Responsible Innovation

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Responsible Innovation

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Preface

When first hearing the term „responsible innovation", it is difficult to find out what it actually means: one has conjectures rather than an understanding about it and even those more familiar with the nature of innovation are at a loss what to think of this concept. After some contemplation, one will soon picture ideas or expectations regarding responsible innovation – but such thinking often deepens the mystery rather than correctly clarifies the meaning.

Putting it very simply, responsible innovation is the interpretation of sustainability in the context of the innovation policy. In the broadest sense, it is *commitment to preserving the future, which can get manifested in the responsible management of science and innovation in the present.* A transparent, interactive process *by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products.* This means that this expanded dimension of responsibility covers and requires the comprehensive and systematic examination of the environmental, social and ethical aspects of innovation.

The term itself refers to an approach which is spreading fast in the European Union and, according to expectations, *may become a central element of the 2014–2020-as programming period,* as the European Commission's most recent report, published in November 2013 under the title „*Responsible Research and Innovation (RRI), Science and Technology*", also shows.

Over the course of the past one and a half years, in the framework of the *FaRInn (Facilitating Responsible Innovation in SEE Countries – SEE/D/0252/1.3/X)* project, which was launched for the examination of the regional application of the concept, we have looked at the questions related to the term's definition, examined what key elements its application has and how responsible innovation can be put into practice in the regional units of our project partners. During our research work, we have managed to deliver the concept of responsible innovation to a large number of innovative actors and stakeholders in the region of Szeged University where, as a result, the approach has been translated into practical application. Among other results, the responsible innovation concept has been integrated into Csongrád County's 2014 – 2020 regional development strategy and operative programme.

On 19 May 2014, we organised a scientific conference under the title „*Innovation Related Social, Ethical and Environmental Challenges"* at the Faculty of Economics and Business Administration of Szeged University, participants being the representatives of different fields of science, where we were glad to see that our colleagues were open to integrating the cornerstones of responsible innovation into their work.

This book is designed to convey to the general public the ideas which the representatives of the individual fields of science have identified as the points of intersection between their respective research areas and responsible innovation. Our hopes are to bring the reader closer to understanding and accepting responsible innovation and that this concept will soon become integral to the everyday lives of the region's players.

Szeged, July 2014.

The Editors

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Addressing the Wicked Problem of Responsible Innovation through Design Thinking

Xavier Pavie[1] – Daphné Carthy[2]

In this paper, we present the results of a study conducted with several major actors from the French financial industry, which aimed at developing a process for developing responsible innovations by deploying a Design Thinking method. We begin by presenting the context for the study which includes a brief description of our approach for understanding and exploring the issues raised by responsible innovation. This first part also includes a comparative analysis of the characteristics of RI (responsible innovation) and wicked problems in order to establish a potential link between the two concepts. Secondly, the Design Thinking method is introduced as a potentially suitable approach for addressing wicked problems and thus, RI. Finally, the process for developing responsible products and services which was developed throughout the study is presented.

Keywords: Responsible Innovation, Design Thinking, Wicked Problem

1. Introduction

A relatively new, yet defining concept of the 21st century, responsible innovation is currently being developed by a multitude of contributors from a wide range of disciplines, from science and technology to philosophy and humanities. So far, the main focus of the RI debate has been geared towards the emergence of new technologies (Blok–Lemmens 2014), which may bring societal risks completely unknown to us, thereby justifying the need for a responsible development (von Schomberg 2014). Many projects have been launched and sponsored by the European Commission[3] (notably as part of the ongoing Horizon 2020 programme) over the past few years, aiming to develop a widely accepted definition of the concept in order to guide policy-makers, organisations and all stakeholders affected by these innovations. Howev-

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[3] GREAT (Governance for REsponsible innovATion); KARIM (Knowledge Acceleration Responsible Innovation Meta-network); Responsibility: Global Model and Observatory for International Responsible Research and Innovation Coordination; FaRInn (Facilitating Responsible Innovation in SEE countries), to name but a few.

er, while RI is increasingly considered to be an imperative for organisations and the literature is growing at a remarkable pace, few contributions have addressed the operational integration of the concept. Moreover, some research has hinted at the 'wickedness' of responsible innovation (Blok–Lemmens 2014). Is it therefore, on the one hand, realistic to imagine a society and marketplace where RI guarantees the required balance between responsibility and competitiveness? On another hand, could responsibility potentially become a lever of creativity?

This paper will analyse the similarities between responsible innovation and wicked problems, thereby establishing whether RI can be considered 'wicked' in the first place. Secondly, design thinking will be introduced as a tool for addressing wicked problems and, thus potentially, responsible innovation. Finally, we will describe the process for developing responsible innovation which was constructed with the design thinking method during the project. It is important to note that the process for developing responsible products and services is only one part of the full RI process required for integrating the RI strategy across the organisation as a whole (Pavie–Carthy 2013). Indeed, the full process is made up of the following five stages: *1. comply with the law; 2. anticipate future legal requirements; 3. treat the value chain as an ecosystem; 4. innovate responsibly; 5. lead the change.*

The study presented in this paper resulted from a project initiated in 2011 in response to a need expressed by several French financial institutions in search of an operational process for integrating RI. The aim of the project was to develop an effective tool to assist organisations in the development of responsible products and services. This project was unique in the sense that it led to the production of a management method for the responsible innovation process of banks and insurance companies. The methodology was largely based on a design thinking approach and involved the creation of a "co-opetitive" working group made up of actors from a sector which is generally known for its extreme competitiveness.

2. Context

2.1. The emergence of a concept

From the first appearance of sustainability as an element of innovation in the literature of the mid-1990s (Fussler–James 1996, Godin 2008) – which followed the introduction of the Sustainable Development theory in the late 1980s (Brundtland 1987) – to the ongoing development of the sustainable innovation concept, it is clear that innovation has become inherently suspect. This in turn has given rise to the concept of responsible innovation which we wish to define as *"an iterative development process which combines a step-by-step impact analysis of a project with the imperatives of creativity stimulation throughout development phases. Social, economic and environmental performance impacts are monitored throughout the entire*

lifecycle and corrective actions are anticipated accordingly through re-integration into previous development phases" (Pavie et al. 2014).

The emerging urgency for a consideration of the practical applicability (Blok–Lemmens 2014) of the concept of responsible innovation was reflected in the study presented in this paper. Indeed, the participating French institutions expressed their need for an operational process of integration of responsible innovation which would fulfill their responsibility criteria and foster the level of creativity needed to spur innovation. This highlights a current gap in the RI literature concerning a process for implementing an RI strategy across an organisation.

As such, we believe that it is important to dissociate responsible innovation from the concept of 'responsible research and innovation' (or RRI, a central theme in the context of the current Horizon 2020 European programme). Indeed, the latter's widely used definition describes *"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)"* (von Schomberg 2011). However, applying responsibility to a research context will raise issues different to the ones faced in the context of innovation. In fact, while research impetus is generally characterized by its epistemic significance, the goal of innovation is to create value for the organization in a competitive context, with the ultimate objective of releasing and commercializing a finished product. Thus, the fundamental difference in the end purpose of each concept defines the separation between responsible innovation – as an operational process – and RRI – as a theoretical concept which is yet to be accurately adapted for organizations in need of practical tools aimed at supporting innovators in their day-to-day activities.

Three axes contribute to a better identification and understanding of the issues raised by responsible innovation (Pavie 2012a, Pavie et al. 2014). Firstly, the questioning of the solutions to develop in response to individual needs suggests adopting a slightly more philosophical approach to business in general and more precisely to the answer of certain consumer needs. Secondly, the monitoring of the direct impacts of innovation on the consumer requires the effective management of the innovation throughout the entire lifecycle to ensure that any negative impacts on the consumer are identified and corrective action is taken accordingly. Thirdly, the consideration of the indirect impacts of the innovation on the surrounding social, economic and environmental factors aims at guaranteeing that the ecosystem as a whole is taken into account in the impact analysis. This is carried out throughout the development of the project and continues once it has been launched on the market. In some instances, responsible innovation may be considered an evolution or modernisation of the sustainable development theory, since it incorporates the issues emerging within the socio-economic and political landscape of the 21st century. Indeed, while the Brundtland report was suited to the society at the time it was issued, it does not

include a specification of the final objectives of innovations nor the strategic aspects and consequences of organisations' activities. Since innovation plays such a critical role in shaping society at a social, economic and environmental level, these are critical factors which can no longer be overlooked (Pavie 2012a).

2.2. Responsible innovation, a new wicked problem?

The theories and issues linked to the sustainable development concept are generally associated with the characteristics attributed to wicked problems (Norton 2005, Raffaelle et al. 2010, Brundiers–Wiek 2010). First introduced by Rittel and Weber in 1973, wicked problems were used to describe untamed problems which are difficult to pin down, highly complex and not amenable for concrete solutions. They represent complex systems in which cause and effect relations are uncertain or unknown. Rittel and Webber developed a set of characteristics to define the complex concept more accurately; these include the fact that every wicked problem can be considered to be a symptom of another problem; there is no immediate and no ultimate test of a solution to a wicked problem, however every potential solution to a wicked problem is also a 'one-shot' operation, as there is no opportunity to learn by trial and error: every attempt counts significantly and the existence of a discrepancy representing a wicked problem can be explained in numerous ways. Part of the reason for the complexity of wicked problems is linked to the multitude of stakeholders with diverging motives who are involved in solving these problems. Due to their differing backgrounds, perspectives and motivations, their individual interpretation of the problem varies greatly (Kreuter et al. 2004).

The same complexity applies to responsible innovation since the implementation of an RI strategy in any sector and organisation is carried out through a process involving a multitude of actors, each with their own specificities and characteristics who will wish to address certain issues very differently from the way employed by their collaborators or colleagues (Blok–Lemmens 2014). It is important to highlight the competitive landscape surrounding innovation which adds to the 'wicked' nature of RI. It therefore follows that responsible innovation can be described and treated as a wicked problem since scratching the surface to solve an issue inevitably reveals new arising issues to be addressed.

2.3. Responsible innovation: a wicked problem in an organisational context

As described earlier, multiple stakeholders are involved in a responsible innovation process. Furthermore, the wicked problem of responsible innovation is defined by its high level of uncertainty with regards to the outcome (Batie 2008) or in the case of innovation: the final product or service launched on the market. This uncertainty also concerns the potential causes and effects underlying the problem linked to the innovation project, whether throughout the development phases of the latter or even at the post-launch phase. As mentioned earlier, the wicked problem of responsible in-

novation is set in a highly competitive context, subject to intense market pressure, thereby adding to its complexity. Since the definition of a wicked problem tends to change over time as potential solutions are being formulated, tested and adapted, it appears that they are never solved (Conklin 2006), but rather become better or worse (Rittel–Webber 1973). However, how can responsible innovation – a necessity for organisations (Pavie 2012b) – translate into an operational process aiming at combining responsibility and performance?

3. Methodology: a new approach for solving the wicked problem of responsible innovation through design thinking

3.1. Definition, general scope and benefits of design thinking

Design thinking is a strategy based on user-centric design methods and principles which first appeared in the 80s and was developed and made popular by IDEO's David Kelley and Tim Brown over the late 90s (Kelley–Littman 2001). In fact, the widely used definition of design thinking was suggested by IDEO's CEO: *"a discipline that uses the designer's sensibility and methods to match people's needs with what is technologically feasible and what a viable business strategy can concert into customer value and market opportunity"* (Brown 2008).

This creative discipline is incorporated into the innovation process in order to develop specific solutions to address complex issues. Design thinking differs from industrial design – which typically tends to apply to the manufacturing sector – through several intrinsic characteristics including its vision and approach to innovation, its experiential, iterative and multidisciplinary method as well as the wide range of sector within which it can be applied. The current revival of interest for design thinking is justified by its effective method for creating concrete solutions to address organisations' new needs and requirements in terms of innovation.

Design thinking's pioneering approach appears to be particularly effective and relevant in terms of solving wicked problems, especially in terms of addressing the operational integration of responsible innovation. Indeed, design thinking represents a unique combination of scientific and technical rigour; an understanding of the needs of human beings and society in general; a clear consideration for the economic imperatives of an organisation and also provides a basis for monitoring the environmental impact of a project.

Today, design thinking has answered the wishes for the progress and development of design which were expressed by Victor Papanek in the 70s. Indeed, at that time, he already hoped for a discipline of design which would be an "innovative, highly creative, cross-disciplinary tool responsive to the needs of men. It must be more research-oriented and we must stop defiling the earth itself with poorly-designed objects and structures" (Papanek 1971).

Design thinking has many benefits, including its ability to articulate itself around and adapt to the organisation's innovation process. There are five main objectives to this method, including the opening up of the innovation process to include customers, stakeholders and experts capable of providing guidance with regards to potential impacts; the improved understanding of customer needs and expectations, by involving these throughout the process; the full use and management of new distribution channels through the cross-disciplinary work; the reduction of risks posed by innovations by making an impact monitoring system central to the innovation process and the redefined role of organizations as actors actively shaping the future of society.

3.2. Explanation of design thinking method for developing responsible innovations

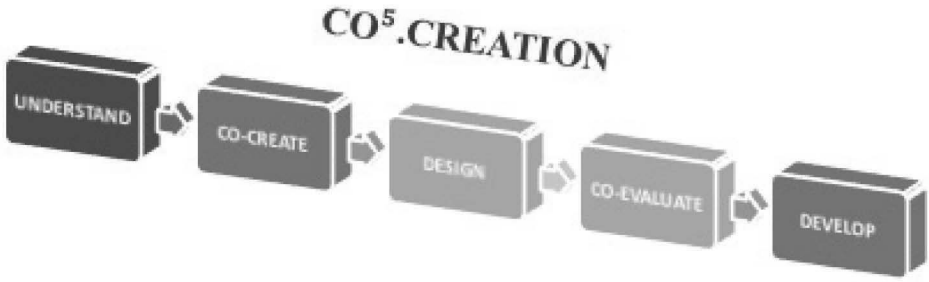
Design thinking has been proved in the past to be an effective tool for solving "wicked problems" (Zimmerman et al. 2010, Nelson 1994, Coyne 2005), for which, as mentioned earlier, there is no simple or straight forward method of solution (Rittel–Webber 1973). The same definition could be used to describe responsible innovation as it raises more questions in the process of trying to provide answers to the already existing issues.

Hence, through a multidisciplinary approach, design thinking tackles wicked problems through a three-pronged approach: desirability (human needs); viability (business needs) and feasibility (technical needs) (Brown 2008). The first point is concerned with putting the users and stakeholders at the centre of development, by assessing whether the solution is genuinely useful and therefore shows empathy towards users by optimising ease of use. The second point addresses the business requirements for developing a specific solution, in terms of adequate resources and know-how as well as previsions on profitability and ROI. The third point deals with the technical needs of the solution, in other words: can we implement the solution rapidly? Is it easy to maintain? Is it consistent with regards to our current situation?

Traditionally associated with the downstream innovation process of products and services and considered to simply provide an attractive packaging for the client thereby providing limited results in terms of value creation, design thinking has now become an integral part of the innovation process. Indeed, it plays a strategic role in value creation through the creation of ideas that better answer the expectations and needs of consumers.

Design thinking methods vary from one organisation to another and can be adapted accordingly to suit specific sectors. The method used in this project was developed by Altran Pr[i]me and is made up of five stages, as illustrated in Figure 1.

Figure 1. CO5. Création



Source: Altran Pr[i]me (2014)

The method used consisted of the following elements:

1. The creation of a multidisciplinary group in order to generate a global vision of the problem at hand, which involves the integration of responsibility into the innovation process of organisations (focusing on the financial sector, while bearing in mind the need to keep the process adaptable and applicable to other sectors). As such, the working group consisted of philosophers, academics, anthropologists, designers, banking and insurance sector specialists as well as end users.
2. The separation of the theoretical and practical dimensions of responsible innovation to ensure that each part was treated accordingly and simultaneously. As such, the theoretical approach consisted in an analysis of existing research surveys and a literature review to conduct a debate surrounding the topic of innovation and philosophy, while the practical approach, in parallel, consisted in conducting a series of ethnological interviews with regular bank and insurance customers and industry specialists, to assess their views on financial institutions, the industry as a whole and the role of innovation and responsibility within that sector.
3. Following the background work and on the basis of resulting syntheses, four workshops were organised to process, exchange and debate surrounding the information and with regards to the issues raised:
   - *Workshop 1* was dedicated to the exact formulation and wording of the issues being treated as well as the definition of the parameter to which the responsible innovation method would be applicable. This facilitated the development of the first draft for the responsible innovation process.
   - *Workshop 2* was dedicated to the research of new service concepts which would be deemed responsible. This workshop was essentially

centred on the final user and resulted in the development of twelve different concepts.

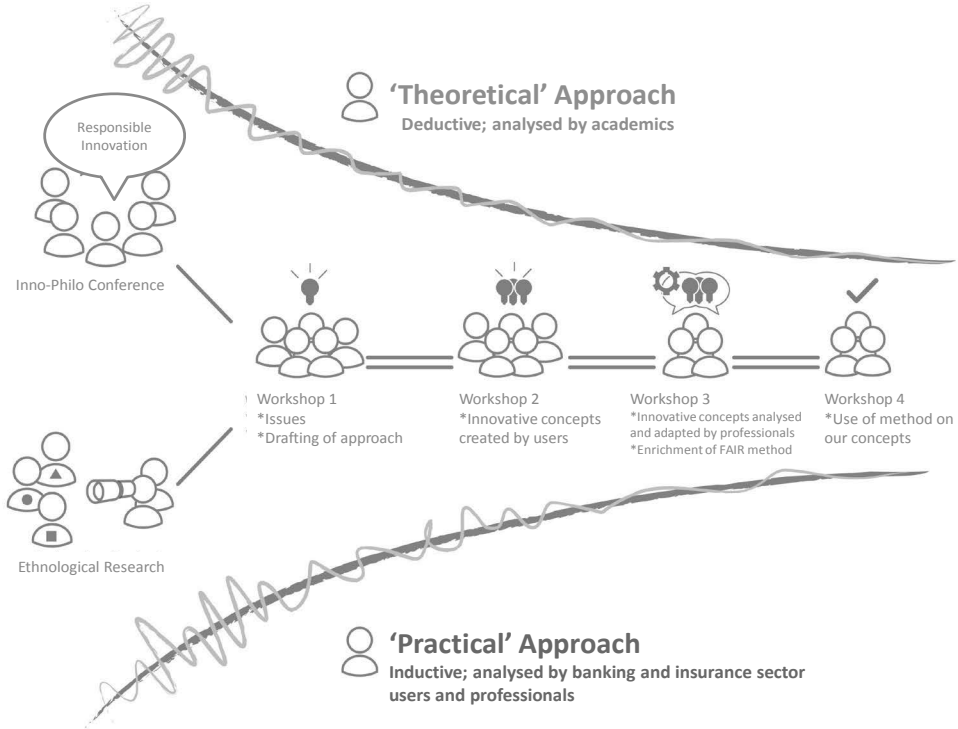
- *Workshop 3* was dedicated to the analysis of the concepts developed in the previous workshop by confronting them to the first draft of the responsible innovation process derived from Workshop 1. This session allowed both the refinement of the process (creation of a responsible innovation process including the evaluation of impacts according to social, economic and environmental criteria) and the further development of the service concepts. Three concepts were then selected as those that were considered most likely to be developed into real responsible services.
- *Workshop 4* consisted in testing the three service concepts by evaluating them in terms of responsible innovation, through the responsible innovation process and its impact analysis based on the social, economic and environmental criteria. This final workshop also enabled the finalisation of the responsible innovation process, as potential practical drawbacks were identified throughout the analysis of the service concepts.

3.3. Design Thinking's contribution to an integration of responsible innovation

The main objective set at the beginning of the project was to design a method capable of supporting the development of responsible innovations in the banking and insurance sector while taking into account social, economic and environmental impacts linked to the new product or service. The design thinking method aimed to provide a process for assessing an innovation in the light of the three axes of responsible innovation and the principle of responsibility, as well as to identify potential innovative and responsible products and services. The design thinking method facilitated the merging of the necessary theoretical and practical approaches to address responsible innovation as a wicked problem.

Figure 2 illustrates the simultaneous approaches of the theoretical and practical elements of the method. On the one hand, academics addressed the issue of defining responsible innovation and how the responsibility of an innovation might be measured in order to feed that information into the analysis of the innovation process based on the three axes of responsible innovation. On the other hand, anthropologists conducted surveys with both financial sector professionals and customers to examine their interpretation of responsibility and how an innovation could become responsible from their perspective. The results of both approaches were then analysed conjointly in order to create a process for the assessment of an innovation in light of the concept of responsibility and the identification of potential innovative and responsible products and services.

Figure 2. Illustration of the design thinking method for developing a responsible innovation process

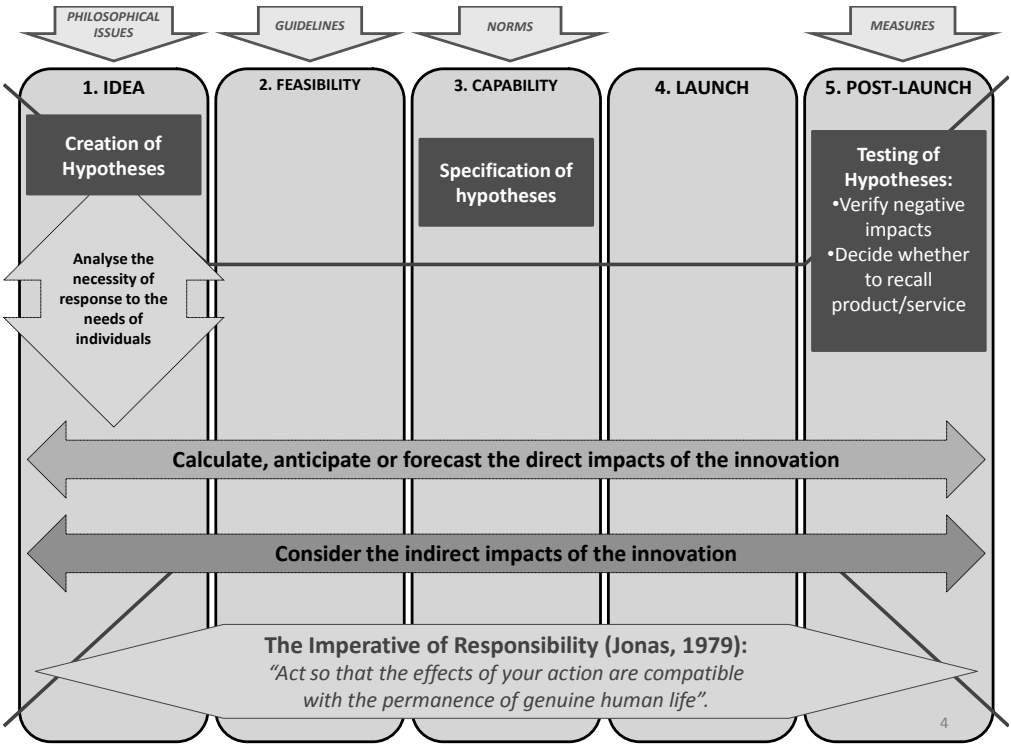


Source: Altran Pr[i]me (2014)

4. Results: a process for developing responsible products and services

As illustrated in Figure 3, a classic five-step innovation process was used as the basis for integrating the principle of responsibility at the heart of the responsible innovation theory. The three axes of responsible innovation were positioned by the participants at different stages of the process to highlight where each question should be addressed. As such, it was agreed that the first axis concerned with questioning whether to answer a particular consumer need should be addressed as early as possible, ie. around the 'Idea' phase. The two remaining axes concerned with direct and indirect impacts were positioned throughout the whole process, thereby representing the need to question all impacts at all stages of the lifecycle of the innovation. In order to address the uncertainty of innovation and its impacts, an iterative system of hypotheses was suggested as a way of evaluating potential risk factors. These hypotheses should be formulated throughout the initial development phases in order to be tested once the innovation has been launched.

Figure 3. An integration of the axes of responsible innovation

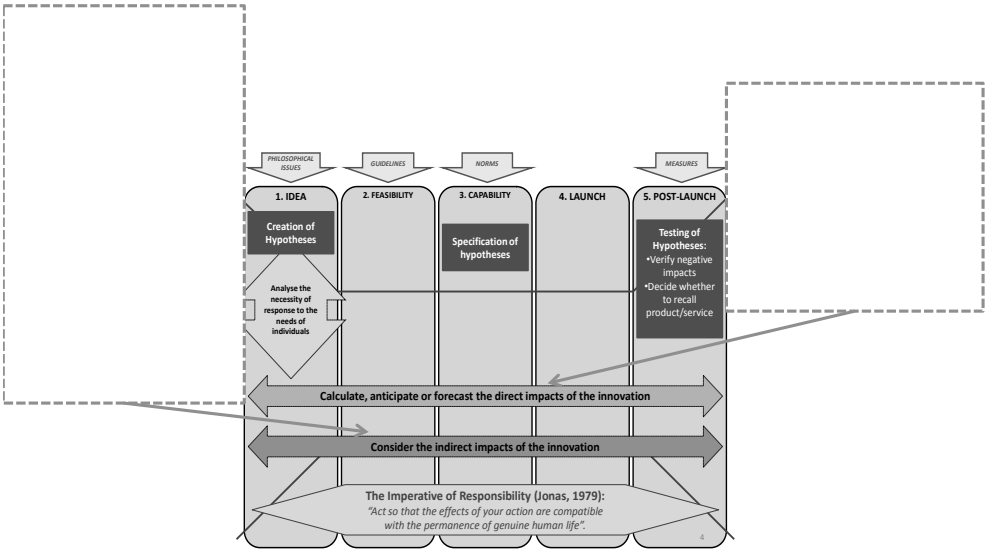


Source: Pavie–Carthy (2013)

Each stage of the process was then attributed a sub-title to further define the purpose of that particular phase in the development of the innovation. As such, the idea phase was labeled as the stage where 'philosophical issues' should be addressed in order to establish whether or not to answer a consumer need. An initial evaluation of potential social, economic and environmental impacts also takes place as the first set of risk hypotheses are created. The feasibility phase was labeled as the stage where the analysis of potential social, economic and environmental impacts should serve as 'guidelines' to steer the further development of the project in the right direction. The capability stage was labeled 'norms' in order to include a verification of the latter with regards to social, economic and environmental impacts. Furthermore, this phase should include a specification of the risk hypotheses as the project is becoming more defined. Additional hypotheses may also need to be added while others may no longer be relevant at that stage. The post-launch stage was labeled 'measures' to ensure that the risk hypotheses are tested and verified once the project

has been launched, thereby facilitating an increased control over the lifecycle as a whole. The results obtained from testing the risk hypotheses should support management in their decision to recall or not a product if negative impacts are deemed too harmful with regards to social, economic, environmental factors or indeed on the consumers themselves.

