UNIVERSITIES AND RESPONSIBLE INNOVATION

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Nowadays the concept of Responsible Research and Innovation (RRI) is a well-noted policy of the European Union. The concept can be understood as the innovation policy of sustainability. On a theoretical level RRI is considered as a developed topic, but the interpretation of its practical utilization is an important task in the future. Universities play an important role in dissemination and implementation of responsible research and innovation. In addition to education RRI, knowledge utilization and proactive economic development have a great significance among the objectives of universities. So universities are the institutions which can effectively enhance the possibilities of RRI implementation. At the moment there are several empirical studies regarding the implementation of RRI (e.g. the STIR research based on Erik Fisher's methodology), universities have a key role in this process. This statement is especially true in less developed countries, where RRI is a relatively new concept, and where the research development and innovation activities are functioning in different ways compared to the practice of developed countries. Universities can contribute to raising awareness as well, in order to make decisions by considering several aspects of a certain topic. They not only follow templates and aim to avoid possible negative externalities. This paper examines the role of universities in dissemination and implementation of responsible innovation by considering particular characteristics of less developed countries.

Keywords: RRI implementation, Universities, Raising awareness, Local economic development.

1. Introduction

In our globalized world, the role of knowledge is appraised. Universities gain even more focus in this knowledge and learning-based economy and society, as these are the institutions where the creation and dissemination of knowledge is performed and where innovation is created. Innovation is an integral part of the structure of nearly all modern societies (Owen et al. 2013). Today the question is not whether our society is in need of developing innovative products/processes/services, but how should we proceed with creating innovation in an ever-changing environment (Inzelt – Csonka 2014).

The concept of Responsible Research and Innovation (RRI) is an increasingly popular approach in the European Union. This is underpinned by the fact, that in the 2014-2020 programming period it has become a kind of policy guideline. RRI can be linked to the concept of sustainability; it can be understood as its innovation policy. On a theoretical level responsible research and innovation is considered a developed topic, but the interpretation of its practical utilization should be an important task in the next few years.

Science parks can be main actors in means of disseminating responsible innovation, because companies in science parks collaborate by taking advantage of geographical proximity. Companies

located in science parks have to accept the parks policy, so if the given science park deals with responsible innovation, this is an excellent way of disseminating RRI. Universities closely linked to science parks could also play a key role in dissemination of RRI. In addition to education RRI, knowledge utilization and proactive economic development has a great significance among the objectives of nowadays „fourth generation" universities. In case of universities, the conscious, future-oriented development of local economy becomes a particularly important task, in which the responsible utilization and dissemination of innovation can have an integral part. Universities can be the institutions, which can effectively enhance the possibilities of RRI implementation. They conduct important basic, applied, and cooperative researches with companies, so their commitment for RRI can incite the corporate sector as well.

The purpose of this study is to examine what is the role of universities in dissemination and implementation of responsible research and innovation by considering particular characteristics of less developed countries. Such researches have already been done in developed countries, but there is lack of empirical evidence from less developed countries.

To answer this question, our paper consists of three main chapters. After the introduction of the most important knowledge about universities and responsible research and innovation, we reveal the methodology of STIR project that concentrates on the opportunities of RRI implementation. Based on this, in the end we present our current primary research, the case of Berényi Lab using this methodology. The necessary data was collected by analysing former case studies using STIR method and by evaluating the results of our primary research based on interviews. The main contribution of our research would be the identification of characteristics of less developed countries related to the innovation process in particular responsible research and innovation.

2. Universities and Responsible Research and Innovation

According to Wissema (2009) universities step into one generation from another in the course of their development. Nowadays most higher education institutions can be considered as second generation universities but more and more are close to a generational change. Between second and third generation universities the biggest difference is that while second generation universities mainly focus on education and research, the goals of third generation universities are expanded by third mission activities that are in line with the changing social and economic expectations. Third mission accounts for the relationships with partners outside the university and the utilization of know-how resulting from these links.

