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KAROL ŚLEDZIK

<http://orcid.org/0000-0003-1269-1358>
University of Gdańsk
karol.sledzik@ug.edu.pl

RENATA PŁOSKA

<http://orcid.org/0000-0002-1716-4496>
University of Gdańsk
renata.ploska@ug.edu.pl

MARIUSZ CHMIELEWSKI

<http://orcid.org/0000-0002-0775-621X>
University of Gdańsk
mariusz.chmielewski@ug.edu.pl

JOANNA PIOCH

<http://orcid.org/0000-0002-7895-1696>
Sopot Academy of Applied Sciences
joanna.pioch@ssw-sopot.pl

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Responsible research and innovation transfer: The perspective of universities

Abstract

RESEARCH OBJECTIVE: The aim of this paper is to answer the research question: Which issues play crucial roles in universities' responsible research and the innovation transfer process? The tool used to achieve the aim of the study was analysis of the specific role of the concept of responsible research and innovation transfer from universities to the economy.

THE RESEARCH PROBLEMS AND METHODS: The research results can generate innovations that can be transferred to the economy. Considering all stakeholders of innovations transferred from universities to the economy, the criteria of evaluating innovations in terms of responsibility should be studied. The research method is based on literature analysis.

THE PROCESS OF ARGUMENTATION: The article begins with a literature review in the area of research and responsible innovation. Then, an attempt is made to synthetically analyze the dimensions of responsible innovation in order to formulate a basis for further inference. In the next part of the study,

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we used six dimensions of responsibility to explore the process of innovation transfer from universities to the economy.

RESEARCH RESULTS: The article shows that on the basis of the assumptions of the concept of responsible research and technology transfer, it is possible to create a framework that is the basis for evaluating the activity of a university in relation to the economic environment. Moreover, the Quadruple Helix framework of innovation is the most relevant tool to analyze actors and their interactions in an innovation ecosystem.

CONCLUSIONS, INNOVATIONS, AND RECOMMENDATIONS: Responsible innovation dimensions such as inclusion, anticipation, responsiveness, reflexivity, sustainability, care could be considered as a basis for evaluating universities' technology transfer process.

KEYWORDS:

innovation, technology transfer, responsibility, university

INTRODUCTION

Knowledge creation, research and dissemination have long been the responsibilities of universities. However, innovation and technology transfer are generally considered part of what has emerged in the policy lexicon as the so-called “fourth mission” of higher education, which leads to innovation (Hayter, 2016). Moreover universities, innovation and research centers and their researchers need to achieve results in very competitive contexts as they are increasingly subject to high-pressure situations, which can lead to unacceptable behaviors. At the same time, there is a growing awareness of the need to conduct such research and innovation activities with honesty and integrity, respecting well-accepted practices and shared ethical and social values (González-Esteban et al., 2023).

Discussions on responsibilities within the fields of science and innovation have been common throughout developments in the fields of ethics (Resnik, 1998), environmental governance (Pellizzoni, 2004), and through extensive philosophical and sociological analysis of the concept (Jonas, 1984; Glerup & Horst, 2014). Presently, there are two types of definitions in the literature that are related to responsible innovation: administrative (RRI) and academic,

associated with the Responsible Innovations (RI) concept (Gwizdała & Śledzik, 2017).

The idea of responsible research and innovation (RRI) has its origin in the following basic activities that are present in literature: evaluation of technology's commercial potential; engineering/technical ethics; social commitment in scientific research; foresight initiatives (such as international futures) (Georghiou, 2008); horizon scanning (Parker et al., 2014; Cuhls, 2020); anticipatory governance (Fuerth, 2009; Boyd et al., 2015); forward engagement (Barben et al., 2008); and the ethical and social implications of new technologies (Ethical, Legal and Social Aspects of Technologies – ELSEA (Hullmann, 2008), Ethical, Legal, and Social Implications – ELSI (Fisher, 2005)). One of the main reasons for the emergence of the responsible research and irresponsible innovation concept was the unsatisfactory participation of universities and scientific institutions in the development of the economy, improving the quality of life, and solving the problems of the modern world. However numerous studies show that RRI lacks clarity and definition, both in concept and practice (Owen et al., 2013; Păunescu et al., 2022). As a result, our acknowledgment of RRI is largely guided more by administrative definitions than by widely accepted academic definitions, a finding that is supported by rigorous empirical evidence (Burget et al., 2017; Păunescu et al., 2022). This in turn has led to multiple and yet incompatible perceptions and interpretations of the core concept of RRI and the role of stakeholders in its implementation (Owen & Pansera, 2019; Păunescu et al., 2022).