Figure 4. Monitoring the direct and indirect impacts of the innovation

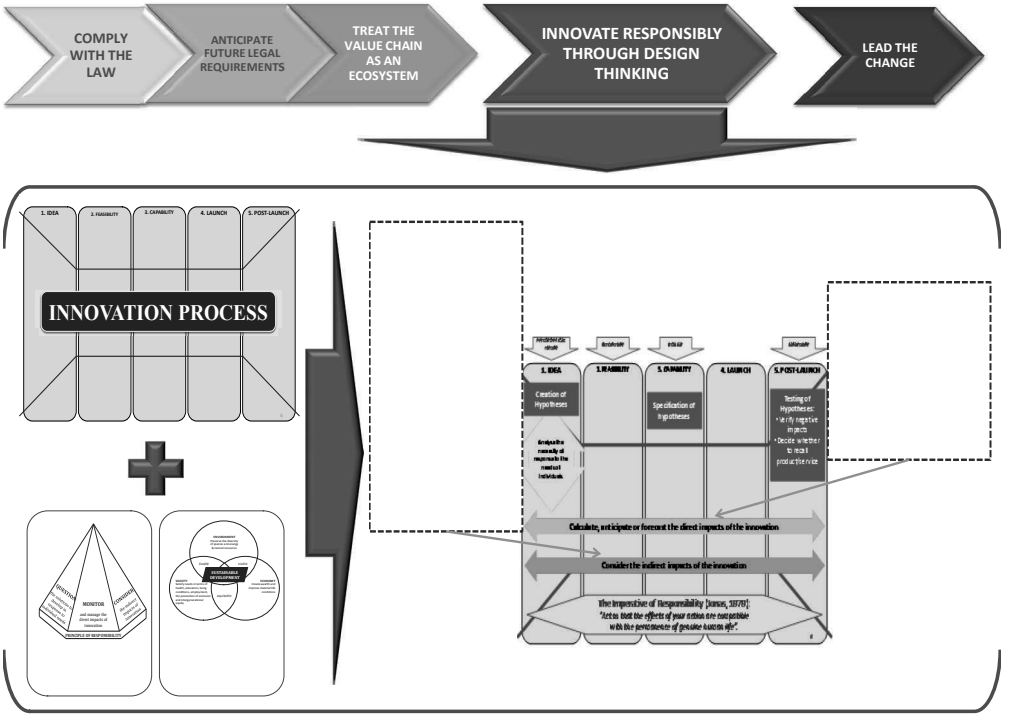


Source: Authors' own construction

It was agreed during the workshops that the impact criteria should be separated into two categories: impacts on the user (direct) and impacts on the ecosystem as a whole (indirect) through the inclusion of social, economic and environmental factors. Figure 4 features examples of such direct impacts (eg. client health) and indirect impacts on social (eg. impacts on HR development), economic (eg. impacts on employment level) and environmental factors (eg. ecological footprint). While direct impacts are focused on the user in terms of his or her physical and mental health, behavior as a citizen and/or a consumer, indirect impacts concern the social, economic and environmental factors linked to the innovation. It is important to note that the list of criteria to be tested is non-exhaustive. Priority should be given to the criteria which are particularly relevant to the sector which the organization operates in. The social, economic and environmental factor criteria most relevant to the financial industry were selected and placed by the participants of the study at different phases of the innovation process. Hypotheses are an integrated part of the process as they are used to represent impacts which cannot be accurately measured

prior to the launch phases. These are formulated and specified throughout the development phases to be tested once the product has been launched (post-launch).

Figure 5. The role of design thinking within a responsible innovation strategy



Source: Pavie–Carthy 2013

It was therefore agreed that a responsible innovation process should be iterative and include a combination of these direct and indirect impacts. Its iterative structure should facilitate a swift reintegration of the project into a previous development phase in order to address particular issues arising throughout the process with regards to design and responsibility criteria. The design thinking method helps to combine the need for creativity with the monitoring of impacts; the need for responsibility is thus used as a lever for developing better innovations which are at the service of citizens and not the other way around. One of the main objectives of the responsible innovation process is to guarantee that the creativity of the multidisciplinary team is unleashed fully, thereby ensuring that the need for responsibility does not stifle the process for generating ideas. In that regard, design thinking can gear the brainstorming session and the reflection of individuals toward answering a particular consumer need, while considering the various responsibility criteria.

As mentioned earlier, design thinking's contribution to a responsible innovation strategy occurs in the development of products and services. The latter is a component part of an organizational process for integrating responsibility at all levels of the company, as illustrated in Figure 5.

5. Conclusion

Social, economic and environmental criteria should be adapted depending on the project; this once again highlights the importance of a multidisciplinary team to ensure varying perspectives can contribute to the analysis. For instance, a social criterion could address the design of the product and question whether it would encourage other responsible activities, while an economic criterion could question the impact of the potential innovation on the level of employment and an environmental criterion could raise the issue of the project's ecological footprint, both throughout development phases and once the final product has been launched. Various questions arise at different steps of the process, as the type of information required will vary depending on the progress made by the project. Figure 5 illustrates the process for developing responsible innovations through design thinking. It also positions it as a sub-process occurring at the fourth stage (*'Innovate responsibly through Design Thinking'*) of the full organisation's strategic RI integration process.

Issues linked to sustainable development are generally referred to as wicked problems. This is partly due to the fact that there generally is no black or white answer to such issues since multiple stakeholders are involved, all with their own diverging motives and perspectives. Responsible innovation is evidently linked to questions surrounding sustainability as it takes into account the potential impacts of an innovation whether on the consumers themselves and/or on a social, economic and environmental level. Indeed, it requires a process which monitors and manages impacts throughout the innovation's lifecycle as a whole. At the same time, how can managers ensure that the need for responsibility does not become a major constraint for innovation activities? How can they continue to stimulate the creativity needed in their team to spur innovation, while at the same time keeping control over impacts? Although research surrounding the RI concept is growing at a remarkable rate, organisations are still lacking a concrete process for implementing a strategy to ensure responsibility and performance objectives are met.

Design thinking has been proven an effective method in the past for addressing wicked problems. Indeed, its multidisciplinary approach allows a broad overview of the issue at hand from various perspectives. The designer then gears the reflection of the group towards addressing the problem. As such, the varying perspectives of all stakeholders were taken into account in the design of the RI process. Developing marketable and responsible products and services is a wicked problem in

itself which benefits greatly from a design thinking approach, as demonstrated in this project.

The RI methodology developed throughout the project encapsulates several advantages for the organisation. On the one hand, it is designed to be used complementarily to the organisation's existing or 'classic' innovation process. This ensures that the entire lifecycle of the innovation is taken into account. On the other hand, despite having been developed in the context of the finance sector, the RI process is perfectly adaptable to other sectors and organisational structures.

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On the responsibility of experience economy: what's wrong with that Prezi is not a cure for cancer?

Norbert Buzás[1]

This paper discusses on what the role of the experience economy would be, especially the social media and mobile applications' development in a second dot-com bubble formation. The incredible expansion of experience economy causes obvious distortions in the evaluation of the companies and it may have other effects on labour and investment markets. We also looked for answers how the government of a small and closed economy as in Hungary could steer the process towards a sustainable innovation ecosystem.

Keywords: experience economy, dot-com bubble, company valuation, investment market

1. Introduction

The customer behaviour in the society was acknowledged by several authors. Toffler (1971) has already spoken about the upcoming „experiental industry" in which the people would be willing to allocate high percentage of their incomes to live amazing experiences. Hoolbrok and Hirschmann (1982) discussed first the experiential aspects of consumption describing the amusement linked to services. A decade later, Schulze (1992) raised the idea of the „experience society" in which people changes focus from external to internal consumption. The term „experience economy" was introduced by Pine and Gilmore (1999) as the identification tag of the next economy following the most recent service economy. They argued memorable moments (the experience) of the consumption became the product itself and experience business charges for the feeling customers get by engaging it.

By the spread of the Internet and smartphones, social media has become the largest segment of experience economy, creating incredible size of populations as users' communities. As it is shown in the Table 1, if the Facebook was a country, it would have the second-highest population between China and India. Moreover, there are only four geographically determined populations among TOP10; all the rest belongs to social media users.

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The rise of web-mobile experience economy has rearranged the recruiting arena. In start-up land the social media and mobile application developer companies seem to be winning the recruiting race, and while the traditional complaint of top quality schools has been that the best talented guys go to Wall Street, a new one is developing: why do these smart, well-trained youngsters, who could help cure cancer want to work for a web-mobile amusement business?

Table 1. TOP10 populations in the world

Rank	Population	Size (million)
1.	China	1385
2.	Facebook	1280
3.	India	1211
4.	WhatsApp	450
5.	USA	315
6.	Tencent	300
7.	Google+	300
8.	LinkedIn	300
9.	Twitter	255
10.	Indonesia	251

Sources: Countries: http://worldpopulationreview.com/countries
Social media: http://expandedramblings.com/index.php/resource-how-many-people-use-the-top-social-media/#.U378MtxVhbU

As Edwards (2013) has recently pointed out, due to the extraordinary growth of web-mobile experience economy, technology market is in a bubble. Deal prices are unjustifiably high and revenues do not confirm the billion dollar valuations. Such overvaluation of social media can be demonstrated by the comparison of two recent transactions: Novartis and GlaxoSmithKline, two of the world's top drug makers reshaped their businesses by trading assets to each other in April, 2014. As a part of this deal, Novartis bought GSK's complete oncology portfolio (17 new drug candidates in 26 indications) for USD 14.5 billion plus another USD 1.5 billion that depends on the results of a trial in melanoma. Two months earlier Facebook acquired the most popular mobile messaging WhatsApp for USD 19.0 billion (grabbing it from Google who has also made an offer of USD 10 billion). WhatsApp deal is worth more than what Facebook raised in its own IPO in 2012. It is larger than any that Google, Microsoft or Apple has ever done. Considering the biggest challenges for mankind to survive, how can it be explained to the society that a free

instant messenger is worth 30% more than 17 promising cancer drugs on clinical trial?

Looking at the long-term effect of the transaction above, we can conclude it contradicts with two elements of the recently spread Responsible Innovation (RI) concept: sustainability and social desirability (von Schomberg 2013). Notwithstanding both dimensions can only be evaluated in the longer term, it can easily be recognized that this exceptional growth of the experience-based market cannot be sustainable. Due to the very low interest rates (around zero) in global banking, savings are diminished and people favourably invest their money into fast growing businesses such as web-mobile experience economy, expanding the bubble. The other factor, social desirability shall be evaluated in terms of intergenerational context: the responsibility to ensure our quality of life does not compromise the chance for future generations to enjoy a comparable quality of life. This means if the very quickly inflating web-mobile experience economy diverts disproportionate resources from developments with high impact on the future of society, future generations will have less new healthcare and environmental invention with lack of chance to sustain the quality of life.

2. Results and discussion

In order to get better insight into the consequences of web-mobile business to the global economy, we examined five hypothetic statements in detail.

2.1. The market for overvalued companies has been created, which threatens with a second dot-com bubble[2]

Although the Facebook-WhatsApp deal in term of amount is totally unique, it is not a one-off case to pay USD 1 billion or more for a company without profit in experience economy. Table 2 shows some famous recent deals in web-mobile sector. Among the cases presented, the most interesting is the acquisition of Viber (which provides, similarly to WhatsApp, free messaging and – in addition – VoIP services) by Rakuten, a Japanese e-commerce platform. The deal was announced only one week after Facebook-WhatsApp acquisition was disclosed, and Facebook could have acquired Viber twenty-one times from the money spent on WhatsApp. Since

[2] Dot-com bubble is a period covering roughly 1997 – 2001. In the bloating part, millions of companies (with "e-"prefix or".com" at the end) in the Internet business were founded and got their stock prizes seriously increased without return. The promises of future profits, stock speculations and unreal valuations by venture capital funds feed the fire of bubble. The collapse occurred during 1999 – 2001. Many companies failed completely, others lost large portion of their market value. One of the most famous examples is Broadcast.com, which was acquired by Yahoo! for USD 5.9 billion. The site no longer exists and redirects to Yahoo!'s home page.

both acquired are without profit, services are similar and Viber has advanced service by the free VoIP call, there must be some non-obvious reasons behind the deal. First should be, which is not unique at all, that WhatsApp has been growing at an incredible rate, doubling its users every year and now it has more than 450 million active users. It can be said, Facebook purchased those extremely large number of users at USD 42.22 each.[3] Second, as Gans (2014) pointed out, is the strategic compatibility. Facebook is known as a trusted social media, which means that connections between individuals are by mutual assent. Its principal pursuit is to give a tool to "stay in touch" with network members instead of "get in touch". WhatsApp is the most compatible messaging platform to this philosophy of trusted communications. In order to last relationship and avoid spams and unrequested messages, WhatsApp also grants access to people you trust. Gans (2014) suspected "there was a meeting of the minds that led to this merger".

Table 2. Some acquisitions of companies in web-mobile sector

Acquired company	Acquirer	Acquisition date	Price (million USD)
YouTube	Google	2006	1.650
Tumblr	Yahoo	2013	1.100
Instagram	Facebook	2012	1.000
Viber	Rakuten	2014	900
Sold.	Dropbox	2013	200

Source: Edited by the author

When we examine the recent acquisitions and investments, we may find three types of hardly justifiable overvaluations (Edwards 2013):

Companies with broken business models raise new investments
Typical example of this category is Fab.com. In December 2010, Fabulis.com, a social network for gay men turned into Fab.com, a flash sales site. Fab's CEO, Jason Goldberg being inspired by social networks thought he could create a new service for the gay community by Fabulis. But the growth of the daily deals business convinced him to turn the ship in another direction and create a Groupon[4]-like platform

[3] As Krantz (2014) has recently concluded "compared to the USD 141 per user valuation at Facebook, WhatsApp was cheap. In fact, the valuation paid for WhatsApp is lower than the per-user price on most other Internet darlings. Investors are paying $85 per user at professional networking firm LinkedIn, $52 per user at review site Yelp and $125 per user of online messaging service Twitter."
[4] Groupon (group coupon) is offering daily deals at restaurants, cinemas, sport events, retailers and many more service providers. It was launched in November 2008 in Chicago.

for gays. Just four months later the next pivot was done: the Fab.com became a top destination for quality-designed products at below retails prices. Notwithstanding the second pivot and the completely different challenges facing the staff with the movement from a gay-focused portal to a designed-by-customer site, Fab.com could recently raise USD 165 million in new investment last year. Goldberg was able to accomplish this even though 440 people were laid off at the last pivot.

Companies valued higher than their revenues justify

There are many well-known examples of this category. In January 2014, cloud storage and sync provider Dropbox raised about USD 250 million at an estimated company value of USD 10 billion. Dropbox revenue for 2013 was USD 800 million. Pinterest, the largest social bookmarking site where users collect and share photos of their favourite events, interests and hobbies recently raised USD 225 million in a new investment round, at a company value of USD 3.8 billion. Its revenue is estimated as a couple of 10 million in USD.

Both fictional valuations would only be based on the notion that the company could be sold or go public at that price. This trend can be observed in almost all social network companies operating with freemium (free + premium) business model. Valuations are not based on justifiable returns, but on the foretold price at next round of investment or IPO. This process results in the continuous growth of the bubble, because even the extremely huge number of early users (using the service free) does not guarantee that premium level accounts will bring the predicted revenue. But it should be finished once and if the company is unable to generate enough revenue at the end, the last investor or the owners of the shares will lose the incredible amount of money representing the distance between the real and inflated values of such companies.

Companies with no revenue at all are ridiculously valued

The most extreme example is that of Snapchat in this category. Snapchat is a self-distracting photo messaging application in which users can take photos, record videos, add text and drawings, and send them to a controlled list of recipients who can view them for a couple of seconds (adjustable limit is 10 seconds now) only. After that they will delete themselves from the recipient's device and from Snapchat's servers. Snapchat has no revenue at all, and it is hard to imagine how money can be made with a service without preserve imprint of transferred pieces.

In spite of that, Snapchat shocked the tech community late last year when it turned down a USD 3 billion acquisition offer in cash from Facebook. Many people even suspected that the founders went out of their minds, just a better offer was expected which would provide long-term gains for Spiegel and Murphy. Not much later Chinese e-commerce giant Tencent Holdings offered to lead an investment that would value the two-year-old Snapchat at USD 4 billion.

Snapchat and Tencent have perfect synergy. The Chinese company runs sort of messaging mobile applications in Asia with over 800 million active users. Tencent could also provide Snapchat with a path into China, where most US-based social media and mobile application companies have struggled in the face of competing native service-providers and strict government regulations.

2.2. Entrepreneurial frenzy overwhelms the web-mobile experience economy

The deals listed above with unrealistic valuation reinvigorated the web-mobile experience economy. New mobile applications developing companies were formed one after another to see if they will be the next acquisition targets of Google or Facebook. According to freemium model operation, users began to gather to demonstrate the viability of their business model.

However, as the recently published Quantcast (2014) report – based on web traffic data from the more than 100 million sites Quantcast monitors – shows, the explosion in the market for mobile applications is an illusion. Of the one million mobile applications for sale on both Android and iOS, Quantcast found that only 1.000 of them (just one per thousand) have more than 50.000 users, which can be considered as the minimum barrier to enter this market. According to Quantcast, 83 percent of people use less than 10 applications regularly. Accordingly it can be said the market for mobile applications is a small group of social media tools and shopping applications that we use frequently, surrounded by a shoreless ocean of trash we never get to.

2.3. Unrealistic compensation packages rearrange the labour market

Unreal company values resulted in expensive wages also. Unemployment rate in the tech sector is very low; the leading companies recruit the probably best and surely best-paid-ever key employees. As Edwards (2013) referred, Vice President of Engineering at Twitter, Chris Fry is paid more than the chairman of the company's board. Mike Schroepfer, who is in the same position at Facebook as Fry, got USD 24.4 million in shares when he joined. Start-up companies used to offer extravagant cars to lease for the coveted key employees and sign-on bonuses for creative dropouts.

The flow-chart on Figure 1 demonstrates how the absurd compensation packages resulting from the unrealistic company valuation can rearrange the labour markets.

Labour market rearranges first the vicinity of the company, because by the higher packages offered, overvalued companies drain the skilled manpower from competitors. The growth obtained from the acquired highly qualified labour force leads to two parallel processes. First, the attractive compensation packages discussed above serve as magnet to the relevant professionals working in other parts of the

world and begin a flow of highly skilled labour force to the power centres of experience economy from around the world.

On the other hand, successful companies are starting the global expansion and their subsidiaries with the help of extreme compensation packages attract the local champions, rearranging thereby the labour market in the vicinity of the subsidiaries. For instance, at the Hungarian affiliation of the word leading presentation software developer, Prezi.com the newcomers' salaries are the industry average supplemented by free lunch and beverage consumption and in-house entertainments (e.g. game room).

Figure 1. Consequences of company valuation to the labour markets

Source: Edited by the author

2.4. Investors turn to the experience economy because of the lower risk and higher return

When looking at U.S. investment processes taking place in the technology regions (Figure 2), we see the following. In Silicon Valley, which has in terms of processes always been an indicator, number and volume of IT investments has reached again the state before the dotcom bubble burst.

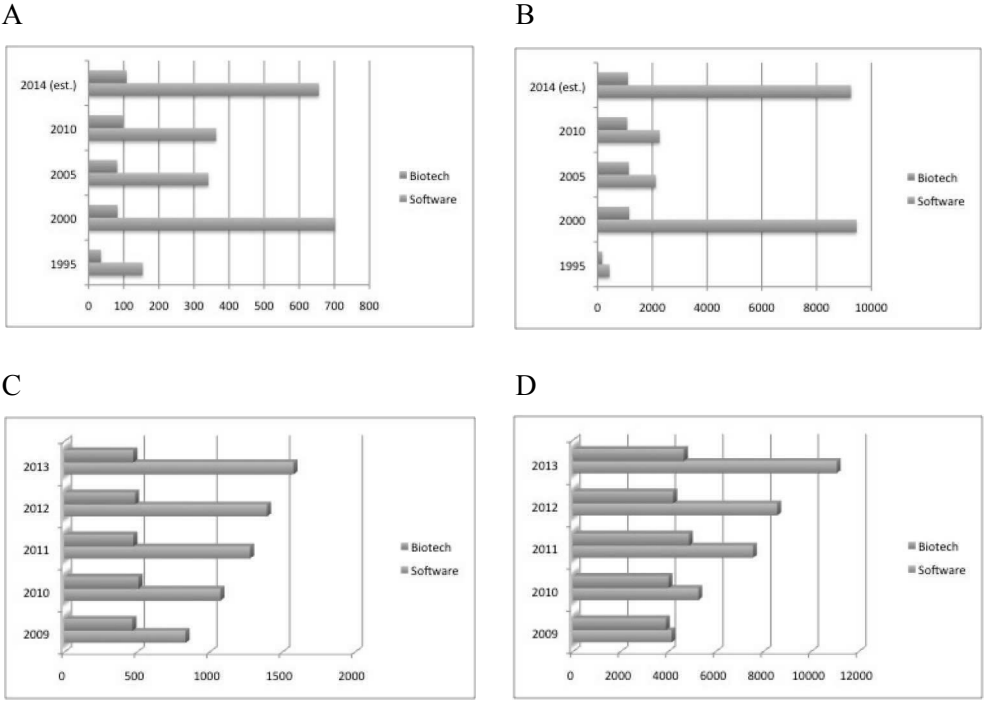
While investment numbers of IT (and mainly web-mobile experience economy within) clearly increased, number of transactions for biotech industry slightly grew and value of the deals actually stagnated.

Considering the data were aggregated for all remarkable technology regions of the U.S., we find both number and value of investments in software industry has grown steadily over the past five years. In contrast, the biotech industry has had no significant change during this period in either term.

We can conclude that the increment of investments in U.S. high-tech industry experienced in the past years was mainly fed by the software industry and the expe-

rience economic actors within. Investors clearly prefer lower risks and their higher returns would result in unrealistic valuations discussed above. Accordingly, the biotech-healthcare sector did not get from the increment of investments experienced in recent years.

Figure 2. Number of investment in biotech and software industry (A, C) and transaction values in M USD (B, D) in the Silicon Valley from 1995 to now (A, B) and in the all major technology region of USA between 2009-2013 altogether (C, D)



Source: MoneyTree (2014)

2.5. Governments do not deliberately intervene

The economic development of a start-up ecosystem is often compared to Silicon Valley history. However, it can not be forgotten that the current situation emerged as a result of a fifty-year-long around organic development. Those were not sounding government objectives at the beginning and even later only limited state interventions were observed. In the development of Silicon Valley, U.S. military played an irreplaceable role behaving as generous "investor": it financed the research project with huge money without claiming returns or shares of the emerging enterprises.

The emerging start-up ecosystem was stabilized by the two factors below:

- "The visible hand of capital" when it comes to venture capital funds such as Kleiner-Perkins, Sequoia and Mayfield moved from San Francisco to Menlo Park between 1972 and 1974.
- "The invisible hand of government" when the Revenue Act lowering the capital gains tax was ratified in 1978.

Besides the above there is one more important thing that many times we tend to stack up: cultural diversity also helped the emergence of Silicon Valley, because of the impact of immigrants' cultures and ideas on one another. As Wadhwa et al. (2007) pointed out, they acted as stimuli to creativity, because 52% of start-up founders in the USA were immigrants, and that immigrant-founded companies created over 450,000 jobs in 2005 only.

In Hungary the government has recently shown a clear interest in the start-up ecosystem. The Hungarian decision-makers have a clear objective: "... the vision that the Hungarian capital in a decade become a Central and Eastern European hub for start-ups" (Runway Budapest 2014). Let's examine how the government measures serve this purpose!

The pyramid of acceleration in Figure 3 reflects the relative proportion of survivors in each phase from concepts to the established companies with exit. In a well-functioning ecosystem, proportion of different financial instruments fits the ratio of firms in different acceleration stages. If government intervention takes place in an emerging ecosystem, it is advisable to provide the appropriate financing instruments can be derived from the proportion of companies at different stages.

In Hungary financing instruments matching with the pyramid above show a varied picture. Proof-of-concept and pre-seed funds are missing completely in the country, so this area could have obviously been the area for government intervention. However, despite the fact that the Hungarian government assisted the creation of venture capital funds with 130 billion HUF about through the EU-funded JEREMIE (Joint European Resources for Micro to Medium Enterprises) financial asset in the last 5 years, the very early-stage funds above were not among them, so this financing segment is still missing.

The situation is not much better either with seed funding. Although in the second round of the JEREMIE program above four seed funds were supported, it is only a small and pretty late step in start-up investment. The stance is similarly poor for incubator market. Under the recently launched „gazelle" scheme four accredited incubators were launched this year. Considering that the first set of JEREMIE-assisted growth funds was formed in 2010, the seed funds and incubators should have been established a few years earlier. Due to the lack of previous funding instruments, the 24 working growth funds can not find enough suitable projects and thus a considerable proportion of their capital – despite the impending deadline of December 2015 – has not yet been invested.