There is already a large number of literature about third generation universities that outline, what the concept exactly means, what kind of goals they have and how many universities aim towards the achievement of third mission efforts in their strategic documents. A polish author, Krzysztof Pawlowski however has published about "fourth generation" universities and examining its impacts on local development (Molnár – Zuti 2014).

In case of "fourth generation" universities the institution can have a greater significance in means of impacts on local economy and society. While third generation universities try to meet the needs of economy and society, "fourth generation" universities focus on shaping their social and economic environment. This can be closely associated with the expansion of the relation of actors in the Triple Helix model as well (Molnár – Zuti 2014).

Besides education, the knowledge utilization, responsible research, development and innovation and proactive economic development can have a great significance among the goals of "fourth generation" universities (Lukovics – Zuti 2014). In case of universities the conscious future-oriented local economic development is becoming a very important task. Responsible utilization and dissemination of innovation can be an integral part of the universities' goals.

Research and innovation should be responsibility-driven with reference to its impacts on society, human beings, the environment and its externalities (Owen et al 2012, von Schomberg 2013, Fisher–Maricle 2014). Science and innovation can be and should be shaped in responsible ways (Guston 2008).

But what does responsible innovation mean exactly? As Von Schomberg (2013, p. 39) expresses *"Responsible Research and Innovation is a transparent, interactive process in 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 advances in our society)".* The concept can be understood as the innovation policy of sustainability. Although the concept of responsible research and innovation (RRI) gained credibility in the EU's policy over recent years, RRI is a relatively new concept for the less developed countries. On a theoretical level RRI is considered as a developed topic, but the interpretation of its practical utilization should be an important task in the future.

Buzás – Lukovics (2015) summarized the most important aspects of responsible research and innovation in terms of content (Figure 1). The significant elements of RRI are social orientation, sustainability, value-based acceptance, social desirability, ethics, future orientation, competitiveness, stakeholder involvement, transparency, interactivity and multidisciplinary.
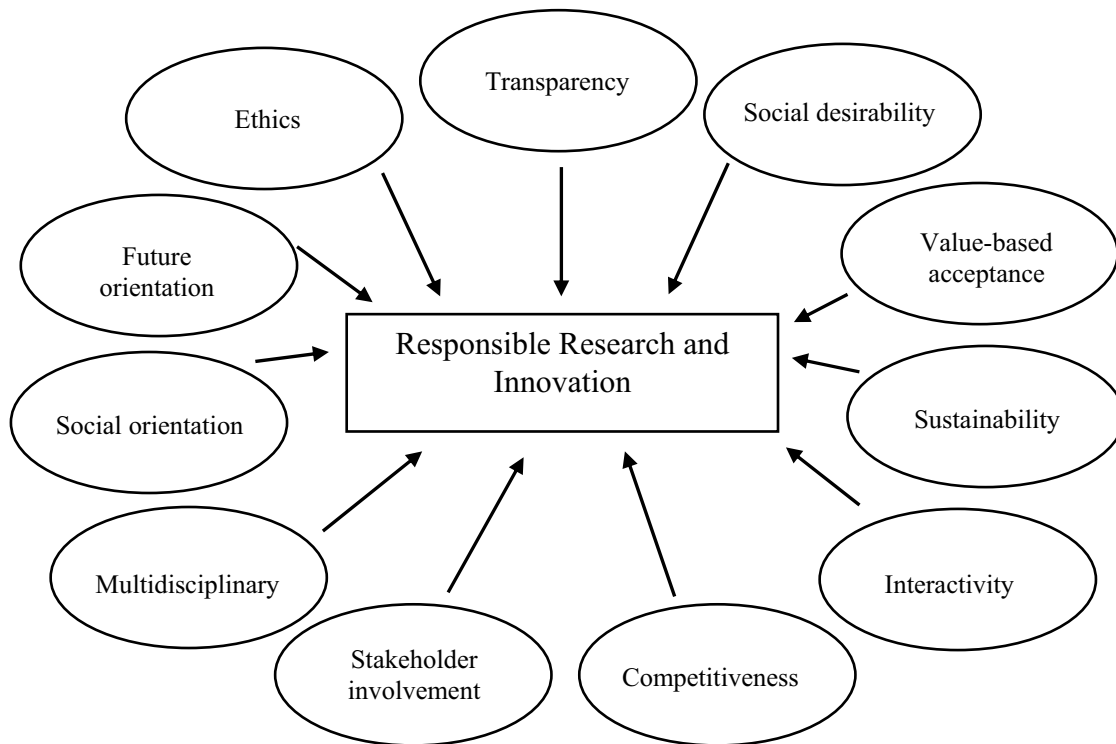