RESEARCH METHODS

The aim of this paper is to answer the research question: Which issues play crucial roles in universities' responsible research and innovation transfer? The tool used to conduct the study was analysis of the specific role of the concept of responsible research and innovation transfer from universities to the economy. The methodology used in this study is literature review from databases such as EBSCO, Taylor & Francis and Wiley Online Library. The basis for selecting the publications included in the study was the review criteria. The period of the study lasted from March to June 2023. This methodology allows

potential linkages and relationships to be generated by exploiting a potential future from a certain present. The theory of innovation formulates the rules on which economic development should be based (Davis & North, 1970; Wennekers & Thurik, 1999). Scientific research carried out at universities may generate innovations that can be transferred to the economy. Bearing in mind all the stakeholders of innovations transferred from universities to the economy, we consider the criteria for evaluating innovations in terms of responsibility (Etzkowitz & Leydesdorff, 1998). Bearing in mind the dynamic change in the conditions of the economy, as well as shocks related to the effects of the pandemic or armed conflict, there is a need for analysis of the key issues related to the idea of responsible research and innovation. In this context, it would seem essential to consider such dimensions of responsible innovation as inclusion, anticipation, responsiveness, reflexivity, sustainability, and care.

UNIVERSITIES' RESPONSIBLE RESEARCH AND INNOVATION TRANSFER – LITERATURE REVIEW

Contemporary universities face many challenges. Their role is now seen very broadly and covers the production and transfer of knowledge, mainly through research and student education, but also support of socio-economic development (see: Maassen, 2019).

The subject of the relationship between business and academia appears in the literature, usually in the context of cooperation in the field of innovation. María García-Vega and Óscar Vicente-Chirivella investigated data concerning R&D acquisitions from universities of more than 10,000 Spanish firms. Based on the results, the authors concluded that: “the knowledge generated by universities makes an important contribution to economic growth through technology transfers, which makes firms more innovative” (García-Vega & Vicente-Chirivella, 2020, p. 1). The positive impact of cooperation between academia and business on innovation and competitiveness, both in enterprises and regional economies, is indicated by various authors (Marinho et al., 2020; Vélez-Rolón et al., 2020; Zhuang et al.,

2021). However, the benefits of knowledge transfer and innovation from academia need to be seen in a broader context: they have not only a business-economic dimension but also a social dimension as they should serve to solve society's problems and meet its needs (Madl & Radebner, 2021).

Researchers are also interested in different models and mechanisms for the transfer of knowledge and innovative solutions from research institutions to the economy and society. This includes their strengths and weaknesses and the limitations associated with their operation (e.g., Kocowska-Siekierka, 2022; Marinho et al., 2020; Terán-Bustamante et al., 2021). Tweheyo et al. (2022), on the other hand, identified key factors affecting the transfer and commercialization of research results. These include both factors characterizing the research institutions themselves (e.g., the competence and motivation of researchers or entrepreneurial culture) and external conditions (e.g. related to regulation, intellectual property protection).

There is an ongoing discussion in the research community regarding the implementation of responsible research and innovation (RRI) in universities and its funding from the perspective of the managing institution (Moan et al., 2022). Responsible management of research processes in this case means choosing one of the concepts of accountability: retrospective or prospective (Moan et al., 2023). The retrospective concept is related to an approach to responsible action, which means avoiding harm and repairing any damage done in the past – we are dealing here with a 'past' perspective. In the case of the prospective approach, the focus is on doing good in the future; it therefore takes a future perspective. The second approach has become the basis for drafting principles for responsible research – the implementation of responsible research assessment has been promoted by national recommendations in three European countries (Netherlands, 2019, Finland, 2020 and Norway, 2021). Also, the European Commission intends to facilitate and accelerate change through a European agreement on the reform of the research conduct-evaluation system (Yi Kai Ong et al., 2023).

