism. As a consequence, clear boundaries between left and right wing are disappearing, and a broad base of the liberally-oriented population, which includes the intellectual elite as well, is not as actively present in public life as it was in the past.

The increase in populism across the global, partially the result of a loss of trust in the existing establishment, and the relative stagnation (or even regression) in improvements of living standards, has created the foundation for the rise of pseudo-science and the spread of distrust in science. Social media platforms have become an uncensored method of communication available to the general population as well as a vir-

tual space for posting various unverified information, comments, and content that may distort scientifically verified facts. This also has the potential to increase polarisation among various groups, and to influence public perceptions and individual attitudes and behaviour.

Because society has proven to be increasingly incapable of dealing with the massive changes affecting it, the role of the media has acquired crucial importance. As the pace of life accelerates (which in turn reduces social reflexivity and critical thinking especially as gaps between the traditional and the digital generation grow) and the speed of reporting becomes an essential element, professional reporting provides the best opportunity for a better understanding between scientists and the public, and for acquainting the public with recent research results. Thus, the presence of scientific topics in the media positively impacts the public's trust in science as it brings a better understanding of research results to the general public, which increases public awareness and trust in scientific truths and in public institutions as well, a phenomenon which was observed during our studies of the COVID-19 pandemic.

Distrust in science – the role of social context and socio-economic factors

In the first part of the paper, we focused on the impact of the media in forming the attitudes of the general public toward science and education. In the next part of the paper, we observed the impact of social context, and especially the socio-political environment in specific countries. In order to better understand the differences between countries, we studied the available data for the periods before and during the COVID-19 pandemic.

In 2018, the global foundation Wellcome Trust generated a report on the results of international surveys conducted by Gallup which measured attitudes about science and health. The report showed that at the time the surveys were taken 18% of people had a "high" level of trust in scientists, 54% had a "medium" level of trust, 14% had "low" trust, and 13% "didn't know". According to this data, a third of the people surveyed in Australia, New Zealand, Northern Europe, and Central Asia had a "high" level of trust in scientists, while only around one in ten had the same attitude in Central and South America (Gallup, 2018, p. 6).

The report also showed that about seven in ten people worldwide felt that science benefitted them, but only around four in ten believed it benefitted most people in their country. In addition, about a third of people in northern and southern Africa, and Central and South America felt excluded from the benefits of science (Gallup, 2018, p. 7). The report showed that people surveyed in Western and Eastern Europe were the most pessimistic about the impact of science and technology on jobs in their countries (7% in Western Europe, 8% in Eastern Europe). In contrast, people from other world regions expressed the belief that science and technology might at least to some extent increase the number of jobs in their local area during the next five years (Gallup, 2018, p. 92).

Among other things, the report also indicated that men are more likely to claim greater science knowledge than women, that young people believe they know more about science than older people, and that almost two-thirds of people worldwide (62%) said they were interested in learning more about science. The report showed that the basic concepts of "science" and "scientists" are not universally understood across all countries, even in high-income nations (Gallup, 2018, p. 6). Finally, internationally, eight in ten people (79%) "somewhat" or "strongly agreed" that vaccines are safe, only 7% "somewhat" or "strongly disagreed". Eleven percent "neither agreed nor disagreed", and 3% said they "don't know". People in France had the highest trust in vaccines. Some 92% of parents worldwide said that their children had received a vaccine to prevent them from getting childhood diseases (Gallup, 2018, p. 7).

A subsequent report by Wellcome, the Wellcome Global Monitor (Gallup, 2020) survey on the way that the COVID-19 pandemic affected people's lives and their views on science, indicated that trust in scientists increased in the period up to 2020, possibly as a result of the COVID-19 crisis. Trust in both science and scientists grew by about 10% in the following three regions in comparison to 2018, where the proportion had been relatively low two years earlier – East Asia (predominantly China), Latin America, and Eastern Europe. In contrast, the level of trust stayed at the same level or declined in the following regions: the Russia, Caucasus, Central Asia, and Sub-Saharan Africa (Gallup, 2020, p. 3). At the time of the pandemic, the survey indicated differences across the

world regarding trust in scientists – the highest percentage was found in Australia and New Zealand (62%), while the lowest was indicated in Sub-Saharan Africa (19%) (Gallup, 2020, p. 3). Data for Western Europe indicated that trust in science increased from 50% in 2018 to 59% in 2020 (Gallup, 2020, p. 26).