Figure 3. The pyramid of acceleration

Source: Edited by the author

3. Conclusions

Based on the observations, the start-up ecosystem has already been distorted even in the advanced economies. Investors have intensified the processes resulting in that the actors in experience economy (especially the web-mobile solutions' owners) are dominant among start-ups. In accordance, the biotechnology, pharmaceutical developments, human healthcare- and environmental technologies, which seek to address the most pressing problems of mankind, are overshadowed.

In a healthy functioning economy social media, mobile applications and the other elements of experience economy obviously have effective and important role. But when the enterprises behind these solutions utilizing lower risk and unrealistic recovery options drain the human and financial capital from development areas to ensure our sustainability, the question arises that there would be a need for incentives that will restore investor- and entrepreneurial attraction for healthcare and environmental businesses within a certain time limit.

If we do not find effective solution, mankind will soon be in big trouble, because the products of experience economy are entertaining, joyful and sometimes practical, but the least of the cancer patients' problems, which one to use editing presentations or sharing photos with friends.

In this progress, the responsibility of government is enormous. Instead of enjoying the quickly-came success of experience economy, they should set back the

reasonable weight of healthcare- and environmental industry through appropriate incentives and awareness raising, lest the hype about experience economy results in a multi-decade setback of developments and it is too late...

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Innovative food products, technologies in the systems of food production
The questions of risks and safety

Péter Savanya[1] *– Sándor Balogh*[2]

In the system of food products related risks we can observe, that not only their consumption but even their way of production contains risks. The environmental impact of food's mass production technologies also deal a great security issue. In judgment of the technology and innovations – as opportunities – risks and threats are developing in interaction, although there can be time diversion between them and direct negative extern impacts are taking effects in different places. In the concept of responsible innovation the most interesting question is, to secure enough time for identifying and analyzing the risks, and to accumulate necessary knowledge to judge them.

The paper reviews the connection of opportunities and risks of food products and innovation in a theoretical perspective, to highlight the potential and relevant attracted fields on the level of society, nature and economy. The comparison of the risks and opportunities points out, that the benefit of innovation also contains a number of risks. Our available knowledge is only the top of the iceberg, which requires caution both from science and decision makers.

Keywords: food products, innovation, opportunities, risks

1. Introduction

To produce foods in proper quantity and quality is a primary objective for societies in the history of humanity (Buday-Sántha 2011). Nowadays big, interdependent systems of value chains transmit food products in the system of economy for consumers (Lakner 1996, Hanf et al. 2013). To assure they successful operation these systems created technological regimes, to provide innovation for food production and to make the systems able to produce more food products for the society.

The foods, that we consume, have an elemental impact on human body (Kharb–Singh 2004, Prokisch 2010). Primary question for the society is to secure the safety of food products, so they do not cause diseases either on short or long

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term. Also important, that the consumed food products should be nutrient and healthy (Tarnavölgyi 2009).

The production of worlds food demand is based on the systems of agribusiness, which is one of the most environmental oppressing human activity and leaves a significant ecological footprint on the planet (FAO 2010, Kendall et al. 2010). For the humanity the most notable challenge in the following decades is the prevention of humanitarian catastrophes caused by overpopulation and starvation. On the other side we can note the pressure of climate change, which primary strikes at the poor of developing countries. The primary solution to this problem is to improve human food producer systems, where new technologies and innovation are needed to develop in the near future (Buday-Sántha 2011, WB 2008).

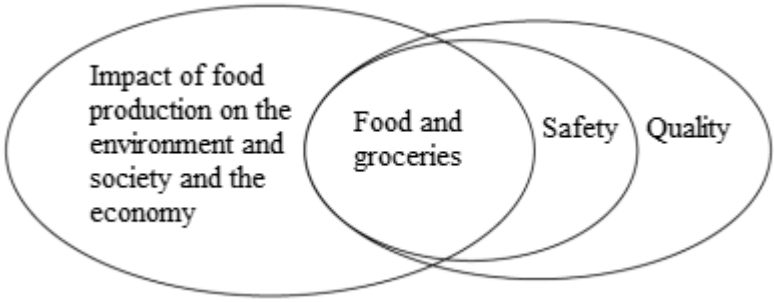
The paper reviews the connection of opportunities and risks of food products' innovation in a theoretical perspective. In the first chapter I review the type of food products' risks according to value chain perspective. This aims to show a horizontal picture how we should evaluate the benefits and risk of innovation on the level of whole society. In the second chapter of the paper I will show some examples from literature, which represent both side of the evaluation when we discuss responsible innovation. To show an empirical example for the responsible innovation I citate an initiative using institutional based innovation, project SAADA, which is a perfect example for the adequate solution regarding innovation in food production.

2. System of risks regarding food products

When evaluating the risks of food products a consumer firstly considers, if the food product which I consume, is harmful for my health or in other words: is it consumable. The other important question connected to the products is, that what kind of affect it has on human organism, therefore how much does it serves healthy nurture (Kharb–Singh 2004, Tarnavölgyi 2009).

The third dimension is where the effects are only experienced in an indirect way for the consumer, which is production's social and environmental impact (Kendall et al. 2010). These social and environmental mechanisms separate in time and space from the physical consumption of food products, although these are the emphasized risks considering food production. These impacts and risks can be separated from each other, but through the system of time differential feedbacks they are connected in the food product's social production and consumption (Figure 1).

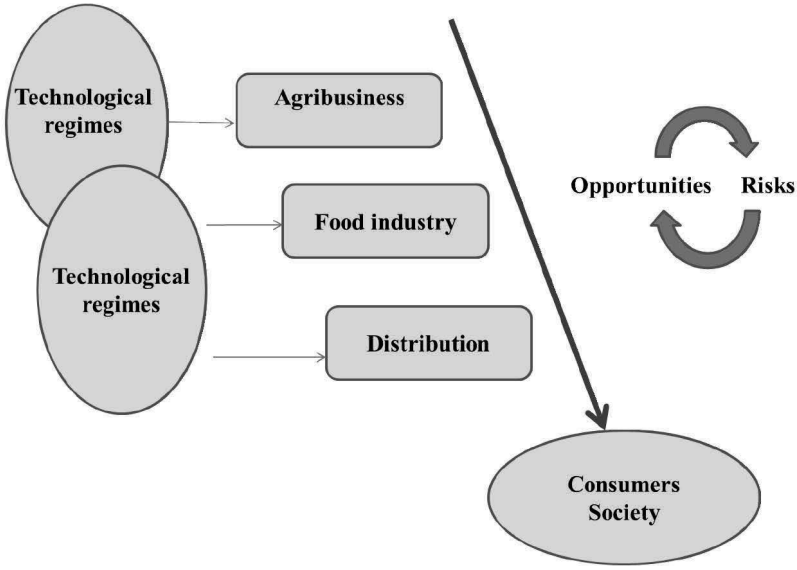
Figure 1. Types of direkt and indirect risks of food products



Source: Own construction

The groceries took off the "shelves" are delivered through a long value chain, which is operated by a number of connected technologies and originations' network. In the chain of the production – processing – distribution of groceries, the food industry has the processing and andconverting functions (Figure 2).

Figure 2. The represented risks in food products value chains



Source: Own construction

2.1. Agricultural systems

The production chain, which delivers the food products also broadcasts the risks present in the system and in the technologies to the consumer. The groceries took off from the shelves literally contains the whole production's risk factors, on a wid-

er scale the production's social and environmental impacts (Heyder–Theuvsen 2009).

The system can be divided into three aspects regarding its role in production: agricultural production (ingredient production), the food industry (processed goods production) and trade (distribution towards consumers). The individual industrial branches are global systems, which contains unique and also related technological regimes (Lakner 1996).

The first step in groceries production is agricultural production. The agriculture firstly produces ingredients for food production; secondly it produces groceries in unprocessed way directly to the consumers (fruit and vegetables). The modern agricultural production system basically relies on technological regimes, such as chemical industry and biotechnology (plant protecting chemicals, artificial fertilizer, and soil protecting chemicals).

The questions behind the food products' security begin at the level of ingredients and production technologies (Tarnavölgyi 2009). The different and more frequently developing technologies means an elemental intervention in food production. Procedures, like breeding improvements are used for centuries, but nowadays it is argued to use gene modified plants and animal ingredients for human consumption (Heszky 2010). The technical regime and development are controlled by global corporations and their networks. Profit oriented companies are using technologies and their development, to reach larger profit and to introduce them on the market. The companies' interest and their demands are forcing quicker employment of innovations, which automatically generates the risk management's institutional and social flaw. Firstly the prescribed time for the evaluation of risks reduces; the applied examination's effectiveness usually does not give enough opportunity to represent long term and metastatic risks. Furthermore the risks caused by future technologies cannot be sensed or shown by todays diagnostically procedures. The procedures' supervision is usually under governmental jurisdiction, in the evaluation of risks and security the social control is reduced. A worldwide known story regarding chemical usage and risks is the case of DDT and Monsanto, where an ecological catastrophe alerted the worlds' attention on the applied, also considered as secure chemical's harmful long-term impacts, which could affect the whole population (Kendall et al. 2010).

The agriculture – as a producing system – is the most environment oppressing human activity. The extensive agricultural production and land use, has a constant effect on environmental rearrangement and on the ecological system. E.g. the chemical usage on bugs eradicates them from the food chain, causing a disturbance in a whole circle's ecological system. The application of artificial fertilizer manipulates soil water's ecological system in the same way. Apart from the protection of environmental values, the society's drinking water is also affected by chemical accumulation and it's spreading in the ecological context (Kendall et al. 2010).

In conclusion we can say that the technological regimes behind agriculture are more concentrated, more and more potential is focused in less companies' authority (Table 1). The 60% of applied chemicals are ruled by the branch's four big companies. So the generating of risks is increasing, and is connected to a more concentrated group of decision makers (WB 2008). On the other hand the evaluation and examination of risks are not developing in the same way, so the opportunity of social control and intervention regarding responsible innovation is decreasing. With the agricultural production's global volume increase the environmental oppressing and the ecological risks are spreading in a great measure around the world.

Table 1. Major suppliers of agricultural inputs and growing concentration

	Agrochemicals		Seeds		Biotechnology	
Company	2004 sales ($ million)	Market share (%)	2004 sales ($ million)	Market share (%)	Number of U.S. patents[a]	Patent share (%)
Monsanto	3,180	10	3,118	12	605	14
Dupont/Pioneer	2,249	7	2,624	10	562	13
Syngenta	6,030	18	1,239	5	302	7
Bayer Crop Sciences	6,155	19	387	2	173	4
BASF	4,165	13	—	—	—	—
Dow Agrosciences	3,368	10	—	—	130	3
Limagrain	—	—	1,239	5	—	—
Others/Private	7,519	23	16,593	66	1,425	34
Public Sector	—	—	—	—	1,037	24
Market concentration[b]						
CR4 (2004)	60		33		38	
CR4 (1997)[c]	47		23			

Sources: UNCTAD 2006b; International Seed Federation at http://www.worldseed.org.
a. Number of U.S. agricultural biotechnology patents issued during the 1982–2001 period.
b. Market concentration is measured by the concentration ratio CR4, which indicates the market share of the four largest firms participating in the market.
c. Fulton and Giannakas 2001.
— = not available.

Source: WB (2008, p. 137)

The agricultural production and products, the ingredients' global trade brings another dimension in to the system (Buday-Sántha 2011, Hanf et al. 2013). Through the context of trade, the food product's consumption separates in space, from the risk creation during the production of the ingredients. So in some societies with the increase of production and consumption volume, the risks and negative externalities are increasing disproportionately compared to their food product consumption – especially in agricultural ingredients exporting countries.

2.2. Food industry

The food industry is the central actor in producing food ingredients and food products from raw materials. More part of nutrition is based on processed or on modified groceries. The food industry and the applied technologies are the main determining elements of the food's security and quality features.

The food industry uses a large scale of technologies, from the handling of raw materials, through the breeding chemical procedures, to the hygienically systems. On the basis the question considering technologies used in food industry is

security, to determine if the product contains harmful components. The other question considering processed food products, is to analyze its effects on the human organism, what kind of quality the product has (Ruckman 2002).

In the food industry applied aggregates (e.g. colourant) are prevalent on a wide scale, and their numbers are growing. In parallel the number of food allergy patients and the food diseases are increasing. The food industry innovation and technology development brings more risk factors in the consumers' life. Even more interesting and troublesome question is the interactions between the chemicals in raw materials and the aggregates applied in the food industry (Tarnavölgyi 2009).

Technological regime and its concentration are similar to the agricultural systems. The food industry is also described by concentration procedures, a few big company rule the market in some sub-branches. The companies have major influence in introducing innovation in the branch's technology development. This concentration although has positive effect on the development of quality assurance. The production and trade of groceries are done on a global scale; this procedure could increase the harmonization of quality assurance standards (Hajdu–Lakner 2000, WB 2008).

In the topic of quality assurance we can find interesting questions such as the effects of food products on health, their effect on human organism (Kharb–Singh 2004). It is enough to mention the food products' flavoring aggregates such as oil, fat, salt and sugar (e.g. energy drinks) and their negative effects on obesity, as the developed societies common illness, and its complications: cardiovascular illnesses, diabetes etc. (Ruckman 2002). The treatment and curing of these diseases comes with great expenses for these societies, and as a factor of risk and social security it is strongly connected to food quality assurance. On the field of illnesses regarding provisioning and nutrition we can also mention some flavoring aggregates with long-term medical impacts. After a decade usage it can be shown, that some of these flavoring aggregates may cause cancerous diseases. Although not in all cases can we clearly state the relation between cancerous diseases and the food industry chemicals, it still makes their usage an elemental social security problem, the application of these technologies in the field of responsible innovation.

One of the main aspects of today's food industrial innovations' is the development of functional groceries, which creates a new approach of foods (Kharb–Singh 2004). In these cases the food's ingredients and agents' collective effects provides medical impacts for the product. The intervention in the function of the human organism through groceries is a cardinal security aspect regarding this type of healthcare (Meister 2002, Ruckman 2002).

2.3. Distribution

The system of distribution delivers the groceries on the consumer's table. The foods on the market's shelves can be considered as the top of the iceberg, this is on-

ly level with the consumer mainly interacts. In the distribution systems we can mention logistic systems and trade of food products. The security measures regarding the trade, containment and shipment of food products have important role in consumer protection. The adequate shipping and containment are fundamental in maintaining the food products warranty and assuring quality. The trading abuse regarding food warranty are unfortunately are well known. The supervision of these is mostly under administrational jurisdiction, the control of distribution is key element in providing sense of secure for the consumers.

The complicated system and long supply chains which are connected to the food products social consumption have a great environmental oppressing impact. The global production and trade of food products is increasing, so its importance becomes more significant. It is not a negligible social angle, that apart from the hegemony of the big systems, the local food providing systems are forced back. The breakdown of these systems makes the society defenselessness in food provision, also the big systems broadcast the global risks to the local consumers (Hanf et al. 2013, Heyder–Theuvsen 2009)

As we saw the production and consumption of food products creates an interdependent system on the level of economy and nature. One of the most important conclusions is, that the risks caused by technologies and innovation; do not absolutely appear in the groceries. This especially concludes the field of agriculture, which directly affects the ecological environment. The risks and the indirect form of negative externalities appear not only in consumable forms but on the level of nature, economy and society. In the awareness of consumer these risks are not connected; for them only the product's material risks are manifested, the consumer detects and evaluates just these risks. But for the society the risks appear aggregately on the level of complete system, in where mass consumption of imported groceries causing ecological damages through the neighbouring countries agrarian production, with the consumption of these products we also consume their industrial chemicals, which's long term effects on human body are not known, and runs the potentials and capacities of the local food production system out.

3. Responsible innovation – opportunities and risks

Through the systematic research of food product related risks we can observe, that not only their consumption but even their way of production contains risks. The environmental impact of food's mass production technology also deals a great security issue. In judgment of the technology and innovations – as opportunities – risks and threats are developing in interaction, although there can be time diversion between them and direct negative extern impacts are taking effects in different places. In the concept of responsible innovation the most interesting question is, to secure

enough time for identifying and analyzing the risks, and to accumulate necessary knowledge to judge them (Sutcliffe 2013, von Schomberg 2011).

In the following I will summarize some of the critical topics mentioned by the specialized literature, which opportunities and which threats must we take into account regarding food product innovation (Table 2).

The presented topics are covering a wider aspect regarding food product innovation, than the groceries secured consumption. The shown problems are only excerpts. The topics detailed discussion, the scientific facts and result, the experts pros and cons offers us a great number of specialized literature. Our goal is not a detailed discussion of the topic. The comparison of the risks and opportunities points out, that the benefit of innovation also contains a number of risks. Our available knowledge is only the top of the iceberg, which requires caution from science and from the societies' decision makers.

Table 2. The challenges of food product innovations

Opportunities	Risks
To secure stabile and adequate food products for the societies, to support the developing countries in their nutrition problem, and fight against deep poverty	
- Gene modification offers opportunity to create new plants, which can provide high harvest volume, even in extreme weather conditions (Heszky 2010, Pepó 2010). - New technologies provide higher harvest volume and improve products' quality (Glits et al. 2008). - The breeding of livestock, which makes animals more resistant in extreme conditions. - Vaccination and medical care of livestock, which leads to a higher survival rate (Tuboly et al. 1998).	- The knowledge regarding gene modified food products' long term effects on the human organism are not efficient (Heszky 2010). - Plant protect chemicals can affect the ecosystem on larger levels, which could lead to species' extinction. Chemicals accumulated in the living organism could cause serious illnesses, when it exceeds a certain level (Kendall et al. 2010). - With the animal based products certain chemicals can directly reach humans, which effects on the human organism have not been tested (Farsang 2003).
Opportunities	**Risks**
Food products, as an instrument to influence the human organism's physiological progresses	
- The innovation of functional food products means a new method in treatment of illnesses, as well as in establishing dietary with functional medical effects (Prokisch 2010). - Through the development groceries' production we have the opportunity to produce food products, which can preserve the consumers' health and can be obtained by a larger number from the society (e.g. high-fiber nutrition), can decrease the numbers of cardiovascular and obesity patients, and the expenses on their treatment (Kharb–Singh 2004).	- The aggregates applied in creating functional food products could cause currently unknown allergies (Ruckman 2002). - The functional food products could cause concerns in the consumers regarding the product's credibility and its price-value evaluation. Promoting the food products medical benefits and introducing them on the market may lead to serious abuses, gives opportunity to mislead the consumers (Meister 2002).

Agribusiness	
- For the developing counties it is a primary opportunity to employ mass numbered, untrained labor, to take part in global trade (Alidou et al. 2010, WB 2008). - The increase of the food industry's capability to create added value and rising productivity is key in the branch's competitiveness (Lakner 1996).	- With the spreading of agricultural opportunities global overpopulation can intensify, the development in nutrition could lead to millions of starving on the world societies' periphery (WB 2008). - The improvement in production technologies mainly increases productivity, which could reduce the number of needed labor (WB 2008). - The growth of the big systems rearranges the national production's system, which could cause social and economic instability (Hanf et al. 2013, WB 2008).
Opportunities	**Risks**
Food product consuming society	
- The development of nutrition science and food production, in cooperation could lead to a healthier society (Kharb–Singh 2004, Tarnavölgyi 2009). - The knowledge about food and the results of nutrition science could improve the society's preparedness and consumer awareness (Kharb–Singh 2004, Tarnavölgyi 2009).	- The demand intensive flavors brought new, still unknown aggregates' mass application in food production, which can be consumed by millions for years (Tarnavölgyi 2009).

Source: Own construction

3.1. The validation of responsible innovation in food products' production and consumption

As we saw the production and consumption of food products is a complex system on the level of economy, environment and society, which is supported by its own technological regime. The main question in the field of responsible innovation regarding food production is to monitor the effects of innovation in other subsystems. I valuate the risks of food products' responsible innovation through the threats system (King–Sutclife 2011).

3.2. Technological security

Food quality assuring systems have a well-functioning and widely used method to notice and evaluate threats regarding short warranty products. The food industry puts great efforts to improve its quality assurance system, and the governments' administration demand these kinds of preparations. It is elemental social interest to secure food products quality, and to maintain trust in food products.

Although the food industry still lacks the necessary procedures when it comes to notice and evaluate long term risks. We can still esteem with high efficiency a new aggregate's or a newly invented food product's negative impact on the human organism. In case of the tested amounts, the product does not have negative effects. But what if the product is consumed for years (Tarnavölgyi 2009)?

We have insufficient data about when the innovation is used on a large scale, in mass numbers and for longer terms, what kind of effect has it on the human organism, when it is used for a long time. What kind of future, global and mass medical risk we take, if the people consume these newly invented products in the present.

3.3. Economy-Society-Environment

Considering the food products systematic risk system, we can observe phenomenon's such as environmental oppression or negative economic and social processes like the connection between increasing yield and population explosion. The responsible innovation has also a key role here.

As an example we can mention the big system's scale-economical and capital based technology development, versus local economies opportunities, which are relying on local labor and production. For the developing countries, improvement based on technology and capital is not an available alternative (Alidou et al. 2010, WB 2008). The increasing production volume shows results in the elimination of starvation, but it has a counter effect on economic development and employment. Moreover, it comes with the environment's extensive exploitation. So forcing these types of innovations is not an adequate solution for developing countries. There are other alternative innovation systems apart from technology based innovations, which are showing good results. These programs are concentrating on institutional innovation, where technology only has a support role. The OECD and the World Bank has launched several of the mentioned programs (Alidou et al. 2010). These programs are targeting the development of agribusiness, with the adaption of network based economic innovation, urban development and the instruments of networking (FAO 2010, Heyder–Theuvsen 2009). These social innovations are offering solutions on production volume, as well on employment improvement (Knickel et al. 2008). Plus the local providing chains are producing with less environmental oppression.

3.4. Project SAADA – example for responsible innovation in food production and agribusiness

A The project SAADA (Strategic Alliance for Agricultural Development in Africa) was carried out between 2006 and 2009 as a pilot project with the participation of West-African developing countries (Burkina Faso, Benin, Ghana, Mali, Niger, Nigeria, Togo). The program was mentored by the IFDC (International Fertilizer Development Centre) and the Dutch Ministry of Foreign Affairs operating as a primary sponsor. The management capacity and knowledge base was provided by the experts from institute of Berenshot and Agrarian Science University of Wageningen. In the program near 150 thousand farmers participated, the programs radius touched 370 thousand household, so the group of the program's stakeholders means

more than 1 million people. The study of Alidou et al. (2010) summarized the practices of the program, we citate this document.

The program aimed to put the CASE (Competitive Agricultural System and Enterprise) initiative in to practice in West-Africa. A conception of the program focused on improving the agrarian production and promoted the farmers to become agrarian-entrepreneurs. The logic of the program aimed to develop the connection in the value chain of agribusiness and to improve the capacities with the instruments of network based enterprise development policy.

The core of the program is the expanding the human capacities with education. The farmers could learn progressive agriculture and business knowledge in an education and skill improving program. On the network organized skilled farmers can get much easier input for the business based production, because they can manage the supply chain and application of resources. The program involved more groups of stakeholders – e.g. government and the institutes of local public government – as the potential organizer of local integrations, and cooperated with other African agrarian development agencies and merchandise agencies.

The improving of the institutional framework is a notable part of the development matrix, which includes the policy mix of enterprise development. The concept of micro-lending system (e.g. Gramen-modell) is a successfully operating construction in much developing countries of the world. The concentration of capital and technology infer the need for improvement of actors' capital absorption capability in the agribusiness systems. The project SAADA tries to improve the connection between the bank system and the farmers through creation standardized credit construction packages. More than 40 financial institutions form 5 West-African countries took part in the lending program, and more than 9 million Euro credit was transferred.

The Project SAADA shows a good practice in responsible innovation, in where adequate solutions are work out for relevant problems. The network business form as a social innovation contributes to stabilise nutrition in developing countries, improve the efficiency of farmers' production system without extensive farming land use; and the effected countries are able to join to the international trade of food products with exportable wares.

4. Summary

After over viewing the connection of responsible innovation in the field of food production and consumption we can make the following theoretical notes:

- The risks of groceries are complex because of the systems' connections, which applies on the risks' origin, on the risks' direction and term and on the prevention measures used against them.

- The risks of food production and consumption are only taken into account by the consumers' point of view; there is not much attention towards the long term social and ecological risk factors of food production.
- To manage the risks in the production and consumption of foods products it is necessary to have a horizontal and vertical cooperation in the risks management systems.

The basic element of the responsible innovation is a society controlled decision mechanism to manage the technological and economic revolution. It is a necessary condition that there should be adequate time for knowledge accumulation in the society. The revolution and the implementation of innovation always include uncertainty. But considering the interests of society we need to evaluate how many risks are we willing to take. The decision and those who are affected by the decision are separated regarding the innovation's negative external effects. The circles of beneficiaries are notably known, but the negative externalities and its shareholders are unknown, if we do not see the potential negative effects. The responsible innovations' message for the decision makers is that we must analyze the foreseeable benefits with their possible risks. The uncertainty is an inherent part of the innovation processes, but more prepared decision makers can give us chance to evaluate: what is worth, and what is not.

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Responsible Science in Societies

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The role of science in economic growth and societal welfare is inevitable in the 21st century. The ever-changing role of science in society is influencing the responsibility of research and innovation. Discussions about the place of science in society mainly address the issue at a European level. However, much less is known about the situation at the national level, which is also true for Hungary.

It is clear that science is an important 'tool' for society to achieve certain goals, such as welfare or development. However, this 'tool' needs to be used with great responsibility, which requires a close relationship between science and society. This relationship is not uniform across countries in Europe or elsewhere in the world. In this paper, we have reviewed many aspects of science-society interactions to better understand how science is integrated into Hungarian society.

This paper provides a review of how the various stakeholders are involved in discussions and decisions on scientific matters in Hungary. It is shown that public engagement in science and policy-making is weak and sporadic. The research on 'science in society' is funded more frequently by the EU than by national sources. Despite the various efforts to improve communication about science and make the scientific results understandable for a broader public, it is still a distant issue for the majority. Overall, there is room for improvement on the place of science in Hungary to better serve our society's needs.