DIMENSIONS OF RESPONSIBLE INNOVATION AND RESEARCH

In the literature, there are various dimensions of RI and RRI. The European Commission (EU, 2013) proposed six dimensions (engagement, gender equality, science education, ethics, open access, and governance); Stahl (2013) proposed three practical dimensions (actors, norms, and activities); Pellizzoni (2004) proposed four dimensions (liability, accountability, care, and responsiveness), and Stilgoe et al. (2013) proposed four dimensions (anticipation, inclusion, reflexivity, and responsiveness). The most frequently discussed and analyzed dimensions (inclusion, anticipation, responsiveness, reflexivity, sustainability, and care) are included in the current analysis, which allowed us to understand the depth of the concept.

Inclusion

Inclusion is a conceptual dimension which can be considered as fundamental for most of the discussions within the RI/RRI area. Inclusion is also associated with all other conceptual dimensions. It engages different stakeholders in the early stages of research and innovation. Inclusiveness is a key theme in scholarship on RI and RRI. RI/RRI researchers make a strong case for involving stakeholders in science and innovation processes. What they have not discussed so far is how to make science internally more inclusive and tackle barriers that prevent marginalized scholars from participating in knowledge production and societal meaning-making (Koch, 2020). When it comes to the discussion of RRI transfer, it is crucial not to forget the societal, economic, political, and human aspects, as well as public involvement (Gwizdała & Śledzik, 2017). Public involvement, like the societal, political and human aspects, is often referenced in the literature as a requirement for finding solutions to technical issues (Mejlgaard et al., 2012; Levidow & Neubauer, 2014; Bozeman et al., 2015; Burget et al., 2017). Engaging public stakeholders in the early stages of innovation transfer from university to the economy is believed to positively influence technological development. An example of inclusion in the view of RRI is the Code of Conduct (CoC),

which leads various actors to follow the principles of a safe, ethical, and effective framework.

Many followers of the RRI concept see inclusion as the “ongoing involvement of society” in various stages of research and innovation. What is crucial at this point is that this should proceed without wasting taxpayers’ time and money at the same time. Inclusion is probably the conceptual dimension that characterizes RI best (Gwizdała & Śledzik, 2017), and that is why, according to Barben et al. (2008), public stakeholders should be engaged in the early stages of innovation transfer. In universities, innovation transfer that engages the public is problematic due to universities’ activities in both pure and applied research. Dialogue as the basis for evaluating whether a given element of research or innovation is responsible or not would have to be based on a plane of mutual understanding. A separate issue is that inclusion in the context of RI/RRI is primarily presented as a matter of stakeholder involvement (Fraaije & Flipse, 2020; Pandey et al., 2020; Koch, 2020), but not as a matter that refers to members within the scientific community. To sum up, inclusion as a dimension of RI/RRI in universities’ responsible research and innovation transfer requires consideration of the public stakeholder (in particular, taxpayers as a group that finances university budgets) as participating in designing research directions, and in particular in co-deciding about the transfer of innovation to the economy. In other words, it is broader public involvement in the research process.

Anticipation

Anticipation plays an important role at the beginning of research and innovation transfer. It indicates the directions to take in order to achieve better and more desirable results. It takes into account understanding how current dynamics help design the future. Moreover, anticipation is a dimension that aims to envision the future of research and innovation, and governance includes those technologies which provide a value-added advantage and, at the same time, avoid the emergence of potentially negative consequences (Karinen & Guston, 2010; Roco et al., 2011; Schaper-Rinkel, 2013; Stahl, 2013; Stahl et al., 2014). In other words, anticipatory governance includes

those researched and transferred innovations that provide profit (Robinson, 2009). Successful anticipation means understanding the economic dynamics that help shape the future technology (Stilgoe et al., 2013). Anticipation of the potential impacts of technology serves the purpose of reflecting on the motivations and implications of a research project, being clear about uncertainties and dilemmas, opening these visions to the broader public, and using the outcomes to shape the research and innovation trajectory (Gwizdała & Śledzik, 2017).

