IMPACT ASSOCIATED TO THE RESEARCH RESULTS GENERATED BY EIDOS DOCTORATES (UPV/EHU)

Gotzone Barandika$^{1,2}$, Begoña Bazán$^{2,3}$, Miren-Karmele Urtiaga$^{3}$, María-Isabel Arriortua$^{2,3}$

$^1$ Departamento de Química Inorgánica, Facultad de Ciencia y Tecnología, University of the Basque Country UPV/EHU (SPAIN)

$^2$ BCMaterials, Building 500, Bizkaia Science and Technology Park (SPAIN)

$^3$ Departamento de Mineralogía y Petrología, Facultad de Ciencia y Tecnología, University of the Basque Country UPV/EHU (SPAIN)

Abstract

The concept of responsible research and innovation (RRI) has been gaining visibility in the EU during the last years. As a result, public funding has been orientated to the promise or expectation of socially-beneficial impacts by means of the social contract for science. In this context, three features of RRI have been identified and related to the idea of science for society: a) democratising the governance of intent, b) institutionalising responsiveness, and c) reframing responsibility. Referred to the last one, scientists’ responsibilities are well known, including those associated with concepts of research integrity which make explicit such morally unacceptable behaviours as data falsification and plagiarism. Thus, the concept of RRI confers new responsibilities and not only on scientists but on universities, innovators, businesses, policy-makers and research funders. However, the growth of scientific research during the past decades has outpaced the public resources available to fund it and as a consequence identification of promising research includes measures to assess the quality of scientific research itself, but also to determine its societal impact. With the aim of promoting RRI, EIDOS, a research group in Materials Science (University of the Basque Country), has been developing and improving its own management system for the last nine years, and this work explains the indicators used to measure the scientific and societal impact associated to the results generated by EIDOS doctoral students. In order to evaluate this impact, the evolution of the formation plan of doctorates during the last 8 years has been studied. The analysis includes both specific and transversal skills that are formulated through scientific and social objectives in the technical reports produced by EIDOS. The results indicate that RRI increases the personal satisfaction and motivations of the researches.

Keywords: Responsible research and innovation, science for society, social objectives, formation plan for doctorates.

1 INTRODUCTION

Responsible Research and Innovation (RRI) has been defined as a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view on the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society). [1] The RRI concept has been gaining visibility in the EU during the last years, and as a result, public funding has been orientated to the promise or expectation of socially-beneficial impacts by means of the social contract for science. Thus, the concept of RRI confers new responsibilities and not only on scientists but on universities, innovators, businesses, policy-makers and research funders.

Owen et al. (2012) [2] described three emergent features of RRI discourse: 1) science for society, 2) science with society, and 3) responsible innovation (Fig.1). The first is focused on purposes, where research and innovation are targeted at Europe’s societal challenges. The second, linked to the first, is an emphasis on the need for research and innovation to be responsive to society in terms of setting its direction, and in modulating its trajectory. Finally, responsible innovation refers to a re-evaluation of the concept of responsibility as a moral and philosophical social aspect where innovation is future-oriented and deeply uncertain. As a consequence innovation is presented as a complex, collective phenomenon that requires an institutionalised response, if this is indeed possible.
The work herein presented is focused on RRI related to science for society. In this context, three features of RRI have been identified and related to the idea of science for society: a) democratising the governance of intent, b) institutionalising responsiveness, and c) reframing responsibility. The last one is directly related to scientists’ responsibilities. Thus, in the recent past those responsibilities included concepts of research integrity which make explicit such morally unacceptable behaviours as data falsification and plagiarism. [3] However, the growth of scientific research during the past decades has outpaced the public resources available to fund it and as a consequence identification of promising research includes measures to assess the quality of scientific research itself, but also to determine its societal impact. [4]

With the aim of promoting RRI, EIDOS (a research group in Materials Science, University of the Basque Country) has been developing and improving its own management system for the last nine years. [5-9] As a result, the current process map of EIDOS (2014) includes some aspects that are related to RRI. As observed in Fig. 2, “society” is the input and the output of EIDOS activities.

Knowledge and doctors are the output to society which becomes added value to community. Therefore, EIDOS group did identify the aspects for which impact on society should be evaluated. Taking the latter into consideration, in order to evaluate this impact, the evolution of the formation plan of doctorates during the last 8 years has been studied.
2 METHODOLOGY

As observed in Fig. 2, EIDOS activities can be described through three operational processes (OP), three management processes (MP), and three supporting processes (SP). The operational processes constitute the core business and create the primary value stream. These processes are:

- **OP1. Knowledge**: This process concerns knowledge generation and diffusion to scientific community.
- **OP2. Formation of doctorates**: This process consists of the formation of doctorates, leading to the elaboration of a PhD Thesis.
- **OP3. Funding**: By means of this process, EIDOS gets financial resources.

Management processes at EIDOS govern the operational processes:

- **MP1. Assessment, revision and improvement**: This process consists of cycles of assessment and revision, producing improvement actions.
- **MP2. Strategic planning**: This process consists of defining the organization’s strategy, as well as making decisions on allocating its resources to pursue this strategy.
- **MP3: Management for Excellence**: The goal of this process at EIDOS is to become an excellent organisation; this is, to achieve and sustain outstanding levels of performance that meet or exceed the expectations of all our stakeholders.