Keywords: Science in society, Hungary, science, policy

1. Introduction

The recognised importance of research is firmly rooted in the needs of society, particularly in light of the constantly changing world. The relationship of science (and technology) to society has been constantly changing over the past 50 years, but the trend of these changes highlights the tightening contact of these two spheres. Beyond the importance of the autonomy of science (Polányi 1962), the impact and application of scientific results and the responsibility of science has become equally important (Mejlgaard–Bloch 2012). This topic was not among the main priorities of

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the European integration at the beginnings of scientific collaboration, but by the mid-1980s, it started to grow in importance. The importance of science for society has been growing during the past two decades (Maastricht Treaty, Lisbon Agenda etc.) and the European Union has been devoting an increasing amount resources to understanding how science can fulfil its new role and respond to the societal challenges in a responsible way.

Responsibility is understood as a broad concept, including moral, environmental, or societal aspects. This paper focuses on a crucial segment of a societal aspect: what the relationship between science and society is like in Hungary.[3] The ever-changing role of science in society (SIS) is influencing the responsibility for research and innovation.

This chapter first gives a short overview on the international literature on the relationship between science and society and how this relates to the current policy discussion about responsible research and innovation. The literature shows that the relationship between science and society is crucial for growth and sustainable development and it has many ingredients and aspects which influence the actual status in every country. The following sections provide a snapshot on Hungarian society's relation to science. Section 3 identifies those few topics that are on the policy agenda in Hungary about the place of science in society and investigates the depth of involvement of the various actors. Section 4 provides a rough picture about SIS-related research activities in Hungary, highlighting a fragmented research landscape where EU-funded research has a major role. Section 5 provides information on the latest trends in science communication in Hungary and the best efforts to revive interest in science. The chapter ends with a summary of how Hungarian society relates to science and scientific activities and lists some of the areas where further efforts can help to improve the role of science in society.

2. The relationship of science and society through the international literature

Science and innovation have become an important field in the policy because their contribution to economic development and social welfare was seen as evidence. (Fagerberg et al. 2004) The recognition that policy-making has not only had to rely increasingly on scientific results, but also that scientific (and technological) activities need to be regulated by the policy raised new questions about the current role of science (a short overview is provided by Mejlgaard–Bloch 2012). Furthermore, why and what kind of research have to be supported from public funds? Strategic research or programme-driven research is the dominant form of

[3] This paper is based on the Hungarian report that was prepared in the framework of the EU FP7 project on 'The Monitoring Policy and Research Activities on Science in Society in Europe (MASIS)' The project investigated this issue in 38 countries (member states and associates). ftp://ftp.cordis.europa.eu/pub/fp7/sis/docs/sis_masis_report_en.pdf.

research support currently in many fields, which are formulated based on societal problems or expectations (EC 2009). The differentiation between scientifically excellent and societally relevant research is still present and the category that combines the best of 'both worlds' is very much needed (Rip 1997).

The idea of 'responsible research and innovation' is a relatively new concept in European discourse which has one of its roots in previous research on the relationship of science and society (e.g. Owen et al. 2012). The quick scientific developments and emergence of new scientific fields in the second half of the 20th century brought up many previously unknown challenges about the role of science. The pace of this development produced new knowledge and results that were ahead of their time and sometimes there was not enough time to assess the potential long-term impacts of these new developments. This situation distanced society from science and some of the unpleasant and unforeseen side effects of the new scientific results made social groups sceptical about scientific development (Cutcliffe 2000 in Mejlgaard–Bloch 2012).

This alienation of science and society lead to a point where researchers identified the need to renegotiate the 'social contract' between science and society. These researchers felt that a growing part of society was expecting science to concentrate more on current social challenges in exchange for public funding (Guston 2000, Nowotny et al. 2001). One may argue that science and society have never been separated from each other so this would not require a new 'contract' but the control over the new, emerging scientific fields where consequences cannot be clearly calculated may demand a new form of science-society interaction (EC 2009).

The changing relationship of science and society is not specific to any nation in Europe or worldwide, but a global phenomenon. In Europe the most visible discussions about this relationship were triggered by the EU when decisions were made about the role and importance of EU-supported research, development and innovation activities. The first EU policy documents – until the early 2000s – were emphasizing the need that scientific knowledge had to better contribute to growth (economic and social welfare). The Lisbon Agenda envisaged that European growth had to be based on new scientific knowledge generated by the European Research Area (EC 2000). The weak results achieved by the end of the decade made people realise that social acceptance and socially desirable results needed an active interaction with society. From that on EC policy documents shifted wording from 'science and society' to 'science in society' or 'science with society' even more emphasizing the interconnectedness of the two spheres (Mejlgaard–Bloch 2012). The European Commission has identified five dimensions in which science can contribute to the benefit of society (EC 2009, p. 15):

- innovation: wealth and economic growth;
- quality of life: health, welfare, education;
- policy: relevant debates, policy advice;
- culture: conserving and respecting cultural diversity;

- intellectual: ‘good society’, sustainable development.

Thinking about these dimensions, it is clear that all of them are under transformation, debates and challenges. It is not possible to identify a definitive best place for science in society or even what would be a generally desirable situation.
Developing further the idea in this direction, a new concept, the idea of ‘responsible research and innovation’ (RRI), emerged in the policy discourse by the 2010s. From a societal point of view, RRI is a broadening and reframing of earlier attempts to find the role of science in society. As a new concept it is not easy to define, but there is a definition widely cited in international literature:

“Responsible Research and Innovation is 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)” (von Schomberg 2012, p. 280).

The RRI concept includes the need to identify the ‘right impacts’ and the right process that research and innovation should target (von Schomberg 2012). It goes beyond what is in the ‘science in society’ with its three main emerging features (Owen et al. 2012). First, it contributes to the starting question of how research (and innovation) activities can be governed in a participatory and ethical way leading to ‘right impacts’. Second, it emphasizes “the integration and institutionalisation of an established mechanism of reflection, anticipation, and inclusive deliberation in and around the processes of research and innovation” (Owen et al. 2012, p. 755). Third, it attributes new, collective responsibility not only for researchers and innovators, but for all stakeholders and public debate participants that are involved in this process.

3. The place of science in political developments, public debates and policy initiatives

Very few topics may be identified in Hungary on the place of science in society. Public engagement in policy-making is in its infancy and both sides are struggling how to find the best form of negotiations and involvement in decision-making. There is no institutional framework established in Hungary to organize this process.
Except for the most debated *ecological and energetic issues*, other topics are not debated in the media or in Parliament. Such issues are related to the use of renewable and nuclear energies, genetically modified foods or food safety. Even in this latter case, which is regarded very important by the public, from time to time debates emerge in the media only when the safety rules are broken and people get

hurt. After a couple of days/weeks even these debates are subsidized and the public is seldom informed about the consequences (Inzelt 2011).

A recent good example was the conciliation on water-supply management. This topic was raised in the frame of the EU Water Framework Directive, which is a sign that such debates are emerging mainly on external stress. In this case, during the conciliation period, local meetings were organized and the broad public was invited to express its views. Thus politics took into consideration the views of both academics and the public in this case as a rare example.

A very fresh example is the debate on a genetically modified corn hybrid. This old debate flared up again in 2011. The new Fundamental Law of Hungary that took effect on 1 January 2012 declared that Hungarian "agriculture remains free from any genetically modified organisms" (Hungarian Gazette 2011, XX (2), No. 43, p. 10663). This prohibition was strongly debated in Parliament and in the media. Scientists and several producers were active in these debates however their voices were weaker than the voices of several authorities and various Churches. The debate got another impetus during the extermination of a genetically modified corn plantation.

The majority of debates occur only in the media / internet. The most active actors in these debates are professional associations and other various societies, such as the Hungarian Academy of Sciences (HAS), the Hungarian Association for Innovation (MISZ), the Association of Teachers and Professors, Hungarian green associations and so on. In very few cases the actors of innovative business are involved in these debates too. In the scientific debates, the different professional groups' views are exchanged and the public is only informed about the different opinions. There are hardly any opportunities when they can represent their own standpoint, but there is hardly any need from the public for such proclamation. The debates remain in the political and partly in the academic arena.

Another usually publicly debated important topic relates to *education in science*. After the beginning of transition a trend emerged that students' interest started to decline in natural sciences. The topic of the attractiveness of science studies is highly debated in the media and in relevant professional associations. The discussions include the topic of new teaching curricula, bringing a new content into education or new modes of teaching to revive the interest in science. There also was a related debate about the role (and financing) of the HAS in the scientific community. Several MPs have also raised these issues in Parliament. Partly as an ongoing process and partly because of the debate over its funding model, the HAS introduced many reforms and became more open towards the public and improved its communication. Even this debate took place between the political and academic arena and the public was only informed.

Less frequently but occasionally the relation of *superstitions and science* and the religious views or principles (with special regards to the conflict between Darwinism and creationism) are debated either in the context of education or social

life. This debate is an endemic issue of the academic arena that is raised from time to time by one of the parties. The public is usually only informed about the latest issues and does not take an active role in the debate.

In a narrower circle of society two other important topics are debated that enjoy the attention of the media, such as building attractive *scientific career models* for the youth and creating the *culture of absorption and exploitation* of scientific results. These issues have become part of the policy agenda. Debates in various professional associations and in the HAS have got the attention of policy makers. However, there are hardly any impacts of these debates yet.

As regards to *policy goals and priorities*, Hungary has no policy specialized on the place of science in society. Nevertheless, there are policy initiatives and reforms on other related areas, which could be relevant to the situation of science in society. During the last decade, one could identify several steps that significantly increased the importance of science-industry interplay in the Hungarian S&T policy. Some government initiatives, such as the establishment of cooperative research centres and regional university knowledge centres show the growing emphasis in funding programmes on enhanced science-industry interplay. (Such government programs were the Regional University Knowledge Centre or 'Pázmány Péter' programme, and the 'Asbóth Oszkár' programme.) The establishment of the title 'Research University' served to identify higher education institutions that were engaged more in research activities and in university-industry collaboration.

The objective of these initiatives, generally, is to boost the number and the intensity of connections between universities and enterprises, between the academic and business sphere in respect to R&D and scientific cooperation. Hitherto, the impact of these recent initiatives is still poor on the relationship between the universities and business actors, thus the impact is modest on the position of science in society too. The main motivation behind these government efforts was to encourage the diffusion, dissemination and practical use of new knowledge stemming from universities. Its impact is ambivalent. On the one hand, the more dynamic flow of university knowledge towards business and society has started, but on the other hand, analysing, for example, the co-operational patent activity of universities and of their members we find that due to spin-offs (and partly due to their inadequate IPR ownership system) formally the universities hardly participate in this process.

Over the past decades, Hungary has developed a broad and differentiated *set of instruments* for public support for R&D and innovation. In 2003, the Act on R&D and Innovation set up a new fund, the Research and Technological Innovation Fund (RTIF) (launched in 2004). The main goal of this Fund was to create stable conditions for funding private R&D and to establish a mechanism for project funding on a transparent and competitive basis. The Fund has two main sources of revenue: the central government budget and the "innovation contribution" paid by medium-sized and large enterprises. (The fund was suspended for a year in 2010 and

seriously transformed after that. It has lost its strong focus on university-industry collaboration.)

Major changes occurred with the in the R&D funding scheme upon Hungary's EU accession. EU sources became available (with national co-funding) in the framework of National Development Plans (NDP). In 2007, NDP was introduced (lasted 2013) and included seven regional and eight "sectoral" programmes. It provided much larger funding sources than the RTIF. Both of these sources mark a shift of focus to applied R&D against basic research.

In the case of NDP, Hungary had to adopt the EU-practice in project monitoring and evaluation, thus providing an incentive to apply this practice elsewhere in RDI funding schemes. According to the first full-scope evaluation of the RTIF, which was performed in 2010, the governmental support of the innovation was not obvious. The RTIF had a visible and significant impact on the economy but the activity and the management of the Fund had to be developed further (source: Evaluation of RTIF for period 01/01/2004-31/12/2009, 16 September 2010).

It is worth to mention another initiative even if it was frozen because of the economic crisis. In 2007, the Ministry of Education and Culture[4] introduced a system of a 3-year Maintainer Contract in the field of higher education with the public institutions to help the institutes to elaborate and improve their own governing methods and management skills, to strengthen their fact-based strategy making and to promote the activity of HEIs in the European Higher Education Area. The Ministry, as maintainer, could monitor (and assess) capabilities of HEIs for setting up and performing strategic targets in various fields during the contracted 3 years. However, the targeted indicators and the values could be set by the HEIs themselves, therefore, it did not really support comparability over the whole system and the relevance of certain targets could be questioned too.

Generally speaking these developments have shown the first steps towards creating a more evidence-based decision-making culture. These efforts have restrained influence. The weak demand for evidence-based policy-making from the side of decision makers themselves is the most important factor of the relatively low level of project evaluation or technology assessment and related activities. The attitude of decision makers has to be changed to achieve considerable progress in this respect.

3.1. Employing statistical facts in the debates

The public tends to be interested mainly in societal and economic issues, with special regards to the reform of the economic and social system in the country. The scientific issues do not reach society on a broad scale and this fact is reflected by the

[4] In 2010, the governmental structure was revised and that Ministry became a division of the Ministry of Human Resources.

scarce appearance of scientific issues in the media comparing to other societal issues.

Between 2000 and 2009 there was no leaflet on R&D indicators as Parliament and even business organisations were hardly interested in facts. In 2010, a leaflet on R&D indicators was published again following the 10-year interruption due to the (temporarily) existing Minister of Science without Portfolio. The short existence of this Ministry is an emblematic case for the problems in policy making, which continuously suffers from constant changes in the institutional and/or legislative environment. Any initiative for public debates can be disrupted with the change in governance, even if Parliament/Government remains the same. In such an environment, there is no opportunity to lay down permanent elements and fora for public consultation and to generalize the culture of public involvement in discussions over different scientific issues. Because of these frequent changes, stakeholders can hardly accumulate good knowledge on STI policy-making.

Hungarian Parliament – as the highest level of policy-making – had only an ad hoc committee dedicated to innovation and development issues during 2010-2014. This committee was overviewing the national system for R&D and innovation support without much daily effect on its operation. Between 2010 and 2014, other various committees (e.g. Budget, Education and Science) of Parliament put STI-related issues on their agenda approximately 20 times.

The availability of STI policy-relevant statistical data and indicators has improved since the Observatory of STI indicators was established in 2012. (It was set up inside the National Innovation Office supervised by the Ministry of Economy.) This Observatory is responsible – among other tasks – for the publication of RDI statistics and information. The Observatory regularly produces the inherited yearly leaflet with the national RDI indicators and short reports on selected issues. The brand product of the Observatory is the on-line 'Kaleidoscope' where latest indicators and analytical reports are available. (www.kaleidoszkop.nih.gov.hu) Up to now the Observatory's work is driven by internal strategy and they hardly had to reflect on the demand-side. Any data/information requests are very rare birds from Parliament or the Government.

3.2. Public engagement in priority setting

In Hungary, the public engagement related to STI or in other areas of policy-making is not characteristic. The tradition of democratic decision-making is not very strong in Hungary. *Formal procedures for citizen involvement do not exist.* It is not only the presence of society that is very weak in STI policymaking, but very frequently the dedicated professional organisations are also neglected. Time-length for public debates is usually very limited. As part of the usual policy-making process, such parallel reconciliation of interests results in a legal proposal that comes to light without

much reference to the public opinion and it is being submitted to the Parliament for approval.

In the S&T policy-making the HAS has special role by tradition. Beside the HAS, a few influential public administrative executives and few business leaders play a significant role.

Activities initiated by citizens and their organisations

The role of citizens as members of civil society organisations, or as individuals is marginal in S&T decision making. The formal negotiation procedure is limited to the appearance of the related documents on the official website of the responsible public institution. In the preparatory phase of S&T policy, the availability of information is limited and thus web-based debates are hardly encouraged and feedbacks on debates are rare. So, citizens are informed about decisions and developments related to S&T policy, but significantly not involved in the preparation of them. In theory, they have the possibility to pursue and control these developments but there are no traditions on how to use these possibilities.

In a proactive society, the informed public or civil societies may take the lead and initiate on actions and not wait for policy-makers. In Hungary, such 'upstream engagement' is in its infancy. There are only sporadic experiments to involve the general public in effect to form policy-making.

One good example for upstream engagement was the so-called 'Innovation Spring' in 2005 organised by the National Office for Research and Technology, on which industrial sectors could be propulsive. More recently, the 'National Consultation on Innovation' was organised as a 'road show' which actually indicated a series of open debates where in the strict sense of the word everyone could explain his/her opinion or standpoint. In the interest of an effective debate, the strategy program called 'Innovative Hungary' was put into words clear to all.

There are certain topics – apart from those mentioned in the first part of Section 3 – that may be of interest for the public, but remain largely the responsibility of professional or non-profit organisations. These are issues related to research and/or medical ethics where debates and discussions are remain within the Hungarian Academy of Sciences or in ethical committees managed by professional organisations. In many cases, the language used in these debates quite simply prevents the broad public from joining in.

The various channels of the media might be important to mediate these and other issues to the public and translate it into a clear form. Currently, scientific issues are not in the focus of the mainstream media, thus they cannot effectively support the improvement of public engagement in Hungary.

Public-private interaction

Public-private interaction has different layers: such as partnership in policy-making and partnership in performing R&D activity. As regards the first layer, business

involvement may be observed only in a couple of cases in Hungary. Some of the business representatives are invited to a few governmental advisory bodies, and some of them may have influence through various informal involvements in policymaking. Most of this interaction has taken place in the final stages of agenda setting.

Technology assessment

Technology assessment (TA) is one of those traditional areas where responsible research and innovation may have its roots. TA activities are basically geared towards preventing non-desired effects of new technologies. There were several initiatives to introduce technology assessment in Hungary in the past, but TA activity hardly exists in the governance of the country. Seeds of the activity could be the related parliamentary Committee or the Deputy Commissioner for Future Generations. However, at present, the governance of TA activity is absent on the level of Government and thus any 'upstream' initiative or good practice cannot get enough attention or even materialize.

Few professional organisations performing traditional assessments are present in the country, such as food-safety control; safety regulation for goods and services; regulation of environment protection. This means that there are a couple of institutions in Hungary capable for conducting or collaborating in technology assessment. Such actors are public and private organizations with measurement capacities.

A sad example is the red sludge disaster in Western Hungary. It turned out that there were a few analyses (conducted 20 years before) about the possible future problem, but these materials could not get attention – not even the owners were aware of it – without a responsible authority.

The attitude of the public towards science and scientific results is also influencing what they are expecting not only from the scientific community but also from the policymakers. One way to assess this attitude is through the public engagement in various debates and discussions over various scientific issues. As it was already shown, this engagement is rather modest in Hungary. EuroBarometer is providing information on the level of public understanding and on public attitude toward science in Hungary comparing it to the European average (Table 1).

An interesting contrast in the public's attitude in Hungary can be seen in the first couple of rows in Table 1. While the public's interest in new discoveries is higher than the EU average (and grew over the 2005-2010 period) they are much less informed about these new discoveries and their level of activity (meetings, petitions) to engage with such S&T issues is below the EU average. Data also reveal that the overall positive belief of scientific discoveries is somewhat declining and more and more people are on the opinion that the pace of change is getting too fast. There is one aspect where the Hungarian public diverges significantly from the Eu-

ropean average. Almost half of them (and their proportion grew over 2005-2010) believes that "we depend too much on science and not enough on faith".

Table 1. Public Understanding of Science in Hungary (2005 and 2010)

% of population…		***2005***	***2010***	***EU27 average/total, 2010***
very interested in new scientific discoveries and technological developments		30	41	30
very well informed about new scientific discoveries and technological developments		7	6	11
regularly or occasionally attend public meetings or debates about science and technology		11	7	9
regularly or occasionally sign petitions or join street demonstrations on matters of nuclear power, biotechnology or the environment		6	9	13
'agree' and 'disagree' that thanks to science and technology, there will be more opportunities for future generations	Agree	82	78	n.a.
	Disagree	5	6	n.a.
'agree' and 'disagree' that science makes our ways of life change too fast	Agree	55	61	n.a.
	Disagree	21	17	n.a.
'agree' and 'disagree' that we depend too much on science and not enough on faith	Agree	46	48	38
	Disagree	22	23	34
'agree' and 'disagree' that because of their knowledge, scientists have a power that makes them dangerous	Agree	54	50	53
	Disagree	21	24	24
'agree' and 'disagree' that in my daily life, it is not important to know about science	Agree	40	37	33
	Disagree	42	41	48

Source: Data from EuroBarometer 340/73.1, cited in the Hungarian MASIS report

4. Research related to Science in Society

A distinction can be made between *SIS research*, on the one hand, and *SIS issues embedded in mainstream research*, on the other (Inzelt 2011). SIS research includes the studies particularly targeting public understanding of science, governance of science, science policy, science education, science communication, ethics in science and technology, the reciprocal relations of science and culture, young people and science and similar issues. However, SIS issues may also be present in other research activities, in which the main objectives of research are *not* SIS related issues, but in which SIS practices or perspectives are embedded. This could include studies within the natural sciences which apply innovative or extensive use of public in-

volvement in the research process, new ways of communicating research results, ambitious efforts to bring ethical and societal issues into research, innovative ways of involving a variety of stakeholders (politicians, NGOs, industry, social scientists etc.). Such efforts are referred to as SIS issues embedded in mainstream research.[5]

The previous section has shown from various perspectives that the topic of SIS is not very important in the Hungarian S&T policy. This means that there is no dedicated Hungarian funding available and there are no organized fora for researchers in this field to exchange their views or research results. Researchers can apply for funding from more general supporting programs (e.g. OTKA funds for basic research) but the number of such projects and the sum devoted to them is very small. More often Hungarian researchers collaborate in EU funded programmes (e.g. the 7th Framework Programme, H2020).[6]

There are very few attempts to research SIS issues in a more detailed way. The research topics listed in the Hungarian MASIS report (in section 3.1.1, see www.masis.eu) are one-time projects. However, two topics seem to be emerging fields in Hungary:

1. biotechnological ethics;
2. communication between knowledge and society.

These topics are regularly discussed in the academic arena and sometimes also the broad public is informed. Beyond them the governance of science; science education and science policy might also be considered as emerging topics.

Formalized science education contains some elements of ethical issues. Public outreach and dialogue strategies are encouraged in calls for research projects. In the last few years, publicising STI results became a significant part of the on-going programs.

Knowledge dissemination is becoming an important criterion for project and institution evaluation. However it has minor weight among the elements of project evaluations.

The practice of knowledge dissemination is on the rise at institutions. Not only because of being an evaluation criteria, but also because the competition among the institutions for funding and for students has made visibility more important to them.

As regards the relative weight in evaluation of research proposals, the gender balance issue is more dominant than ethical issues. The regulation of such ethical

[5] This section is concerned with mapping research activities which are not fully EU funded. Activities funded solely under the European framework programs are already well-documented elsewhere.

[6] Section 2 has referred to EU documents and initiatives discussing the situation of SIS on the European level. The EU's RTD Framework Programmes (RTD FPs) had dedicated research calls to investigate this topic just like the current Horizon 2020 program. These regular funding opportunities are open also for Hungarian stakeholders that are interested in the investigation of such topics, so there is an open way to join European consortia supported by the RTD FPs.

issues as conflict of interests is a bit confusing. Same organisations and/or individuals may work for business research and for standardisation, quality control and so on at the same time.

5. Trends in national science communication

Any kind of media has an important impact on how science is present in society and how citizens are able to understand new developments in science. The media influences the interest of the young generation towards or against science.

The overall characteristic of the science communication scene in Hungary is not very intense. There are, however, several good initiatives (Inzelt 2011). The scientific community could fight more or less successfully against the esotericism and superstition that occurred in the initial years of transition in the mass media. However the intensity of communication on scientific matters is not very strong. Some fields of science are much better present in the media such as the advancement in information and communication technology and biotechnology. As regards the actors, the scientists with good communication capabilities play important role. The citizens have access to information, but the supporting activities for using available information are absent.

Table 2. Changes in last decade in the use of various communication means

Means	Increasing	Same	Decreasing
Large scale festivals	↗		
Web-based communication	↗		
Museums, exhibitions	↗		
Science TV programmes		=	
Radio		=	
Magazines		=	
Citizen- or CSO initiatives		=	
Newspapers			↙

Note: ↗ increasing; = same interest; ↙ decreasing
Source: Authors' compilation based on the Hungarian MASIS report

In accordance with some general trends, the role of the traditional media (e.g. printed newspapers) has declined or stagnated in Hungary. TV and radio programs kept their role by re-balancing their content towards more light, eye- (ear) catching topics, or by presenting the views of scientists more interesting for a wide audience. At the same time, some new media (internet and blogs) have become more popular. As part of the efforts to improve the relationship of society with science, some new, more interactive types of communication gain in importance. Thus, science festivals and new-type museum activities (interactive exhibitions, out-reach activities) have become very popular (Table 2 illustrates the changes by means of communication).

It also has to be noted that in many cases newspapers or science magazines publicize the translation of foreign articles or news on science and only the minority of articles are about Hungarian research results.

Since 2002, a TV program called 'Mindentudás Egyeteme' (ENCOMPASS) has had significant successes in the public communication of science. This good practice has resulted in more than 300 lectures by renowned Hungarian (and some foreign) researchers on a very broad scale of scientific topics from all fields of science. The program was broadcasted on MTV (Hungarian public television) weekly or biweekly and attracted considerable public attention. The modified program 'Mindentudás Egyeteme 2.0' proved more attractive to the public. In several Hungarian cities where there is a large university and a regional HAS organisation have also been organizing similar local programs broadcasted on local TV and radio channels based on local scientific products or with invited non-regional scientists. Unfortunately, due to the lack of devoted financial sources there has been a break in the programmes.