As with the inclusive society, taxpayers play an important role in anticipation. Early societal intervention would prevent negative consequences (Laroche, 2011). The basic question that arises at this point is how – according to some mechanism in the legal and administrative space – society would have a real impact on the dialogue with universities in the context of inclusiveness regarding research and innovation transfer. In the literature, the following propositions occur: upstream public engagement and Constructive Technology Assessment, Real-Time Technology Assessment, foresight, technology assessment, horizon scanning, and scenario planning. The Upstream public engagement described by Wilsdon and Willis (2004) and the Constructive Technology Assessment mentioned by Rip et al. (1995) are two techniques that engage anticipatory discussions of possible and eligible futures (Stilgoe et al., 2013). Guston and Sarewitz's (2002) proposed 'Real-Time Technology Assessment' is another model of implementation of inclusiveness in university research and innovation transfer. This approach was also called 'anticipatory governance' (Barben et al., 2008; Karinen & Guston, 2010). Anticipation is different here from forecasting or predictions in its distinct recognition of the complexities and uncertainties of science and society's co-evolution (Stilgoe et al., 2013; Barben et al., 2008). Methods of foresight, vision assessment (Grin & Grunwald, 2000), technology assessment, horizon scanning, or scenario planning (Selin, 2011; Robinson, 2009) can be important techniques, although when narrowly used they risk exacerbating technological determinism (Stilgoe et al., 2013). Increasing access to research results and promoting formal and informal learning in forecasting and vision assessment all contribute to strengthening this dimension.

Responsiveness

Responsible research and innovation transfer require an ability to change configuration or direction in response to stakeholder and public values and changing conditions. When social agencies have a limited ability to modulate technologies and innovation trajectories, public involvement in the process is seriously undermined (Stirling, 2008; Macnaghten & Chilvers, 2013; Stilgoe, 2013). This is one of the main problems related to the proposal to involve public stakeholders in the assessment of innovation responsibility. The responsiveness of innovation systems in economies seemed to be the solution to this problem.

The responsiveness dimension of responsible research and innovation transfer is linked to risk, which is the probability of an occurrence a cost that new technologies may bring about. The risks involved in new technologies can be medium or long term, economic, environmental, security, or societal. In this case, identification and analysis of risks as part of responsiveness is linked to anticipation. In the literature, discussions involving responsiveness are also primarily linked to ethics, risks, transparency, and accessibility (Burget et al., 2017; Gwizdała & Śledzik, 2017). Pellizzoni (2004), who introduced responsiveness as a conceptual dimension of responsible innovations, has emphasized that responsiveness in policy practice primarily focuses on an assimilative, reactive, or exclusionary attitude instead of a responsive or inclusive one. Responsiveness is also related to transparency and accessibility (open access of research results). Accessibility of research is associated with the system of financing universities' scientific activity with public funds. That means that the results of publicly funded research have to be accessible to the public (Burget et al., 2017). According to Pellizzoni (2004), we must consider how systems of innovation can be shaped so that they are as responsive as possible. Presenting a clear link to inclusion, he suggests that responsiveness is about adjusting courses of action while recognizing the insufficiency of knowledge and control. Responsiveness involves responding to new knowledge as it emerges and to emerging perspectives, views, and norms (Burget et al., 2017). For responsible research and innovation transfer to be responsive, it must be situated in a political economy of science governance that

considers both products and purposes (Stilgoe, 2013). Existing approaches to technology assessment and foresight may be expanded to induce improved responsiveness (von Schomberg, 2013). Furthermore, responsiveness should be based on presenting the value of scientific research and the value of the transferred innovations to public stakeholders as well as encouraging participation in scientific projects by these stakeholders.

Reflexivity

Responsibility turns reflexivity into a public matter where it is linked to public dialogue, scientific and public collaboration, and anticipation. Involving the public in research may help researchers reflect on the ethical and social dimensions of their work. Scientific and public collaboration is a key component of reflexivity. The connection between reflexivity and anticipation allows the risk of making erroneous predictions to be avoided, especially in the early stages of innovation development (Wildson, 2005; Robinson, 2009; Gwizdała & Śledzik, 2017). Furthermore, mechanisms such as codes of conduct, moratoriums, and the adoption of standards may create reflexivity by drawing connections between external value systems and scientific practice (von Schomberg, 2013).