Figure 1. The most important elements of RRI
Source: Buzás – Lukovics (2015, pp. 446)

Universities can play a key role in the dissemination and implementation of responsible research and innovation. In table 1 the generations of universities can be seen and their role in the dissemination and implementation of responsible research and innovation.

First generation universities, which aim only education, ignore to do anything for RRI. Goals of second generation universities are education and research. They take into consideration some elements of RRI, but not consciously, only in an implicit way, so a low awareness could be identified in terms of responsibility in innovation. Goals of third generation universities are complemented with a third activity, the so called third mission. In case of these types the number of elements taken into account is growing, but there is still a low awareness, so the integration of RRI remains only implicit. Fourth generation universities differ from third generation universities in their goals as mentioned above. A more conscious RRI orientation could be observed, this is the so called "raising awareness".

Table 1. Characteristics of first, second, third and fourth generation universities

Aspect	First generation universities	Second generation universities	Third generation universities	Fourth generation universities
Goal	Education	Education and research	Education, research, and utilization of knowledge	Education, research, R+D+I, utilization of knowledge, and proactive economic development
Role	Protection of truth	The cognition of nature	Creation of added value	Local economic accelerator, strategy determination
Output	Professionals	Professionals and scientists	Professionals, scientists, and entrepreneurs	Professionals, scientists, entrepreneurs, and competitive local economy
Language	Latin	National	English	Multilingual (national and English)
Management	Chancellor	Part-time scientists	Professional management	Professional management and local experts
Responsible Research and Innovation	-	low awareness (few not consciously considered RRI-elements discussed in an implicit way)	growing awareness (growing number of RRI-elements, also in an implicit RRI)	"raising awareness" conscious responsible research and innovation

Source: Own construction based on Lukovics-Zuti, 2014

The next figure shows the generations of universities and their role in implementation of responsible research and innovation as well. The two axes are awareness and elements taken into account. The figure is presenting the degree of contribution of universities in different generations (figure 2).
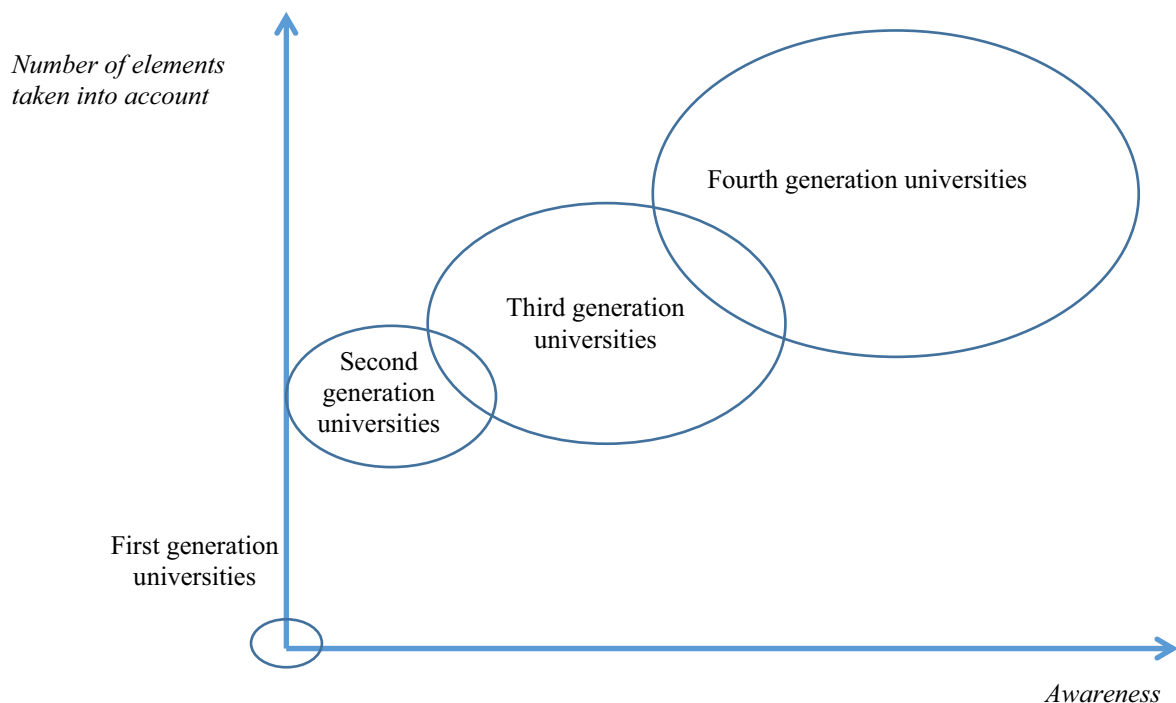