Another interesting attempt is the inclusion of the topic 'Science in Society' in the courses of higher education institutions. They are usually not part of the main curricula rather an optional choice for the students not offered in every semester. One example from the recent past is from ELTE (Eötvös Loránd University of Budapest) where the Department of Science History and Science Philosophy had 'Science in Society' as an optional course. Another example is from the Budapest University of Technology and Economics, which offers courses on Science History and Science Philosophy and there are occasionally voluntary courses at other universities too, on similar topics.

6. Conclusions

The public understanding of science and scientific results is not particularly strong in Hungary. Although the public is interested in these results, the information provided to them seems to be insufficient, and the public lacks a pro-active attitude. The active public engagement in the policy-making process suffers from weaknesses from two sides: in Hungary, the policy and institutional framework still faces frequent changes and reorganisations that prevent the establishment of standard mechanisms for public discussions and for taking into account public opinion during decision-making. The public itself is keen to express its opinion only on a handful of topics and in many cases these public debates fade away without taking any effect on policy decisions. In some cases, professional or non-profit organisations take the lead and try to influence certain developments or decisions, but their successfulness is inconsistent without strong public support.

The fact that the topic of 'science in society' and the responsibility of science (in terms of research and innovation) is not among the national priorities is

evidenced by the low level of research activities in this field. Not only are there only a few research initiatives, but their visibility also suffers from a fragmented research landscape. Even if there are still not many initiatives for SIS-related research, the capabilities are available in Hungary. The scattered on-going research is financed mainly by the EU or by other foreign sources. The problem is that national authorities are not only absent from the financiers but they are quite reluctant to employ the findings of such research. Another problem could be that the dissemination of research findings is concentrated at the European/international level and neglects the information-dissemination in Hungary. Therefore, the visibility of EU-funded SIS projects is very low, and this limits their potential impact.

Table 3 summarizes the main types of public engagement in this process, hinting at their importance.

Table 3. Stakeholder involvement in S&T policy-making

Presence in policy-making of…	**Quality, frequency**
Social involvement / commitment to scientific activities	Weak
Collaborations (public-private)	Sporadic
Regular mechanism for public debates	Missing
Open fora	In its infancy
Civil society participation	Hardly feature
Business sector representatives	Mostly formal
Scientific advisers and organisations	Modest, in a narrow circle
Supporting social innovations	In its infancy
Overall the science policy	Low priority, most efforts towards university-industry collaborations

Source: Authors evaluation

One way to improve on the present relationship of science and society is to better inform and involve the public through better science communication, knowledge dissemination, and education. During the past decades there have been various attempts in these fields in Hungary with varied success and impact. Many interactive audio-visual ways of communication seem to be popular and mobilize

the public, even if only for a short time period. The development of new curricula and new methods in education might also bring results in the mid or long-term.

At present, science and scientific results still seem to be too distant for the majority of Hungarians. Either they lack the necessary (and understandable) information to interact in scientific issues, or they act based on some prejudice. Continuous efforts in science communication and better education can help raise the interest of the public in scientific matters and improve their willingness to interact with such decisions. The policy-makers need to create a stable framework in which mechanisms could lay the foundation for enhanced public engagement.

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Entrepreneurship Education For Responsible Innovation

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Within the dynamically developing entrepreneurship education, creating and shaping entrepreneurship attitude is a special issue. In the last couple of years, ecopreneurs, 'green' entrepreneurs emerged among entrepreneurs. Ecopreneurs are identified as powerful tools in turning towards sustainable products and processes, and viewed as some kind of 'remedies' to many social and environmental problems. Sustainable businesses, in a narrow sense, are largely innovative start-up businesses that create environmentally and/or socially useful goods and services via responsible innovations. The attitude of social and environmental responsibility may be strengthened in entrepreneurship education, focusing on shaping such attitude, creating and strengthening commitment, and conveying the basic entrepreneur competences necessary for such responsible innovations.

Keywords: Entrepreneurship education, Ecopreneurship, Entrepreneurship, Responsible innovation

1. Introduction

Unsustainability of present social-economical processes is recognized by now both by the public and the researchers. The ecological crisis and its consequences may constraint social-economical choices in the future. Since the Brundtland report, sustainable development became a significant 'character' in scientific discussions. There are almost no areas where it is not presented as a priority. Sustainability may be interpreted in several ways depending on which economic approach we choose. Thus we get different definitions when approaching from neoclassical environmental welfare economics or from ecological economical approach (Málovics 2007). The first approach is economic growth oriented techno-optimistic, while the second is steady state oriented techno-pessimistic.

Neoclassical economics, considered as mainstream paradigm of economics, assumes that resources (consequently natural capital) can be infinitely divided and are infinitely available, which assumption is incorrect because changes in natural capital are often irreversible (Norgaard 1985). Neoclassical economics views nature

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as a subsystem of economy; but this problem should be viewed quite the contrary, that is, to define economy as a subsystem of nature because human economy cannot be imagined without the services of natural capital.

The concept of entrepreneurship might be even more difficult to grasp than that of sustainability, and it also appears in every area as a cure to economic problems. We do not intend to fully explore the concept of sustainability and entrepreneurship in this article, as there are whole dissertations made or in the process of making on those two concepts. We shall here concentrate on a new issue, evolving at the intersection of the two-abovementioned concepts. As environmental problems came more and more into focus, concepts such as 'ecopreneurship', 'environmental entrepreneurship', and 'sustainable entrepreneurship' emerged. These are sometimes used as synonyms, but sometimes not. This is a really new area of study, but many researchers have recognized the importance of businesses in achieving sustainability. As the ecological crisis is growing, the recognition of ecopreneurship is also growing.

In the knowledge intense economy innovation and entrepreneurship are concepts linked closely. Thus the related institutions and organizations must cooperate to operate successfully and effectively. In this paper we are going to investigate the concept of ecopreneurship and related concepts, and the possible role of entrepreneurship education from the viewpoint of supporting responsible innovations realized by ecopreneurs.

2. Ecopreneurship

It is quite hard to define both entrepreneurship and sustainability because there are many different approaches and conceptual limitations. Thus defining sustainable entrepreneurship is a real challenge. By now, sustainability has become a 'magic word' that can 'sell almost anything' and this makes it even harder to explore the concept of ecopreneurship/environmental entrepreneurship. It obviously matters whether there is real commitment in certain activities and intentions or it is only a slogan. Nowadays sustainability is a concept playing central role in national and corporate strategies also. And the same applies to entrepreneurship as small and medium-size enterprises and entrepreneurship education have a prominent role in different strategies. In this chapter we are going to try and introduce entrepreneurship from the environmental aspect of sustainability.

2.1. Pros and cons of the environmental role of entrepreneurship

When examining the environmental role of entrepreneurship, the question arises: how can entrepreneurship contribute to achieving sustainability and how may it be a solution to environmental problems? In related literature there are papers that argue for, and there are papers that argue against the environmental role of entrepreneur-

ship. On the one hand, entrepreneurship has been recognized as a major conduit for sustainable products and processes, and new ventures are being held up as a cure for many social and environmental concerns (Hall et al. 2010). On the other hand, there is significant uncertainty regarding the type of role entrepreneurship has in supporting sustainability and so far there has been only a few studies on this issue in mainstream entrepreneurship literature.

Theories of traditional environmental economics and welfare economics might lead us towards thinking that *market failures arising from the system of economy prevent* entrepreneurship from solving environmental problems, and actually often are motivation to environmentally degrading entrepreneurial behaviours. But other authors, including Dean and McCullen (2007) actually say that entrepreneurship can be a solution to problems arising from market failures, more specifically, to environmental problems. They say a group of market actors are trying harder and harder to eliminate their environmentally degrading activities and are willing to spend money to do so. They actually perform entrepreneurial activities promoting environmental sustainability. This concept of sustainable entrepreneurship differs substantially from explorations of social entrepreneurship, which tend to address mission-driven entrepreneurial activities instead of profit-driven activities. Regardless of its mission, the sustainable entrepreneurship discussed by Dean and McCullen (2007) is defined by its alleviation of environmentally relevant market failures through the exploitation of potentially profitable opportunities.

Schumpeter's 'creative destruction' is highlighted again when talking about the new pressure of sustainability creating different types of market failure, and creating opportunities for the newcomers. These authors define entrepreneurship as means of resolving market failures, e.g. environmental and social issues (Hall et al. 2010). According to Schaltegger (2002), ecopreneurs destroy existing conventional production methods, products, market structures and consumption patterns and replace them with superior environmental products and services. They create the market dynamics for environmental progress. For this reason, regarding responsible innovation, special attention should be paid to ecopreneurs as they will have a special role in sustainability, welfare and economic growth.

2.2. Ecopreneurship-sustainable entrepreneurship

To date, the majority of the corporate sustainability has been focused on how established firms can reduce their environmental impacts and how sustainable development affects competitive advantage (Hall et al. 2010). But recently the concept of sustainable entrepreneurship came into focus when comprehensively discussing the contribution entrepreneurial activities make to sustainable development. Sustainable entrepreneurship is in essence *the realization of sustainability innovations aimed at the mass market and providing benefit to the larger part of society*. By realizing

such (radical) sustainability innovations sustainable entrepreneurs often address the unmet demand of a larger group of stakeholders. Stakeholders are groups or individuals that materially affect or are affected by a firm's activities (Schaltegger–Wagner 2011). As a consequence, the subject of sustainable entrepreneurship – *defined in a narrow sense – is a very innovative company start-up* supplying environmentally and/or socially beneficial products and services with the potential to conquer a large part of the market. *Defined more widely*, sustainable entrepreneurship can thus be described as an innovative, market-oriented and personality-driven form of creating economic and or social value by means of *break-through environmentally or socially beneficial market or institutional innovations*.

Isaak (2002) compares 'green businesses' to 'green-green businesses'. He says a typical 'green business' did not start out that way but, once it was established, managers discovered the cost, innovation and marketing advantages, but not always the ethical arguments, for 'greening' their existing enterprise. In contrast, a 'green-green business' is one that is designed to be green in its processes and products from scratch, as a start-up, and, furthermore, is intended to socially transform the industrial sector in which it is located towards a model of sustainable development. According to Isaak (2002) the ideal ecopreneur creates green-green businesses to radically change the sector in which he or she operates. Similarly, ecopreneurship is seen as an existential form of business behaviour committed to sustainability.

Schaltegger (2002) says that as the term 'ecopreneurship' is a combination of two words, 'ecological' ('eco') and 'entrepreneurship'. Ecopreneurship can thus be roughly defined as 'entrepreneurship through an environmental lens'. Ecopreneurship is characterised by some fundamental aspects of entrepreneurial activities that are oriented less towards management systems or technical procedures and focused more on the personal initiative and skills of the entrepreneurial person or team to realise market success with environmental innovations. Ecopreneurship can thus be described as *an innovative, market-oriented and personality-driven form of value creation* through environmental innovations and products exceeding the start-up phase of a company.

Shepherd and Patzelt (2011) say sustainable entrepreneurship is focused on the preservation of nature, life support, and community, and its goal is to use perceived opportunities to bring into existence future products, processes, and services for profit, where profit is broadly defined to include economic and non-economic benefits to individuals, the economy, and society. Thus ecopreneurship is part of sustainable entrepreneurship, but it is not a synonym to it, because ecopreneurship does not necessarily mean direct support to communities and creation of economic and non-economic benefits to individuals and societies.

From this point on we are going to examine whether responsible entrepreneurship (ecopreneurship) can be taught, and if the answer is yes, how can we support it through entrepreneurship education.

3. Entrepreneurship education

We want to explore the question that creates lots of argument even among professionals: can the science of entrepreneurship be taught, and if yes, how? What are the clear experiences published internationally, and can entrepreneurship competences be widened within the framework of higher education? After these questions we will move on to the possible role of entrepreneurship education, and we will specifically focus on how responsible innovation may be improved in students.

3.1. Can the 'science of entrepreneurship' be taught?

Many studies deal with the question whether entrepreneurship can be taught (Vesper–Gartner 1997, Klofsten 2000, Kuratko 2003, Todorovic 2004, Henry et al. 2005, Klein–Bullock 2006). The researchers who say that it cannot be taught start out from that *certain people are born with entrepreneurial traits* (the so-called "trait theory") (Todorovic 2004). According to another approach, entrepreneurial role is often acquired in a cultural or practical way. The latter supports the *view* that *"entrepreneurship" can be also influenced through education and training*. Gartner has a convincing argument that it is wrong to investigate entrepreneurship from the viewpoint of personal traits (Todorovic 2004). Entrepreneurship is *rather an attitude (that is learnt), not a personal trait (inherited)*. And others believe entrepreneurship is similar to leadership skills (e.g. communication, team building, etc.), which can and should be taught.

There are many challenges in entrepreneurship education. According to Charharbaghi and Willis (cited by Solomon 2007) entrepreneurs cannot be manufactured, only recognized. Curran and Stanworth (1989) believe that entrepreneurship education is not cost-effective. Garavan and O'Cinneide (1994) are a little less strict and suggest that the problem is that related literature is quite limited yet, and there is no well-prepared curriculum and clear theoretical background that would form a good basis for such programs. Those who argue for teachable entrepreneurship, Gorman et al. (1997) says that it can be confirmed that entrepreneurship is teachable or at least can beencouraged, by entrepreneurship education. Nobody will dispute the fact that medicine, law or engineering can be taught but there are doctors, lawyers and engineers who are talented and others who are not. A similar argument can be made for entrepreneurship and entrepreneurs (Fayolle–Gailly 2008, Fayolle–Lassas-Clerc 2006).

To a certain degree all of these ideas go back to the main questions a teacher must ask: What? For whom? What will be the outcome?

According to Jack and Anderson, teaching the 'science of entrepreneurship' is a mystery, as the real entrepreneurial process includes both art and science (Henry et al. 2005). The *'science'* of entrepreneurship means practical finance and manage-

ment skills, and is *considered to be teachable* using conventional methods. However, the *'art'*, including creation and innovation *is not teachable in the same way*.

Kuratko (2003) says that entrepreneurial skills or at least some of their aspects are teachable by entrepreneurship teachers and/or training experts before starting, during operating and after an enterprise. Johannison says teaching individuals to become not only more entrepreneurial but businessmen […] is a challenge too big both in time and in size for business schools (Matlay 2008). Additionally, Rae (cited by Matlay 2008) states that the skills taught in business schools are necessary but not enough to make successful entrepreneurs.

Taking these opposing opinions into consideration it is not surprising that there is a long on-going debate on whether universities can significantly improve number and quality of entrepreneurs in the economy. Still, despite the continuous debate the number and variety of available entrepreneurship education programs have greatly increased in Europe, Asia, North America, Australia and New Zealand (Kuratko 2003). There has been a tremendous increase in the available related courses between 1990 and 2005 even in the USA, where entrepreneurship education has a long and strong tradition. In the middle of the 1990s, dominating international trends and increasing globalization of markets motivated decision makers in the United Kingdom to value the connection between industry and higher education, and the position of entrepreneurship education.

3.2. The importance of entrepreneurship education

Entrepreneurship education was created in 1938 and is attributed to Shigeru Fujii (McMullan–Long 1987). In these days entrepreneurship education is a significant part of economic strategies, and is present in the majority of higher education institutions of economics (Matlay 2006).

In the past decades the role of enterprises in local economic development has become more and more valued (Wennekers–Thurik 1999, Vilmányi–Kovács 2008), and the same applies generally to the different forms of cooperation between universities and the industry (Vilmányi 2011). Furthermore, the *spin-off enterprises creating products and services of high added value* also get higher recognition (Imreh et al. 2013). And this is the reason why entrepreneurship education, as means of creating successful businesses has an emphasized role. According to the European Commission (2013), Europe *in the current economic situation needs more enterprises* in order to return to growth, and to achieve higher employment. Higher entrepreneurial skills of the public ('entrepreneurial capital') play a significant role in creating jobs and economic growth as it creates new places of work and new markets, while making the economy more competitive and innovative. Annual Growth Survey of the European Commission (2013) emphasizes the importance of improving the business environment in order to promote growth in the European Union.

According to Fayolle (2009), entrepreneurship education includes all activities aiming to foster entrepreneurial thinking, attitudes and skills and covering a range of aspects such as generating ideas, start-up, growth and innovation.

Supporting to become an entrepreneur via the education system to promote innovative regional development is a great challenge. The first step is to enhance the concept of entrepreneurship in the public, and reorganize the didactic, methodological and conceptual framework of education, training and counselling. Entrepreneurship education may help *creating an entrepreneurial and innovative culture by changing ways of thinking* and offering the necessary skills.

Higher education can contribute to forming and enhancing entrepreneurial attitude via two methods: conveying knowledge, and improving entrepreneurial skills. To enhance responsible innovation, forming of a 'responsible innovation attitude' and entrepreneurial and business knowledge (innovation management, responsible leadership, CSR, etc.) closely linked to such activities. Entrepreneurial knowledge is obviously not the same as business (management), but they are closely linked and both are needed in realization of a successful entrepreneurial education. We have to emphasize again that in order to achieve more successful entrepreneurial education, a shift in perspective and in content may be necessary when improving entrepreneurial attitude and conveying specific business knowledge.

One of the most important goals in entrepreneurship education is to enhance the presence of ecopreneurs within entrepreneurship, as they are the future innovators who will become the dominant actors of the next economic years. Therefore we think that in entrepreneurship education one of the most serious steps towards responsible innovation is the strengthening of the ecopreneurship approach.

Now we are going to present some methods that help to strengthen responsible innovation through entrepreneurship education.

4. Suggestions to improve responsible innovation via entrepreneurship education

As the methodologies applied in entrepreneurship education are very diverse, and different successful practices are used in different higher education institutions, the available methods are also numerous and varied. For this reason we are not attempting to make specific suggestions, but to create general guidelines.

Methodologically we chose the alternative that, on the one hand, we examined the general methodology of entrepreneurship education, with particular emphasis on the applied system of tools. On the other hand, we mapped the most important possibilities of intervention promoting ecopreneurship, with particular emphasis on the development of required competences. Thereafter we compared the two lists and based on the potential intersections we attempted to map the relevant activities of entrepreneurship education.

Generally speaking, considering the mainstream methodology of entrepreneurship education, the following may help 'start forming' responsible innovation in students:

1. Practical training in small groups.
2. Involving entrepreneurs in education.
3. Formal events and forums.

One of the most important (or maybe the most important) entrepreneurship education services is *practical training in small groups*. Good international practices have many times proved that this is one of the best methods. Within the training, educators should especially focus on developing the following competences besides general entrepreneurial knowledge. Creativity, innovative thinking and openness to new things and ideas are extremely important in enhancing responsible innovation. During training these areas should get special attention. Closely linked to these areas, the other group of competences includes problem-solving skills. 'Future ecopreneurs' should be the best problem-solvers they can be. Actually, they should perceive some of the problems as opportunities. The third aspect is the most obvious: responsible thinking within innovation. Case studies and acting out situations help significantly to streamline ideas and sets of values. One of the most current problems is to create good professional materials to help such practical trainings.

Involving entrepreneurs in education may happen in several ways. First, they can be guest lecturers (involved in responsible innovation) and convey their experiences and present case studies on being an entrepreneur, especially focusing on taking environmental social actions. The positive effects of such good examples are inevitable; they can effectively help forming characters. Probably these would be most effective on BA level, in forming basic entrepreneurial attitude. Second, and probably more effective in terms of entrepreneurship education results, entrepreneurs can present specific and real problems that the students will work on in small groups and will have to come up with solutions. The right way of progress here is probably to orient some of the examples towards 'responsible innovation'.

An third, *formal student-entrepreneur meetings* may be necessary during the trainings. In these meetings interaction and thinking together within the frameworks of responsible innovation are also extremely important. It is essential that the entrepreneur –when possible- would not simply present 'his/her story' but motivate students to think and cooperate by analysing a certain problem, difficulty or typical mistakes. Based on experience, the biggest challenge in this field too may be achieving a balance.

5. Summary

In this study we attempted to review the possibilities of entrepreneurship education focusing on ecopreneurship and responsible innovation, both getting great attention nowadays. In the first part of this paper we closely examined the relationship between business and sustainable development. We pointed out that when investigating the environmental role of entrepreneurship, the question arises: how can entrepreneurship help to achieve sustainability and solve environmental problems? After synthetizing many approaches we concluded that the subject of the sustainable enterprise in a narrow sense is a largely innovative corporate start-up that makes environmentally and/or socially useful products and services suitable to conquer a larger segment of the market. In a wider sense the sustainable enterprise is an innovative, market-oriented and personality-driven form of creating economic and social values; and it creates such values through breakthrough, environmentally or socially useful market or institutional innovations. Based on the abovementioned it is safe to conclude that the innovative ecopreneurs creating sustainable businesses are going to be the innovators executing responsible innovation in the future. Thus presenting responsible innovation and the approach of ecopreneurship within the frameworks of entrepreneurship education is definitely desirable. Therefore in the second section of this paper we analysed whether entrepreneurship education can contribute to the improvement of such competences, and if yes, how. We pointed out that based on current practices, higher education can help shaping and strengthening the entrepreneurship attitude basically in two ways: by conveying knowledge and improving entrepreneurship skills. To strengthen responsible innovation it is necessary to create a 'responsible innovation attitude' and to acquire the related entrepreneurial and business knowledge (e.g. innovation management, responsible leadership, CSR, etc.). We want to emphasize once again that a shift in approach and a change in content may be necessary when improving entrepreneurship attitude and conveying specific business knowledge in order to achieve a more successful entrepreneurship education. At the end of the study we briefly reviewed how the related knowledge could be included in the most popular methodologies, as we are convinced that improving the ecopreneurship approach in entrepreneurship education can be one of the most significant step to achieve responsible innovation.

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The influence of values on the strategic orientations of entrepreneurs[1]

Gergely Farkas[2] – Beáta Kincsesné Vajda[3] – Éva Málovics[4]

According to Schwartz, behaviour is oriented by values through motivations. These values are expressed in the factors influencing the innovative entrepreneurial activities that are presented as different types of strategic orientations in the literature. Entrepreneurial orientation includes the dimensions of risk taking, innovativeness and pro-activeness. Learning orientation summarizes the existence of a common vision, a commitment to business and the ability to accept bottom-up initiatives in a well-defined approach. In our paper, we study whether there is a difference of values among entrepreneurs that have different levels of entrepreneurial and learning orientation. Our results suggest that Hungarian entrepreneurs differ from each other in several dimensions of fundamental values, along the two types of the aforementioned orientations. This may be important from the aspect of sustainable innovation, as our results indicate that the value of universality, which refers to the attitude towards sustainability and the protection of the environment, is positively related to learning orientation.

Keywords: values, entrepreneurial orientation, innovativeness

1. Introduction

Strategic decisions of entrepreneurs have a core importance in success. However, these decisions cannot be rational; moreover, information is far from being complete in business. Therefore, these decisions can only be made by taking risks, trusting in the future. The basis of this trust is to coordinate the organization along values that provide the possibility for a fruitful cooperation with its social and natural environment. In our paper, we investigate the relationship between values and strategic ori-

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entation. Our research question is: how entrepreneurs with different strategic orientations differ from each other along fundamental values? The answer was sought by using three different measures. By using the model of Schwartz on fundamental values, we studied ten values that characterize everyone to a certain degree, according to Schwartz (2011). This is the most widely used value model of universal values. Somewhat different versions of it serve as a part of international measures like the World Value Survey and the European Social Survey. Among strategic orientations, we studied entrepreneurial orientation through the method of Covin and Slevin (1983), on the one hand, and learning orientation (Sinkula et al. 1997) on the other hand. Entrepreneurial orientation has become a central concept in this field (Rauch et al. 2009), which cannot be avoided. We complement this with learning orientation, because, according to Wang (2008), it is an important dimension along with entrepreneurial orientation. Strong learning orientation maximizes the effect of entrepreneurial orientation (Wang 2008). In our opinion, entrepreneurs do not make a rational choice among strategic orientations, but instead, they represent their personal values, therefore the research of connections between values and orientations is also an important, yet less known topic.

Váriné (1987) defines values as specific ideological objectivations in which human experiences and knowledge, desires and emotions about the importance and role of things in human existence are condensed into some sort of consensus as a result of the concept of common knowledge. Their specific characteristics are that they are culture-specific and emotions are attached to them.

"The core of the organization of values actually is the discovery of the quality of things, and within, the discovery of the practical usefulness of the natural properties to us as well as their aesthetic quality" (Váriné 1987, p. 54). This is reflected in value concepts, value dimensions and value beliefs, which influence and rule human activities by generating further systems of rules. An important element of the evaluation process is thus selectivity, which determines the direction of behaviour and has a large role in adaptive behaviour. In summary, if a value system is stabilized, it has a crucial motivating force in daily activities. It is a widespread assumption that the cognitive and verbal acceptance of values is the first step towards behaving according to them.

In this paper, the starting point is Schumpeter, who emphasized the psychological aspects when describing the innovative behaviour of entrepreneurs. After that, we describe the model of Schwartz on universal values, followed by an overview of Hungarian research results about such values of entrepreneurs and a summary of entrepreneurial and learning orientation before presenting our empirical research methods and partial results of our ongoing research seeking the answer to the question raised above.

2. Schumpeter and the psychology of entrepreneurs

From a psychological aspect, Schumpeter (1980) claims that certain attitudes are required for a specific entrepreneurial behaviour and these attitudes characterize only a small proportion of populations. According to him, the entrepreneur has a specific personality that is also different from the rationality of the rest of the economic agents.

Schumpeter agrees with his successors in claiming that initiative, authority and foresight are important features. He considers intuition, the ability to foresee what will happen even when it is not well founded a significant factor of success. Contrary, he does not think that the role of inventions is central for innovations. The function of entrepreneurs is the realization of innovations, but it is not necessary for these to be actual inventions; it is more important to defeat the resistance of the environment and to focus on the opportunities that turn up. Entrepreneurs apparently just follow their own individual interests, often very rudely, are highly competitive ("conquest ambition"), success- and risk-seeking, and have high self-motivation ("joy of creation"), but are not at all hedonistic (Schumpeter 1980).