Stilgoe et al. (2013) showed that there were initiatives to involve social scientists and philosophers in laboratory processes. This was supposed to lead to the creation of an effective tool for engaging the public in discussing the ethical and social dimensions of science, research, and innovation transfer. We would argue, following Stilgoe et al. (2013), that there is a need for institutional reflexivity in science governance. These institutions have a responsibility not only to reflect on their own value systems, but also to help build the reflexive capacity within the practice of research, science, and innovation transfer. On the basis of connecting anticipation with reflexivity, a significant challenge occurred. The problem is how to identify effective methods to ensure scientific cooperation with the community and openness to diverse audiences.

Sustainability

Sustainability and care are emerging conceptual dimensions of responsible innovations and responsible research. Although sustainability issues can be found in the majority of the research, it is not clearly referred to as a dimension. In recent research, sustainability is identified as a key driver of innovation, research and development. Sustainability is already starting to convert the competitiveness concept, which will force organizations and business to change their strategy. Research focused on science, technology and innovation for sustainable development is also conducted in the field of economics. Sustainability often refers to the so-called resource efficiency of new products. This approach highlights the underuse of resources, and the main problem is the implementation of resource-efficient, techno-scientific innovations (Levidow & Neubauer, 2014; Burget et al., 2017). Research and innovation are closely related to social responsibility because they can implement more sustainable research and innovation transfer to the economy (Flipse et al., 2013). From the perspective of this study, it seems crucial to consider sustainability as a dimension of responsible research and innovation transfer and to present new technological solutions and the possibilities of their use, combined with the introduction of new technologies into the teaching and research process.

Care

The main challenge of future-oriented ethics is to answer the question of how to deal with uncertainties derived from social practices like technology and innovation. Care is a “public domain” dimension, such that society is responsible for decisions taken and activities implemented. Care is also explained as a process through which people develop the abilities to perceive, act and judge together. As far as care as a conceptual dimension of RRI is concerned, it is crucial to see inclusion not just as a means to meet the “grand challenges”, but rather as a way to unite people’s high objectives and day-to-day practices (Groves, 2009; Gwizdała & Śledzik, 2017). RI/RRI scholars have argued for an ethos of care as part of responsible research

(Owen et al., 2012), emphasizing scientists' responsibility in caring for the body of knowledge that societies can tap into to solve societal problems – both today and in the future (Felt et al., 2018). Care is also closely linked to the concept of responsibility, which implies the need to tackle inequalities in the community which produces this knowledge (Koch, 2020). Summarizing, it can be stated that care as a dimension of responsible research and innovation transfer means increasing public awareness of the opportunities offered by science and technology in solving contemporary and future problems.

CONCLUSIONS AND RECOMMENDATIONS

The aim of this paper was to analyze the specific role of responsible research and innovation transfer from universities to the economy. In this context, responsible innovation dimensions such as inclusion, anticipation, responsiveness, reflexivity, sustainability, and care were analyzed. Partial conclusions are adjacent to the assumptions of the Quadruple Helix model of innovation. This tool for analyzing the actors and their interactions in an innovation ecosystem was developed by incorporating public or civil society as the fourth helix in the Triple Helix model of university–industry–government for innovation and entrepreneurship (Carayannis & Campbell, 2009). It is a useful tool for universities if, in each helix, processes, activities, and actions are separated and listed. From a university's RRI transfer point of view, data must be gathered for decision-making purposes, as well as social involvement in research, which in turn requires the following activities:

- broader public involvement in the research process;
- identifying methods to ensure effective cooperation with stakeholders and communities;
- encouraging stakeholder participation of (esp. taxpayers) in scientific projects;
- increasing access to research results;
- increasing public awareness of the opportunities offered by science and technology in solving contemporary and future problems;
- presenting new technological solutions and their possible applications to the audience;

- introducing new technologies in the teaching process;
- presenting the value of scientific research;
- taking into account the ethical dimension.

Concerns about the impact of new technologies on the economy and society explain growing calls for responsible research and innovation transfer, the sustainable transition of social and technical arrangements, and stronger engagement between science-driven innovation and society. Innovations are not created only for the creation process. Innovations are implemented in the economy and comply with the requirements of meeting needs in terms of value creation for society, the public, and other stakeholders in the process of economic development.

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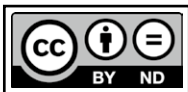
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