Figure 2. RRI and generations of universities
Source: Own construction

There is an existing methodology for the practical utilization of Responsible Research and Innovation, this is the so called STIR (Socio-Technical Integration Research) project, which has been adapted successfully in many developed countries, but not in less developed countries. This fact raises the possibility of the method's adaptation in Hungary and can provide a basis for a comparative analysis as well.

In our next chapter we are presenting our methodology in details.

3. Methodology

The methodology we are using in our research is STIR, Socio-Technical Integration Research, the method from Erik Fisher (Arizona State University). STIR attempts to reveal important but often overlooked contextual dimensions that may be important in any decision situation for researchers (e.g. ethical, social and public values) (Fisher 2007).

STIR is "the process by which technical experts account for the societal dimensions of their work as an integral part of this work" (Fisher – Miracle 2014). According to Fisher (2007) STIR assumes that scientists do make decisions and are reflexive but selectively. The method has the hypotheses that it is possible for scientists to become more reflexively aware of the broader context of their decisions, and that more reflexive decision-making leads to bigger social and public value. This can be beneficial from governmental aspect, the capacity of responsiveness is a resource for the governance of science.

This research project is a laboratory engagement study which differ from the traditional participant-obervation, because it expects to interact with and thereby alter the research subject in order to understand possibilities for boosting reflexivity and responsiveness (Fisher 2007). STIR needs to be collaborative, where collaboration is means to an end. This goal can be understanding the conditions for enhancing STIR.

Fisher (2007) presents that STIR has a decision protocol which have to be used regularly and in-depth manner. This is not only an interview schedule, because the goal of the observation is not simply collecting information. It can involve collaborative decisions as well. The protocol can be used in several ways depending on the researcher's knowledge and skills. There is an opportunity to use the protocol grid which allows greater transparency and the use of graphics. The grid focuses on the activities of description and inquiry.

The decision protocol consists of four components: opportunity, considerations, outcomes and alternatives. According to Fisher (2007) the first component is **Opportunity**, which can be a perceived state of affairs eliciting a response. It can be e.g. a situation or a problem that needs a response, a solution. Researcher has to understand how this problem came and focus on how the participant became aware of it. **Considerations** can be things that potentially influence the selection of the response to the opportunity, so this is selection criteria that mediate the response (e.g. human and social values that establish practices and interests. Researchers have to understand what human, social and material considerations can be taken into account by scientists giving a response to the opportunity. They have to concentrate on what is at stake in the decision or on what prevent the scientists making a decision. The third component of the decision protocol is **Alternatives**, which can be the perceived available courses of action for responding to the opportunity. Researchers have to understand the set of traditional options as well as all other possible opportunities. Options that are initially ruled out by the observed scientists have to be also taken into account. And finally, **Outcomes** are expectations of selecting an alternative in light of the considerations. These can be anticipated effects and meanings of a given response. Researchers have to concentrate first on short-term expectations but continuously more on long-term issues. They have to understand the expectations of the participant scientists and of participants of the broader decision process.