Furthermore, the number of people who claimed to have "some" knowledge of science grew globally from 39% in 2018 to 48% in 2020, as well as the number of those who claimed to know "not much" or "nothing at all" about science, from 25% to 33%. Roughly 80% of those surveyed claimed that COVID-19 influenced their life (although 45% responded they felt "a lot" of impact), data indicating differences in certain parts of the world with most explanatory comments related to economic issues (losing jobs, stopping working temporarily, receiving less pay, etc.) (Gallup, 2020, p. 26). Finally, only a quarter of the public said that their government valued the opinions and expertise of scientists "a lot". Conversely, nearly three in ten (28%) felt that their government did not place much or any value on the opinions of scientists. As indicated in the report:

In 25 of the 113 countries surveyed, including eight in Eastern Europe and six in Latin America, people were significantly more likely to say their government leaders placed little or no value on scientists' opinions than to say leaders placed 'some' or 'a lot' of value on them. (Gallup, 2020, p. 4).

A more detailed dataset (published only in several selected countries in Europe as noted in the report) indicated that, for example, 44% of respondents in Bulgaria claimed their leaders in the national government value the opinions and expertise of scientists "a lot or some", while 50% said "not much or not at all" (Gallup, 2020, p. 36). Respondents also claimed that governments need to invest more money to prevent and cure diseases either on a national or international level. Unfortunately, the survey did not provide more detailed information on each research question for specific countries, but only gathered data for specific world regions.

The Special Eurobarometer 516 Report on the knowledge and attitudes of European citizens about science and technology (European

Commission, 2021) analysed beliefs in conspiracy theories among the population of thirty-eight European countries. The report indicated that a majority of the overall population in the analysed countries believed that it is not true that viruses are produced in government laboratories to control our freedom (55%) (European Commission, 2021, p. 73). However, data from Romania showed that 53% of the population believed that the proposed claim was true, 31% said it was false, and 16% provided no answer. In Bulgaria, 52% of the population believe that viruses have been produced in government laboratories to control our freedom, 19% think that is not true, and 29% provided no answer. In Croatia, 50% of the population believe the proposed claim, 28% thought it was not true, and 22% provided no answer. The results for Hungary indicated that equal percentages of the population believed or did not believe in the proposed claim (43% for each group), and 14% of the population provided no answer. In contrast, at least seven in ten respondents in six northern countries believed that the claim was false: Netherlands (84%), Denmark (83%), Sweden (75%), Belgium (74%), Ireland (73%), and Germany (70%). In Finland, only 10% of the population replied that the claim was true, while 69% answered that they did not believe it, and 21% provided no answer. In France, 30% of the population believed that viruses have been produced in government laboratories to control our freedom, 54% answered that the claim was false, and 16% did not provide answer (European Commission, 2021, p. 73).

All the presented data indicate a connection between social context and public trust in science and scientists. In addition, it is observed that a range of socio-economic factors deeply impact people's attitudes about science. Because of this, we decided to provide a kind of sociological analysis of statistical data on the following four factors that we believe have a significant impact on the level of trust in science in various national contexts: level of education, economic growth and percentage of GDP, security and economic stability of the country, and presence of corruption.

Table 2: Data on four factors

Country	Population (2021)	Level of tertiary education (%) (2021)		GDP per capita ($) (2021)	Best country rankings (2022)	Corruption Perceptions Index (CPI) (2021)	
		25-34	25-64			Rank	Score
Finland	5,541,696	40.1%	42.3%	53,982.6	#15	1/180	88/100
France	67,499,343	50.3%	40.7%	43,518.5	#9	22/180	71/100
Germany	83,129,285	35.7%	30.9%	50,801.8	#2	10/180	80/100
Hungary	9,709,886	32.9%	29.3%	18,772.7	#48	73/180	43/100
Croatia	3,899,000	35.7%	24.9%	17,398.8	#45	63/180	47/100
Romania	19,115,146	23.3%	18.8%	14,861.9	#54	66/180	45/100
Bulgaria	6,899,125	33.6%	29.6%	26,705.4	#60	78/180	42/100