According to Rimler (1998), the characteristic of entrepreneurs as described by Schumpeter roughly meets the contemporary philosophical-psychological definitions of creativity. He only debates that success is fully due to intuition. In our opinion however, this statement is debatable, as the entrepreneur characterised by Schumpeter, having the core feature as being innovative, is also described as the most rational by him, stating that conscious rationality has a more important role in realizing new plans waiting to be operationalized compared to the business operations of companies, which are routine processes (Schumpeter 1980).

With these thoughts, Schumpeter laid down the foundations of the psychology of innovative entrepreneurship, despite the fact that in his era, economics and psychology were two distinct disciplines with no common areas of research. Schumpeter's claims are often attacked at the point where he views business success as depending on a person having some special properties, although obviously there are other important factors, such as teamwork, supportive relationships, or the broader cultural environment (Szerb et al. 2008). Despite all the criticism, studies about innovative and creative entrepreneurship to date use Schumpeter's findings as a starting point, completing or developing them. An example of this is the definition today's strategic management literature uses for entrepreneurial orientation – this is also based on Schumpeter's thoughts and plays an important role in our research.

3. The universal value model of Schwartz

The goal of Schwartz is to provide a universal insight, namely to provide an opportunity to measure values that are present all over the world. On the basis of the man-

uscript of Schwartz, Bugán (1994) describes the relationship between motivation and behaviour in its complexity. Based on this, it is safe to state that Schwartz highlights three areas as the universal characteristics of values: biological needs, interaction needs serving interpersonal coordination, and societal expectations for the group thrive. Of this, he derives the following eight areas of motivation: enjoyment, safety, performance, independence, sociability, restrictive conformity, social power and maturity. The first four categories define the individual's relationship with his value providing environment from the aspect of internal balance, while the second four categories define those of external balance. These are expressions of social adaptation, that is the motives of self-control. According to Schwartz, the value as a goal does not control behaviour directly as a desired end state, but rather, related motivational areas have an effect in the process of being "ritualized" by a constant information retrieval from the environment, getting to the end-state in continuous interaction with the former structure (Bugán 1994).

Bugán (1994) summarizes the relationship between values aiming at an external balance and behaviour: end-states and values do not affect the individual's behaviour in a causal context; rather, it is always done according to actual environmental information an conditions. The variability of behaviour is consequent of this, which is why there is no direct relationship between actual behaviour and values as end-states.

Thus, it is necessary to account for value relations in every human group. Organizational connections are value-oriented as well; they can often be characterized by nonrational choices. The transfer of values is different from the transfer of the results of rational cognition. It has no institutionalized form, but instead, there are hidden or more open channels, habits, roles, stereotypes that are mediating values, i.e. the transmission of values happens through culture.

If we wish to investigate the entrepreneurial character in the context of values, it is important to deal with the relationships between values and behaviour. Schwartz (2011) considers values as attainable goals that affect our behaviour as guiding principles through the following mechanisms:

- Values are beliefs that directly affect emotions.
- Values express desirable goals that keep the individual motivated.
- The significance of values is beyond specific individual situations.
- We judge things as good or bad on the basis of values.
- Values can be ranked based on their importance.
- Different values are interacting with each other, and govern our behaviour depending on how much they are relevant in a given situation.

The frequent question about the culture of the relationship between the individual and group level was answered by Schwartz; according to him, these two measurement levels are completely different, that is why he developed two different test devices for measuring individual and group level values. As in our research, our

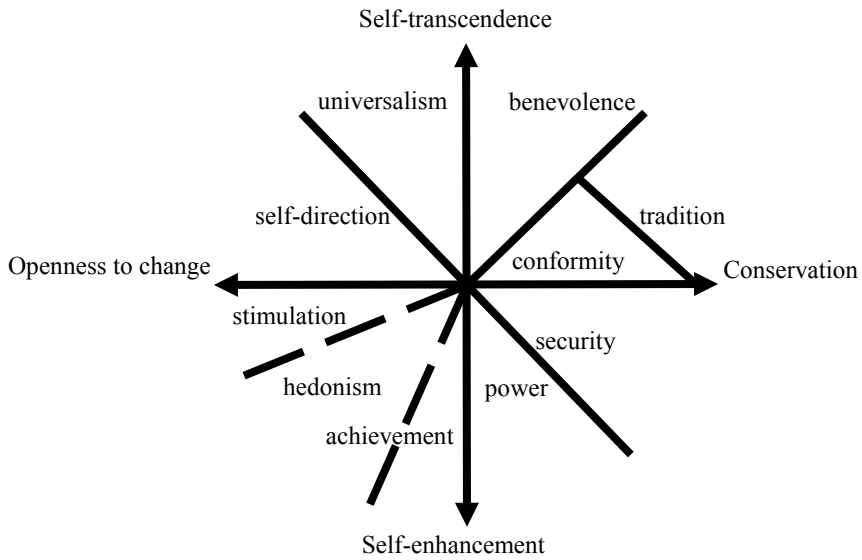
goal is the investigation of individual values of SME's leaders of various levels that will provide information about the entrepreneurial character, we will describe this measurement level in detail.

Schwartz (2011) has set out ten universal values with associated motives, which are: autonomy, stimulation, hedonism, achievement, power, security, conformity, tradition, benevolence, and universalism. According to Schwartz (2011), some values are compatible with each other, while others are in conflict. Hedonism, for example, is not compatible with benevolence, but it is with achievement.

The questionnaire developed by Schwartz to his value orientation model exists in several different forms and lengths, from among which we have chosen the shortest one which has also been used by the World Value Surveys in several countries. When filling in this questionnaire, respondents have to indicate on a six-point scale how much they think the unknown person characterized by specific statements is similar to them.

It is also important to mention the research of McGrath, MacMillan and Scheinberg (1992), in which the authors have made some important statements regarding the formation of entrepreneurial values. In their research, they used the four-dimensional framework of Hofstede in order to compare value orientations of entrepreneurs and non-entrepreneurs in different countries. According to their results, entrepreneurs have a permanent, durable and distinctive value structure that is independent from country-specific cultural values.

Figure 1. Value dimensions of Schwartz



Source: Own construction on the basis of Schwartz (2011, p. 466)

Schwartz identified universal values that, according to him, contribute to satisfy the three main needs of people independenty from culture: biological needs, the desire for social relationships, and the need for well-being. Placing a circle around the ten universal values (Figure 1) expresses the fact that the values that are in opposite positions are often in conflict with each other. Even Schwartz admits that these values are not measured precisely during the development of behaviour, but instead, they appear as a dynamically changing system of motivation (Schwartz 2011).

4. Values of entrepreneurs in Hungary

What are the values of Hungarian entrepreneurs? Sociological research on values has made significant efforts to answer that question. Authors of this field usually use data from different waves of the World Value Survey (WVS) and the European Social Survey (ESS) for analysis, and have come to several conclusions in analysing Hungarians' value choices.

Csite (2009) analyses Hungarian systems of value from the aspect of the business environment, based on the European value surveys. Entrepreneurship, as a value stands at the last place in Europe, while Hungarians put a little more significance to it, however, the proportion of those who perceive "businesses as a foundation of the economy of a country" is lower. The author claims that the majority of respondents would prefer to work as an employee rather than being an entrepreneur. But those who chose the latter would do this because of independence and self-realization, and in hope of a better income. Key components of the self-image of Hungarian entrepreneurs are diligence, ambition and hard work. But she also points to the fact that the prestige of being an entrepreneur is not very high in Hungary, and the majority of people prefer peace and stability. Comparing the social status of entrepreneurs with leaders and public officials, it is the lowest. In summary, the recognition of values and attitudes that are important in the entrepreneurial image is low in Hungary, and this may be the explanation for why the prestige of entrepreneurs is low and why the majority of respondents would rather opt for the stability given by big organizations rather than founding their own business.

Later Luksander, Mike and Csite (2012) mapped the world of values of European, including Hungarian entrepreneurs. The analysis used 2008 data from the ESS, which was supplemented by a survey of businesses in 2011. According to them, the entrepreneur's character is similar to that described by Schumpeter. The values of Hungarian entrepreneurs are essentially no different from those of European entrepreneurs. Autonomy and performance are important, they are looking for exciting challenges, but are more hedonistic compared to the average, attach low significance to providing equal opportunities and to the respect for differing opinions. The difference between the Hungarian sample and the European one is that Hungarians place security before universality in their importance, and performance, hedonism and the

respect for social norms are also given a higher place. However, Hungarians consider caring for traditions, gaining respect, following rules and becoming rich less important. According to the authors, these latter aspects partly reflect the specific values of the Hungarian population (Csite et al. 2012).

5. Entrepreneurial orientation

Entrepreneurial orientation is part of the corporate strategy, which can be analysed through organizational processes and behaviour (Covin–Slevin 1988). According to this, an entrepreneurship-oriented company is committed to innovation, takes risks and foregoes its competitors by proactive innovations (Miller 1983). The construct of entrepreneurial orientation is based on research related to the spirit of entrepreneurship and, so to speak, it has grown out of that. The research on entrepreneurship has become a rapidly developing research area during recent decades. Its topics include the search for opportunities, the process of discovery, evaluation and the exploitation of possibilities (Shane–Venkatraman 2000). Entrepreneurial orientation is a multidimensional construct which attempts to capture entrepreneurial behaviours (Hofmann 2009). Assumptions of Miller (1983) were first operationalized in greater detail by Covin and Slevin (1988). According to them, all dimensions that characterize entrepreneurial organizations represent the following distinct behaviours:

1. innovativeness, which includes the tendency for creating new combinations;
2. risk taking, which is connected to making courageous decisions and taking uncertainties;
3. proactivity, which includes the search for opportunities and pioneer attitudes (Hofmann 2009).

These three dimensions are related to the entrepreneurial values that control the organization's relationship with its external environment. That is why this orientation is frequently investigated in the context of marketing orientation, which also is an outward strategy, but focuses on the use of the information flow between the organization and its environment with marketing tools. As we have already discussed in other publications (Málovics–Farkas 2013), the latter is more co-related with short-term growth both in an Austrian sample investigated by co-researchers and in Hungary. However, the relationship between entrepreneurial orientation and performance stands on a solid foundation, also confirmed by Rauch et al. (2009), who on the basis of their meta-analysis of more than fifty researches, found a positive correlation between entrepreneurial orientation and performance.

On the basis of our previous research, we can conclude that although it is worth modifying the method used in that and go back to the basics laid down by Covin and Slevin (1988), entrepreneurial orientation definitely has an important role

in the entrepreneurial attitude or character, as it is fundamental in the appearance of entrepreneurial orientation in corporate strategy.

6. Learning orientation

Organizational learning has two main approaches in the literature. One of them focuses on the processes of information distribution, appearing several times since Argyris and Schön as learning cycles of different numbers and content. The other type focuses on cultural characteristics of the organization such as shared vision or open thinking, as Senge uses it. All organizations have to learn in some way, collecting information of their environment as well as about themselves. However, this may not be appropriate to be utilized in such a way as to be called a learning organization. According to Sinkula (1994), organizational learning can take place if the individually acquired knowledge is made available to others in the organization. In the long term, organizations must learn at least as fast as their environment changes, if they do not wish their market share to be reduced over time (Sinkula et al. 1997). The ability to learn is crucial to the organization not only develop the current paradigm, but also to allow for a paradigm shift (Baker–Sinkula 1999a). Such paradigm shifts can clearly be regarded as innovations to the organization. It is therefore not surprising that Sinkula and Baker (1999b) found that learning orientation has a greater effect on organizational performance and its innovative activities compared to marketing orientation which focuses on meeting consumers' needs, but not on innovative activities.

Learning principles described by Senge (1990) cannot easily be operationalized on the level of self-evaluation questionnaires. Researchers (Sinkula et al. 1997, Baker–Sinkula 1999a, 1999b) emphasize three dimensions that can be found in several descriptive approaches: commitment to learning, open thinking and shared visions. At organizations which are committed to learning, leaders support strives for learning. The organization continuously strives for obtaining new information, evaluates it and revises its own behaviour. This behaviour is in accordance with the two-circle model of learning (Argyris–Schön 1978), as well as with the learning principle of Senge (1990). Where this commitment is absent, there is less learning (Baker–Sinkula 1999a). The second dimension deals with the mental principles that are shared by leaders and employees as well. These principles are created on the basis of experiences, but the changing environment degrades their value from time to time. Open thinking enhances re-learning along with forgetting old patterns and developing new abilities (Sinkula et al. 1997). This may also lead to innovation, bit it is more important that open thinking is a proactive process, as it supposes that previously gained knowledge is not sure and continuous renewal is required. While the aforementioned defines the intensity of learning, shared vision defines its direction. Tobin (1993) defines this as visible leadership. Shared visions provide shared expe-

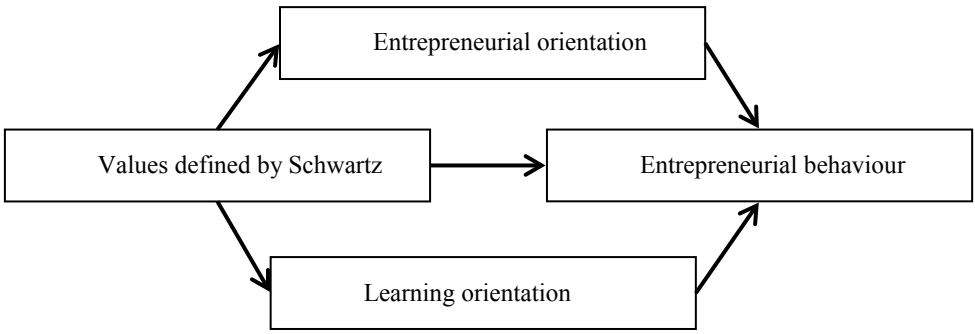
riences and a direction for the members of the organization, improving motivation for learning. Shared visions direct learning processes in one direction making them more efficient this way (Baker–Sinkula 1999a).

In our opinion, although learning orientation is embedded in organizational culture, it originates from processes induced by leaders, or in our case by the entrepreneur. Without their support for learning orientation, it is difficult to imagine that innovations or proactive changes take place in the whole organization. Commitment for learning and open thinking is in parallel with the axis in Schwartz's model of openness to change. Shared vision, on the other hand, is an extension of the self-fulfilling aspirations of the entrepreneur to the entire organization to work towards the realization of his ideas.

7. Methodology

Our research is part of a more complex survey aiming at preparing businesses that are to be relocated into the science park around the ELI in Szeged for a knowledge-intensive cooperation framework rich in innovation and research and development activities. In the context of this, we conduct a broader study investigating the characteristics of entrepreneurs and their firms together. It is possible to compare characteristics, behaviour and growth and innovation performance of businesses, but here, due to space limitations, these cannot be elaborated in detail. Therefore, this study aims to analyse the relationship between values and strategic orientations presented in Figure 2. By this, nonrational managerial decisions may be explained in the context of values – values that affect the operations of businesses, explaining, for example, the priority of becoming rich or the motivation to deal with the natural environment.

Figure 2. The effect of the values defined by Schwartz on the behaviour of entrepreneurs



Source: Own construction

In this paper, we only present the key demographic indicators and the results from measures connected to the three aforementioned concepts, and not our entire work. Schwartz's 10-item scale measuring values is part of the World Value Surveys. Each item measures one value of this model, and respondents have to indicate on a six-point scale how much they think the hypothetical person characterized by the specific statement is similar to them. This formulation enhances a more comfortable declaration of the respondents' true values instead of choosing what they think would be socially acceptable.

Measurements of entrepreneurial and learning orientation use semantic differentials. Both endpoints of these scales show opposite statements in connection to which respondents have to indicate their opinion on a seven-point scale. Therefore, they indicate their distance from two extreme opinions. The subscale of entrepreneurial orientation consists of 3 statements each, while that of the learning orientation consist of 2. The former is a translation of the questionnaire of Covin and Slevin (1988), while the latter is a shortened and adapted version of the scale of Sinkula, Baker and Noordewier (1997).

Responses were collected in May 2014 in the form of an anonymous questionnaire. Data collection was based upon convenience sampling both online and on paper; respondents had the opportunity to choose which type was more convenient for them. Paper-based answers were immediately uploaded to the online interface in order to gain one common database. Analysis was carried out by the use of MS Excel 15.0 and IBM SPSS 22.0 software.

8. Results

During this analysis our questionnaire was filled in by 398 respondents, of which we could use 351 after cleaning the data. Respondents were Hungarian entrepreneurs, 80% of whom were between ages 31 and 60, 14% of whom were younger, while 6% of whom were older than that.

80% of businesses investigated had a maximum of two owners. 90% of the respondents were the founder or one of the founders of the business. Among the forms of businesses, the most frequent types were Ltd's (57%) and individual proprietorships (29%); other legal categories only appeared in 3% of our sample. Regarding their size, half of the businesses were micro-sized, 35% of them were small, 13% of them were medium sized, while 2% of them were large companies. It is important to note that even those businesses in our sample which were not micro-sized by definition had a maximum of 10 employees, so they could have fallen into other size categories on the basis of their turnover or balance sheet data. 60% of the businesses were more than 10 years old, and 77% of them had their headquarters in the Southern Great Plain region.

As each of the Schwartz-values had only one item in the questionnaire we used, we could not calculate mean, but instead, median and mode shown in Table 1. These results suggest that self-direction is the most important value for entrepreneurs, while power and stimulation have the lowest priorities. Spearman correlations are obviously not strong between the values, due to their method of formulation. The highest correlation coefficient is between power and achievement ($r = 0.467$). This reinforces our presumption that there is correlation between success and richness in the Hungarian values.

Table 1. Medians and modes of the values of Schwartz in the sample

Values	Median	Mode	Values	Median	Mode
1 self-direction	2	1	6 achievement	2	2
2 power	4	3	7 stimulation	4	5
3 security	2	2	8 conformity	3	2
4 hedonism	2	2	9 universalism	2	2
5 benevolence	2	2	10 tradition	3	2 and 3

Source: Own construction

Orientations were not divided into subscales during our analysis. In both cases, the possible minimum value of the scales was 1, while the possible maximum value was 7. Measured values were close to these, but did not always reach them. Descriptive statistics shown in Table 2: standard deviations are similar, but the value of learning orientation is higher. Correlation between them is significant, but weak ($p < 0.01$, $r = 0.253$). The values of entrepreneurial orientation do not differ from what we measured two years ago in a similar sample.

Table 2. Descriptive statistics of entrepreneurial and learning orientations

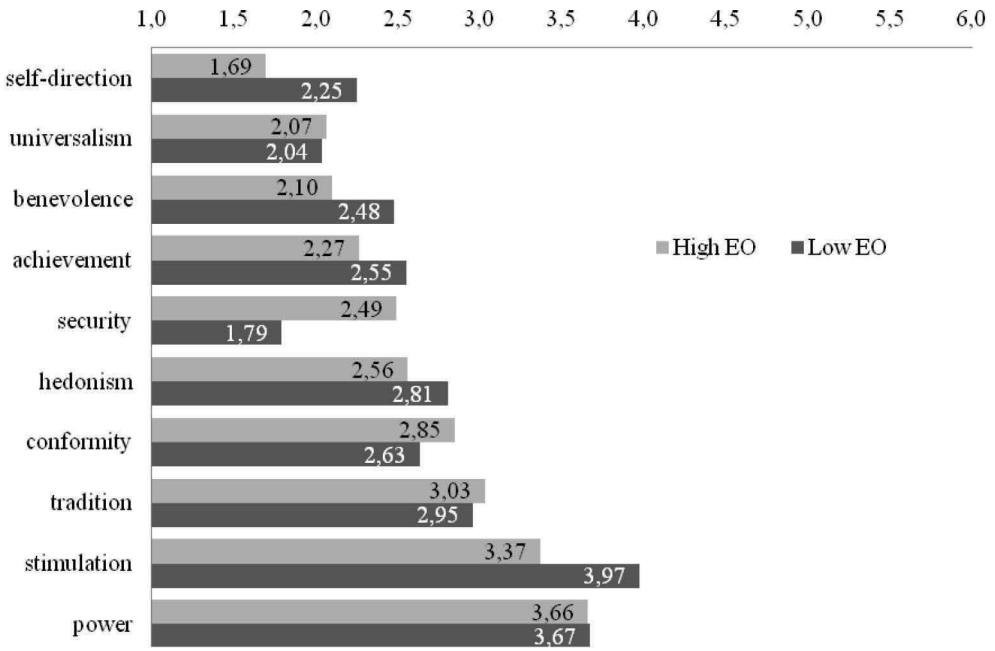
	Minimum	Maximum	Mean	Std. Deviation
Entrepreneurial orientation	1.11	6.44	3.7019	1.09411
Learning orientation	1.83	7.00	5.3542	1.05064

Source: Own construction

For further analysis, we divided our sample along both orientations into three groups of approximately the same size (above 100 in all groups). In the following, we shall disregard the middle group. Members of the lower and the upper thirds are described by low and high entrepreneurial (EO) and learning (LO) orientation. We compared these two groups by nonparametric Kolmogorov-Smirnov Z tests. Figures 3 and 4 show the group mean values despite that we are aware of the fact that this is questionable from a mathematical point of view. However, in social sciences, mean values are more expressive for the reader regarding the differences between groups. In the figures, statistically significant differences are also indicated. During interpretation it is important to know that according to the Schwartz value scores, lower

scores indicate values that are close to the respondent, e.g. self-direction characterizes entrepreneurs with high EO and high LO.

Figure 3. The comparison of the value scales of the high EO and low EO entrepreneurs



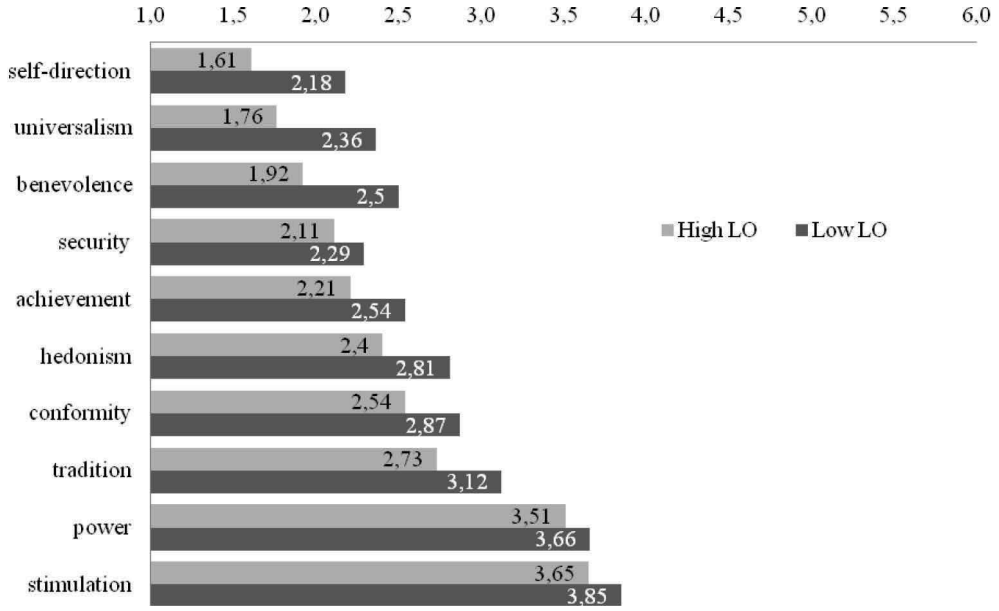
* The differences between the values of the marked scales are statistically significant ($p < 0.05$).

Source: Own construction

In the case of EO, we have found significant differences in four cases (Figure 3). The lower value of stimulation ($p = 0.029$) and the higher value of security ($p < 0.001$) suggests that entrepreneurs take significantly more risks. Self-direction ($p < 0.001$) is in a relationship with innovativeness that is also more characteristic of those having a high EO. Based on the values of achievement ($p = 0.048$), we may claim that reputation is also more important for the group that has a higher EO. These results seem to be trivial if we consider that more innovative, proactive and risk-taking entrepreneurs are also more performance-centered and are willing to experiment with new things. However, if we take the lack of differences as well as the relationships with values into consideration, we may see that despite lay perceptions of entrepreneurs, they do not hold the values of some capitalist exploiters. Universalism (that includes the protection of environment and sustainability) is at the second place based on the average distances of values in both cases. Benevolence, re-

ferring to helping a group close to the individual, is also a value belonging to entrepreneurs. Power, in turn, which includes striving to be rich, is among the last ones. The order of the values is similar in the case of those that have low EO as well, aside from the salient differences in self-direction and security, which derives from the definition of EO.

Figure 4. The comparison of the value scales of high LO and low LO entrepreneurs



* The differences between the values of the marked scales are statistically significant ($p < 0.05$).

Source: Own construction

In the case of LO, it is also true that the order of values is similar. In this case, the difference is significant in the first three places of the list ($p < 0.01$). Self-direction is closely related to learning, the difference here was expected. In the case of benevolence, the difference may be explained by the fact that one of the subscales of LO, namely openness, is about supporting bottom-up initiatives and taking group interests into consideration. It is important, however, that universalism in not only a value characterising entrepreneurs, but is increasingly important in the case of a high LO. This may be explained by the fact that environmental protection and sustainability are concepts that entrepreneurs need to interiorize, and during their application, many new things have to be learnt. Those who are capable of doing this are more open to new ideas.

9. Conclusions

In this paper, we could only present a small section of our research. An important result is that universalism is a value close to entrepreneurs, indicating that many actors of economics realize the importance of environmental protection and sustainability.

The difference between the two strategic orientations is important where learning orientation is high – they can especially be characterised by universalism. In the case of future entrepreneurs, the values that are brought from their families, learnt through socialization will certainly have significance. Therefore, we must consider that in order to accept a positive attitude towards responsible innovation, we must be capable of learning. So, the probability of realising such innovations may be increased by orienting entrepreneurs towards realising the importance of open thinking and shared responsibility.

Analysis presented in this paper will have to be broadened at several points in the future. Augmented by existing data, these results might be supplemented by information about characteristics of economics and industries perceived by entrepreneurs, as well as about relationships between the measured values, orientations and economic performance. Our research is not representative; convenience sampling might have had a significant effect on the distribution of demographic factors. However, we suppose that the emergence of the discussed values and orientations is characteristic of the given culture.