Therefore, the point of this methodology is that social scientists (embedded humanists) are moving into scientist's laboratory for twelve weeks and cooperative with them. Humanists try to expand horizon of scientists, try to show that also RRI elements can be taken into account during the research. Social scientists are detecting their decision points and attempt to show them that they have important decision points.

STIR starts with pre-study interviews, and the same questions are going to be asked in form of post-study interviews after the research. The interviewees are high interaction person and no interaction person in order to provide a control group as well. The questions are related to among other things researchers' activity, responsible innovation and innovation process. The questions are investigating country-specific facts related to innovation process and RRI as well (e.g. what kind of Hungarian specialties do you see in the innovation process?).

After the pre-study interviews the observation of scientists starts. During the observation humanists are questioning scientists along these four questions (Fisher 2007):

– What are you doing? (Opportunity)
– Why are you doing it? (Considerations)
– How else could you do it? (Alternatives)
– What do you expect to get out of this? (Outcomes)

With the help of the questions the scientists' attitude regarding the research activity and thinking can be identified, and the country specifics or institutional specialties can be highlighted.

4. The case of Berényi Lab

In this chapter we are presenting our current study using the STIR methodology. This is still an on-going study, so we cannot share final conclusions, but there are some statements that we can present based on the pre-study interviews.

In the beginning as first step we attempt to find a research group with the aim of cooperation. We sent the emails to research groups in our city Szeged in the name of a PhD student who hasn't got any personal contacts. We followed the original methodology and used the original invitation letter. While in the developed countries the researchers gladly accepted the invitation and joined to the project without any prior acquaintance, here in Szeged we could involve research subjects into our research only through informal contacts. This fact confirms that personal relationships are very important in Hungary; this is a Hungarian specialty regarding the innovation process. So we built on our personal contacts and we found a research group which was ready to cooperate. Now we are working together with this research group, with Berényi Lab.

Berényi Lab is an oscillatory neuronal networks research group at University of Szeged, Department of Physiology. The lab is committed to advance our understanding in how the healthy or diseased brain works. They are investigating the possible therapeutic effects of Transcranial Electrical Stimulation on epileptic seizures. Many neurological and psychiatric diseased are associated with altered brain dynamics. The diseased brain activity, in principle, can be restored through electrical stimulation, as the research group said. Formerly, it has been shown by this research group that seizure-triggered, transcranial electrical stimulation (TES) can largely reduce the duration of the epileptic seizures. If they have success with their research, TES can be an effective clinical tool to decrease pathological brain patterns in drug-resistant patients.

In the laboratory we are working with two researchers. They conduct their research on laboratory rats. One of the two researchers is working with rats 8-12 month, the other researcher's every experiment ends with the death of the rats.

According to the STIR methodology, we started our study with pre-study interviews, then the observation has begun. During the observation we are creating the grids in each topic separately along the four questions mentioned above.

The interview questions were the followings.

1. Could you speak about your education, research field, the scientific program you are working on and the institution you are working for? For which laboratory do you work and where it is located?

2. Have you ever heard about responsible research and innovation? If yes, what do you mean by the concept? If no, what do you mean by it?
3. Which social and ethical considerations do you take into consideration during the R+D process? In addition, which a) legal, b) environmental, c) medical, d) safety, e) political considerations do you take into consideration during the R+D process?
4. What could you or the research team do in order to social and ethical considerations be involved into the R+D activities?
5. What should be done in order to improve the possibilities of the research team, which aim the integration of social and ethical consideration into the R+D activities?
6. What do you think, how many percent is the proportion of interaction between scientists and social scientists during the R+D process?
7. In your opinion, would it make sense to increase this percentage?
8. In your opinion, how much is the difference between the Hungarian innovation process and the practice abroad?
9. What do you think about the informal relationships during the R+D activities?
10. In your opinion, how much do researchers trust each other?