Finally, supporting processes support the operational processes, and we have identified the following ones:

- **SP1. Administration**: This process is related to the administration of EIDOS’s resources.
- **SP2. People**: By this process, the head researcher (the manager) understands the people who work for EIDOS as individuals and motivate them to do their best work. The management of people includes current and future situations.
- **SP3. Innovation**: Innovation management is the discipline of managing processes in innovation. It can be used to develop both product and organizational innovation.

Operational processes have as inputs three elements existing in society: a demand for science and technology, future doctorates, and financial resources. As a result of the operational processes “Knowledge” and “Formation of doctorates”, EIDOS produces new scientific knowledge and doctors that add value to community. As EIDOS is a non profit organization, the financial resources obtained by means of the process “Funding” are consumed in the later two processes.

The process map contains the key aspects used to measure both the scientific and societal impact associated to the results generated by EIDOS doctoral students. In the other hand, EIDOS doctorates have a personal formation plan that has been used to evaluate the scientific and societal impact associated to their activities. Since this plan has undergone assessment, revision and improvement during the last years, the evolution of the formation plan of doctorates during the last 8 years has been studied.

3 RESULTS AND DISCUSSION

The EIDOS formation plan of doctorates contains the definition of three types of skills: experimental, research field, and transversal. These skills are aligned with the Dublin descriptors for postgraduate education. [10] Table 2 summarises the as-described correspondences.

As observed, the concept of “science for society” can be discerned in skills 7 and 10. However, the need of explicitly assume the Europe’s societal challenges has been identified in EIDOS research group. As a consequence, current EIDOS doctoral theses formulate not also scientific objectives but also social ones.
Table 1. Correspondence between Dublin descriptors and EIDOS skills.

<table>
<thead>
<tr>
<th></th>
<th>Experimental skills</th>
<th>Research field skills</th>
<th>Transversal skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>systematic understanding of a field of study</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>mastery of the skills and methods of research associated with that field</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>ability to conceive a substantial process of research with scholarly integrity</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>4.</td>
<td>ability to design a substantial process of research with scholarly integrity</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>5.</td>
<td>ability to implement a substantial process of research with scholarly integrity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>ability to adapt a substantial process of research with scholarly integrity</td>
<td>X</td>
<td>x</td>
</tr>
<tr>
<td>7.</td>
<td>contribution through original research that extends the frontier of knowledge by developing a substantial body of work, some of which merits national or international refereed publication</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>8.</td>
<td>capability of critical analysis, evaluation and synthesis of new and complex ideas</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>9.</td>
<td>capability of communication with peers, the larger scholarly community and with society in general about the areas of expertise</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>10.</td>
<td>ability to promote, within academic and professional contexts, technological, social or cultural advancement in a knowledge based society</td>
<td></td>
<td>x</td>
</tr>
</tbody>
</table>

Identification of those social objectives starts with the alignment of EIDOS activities with the EU societal challenges (Fig. 3). Thus, EIDOS activities have been framed in the context of H2020, the EU Research and Innovation programme. In the energy area, the challenge consists of satisfying the constantly increasing energy needs while fighting climate change. Thus, the first work programme for "Secure, Clean and Efficient Energy" is split into the following focus areas: a) Energy Efficiency, b) Low Carbon Technologies, c) Smart Cities & Communities, and d) Policy driver. [11] In particular, research activities within the “Low Carbon Technologies” area covers: Photovoltaics, Concentrated Solar Power, Wind energy, Ocean Energy, Hydro Power, Geothermal Energy, Renewable Heating and Cooling, Energy Storage, Biofuels and Alternative Fuels, Carbon Capture and Storage. The result of the above analysis is that EIDOS activities are aligned with three of those aspects: Energy Storage, Alternative Fuels, Carbon Capture and Storage.

Figure 3. Alignment of EIDOS activities with the EU societal challenges.
Once the impact areas had been identified, the next step consisted of formulating both specific and transversal skills (in the formation plan of doctorates) through scientific and social objectives in the technical reports produced by EIDOS. These reports include all kind of projects and memories attached to the activities carried out in the frame of the doctoral theses.

Another aspect to be taking into account is the RRI impact on personal satisfaction and motivations. Integration and fulfilment of needs is essential to build a successful community. Each member needs to bring something (such as knowledge, connections, resources) to the value chain of the community: i.e. a purpose that affects the sense of belonging to the group. In order to quantify the latter, EIDOS group uses an indicator that measures the personal satisfaction of researches. The results reveal a continuous increase (from 2008 to 2016) for all members of the group (doctorates and seniors).

4 CONCLUSIONS

RRI in EIDOS research group is a significant matter of interest. In fact, in addition to scientific objectives, the group is including social ones in the technical memories attached to the doctorates activities. To this purpose, alignment of the research to the H2020 area of "Secure, Clean and Efficient Energy" has been previously visualised. In this way, doctorates are conscious of the impact associated to their research results generated by EIDOS doctorates, and this results in an increase of their personal satisfaction.

ACKNOWLEDGEMENTS

This work has been supported by the “Ministerio de Economía y Competitividad” (MAT2016-76739-R (AEI/FEDER, UE)) and the “Dpto. de Educación of the Basque Government” (Basque University System Research Groups, IT-630-13).

REFERENCES