Our results are interesting from the point of view that they contradict typical negative stereotypes of entrepreneurs. On the basis of the order of values, the well-being of communities is more important than personal interests. In this context, it might not be hopeless to promote sustainable innovations and to reach a critical mass applying this attitude in the near future.

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Responsible Innovation and R&D&I Controlling

István Deák[1] – Miklós Lukovics[2]

The compulsion to quickly change technologies, continuously shortening product life cycles, the acceleration of product development processes, customers' increasing expectations regarding price, quality and services pose ever more difficult challenges on organisations in the keen market competition of our days. The importance of research and development is growing, expenditures on research, development and innovation (R&D&I) are increasing – yet, this can accompany an increase in the unintended negative impacts of the results of innovation. For this reason, the concept of "responsible innovation" has by now become a key focus point in the European Union. Controlling functions and tools must also be adapted to these challenges. The widespread application of controlling tools and methodology is becoming natural in nearly all companies. Consequently, it is also natural that companies willing to gain long-lasting competitive advantages that come from different sources need state-of-the-art R&D&I controlling to support their R&D&I activities. The importance and necessity of R&D&I controlling are, therefore, indisputable in our days.

This study will try to identify the reasons for the growing importance of the two current megatrends, R&D&I and responsible innovation. It will review the information content of R&D&I related costs and expenditures and the possibilities of their management in a decision supporting system, attempt to define the key components of R&D&I controlling and try to position one of these components, the concept of responsible research and innovation.

Keywords: accounting, R&D&I controlling, responsible research and innovation

1. Introduction

As a result of globalisation, market competition is also becoming ever more global: large companies' competition strategies reach beyond the boundaries of national markets and extend market competition to the entire developed world. „Corporate success clearly depends on innovation" (Lengyel 2003, pp. 101). In our days' information society, knowledge has become a key element of competitiveness and the driver of economic development. „The quick introduction of innovations and new

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technologies is a competitive advantage" (Lengyel 2000, pp. 980). Innovation can be considered as one of the most important sources of the competitive advantages of modern economies (Holbrook–Wolfe 2002). The ability to acquire, adapt and create knowledge determines the innovation opportunities and, through these, the competitive power of both companies and regions.

In the 1960s, the linear model of R&D&I was the generally accepted one (Inzelt 1998). Today, by contrast, a competitive advantage comes from the existence of a highly developed innovation culture. Product life cycles have shortened, processes must be accelerated: to improve competitiveness, the *simultaneous* development of research, innovation, education and vocational training, the spreading of scientific and technology related knowledge and its appearance among the competitive advantages of the businesses operating in a given region are a must. Lengyel, Imre (2003) highlights the importance of the knowledge based economy: „A corporate competitive advantage can be maintained in the long term only where innovation-targeted research and development activities, i.e. knowledge creation, are permanent" (Lengyel 2003, pp. 19).

The compulsion to quickly change technologies, continuously shortening product life cycles, the acceleration of product development processes, customers' increasing expectations regarding price, quality and services, environment consciousness requirements, etc. pose ever more difficult challenges on organisations in the keen market competition of our days and, in many instances, an unavoidable side-effect of this accelerated compulsion for innovation is the occurrence of certain unintended, negative impacts of the innovation activity. It is this challenge that Responsible Research and Innovation (RRI) addresses: RRI is a fast spreading approach in the European Union, which *has become a central element of the 2014–2020 programming period.* Responsible innovation is an important direction of development to the European Union, as the European Commission's most recent report entitled „*Responsible Research and Innovation (RRI), Science and Technology*" (published in November 2013) also shows. For the purposes of this study, the term 'responsible innovation' carries the following meaning: *Responsible Research and Innovation is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products* (von Schomberg 2013, pp. 51-74).

2. Controlling in the Service of R&D&I

The importance of research and development is growing and the functions and tools of controlling must adapt to this change. As the application of controlling activities and tools is becoming ever more natural in nearly all companies (Horváth & Partners 2003), those that want to gain long lasting competitive advantages coming from

different sources will increasingly apply some controlling methodology to support their research and development activities. The aim of R&D&I controlling is to make research and development activities as transparent as possible with regard to costs, objectives and variances and is used for the target-oriented coordination of R&D&I activities (Jung 2001). R&D&I goals – similarly to most goals – may be strategic or operative. The starting point of R&D&I controlling is an up-to-date information system, whose data form the basis of all sorts of planning, variance analysis and information supply for decision preparation. For the reasons outlined above, the importance and necessity of R&D&I controlling are, therefore, indisputable in our days (Jung 2001).

In its research project closed in February 2003, the Boston Consulting Group surveyed the research activities of 13 market leading technology intensive large companies. Successful R&D&I management can be built around three factors (BCG 2003):

1. The corporate strategy must be the starting point for the definition of a clear R&D&I strategy and the strategic objectives of R&D&I must be detailed.
2. R&D&I projects must be prioritised. This is the only way to efficiently achieve the R&D&I objectives defined.
3. The efficiency of R&D&I projects can be improved through the use of so-called success boosting tools. These are time management, quality management, resource management, human resource management, knowledge management and R&D&I-controlling. The successful companies covered by the survey have a separate and independent R&D&I controlling office, which is responsible for the efficient utilisation of the available research and development costs and the achievement of R&D&I objectives.

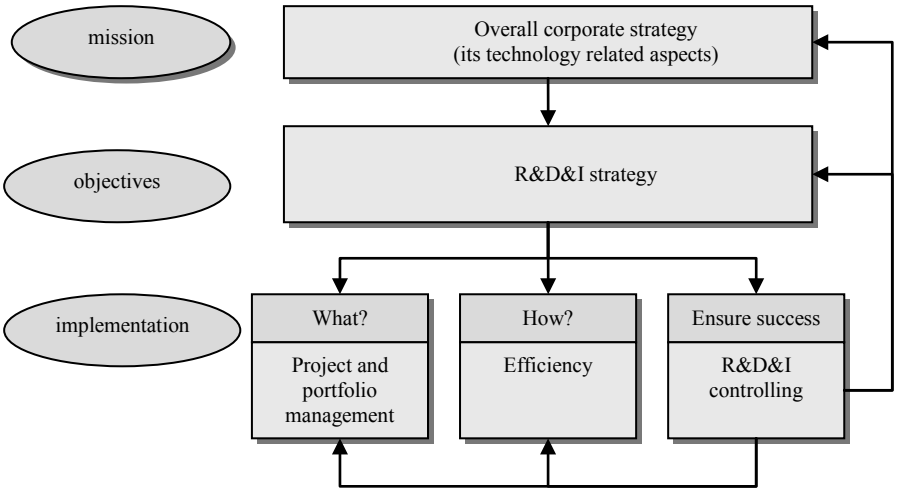
In successful companies, R&D&I controlling plays roles that are similar to traditional controlling functions (BCG 2003). Its aim is to make the whole process as conscious, transparent, easy to plan and controllable as possible. For the sake of controllability, it must certain items of information available to decision makers in a timely manner, in the appropriate quantity and quality and in the most cost efficient manner (Borchert–Hagenhoff 2003). In other words, it plays a key role not only in implementation but permeates the whole process, all the way from strategy compilation through implementation to feedback (Chart 1).

In general, controlling traditionally deals with hard data (cash-flow, payback, productivity, turnover rate, cost data, coverage amounts, etc.). In the knowledge based economy of our days, controlling must offer an increasing coverage of other factors, which affect the company's level of success but are difficult or impossible to measure, called "soft factors". This is where the *Balanced Scorecard* (BSC), a balanced system of strategic indices that became widely known in the late 1990s and quickly went very popular, offers some kind of help. Besides translating the strategy

into operative actions, it attempts to take into account soft economic factors – which is where it becomes significant for the purposes of our topic. What it does is it supplements traditional financial indices with further aspects, which map the strategic direction (Laue 2004). The BSC operating processes aspect[3] incorporates three fundamental processes (Kaplan–Norton 1999):

1. innovation process;
2. production process;
3. after-sales services process.

Chart 1. The connection of R&D&I controlling to the strategy and to the implementation level



Source: BCG (2003)

Many companies' performance measurement systems focus primarily on the efficiency of the production process when it investigates the operating process, though the efficiency of the research and development process is at least as important. One of the obvious reasons for this approach is that the relationship between the *input used* and the *result achieved* is far weaker and uncertain in the case of the research and development process than with the production process. The problems arising in connection with the measurement of the input-output ratio ought not to prevent the controlling system from translating the corporate strategy into indices and objectives for R&D as an operating process, following the BSC logic. The indi-

[3] The Balanced Scorecard is comprised of four aspects aspect: the financial aspect, the customer aspect, the aspect of operating processes and the learning and development aspect (Kaplan–Norton 1999).

ces applied – which make research and development „easier to handle" for controlling – could include[4] (Kaplan–Norton 1999, Laue 2004):

- Percentage of sales revenues from new products.
- Launching of new products compared to competitors or the plan.
- The potential in the production process.
- The time required for the development of a new generation of products.
- Number of innovation proposals.
- Ratio of successful product development projects.
- Ratio of idea utilisation

3. Strategic R&D&I controlling

To be able to take an even more sophisticated approach to the role of controlling in research and development, we must separate the strategic and operative levels. Strategic controlling works along a long term planning time horizon: it tries to tailor the company to its actual environment, aims at maintaining the already achieved success potential and return on capital and takes part in the compilation of the corporate strategy (Körmendi–Tóth 2003). Consequently, R&D&I controlling must make fundamental decisions at the strategic level, like set the route for the long term R&D&I activity (Borchert–Hagenhoff 2003). Based on these general features, the tasks of strategic R&D&I controlling can be described as follows (Göpfert–Hoppenheit 1991):

1. One of the key tasks of strategic R&D&I controlling is to seek, find and evaluate new ideas. An idea can be channelled through the innovation process and can ultimately become a successful innovation result. For this, a variety of idea generating techniques is available and a database can be compiled of ideas that seem viable.
2. Recognition of technology trends: an obvious strategic matter is to define the research route which must be followed in the next few years. A prerequisite of this is the knowledge of current international trends. For this purpose, trend extrapolation can be performed and, at this point, we must also make mention of the follow-up and analysis of patents, which is also a task of strategic R&D&I controlling.
3. Preparation of technology related make-or-buy decisions, supply of the necessary information. The desired level of technology can be achieved, besides internal development, through the adaptation of state-of-the-art technologies and technology takeover/sharing, i.e. technology transfer

[4] Naturally, the indices applied are company-specific: they heavily depend on the actual corporate strategy and the management's information need.

(Buzás 2002). In general, the following company types stand on the demand side of technology transfer (Buzás 2002):

a) which do not have the opportunity or need to assemble an R&D&I unit of their own;
b) which need basic research that they can only obtain from external sources;
c) whose R&D&I capacity is already fully utilised;
d) which must amalgamate their own know-how with some external technology.

4. Setting and coordination of general corporate and R&D&I objectives. Strategic R&D&I controlling plays a coordinating role in the definition of the organisation's strategy – and this role comes into its own when the strategy's technology related aspects are defined. This is a key point as this is the cornerstone of the company's R&D&I strategy – which is the starting point of future activities in all areas. Once the strategy is defined, R&D&I-controlling fulfils the traditional controlling functions, i.e. planning, plan/actual variance analysis and information supply for the preparation of decisions.
5. Strategic controlling has the task of selecting that/those from all the project alternative(s) it is familiar with which is/are relevant from the point of view of the corporate and/or R&D&I strategy. Once this selection is made, the company's research programme has to be recorded.
6. Strategic control of research projects: strategic R&D&I controlling monitors the implementation of the strategic plan, evaluates variances (if any) and works out decision alternatives for cases where variances are identified.

Over and above these, the roles of strategic R&D&I controlling also include:

7. Supporting all decisions related to responsible innovation, provided that we consider responsible innovation as the narrowing down of the concept of 'sustainability' to 'innovation policy', which, in the broadest sense, is commitment to protect the future, which, in turn, can be implemented through the responsible handling of science and innovation today.

4. Operative R&D&I Controlling

By contrast, operative controlling works along a short and medium term planning time horizon: it focuses on the economic efficiency of operating processes. It primarily investigates the profit-return-cost dimension. Its goal is to ensure profitability, economic efficiency and liquidity (Körmendi–Tóth 2003). At an operative level, R&D&I controlling primarily performs the planning, controlling, coordination and

checking of the individual R&D&I activities, with an eye to ensuring that the objectives set can be achieved. Its tasks are (Göpfert–Hoppenheit 1991):

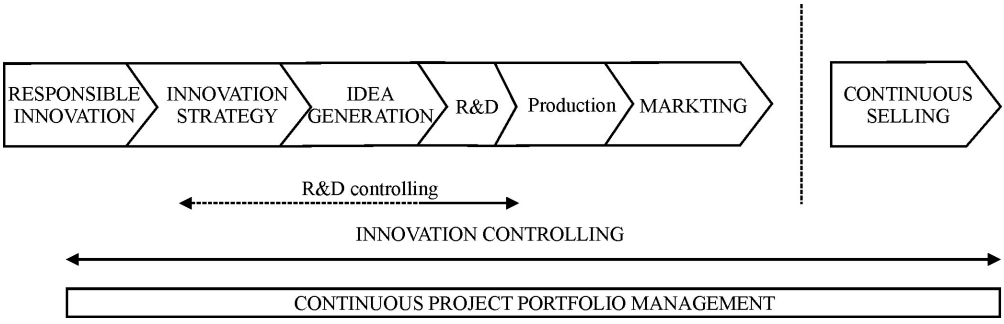
1. Support planning: operative R&D&I controlling helps to plan the rollout of the given research and development project, breaking it down to deadlines, responsible people and tasks. Another important task is assistance in the planning of the budget and the required human and technical resources. The documentation of the framework plans of the individual projects and partial projects and the making of proposals for the improvement of the efficiency of projects also fall in the scope of responsibility of operative R&D&I controlling.
2. Variance analysis. The follow-up of project goals and project plans – especially with regard to deadlines, costs and quality –, the identification of the reasons for and the expected impacts of any variances and the elaboration of adjustment proposals are among the key tasks of operative controlling. Further important roles include the identification and analysis of actual costs and the performance of efficiency analyses.
3. Coordination: the activities of the units and persons taking part in the R&D&I process must be coordinated. The vertical and horizontal coordination and integration of project goals and plans must be implemented.
4. Information supply: among other things, the difference between controlling and the performance of simple checking and monitoring tasks is that the former provides decision makers with information that can be used as grounds for and to prepare decisions (Körmendi–Tóth 2003). As part of these activities, such indicators can be defined and integrated into the system which recognise deviations from the planned route in time and hence enable early intervention. Operative R&D&I controlling plans and operates the information system which is relevant to research and development.

The information system supplies the input for the panning and monitoring system and is, therefore, tightly connected to it (Neubauer 2004). Accounting primarily deals with events of the past and, given that, can say very little about the future, though the value of the company is primarily no longer in its assets but in its strategy and the intellectual resources that support it (Daum 2001). Consequently, we consider it important that we describe how accounting handles research and development activities and, through that, what starting data it supplies for the controlling system. „… we must deal with those intellectual resources in more depth which lay the foundation for the future" (Buda 2003).

A typical case of recognising opportunities is when the research and development unit comes up with novelties, using their abilities and technology related knowledge obtained from previous products and innovation processes. Besides their internal resources, innovative organisations can use external sources – like universities, research institutes, suppliers – to collect ideas for their projects, from which

they can then assemble their R&D&I portfolio. The "research and development portfolio" means a mixture of projects of different types which the management continuously reviews, i.e. initiates new R&D&I projects and stops others due to their unsatisfactory results. The purpose of product development is to create an innovative product/service that is attractive to the target market and can be produced at an appropriate cost level. At the end of the product development cycle, the new product/service is prepared for commercial production. The project team made responsible for this task performs experimental development, makes a prototype, tests the finished product and, finally, initiates commercial production. The follow-up of the entire innovation process is the task of innovation controlling, within which R&D&I controlling plays a key role already during the collection and evaluation of ideas but, especially, in the course of the planning and development of products/services (Gleich–Schentler 2011). However, it is a good practice to manage the whole process through the eyes and approach of responsible innovation as the ethical acceptability, sustainability and social desirability of the product born as the result of the process are of fundamental importance (Chart 2).

Chart 2. The innovation process and controlling



Source: Edited by the authors, based on Gleich–Schentler (2011)

5. Input Data: Handling of R&D&I in Financial Accounting

The accounting of R&D&I activities basically means the accounting and recording of the costs incurred. In the course of this activity, at least three areas must be focused on:

1. the information needs of the controlling system;
2. the related provisions of accounting regulations;
3. the related taxation rules.

It is a good practice to create all these three areas within the closed system of accounting, i.e. in synthetic accounting, a purposefully compiled system of the cost accounts must be created. As much as practicable, the satisfaction of the needs and requirements of the controlling system must be ensured. When this is done, it is not easy to find the optimal relationship between the strictly regulated (standardised) accounting that ensures the satisfaction of external information needs and the accounting that is suited to internal information needs and supports the company-specific monitoring of operating processes.

In this area, there may arise a particularly strong need to utilise the opportunities offered by management accounting: it often happens that a cost appears in traditional accounting with a significant delay (when it becomes an economic event, i.e. when it is incurred) (Boda–Szlávik 2001). Financial accounting can support this, utilising the high level of freedom provided by regulations, by enabling the creation of a cost centre-cost bearer structure that is tailored to actual information needs. This is necessitated by factors like capitalization performed within the framework of accounting regulations, the separation of activities carried out for internal purposes and on order and the application of tax relief types offered by the taxation system.[5] With only a few exceptions, accounting rules usually prohibit the capitalization of such costs as the same would not comply with the general requirements of B/S capability, with special respect to the condition that future profit can be expected.[6] Nevertheless, the same procedures can be followed with the definition and keeping of cost accounts, the payment and allocation to order number of costs incurred and the breakdown (if any) of indirect costs as with any other self-produced assets. The costs of human resources, the value of the services provided by external experts or procured from other sources and of materials used, the depreciation of the tangible assets used for business activities, etc. and the costs subsequently divided among different projects are accounted among the direct costs of R&D&I activities, in different proportions, depending on the actual type of activity.

In accounting, a sharp distinction must be made and separation should be applied between the *research* and the *development* phases. The different accounting regulations (including the Hungarian one) take a uniform approach towards the accounting of *research* (basic and applied research) activities in that they do not permit the reallocation of such costs to different years either through capitalization or by accruing/deferring (Chart 3). The explanation behind this approach is that, during the cost accounting period it is (usually) not possible to verify the certain collection of future profits, which makes comparison with future revenues dubious. For this

[5] Not disputing the acceptability of the solution in which the exclusively cost type based accounting is supplemented with some sort of analytic collection.

[6] One of the most important features of research and development activities is their high level of uncertainty (Inzelt 1998).

reason, R&D&I mostly occurs in the reports of companies as an *invisible asset*[7] (Hollender–Deák 2004). The allocation of costs to the year of their incurrence may cause a significant variability of the result[8], rendering the direct comparison of the results of the different years unreliable. This statement may significantly change if the price of activities carried out on order is accounted as sales revenue and if the non-refundable subsidies that partly or fully provide the financing for R&D&I activities are accounted as other revenues.[9] The amount of subsidies received on or before the day of B/S compilation must also be stated in the reported year's financial report (as accrued income). Special attention must be paid to the accounting of the tangible assets serving R&D&I activities and the non-refundable supports received for these.

In the case of projects in the *experimental development* phase, it is now allowed by regulations to include these costs in the B/S as an intangible asset, if so decided by the company (stringent conditions applying), and to thus offset the expenditure burdens of the different years[10] (Chart 3). Similarly to the research phase, the allocation of costs to the year of their incurrence may cause a significant variability of the result, rendering the direct comparison of the results of the different years unreliable.[11] A precondition of capitalization is the properly documented statement of the future extra revenues or cost savings achieved as a result of experimental development and providing a return on coverage. When determining the self-cost of the asset so stated, the related provisions of the Accounting Act must be applied, i.e. only those costs may be taken into account which have been directly paid and accounted as the development to be capitalized, with the contents described in the company's internal regulations on self-cost calculation (Nagy 2004). Capitalization does not depend on whether any non-refundable support (subsidy) has been used to finance development. In such cases, it is reasonable to apply accruals for that part of the accounted supports (subsidies) among the reported year's revenues (due to capitalization) which is not offset with costs and to thus allocate the support (subsidy) to those years in which the capitalized development cost is accounted.

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[7] For the purposes of this document, the authors of this article, similarly to the authors referred to or quoted herein, use the term „*intangible assets*", widely used in international professional literature, to mean 'intangible assets', as used traditionally, *and* the 'invisible asset' types described in the body text *together*.

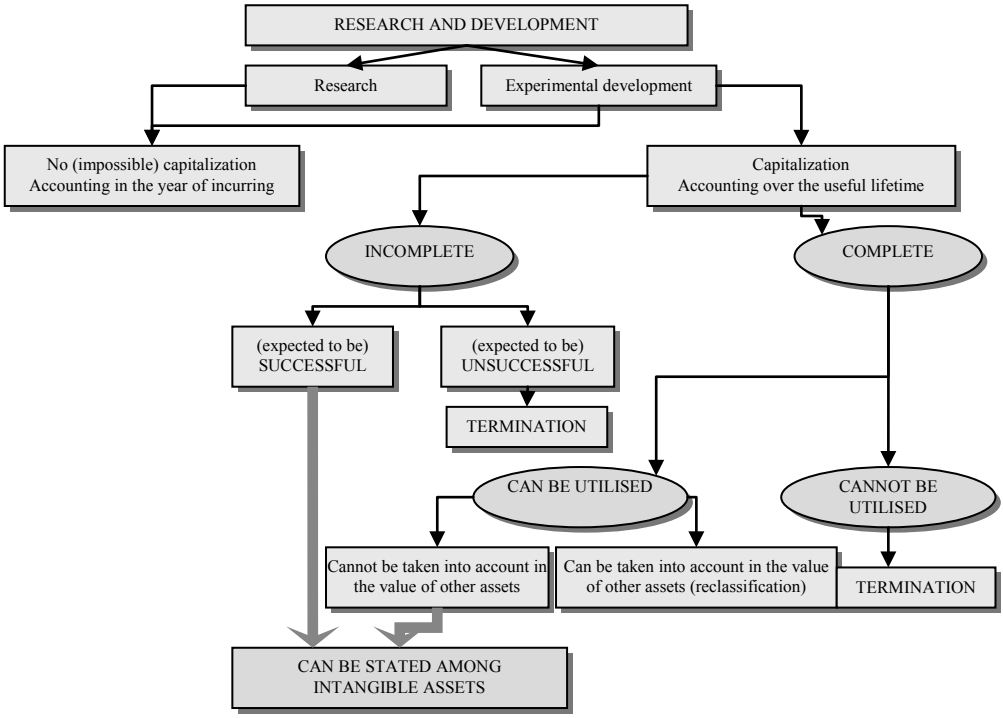
[8] Because, in the vast majority of the cases, these costs are not incurred evenly in time.

[9] The amount(s) of subsidies/supports already received under contracts or law to cover costs must be accounted as other revenues.

[10] It must be emphasised that the motivation behind capitalization may never be to improve the financial result.

[11] In the electronic industry, the product development process is usually comprised of two years of product development, followed by a five-year sales phase. As a result, the company starts to receive the first items of feedback about the level of success of the product development process (Kaplan–Norton 1999).

Chart 3. Decision making tree for the accounting of R&D&I activities



Source: Edited by the authors, based on Róth (2001)

The division of the costs of R&D activities into 'direct' and 'general' parts is necessary not only to determine the cost value, necessary for capitalization, but also to comply with certain taxation related rules and regulations. The purpose of the so-called innovation tax, introduced in the year 2004, is to collect government funds (Research and Technology Innovation Fund / "Kutatási és Technológiai Innovációs Alap"/) through direct taxation, to finance R&D. When the amount of this tax is determined, companies carrying out R&D activities can decrease the base of the tax with the amount of the direct costs accounted for this activity, whether or not such costs can be capitalized from an accounting point of view. The said decrease may not contain direct costs covered from any subsidy received from any local or regional organisation managing state budget funds.

Special types of tax relief are granted to companies performing research and development activities also in company tax and local business tax rules. These tax relief types can be applied when calculating the amount of tax base. According to this regulation, the amount of the direct costs of research and development activities performed for internal purposes or on order and accounted can be deducted from the tax base. Depending on the decision of the company, the tax base can be reduced in

one amount, in the year when the costs are incurred (accounted), or, alternatively, (in the case of experimental development that can be capitalized according to the Accounting Act) in the amounts of depreciation accounted in the individual years of depreciation. No tax relief can be applied after the value of R&D activities ordered from other parties, to avoid the deduction of the same amount as tax relief in different business organisations. For this reason, special attention must be paid to the separated accounting of these. This limitation does not apply to research and development ordered from organisations that operate in a state budget management system or from public benefit non-profit organisations. A special rule applies to companies that carry out their research and development activities jointly with an institute of higher education or with the Hungarian Academy of Sciences ("Magyar Tudományos Akadémia") or with any research institute founded by either of these. In these cases, the amount of deduction from the company tax base can be three times the original amount, though may in no case exceed HUF 50 million. As a result of tax base reduction, the company tax base may become negative. This negative amount may be offset against the positive tax base(s) of later years, in accordance with rules related to the carrying forward of losses. Companies carrying out research/development activities can reduce their company tax, local business tax and innovation tax payment obligations and can apply for state subsidizing for such activities. However, it is not possible to deduct such R&D costs from the tax base which have been financed from non-refundable support/subsidy (received, for example, from the Fund itself). It is obvious from the above that special care must be taken in the accounting and registration of costs related to R&D activities.