During the study we are visiting the lab twice a week for 12 month. We are observing and questioning the researchers. First we tried to understand their research, what they are doing exactly in order to make questions more specifically later. We try to illuminate other aspects of the research and development processes, to show that also RRI elements can be taken into account during their research.

Analyzing the pre-study interviews with the two researchers and two control persons (no interaction persons), we can share some partial conclusions regarding the characteristics of Hungarian innovation process and RRI-attitude of the persons interviewed.

From the pre-study interviews we can see some Hungarian specialties regarding the innovation process.

− Innovation process is very slow and ineffective and the bureaucratic processes make things more difficult. E.g. if scientists want to buy something important tool for their research, they have to wait very long for it, because there are a lot of steps going through and the management ignore to understand its importance and urgency.
− Personal contacts have a great significance, without them in principal there is no success. A great example is our attempt to find a research group in our city in order to cooperate. We could find a research group only based on our personal relationships. To prevail, personal links are necessary and indispensable.
− Another characteristic is that there is a high degree of distrust. In Hungary we are living in a "trust-deficient", envious environment, people and scientists exclude to trust each other, ignore to cooperate, they are afraid for their results.

In the following we are presenting some concluding remarks regarding responsible research and innovation.

− The concept is unknown, the interviewees have no idea what RRI exactly means.
− The interpretation of the concept is narrow, they could not define RRI's dimensions.
− Other characteristic is that there is a low degree of cooperation between scientists and social scientists. Social scientists or scientists from other research areas could help expanding horizons of scientists, terminate the professional tunnel vision. If scientists cooperate with someone, it is only from scientific area.
− They disregard the opportunity to increase this cooperation, to consult with researchers from other areas.
− Scientists follow only the ethical allowances and they exclude to think about other solutions however there are other solutions. During our research we try to draw attention to these other solutions.

Summary

The goal of this study was to examine the role of universities in dissemination and implementation of responsible research and innovation by considering particular characteristics of less developed countries. To achieve this goal, we discussed this topic in three main chapters.

In our first chapter we demonstrated the most important knowledge about universities and responsible research and innovation. We wrote about and illustrated the generations of universities and their role in the dissemination of RRI. We gave a definition for responsible research and innovation and presented its most important elements.

In our second chapter we presented the methodology using in our research. We shared the most important information about STIR, the method of RRI's practical utilization. We demonstrated the decision protocol of STIR with its four main questions. Along these questions are the researchers asked during the research. We wrote about the starting point of the methodology, the so called pre-study interviews.

In the third chapter we presented our current research, the case of a Hungarian laboratory, the Berényi Lab. We made the pre-study interviews with two researchers from Berényi Lab team and we shared their most important conclusions. We can see some Hungarian specialties regarding the innovation process and responsible research and innovation. We found that innovation process in Hungary is very slow and ineffective and the bureaucratic processes make things more difficult. According to the interviews it is clear that personal contacts have a great significance during the R+D activities, without them in principal there is no success. Another characteristic is that there is a high degree of distrust. In Hungary there is an envious environment, people and scientists exclude to trust each other or to cooperate.

We found that responsible research and innovation is an unknown concept and its interpretation is very narrow. We can see a very low degree of cooperation between scientists and social scientists. They ignore the opportunity to increase this cooperation. Scientists follow only the ethical allowances and they exclude other solutions however there are other solutions. During our research we are experimenting to draw attention to these other solutions.

At the moment we are before the post-study interviews. After the post-study interviews we are going to compare them with the pre-study interviews and analyze the changes in thinking regarding responsible research and innovation. In the next few month we are going to visit another lab in our city to use the STIR methodology in order to get more information about the Hungarian characteristics.

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