- Population – The World Bank (retrieved October 9, 2022, from https://data.worldbank.org/indicator/SP.POP.TOTL)
- Level of education – Percentage of Population with Tertiary Degree. Eurostat (retrieved October 9, 2022, from https://ec.europa.eu/eurostat/databrowser/view/EDAT_LFSE_03__custom_2733311/bookmark/table?lang=en&bookmarkId=6fa0f5e0-2450-46be-bdb5-3ba64fcddc42)
- GDP per capita – The World Bank (retrieved October 9, 2022, from https://data.worldbank.org/indicator/NY.GDP.PCAP.CD)
- Best country rankings – The Most Economically Stable Countries. U.S. News (retrieved October 9, 2022, from https://www.usnews.com/news/best-countries/rankings)
- Corruption Perceptions Index – Transparency International (retrieved October 9, 2022, from https://www.transparency.org/en/cpi/2021)

As presented in Table 2, data for 2021 show that selected western European countries (e.g. Finland, Germany, and France) have a higher percentage of GDP per capita than other countries, which is also reflected in the population of citizens with a tertiary-level education, particularly in Finland and France, and to a certain degree, in Germany. Interest-

ingly, this data correlates with the Corruption Perceptions Index (CPI), according to which Finland is considered to be the country with the lowest potential of exposure to corruption, while Germany occupies tenth place, and France twenty-second place. The data in Table 2 also shows the high position of Germany on the Best Country Rankings list (second in the world in 2022), with France and Finland having high positions as well (ninth and fifteenth respectively). Comparison of the data in Table 1 and Table 2 indicates a correlation between the selected socio-economic factors and the level of vaccination against COVID-19 disease in the selected countries, with the total population's uptake of the primary course of vaccination being relatively high (91% in France, 78.7% in Finland, and 78% in Germany).

On the other hand, data for three (see Table 2; Bulgaria, Croatia, Romania) among the four observed transition countries indicate much lower percentages of GDP per capita in comparison with selected long-term EU member countries, a lower proportion of citizens with tertiary-level education, and much higher exposure to corruption. These data could be potentially linked to the duration of EU membership with Croatia joining in 2013, and Bulgaria and Romania in 2007. Hungary, however, was among ten countries that jointly entered into the EU as early as 2004 during the EU's largest enlargement phase. These data correlate with the percentages of vaccination against COVID-19 disease presented in Table 1, especially in the case of Bulgaria where the lowest uptake of the primary vaccination course was observed (only 30% of the total population).

The perspective for improved science communication in transition countries

The presented data on the social contexts and the impact of four selected socio-economic factors in transition countries provide a reflection on the quality of science communication in general and the activities carried out to inform the general public about the results of research and science. In social contexts, it appears that science communication is insufficient and inadequate, and its development has been relatively slow.

Although education and learning about science is important and one of the key factors for the development of society in general, it seems that

transition countries persistently lag behind in these areas. This situation should be addressed because the long-term consequences are potentially far-reaching and severe for the development of a society both on the local and global level.

The governments and policy makers in transition countries would need to recognise the important role that scientists and science should play in society. In addition, scientists and science communicators should strive to acquire improved communication skills, and journalists who cover science and scientific topics should be well (or better) prepared for reporting in this area. Following the need for further development of science communication in transition countries, decision makers and university leaders should become more aware of the importance of education in general, and education in social sciences and humanities in particular, with technology directly bringing further development. The need for rapid social progress must include an emphasis on social and humanist education, which should not be detached from scientific fields and other disciplines.

Our analysis indicates that, especially in transition countries, less and less emphasis is being placed on education, in particular educational fields that do not appear to generate quick economic returns. The level of corruption, which often creates the appearance of other ways (and indeed shortcuts) to achieve success and social position, also casts doubt on the relevance of education and reduces faith in experts and professionals dedicated to the creation of new knowledge.

Conclusion – the relevance of science communication

The global COVID-19 pandemic was an extreme situation that shed light on the high level of distrust in science among general populations in Europe, and particularly in transition countries. Further research and analysis could provide additional data and new insights that would help us to better understand a number of contradictions that appeared in the data, but nevertheless the present analysis highlights several relevant issues.

The purpose of science is not only to publish papers and conduct research significant within the field of science itself, but also to make changes in society, and provide information and insights that will help us deal with specific challenges. In this sense, scientific results should

be used to help policy makers create progressive public policies that positively affect people's lives. Insufficient investment in HE and science has a negative impact on all parts of society. Countries that perceive it as an expenditure and not an investment tend to lag behind, while societies with an awareness of the importance of science and HE use it as a generator for positive changes and further progress. Education is crucial for the better understanding of scientific topics and provides a foundation for understanding causality, consequences, and connections, which is a precondition for accepting scientific truths and their implementation in everyday life.

Going forward, scientific "content" must be carefully and skilfully presented by scientists and science communicators. Science communication and its continued development is crucial for the process of building trust in science and scientists. In this context, science communication should be perceived as specific know-how and an essential tool in a kit that gathers various models, approaches, and practices for bringing a range of topics to different audiences by using vocabulary and forms that are understandable to the general public. In addition, timing is a key factor as delayed or confused presentation of information can have negative long-term consequences. Furthermore, contradictory, sometimes even controversial, statements from individual members of the scientific community act as potential obstacles to more efficient and successful science communication. Such statements confuse the general public and tend to reduce trust in science and scientific facts. In sum, the public must be continuously exposed to well-presented topics related to science, which will raise the level of confidence in science and the understanding of new scientific results.

Universities in transition countries should invest more in the development of science communication activities and create training programmes for scientists to provide them with the skills needed for the efficient presentation of scientific topics in the media and to a broader public. The establishment of special courses and study programmes in the area of science communication will prove to be beneficial in the long term as they would create a cadre of well-educated and skilled science communication experts and journalists. This would have the consequence of increasing public trust in science in general.

We encountered certain contradictions in our observations. For example, EU countries with a higher percentage of citizens with tertiary-level education (Table 2 – Finland and France; Germany to a lesser extent) and consequently a population that is more exposed to topics related to science and had relatively high vaccination rates, still experienced resistance to vaccination in specific subsets of the population vulnerable to the anti-vax movement. Although this was more evident in transition countries where the anti-vax movement grew during the pandemic, data indicate the existence in all countries of more or less stable parts of the population receptive to pseudo-scientific claims and attitudes. What is most concerning is the phenomenon of anti-vax messages coming from prominent individuals, even those in academic milieus, which led to an increase in the number of people in the general population who did not believe in science and knowledge, and hence also to lower vaccination rates during the COVID-19 pandemic.

Unfortunately, science communication in many countries and milieus does not get enough attention in general. Little, if any, attention is dedicated to science communication activities in transition countries which by definition operate under economic constraints and where educational levels tend to be lower on average than countries that have more favourable economic conditions. Unfortunately, transition countries do not recognise science communication as an important issue, and therefore it is rarely defined as a priority either at the national or institutional level. At the very least, small steps forward are necessary because systematic work on science communication must become a part of the educational reality, from kindergarten and elementary school to higher education.

In general, the data presented in this perspective paper, which was generated by descriptive statistical analysis, indicate that there are subsets of the population that distrust science and scientists. Our observations showed that many different and overlapping factors have an impact on this situation and have caused similar effects in a range of countries. Although mistrust in science is present to some degree in all the countries surveyed, statistical data indicates that a larger population in transition countries is inclined to be sceptical of scientific truths. While the level of tertiary education might be one of the factors influencing

scepticism in science in transition countries, dissatisfaction with the economic situation and a general mistrust of institutions and governments also sharpen the thin line between trust and distrust in science.

The COVID-19 pandemic opened a Pandora's box of broad public distrust and misunderstanding of science and scientific knowledge. Because of this, we have become acutely aware of the urgent need to develop and implement activities that might help the general population understand the risks of various diseases and measures that could prevent their spread.

Finally, the analysis of the COVID-19 pandemic is just one illustration or warning of similar effects that could appear in the future in response to a range of situations. It is therefore crucial to find new and effective science communication models and approaches. In an era when society is facing and will face more such challenges in the future, it has become even more important to fully take advantage of the role that science communication could have in the promotion of research output and the identification of suitable solutions for long-term societal problems.

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