6. The Answer of Financial Accounting to Challenges

As was presented in the previous chapters, some of the costs of research and development appear in accounting with a certain delay, in an uneven distribution and in a manner that does not enable their offsetting against current revenues. Moreover, an often significant part of R&D remains hidden to the eyes of analysts preparing a report based on financial accounting, as an invisible asset. These make the identification of the company's real value difficult (Daum 2001). The U.S. Securities and Exchange Commission recognised this and tried to give an appropriate answer to new challenges. They made the proposal that, with the assistance of experts, it should be investigated how additional information could be provided on a voluntary basis about invisible asset types in addition to the currently compulsory reports and what further information could be used to help investors make the most accurate possible estimate of the future performance of a company (SEC 2001).

This approach also appears in the Hungarian Accounting Act: the rules on the textual parts of the financial report contain provisions regarding the presentation of R&D&I. As a general rule, the supplementary appendix must contain those data and

textual explanations that are required for the fullest possible presentation of the company's real wealth and financial situation and the result of its operation. According to the Act, the itemised supplements to the P/L Statement shall include the presentation of the costs of research and experimental development incurred in the reported year. As one of the purposes of the report is to present the data of at least two years beside one another, it is a good practice to state the R&D&I data of not only the reported year in the supplementary appendix but also those of base period(s). There are no rules as to how and in what form this should be done, it is up to the company to create the form of presentation with which it can best translate this rule into useful information supply, making sure that that usability of the information made available to the public should be in proportion with the costs of its collection and generation. As the data published in the supplementary appendix must also be supported with bookkeeping data, the obligation to comply with this rule also justifies the breakdown of costs by project and, within each project, into direct and indirect costs.

Research and development are focus areas of information supply not only in the supplementary appendix but also in the business report, which is a compulsory document to be compiled with the annual report. According to the Act, the business report must discuss business management together with the main risks and uncertainties occurring with the business activities, in an analytic manner. In our opinion, R&D&I activities (especially research) can be identified as such a risk factor and, as such, cannot be left out of consideration when the business report is prepared. As opposed to the supplementary appendix, which presents facts, the business report, which though also uses actual data, should put more emphasis on expected and planned factors and processes (expected results, expected time of completion, future research and development plans, etc.).

We think it is important to note that special care should be taken when the level of detail of the information published in the report is determined. We ought not to forget the trivial fact that financial accounting provides information for *external* stakeholders and, therefore, the essence of research and development would get lost if anyone could collect information about all of its details.

7. Responsible Innovation as a Part of R&D&I Controlling

To the management, it is of fundamental importance that they receive up-to-date and accurate information regarding corporate research and development. Financial accounting that complies with regulations can be a useful tool to achieve this. The arrangement, further breakdown and follow-up of the base data so collected belong to the competence of the controlling system.

Kaplan and Norton make an attempt at taking into account the earlier defined 'intangible assets' (Hungarian: "nem anyagi eszközök"[12]) in the company value. From the point of view of responsible innovation, such an approach is very important as the application of responsible innovation principles in R&D&I practice is an intangible asset whose internalisation may be a very important step towards successfully convincing decision makers that responsible innovation activities are a must.

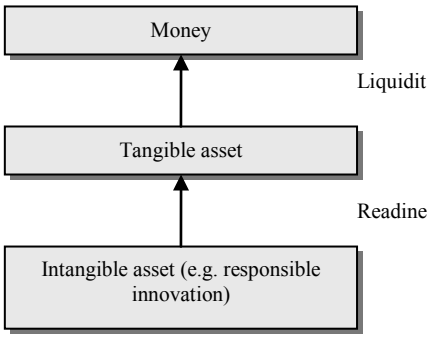
The strategic map is a framework which connects intangible assets, through the four aspects of the Balanced Scorecard, to the calculation of shareholder value (Buda 2004). The strategic map helps identify the internal processes that are properly aligned to intangible asset types and value creation. Value creation takes place along four main internal processes (Kaplan–Norton 2004a):

1. Operation management.
2. Account management.
3. Innovation process.
4. Society, regulatory environment.

Intangible assets fundamentally determine the efficiency of the above four processes and, hence, the entire corporate value creation and the successfulness of strategy implementation. To convert intangible assets into added value, all of the company's intangible assets must be defined, they must be aligned to the corporate strategy and the readiness of each intangible asset must be determined (Kaplan–Norton 2004a). By the term 'readiness' the authors mean the extent to which the given asset can satisfy the requirements of the corporate strategy. The higher this extent is, the sooner the given intangible asset will begin to generate money (Chart 4). The extent to which the given asset contributes or fails to contribute to the performance of internal processes determines the role of that asset in the company's value creation (Kaplan–Norton 2004b).

[12] As there is no generally accepted Hungarian translation for the term „*intangible assets*" yet, the translation of Szabolcs Buda ("nem anyagi eszközök") is used, based on the term's content and meaning (Buda 2004).

Chart 4. The role of intangible assets in value creation



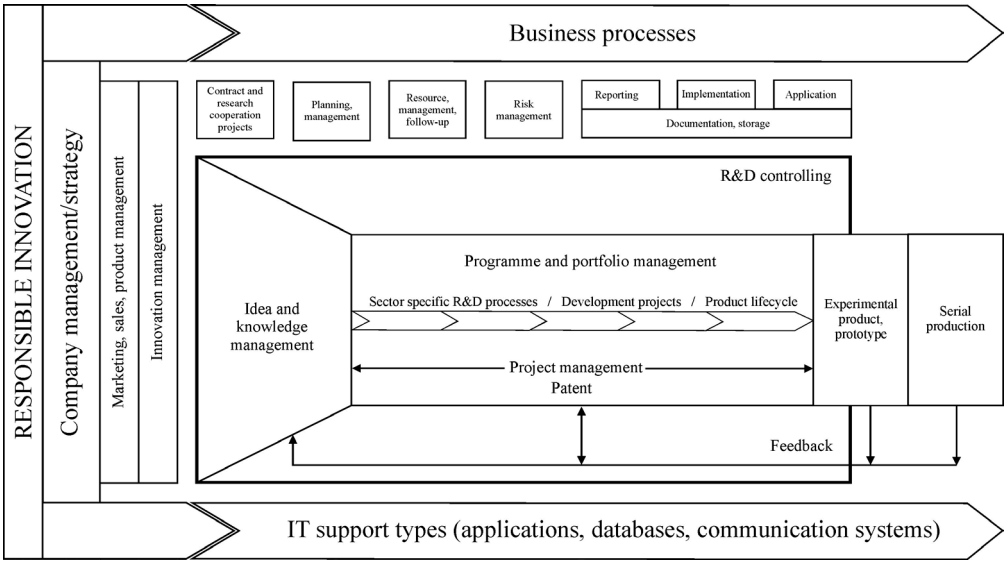
Source: Edited by the authors, based on Kaplan–Norton (2004b)

An intangible asset can be converted into tangible outcome (revenue increase or cost reduction) only if it is coordinated with the strategy. For this reason, companies are unable to allocate an appropriate financial value to intangible assets since financial value can be gained only from the successful implementation of the selected strategy. To achieve this, we must be able to define, measure and manage the readiness of each intangible asset. In practice, for each intangible asset type a table has to be compiled, which contains, in actual figures, the objective to be achieved – readiness can be determined in the light of and as the level of achievement of that objective (Kaplan–Norton 2004b). In practical terms, this is nothing else than variance analysis well known from controlling – just for an asset/asset group that was left out of the traditional toolset of controlling due to its 'soft' nature.

We can see that R&D&I is an area of increasing importance but its handling in financial accounting does not provide the information content that decision makers would need. By introducing R&D&I controlling, we can set up a constant process oriented model, with an eye to planning, measuring and controlling R&D&I activities as best as possible. Future-focused factors like forecasts, risks evaluations and early warning signs play an important role in the operation of companies.

Controlling should be viewed not as an independent, isolated solution but as an integral part of economic processes and as part or corporate controlling processes. R&D&I controlling follows R&D&I activities throughout the entire lifecycle, i.e. from operation through the strategic requirements of business development, marketing and production management to systematised feedback from the appropriate areas of development and knowledge management. However, it is a good practice to manage the whole process through the eyes and approach of responsible innovation as the ethical acceptability, sustainability and social desirability of the product born as the result of the process are of fundamental importance (Chart 5).

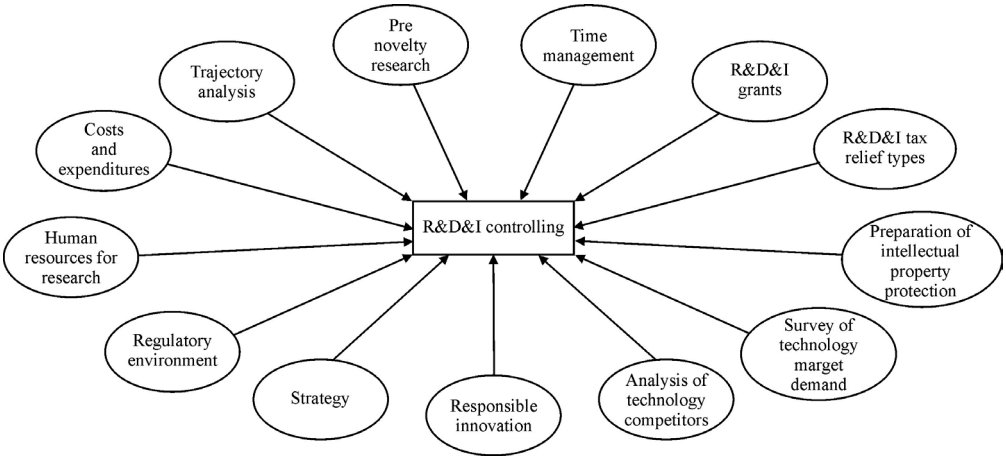
Chart 5. Tailoring responsible innovation and R&D&I controlling to company processes



Source: Edited by the authors, based on Plaut (2014)

As the above pages show, R&D&I controlling is a very complex system, in which a large number of components can be defined (Chart 6). These components can have different weights in the R&D&I controlling model in different organisations since innovative businesses and organisations have very different characteristics. There is no „average" innovative organisation and, consequently, R&D&I controlling functions can neither be tailored en mass: the heterogeneity of different organisations requires individual tailoring in each organisation. The chart found below is an attempt to present a general model, which, in our experience, contains the most common components, which most innovative organisations are likely to need when it comes to R&D&I controlling. Naturally, due to the impossibility of mass tailoring, it is possible that certain individual organisations consider completely different aspects as important in the area of R&D&I controlling.

Chart 6. Most typical components of R&D&I controlling



Source: Edited by the authors

8. Conclusions

Some of the costs of research and development appear in accounting with a certain delay, in an uneven distribution and at a time different from the time of collection of R&D revenues. Moreover, an often significant part of R&D remains hidden to the eyes of analysts preparing a report based on financial accounting, as an invisible asset. These make the identification of the company's real value difficult.

There is a possibility to follow up intangible assets using controlling methods – but this requires an approach somewhat different from the simple application of traditional controlling tools and methodology. Nevertheless, we consider that since innovative companies are more successful than others, the same may be true for the controlling methodology applied. We are, therefore, convinced that there will be a trend that only those companies will be able to gain a lasting competitive advantage from different sources that operate a controlling system that is more enhanced than that of its competitors'.

Those companies will be able to gain a lasting competitive advantage from different sources which are able to operate a controlling system that is more enhanced than that of their competitors'. Hungarian politician, reformer and statesman Count István Széchenyi suggested as long ago as in the first half of the 19th century that cost advantages cannot provide long lasting competitive advantages; the latter can only be achieved in a knowledge based economy, through innovation: *„It is not fertile plains, mountains, climate et cetera that make public wealth but the mind that can use them wisely. There is no truer weight n' power than the human brain. The more there is of it the luckier the nation will be – the less there is, the less luck we*

will have." (*„Nem termékeny lapány, hegyek, ásványok, éghajlat 's a' t. teszik a' közerőt, hanem az ész, melly azokat józanon használni tudja. Igazibb suly 's erő az emberi agyvelőnél nincs. Ennek több vagy kevesebb léte a' nemzetnek több vagy kevesebb szerencséje"*) (Széchenyi 1830, pp. 178).

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Responsible Innovators – successful role models at the beginning of the 21st century in Hungary

Ádám Kerényi[1]

Responsible innovation is a new idea, but responsibility has always been an important element of innovation. The framework of responsible innovation is gaining increasing relevance all around the world, thus in Hungary too. There exists a paradox, according to which Hungary currently has a very modest innovation-related result in international rankings, but the country can be proud of some leading (even world leading) innovator companies in the frontline of global markets. In this paper, I present three Hungarian innovators who have played and still play a very crucial role in the companies that they have founded (or privatized). From an open, small, capital-lacking and export-oriented country – like Hungary – mainly the IT industry can provide world leading ideas and companies. Without any degree in economics or business administration, all three men are classical examples of Schumpeterian entrepreneurs, but they also show responsibility towards the society and towards the country, especially in the field of innovation and education. They have received many prizes, but two of them refused any kind of financial state subsidies, on the grounds that taxpayers' money should be invested in education according to their values regarding social responsibility. The respect for their companies and for their responsible entrepreneurship attitude generates not only from Hungary, but also from abroad; even the president of the United States, Barack Obama made a speech mentioning the USD 100 million investment in the American educational system which followed his request from one of these Hungarian companies. Prezi.com has just received the Europas Award, which is one of the most prominent European start-up prizes

Key words: responsible innovation, responsible entrepreneurs, Hungarian economy

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1. The definitions of innovation and the new theory of responsible innovation

100 years ago, the brilliant mind, Joseph A. Schumpeter created the definition of the innovation (Schumpeter 1912). He described it as the critical dimension of economic change. He mentioned 5 types of the innovation.

Innovation is preceded by invention. The first step is made by the inventor: the professional or amateur researcher, the academic scholar or the company's engineer is the one to whom the new idea occurs. However, the originality of the idea, its novelty, and its ingenuity are not at all enough. In the second step, the invention becomes an innovation; the practical introduction begins, that is, the organization of production and the diffusion of the new product, or the application of a new organisational form. In capitalism, the entrepreneur plays a distinguished role. Innovative entrepreneurship is a function, a role, which can be fulfilled by an individual alone, or by teaming up with one or more partners, or with the support of a small firm. However, even a large firm can function as an entrepreneur. The main point is that the entrepreneur is the one who brings together the necessary financial and personal conditions that the innovation calls for, in other words, the human resources, the physical instruments and the financial resources essential to the activity (Kornai 2010, pp. 7-11). In some cases it might occur that the inventors and the innovators are the same persons. Schumpeter had a pessimistic view regarding the future of innovation (Schumpeter 1939). He thought that it would inevitably become a bureaucratic process. Perhaps he was right, and that is why, 100 years after the adoption of the term, there is a need for rethinking the definition of the innovation.

Some responsible entrepreneurs founded their companies, at least in part, to achieve idealistic objectives, and pursued financial and non-financial objectives simultaneously. Most avoided funding from institutional sources, hired employees for their shared values, and shrewdly leveraged their social identities to differentiate themselves in the marketplace. Many of these entrepreneurs made unusual efforts to create a strong organizational culture and implement sustainable operational processes to meet their self-imposed ethical standards. These socially responsible entrepreneurs gave a substantial amount of their profits to causes of their choice, and volunteered themselves as role models for other businesses and entrepreneurs to follow (Choi–Gray 2008, p. 1). The founders of the most successful innovative companies might respond to public expectations. In extreme situations, some managers might have unlimited resources and full potential for obtaining social impact regarding cultural value changing or sharing.

Responsible Innovation (Pavie 2013, p. 8) may, in a form of an innovation, initially stem from a client's need, which the firm, institution or organization decides to meet by developing a specific solution, which in turn enables it to grow with profit while being aware of the possible damages on the economy, society and environment in the short, middle and long-term. Responsible innovation means taking care

of the future through collective stewardship of science and innovation in the present. (Stilgoe et al. 2013, p. 3).

In the Hungarian economic context, there is a need for anchoring and creating corporate partners for the expression "responsible innovation". According to Xavier Pavie[2] questioning the direct impact of innovation – where innovation is always a huge risk in itself – is one pillar of the idea of responsible innovation. I hope that after understanding this new concept, it refreshes and drives the Hungarian innovation policy. Some successful Hungarian innovative corporate case studies would support its importance and feasibility. One of the objectives of this paper is that the founders and managers of Hungarian innovation companies join the concept of responsible innovation.

2. Hungary in innovation-related rankings

Innovation composite index results correlate with the ranks of the competitiveness ranks (Hámori 2012, p. 59). In my paper I quote recent data from the Innovation Union Scoreboard. In my opinion, innovation has got to be a key measure of progress and a central objective for any government. The index allows scholars to compare innovation across 34 European countries in 8 innovation dimensions (see Table 1).

The composite index of the Union Scoreboard:

- has defined the dimensions affecting innovation to be measured;
- has specified the indicators which best reflect the selected dimensions;
- has determined the databases to assign to the indicators.

The measurement framework used in the Innovation Union Scoreboard distinguishes between 3 main types of indicators and captures 25 different indicators in total (Table 1). The Enablers capture the main exogenous drivers of innovation performance external to the firm and cover 3 innovation dimensions: "Human resources", "Open, excellent and attractive research systems" as well as "Finance and support". Firm activities capture the innovation efforts at the level of the firm, grouped in 3 innovation dimensions: "Firm investments", "Linkages & entrepreneurship" and "Intellectual assets". Outputs cover the effects of firms' innovation activities in 2 innovation dimensions: Innovators and Economic effects. In this paper, I tend to focus on and show charts relating to the data and ranks concerning Hungary (see also the analysis of another composite index, Kerényi 2011).

[2] Pavie (2012): http://councilonbusinessandsociety.com/perspectives/videos/xavier-pavie-the-importance-of-responsible-innovation-and-the-necessity-of-/.

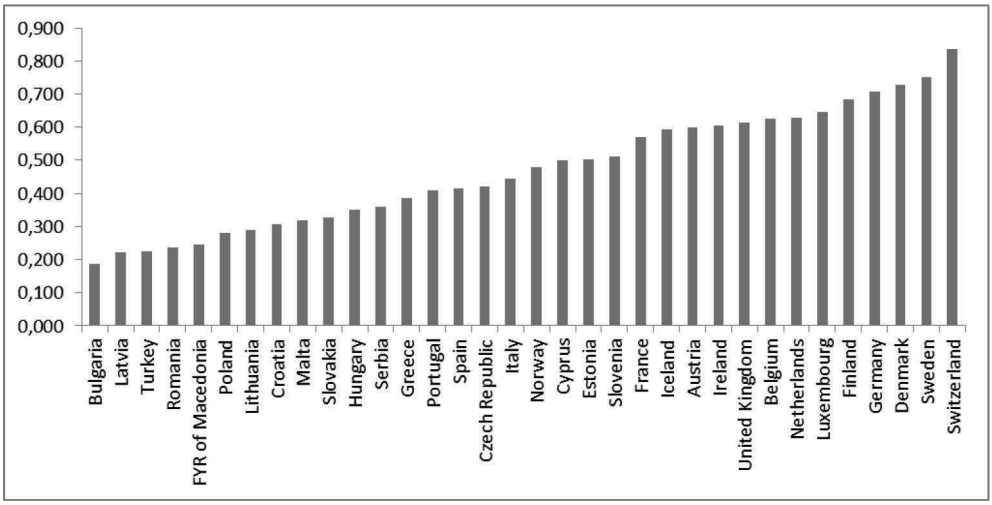
Table 1. The dimensions of the Innovation Union Scoreboard

ENABLERS	**Human resources**	1	New doctorate graduates
		2	Population completed tertiary education
		3	Youth with upper secondary level education
	Research systems	4	International scientific co-publications
		5	Scientific publications among top 10% most cited
		6	Non-EU doctorate students
	Finance and support	7	Public R&D expenditure
		8	Venture capital
FIRM ACTIVITIES	**Firm investments**	9	Business R&D expenditure
		10	Non-R&D innovation expenditure
	Linkages & entrepreneurship	11	SMEs innovating in-house
		12	Innovative SMEs collaborating with others
		13	Public-private co-publications
	Intellectual Assets	14	PCT patent applications
		15	PCT patent applications in societal challenges
		16	Community trademarks
		17	Community designs
OUTPUTS	**Innovators**	18	SMEs introducing product or process innovations
		19	SMEs introducing marketing/organizational innovations
	Economic effects	20	Employment in fast-growing firms of innovative sectors
		21	Employment in knowledge-intensive activities
		22	Contribution of MHT product exports to trade balance
		23	Knowledge-intensive services exports
		24	Sales of new to market and new to firm innovations
		25	License and patent revenues from abroad

Source: Hámori, B. – Szabó, K. (eds) (2014): Innovation Union Scoreboard. http://ec.europa.eu/enterprise/policies/innovation/policy/innovation-scoreboard/index_en.htm. Download date: 20th May 2014.

Hungary is a Moderate innovator according to this composite index Aschner Lipót Group 2013). This definition includes Member States where the innovation performance is below the EU average at relative performance rates between 50% and 90% of the EU average (see Figure 1).

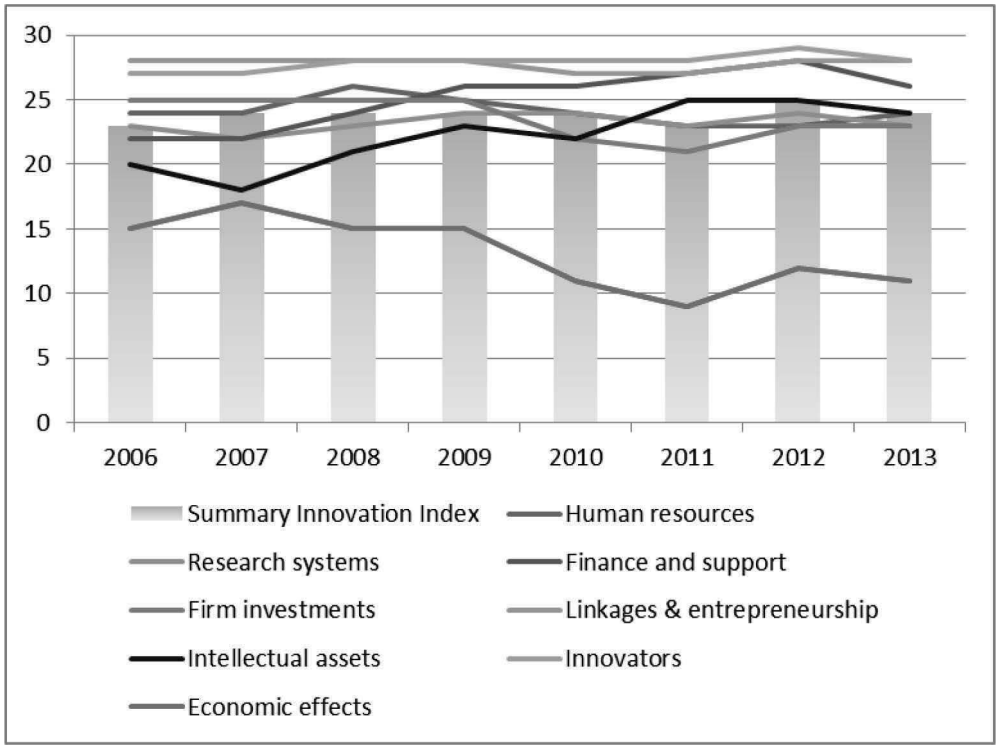
Figure 1. The current ranking of the Innovation Union Scoreboard



Source: Hámori, B. – Szabó, K. (eds) (2014): Innovation Union Scoreboard. http://ec.europa.eu/enterprise/policies/innovation/policy/innovation-scoreboard/index_en.htm. Download date: 20th May 2014.

If we analyse the historical results of Hungary (see Figure 2 and Table 1) we may state that besides the economic effect dimension the Hungarian results are at the bottom among the European results. The Innovation Union Scoreboard Index juxtaposes factors affecting wellbeing against one another, rather than arranging them hierarchically. This means that all 8 dimensions are similarly weighted in the composite index.

Figure 2. Hungary's historical data Innovation Union Scoreboard



Source: Hámori, B. – Szabó, K. (eds) (2014): Innovation Union Scoreboard. http://ec.europa.eu/enterprise/policies/innovation/policy/innovation-scoreboard/index_en.htm. Download date: 20th May 2014.

3. Three case studies for Hungarian innovator entrepreneurs

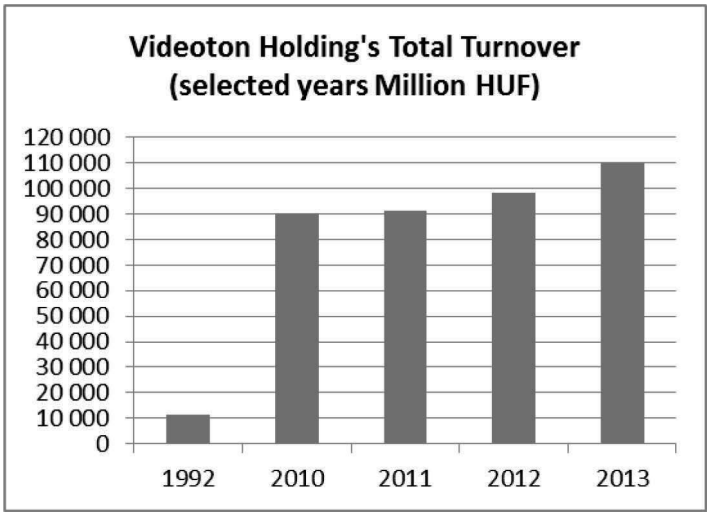
3.1. Péter Lakatos, CEO of Videoton Holding

Videoton Holding is a very spectacular example. The company was founded in 1938, 76 years ago. In 1992, it was privatized by the company Euroinvest. Videoton Holding gained relevant goodwill as being a significant producer of car manufacturing, automotive parts manufacturing, household appliances, industrial applications and metal technologies. The portfolio of the Videoton Holding includes classic manufacturing services typically offered by multinational competitors such as complete supply chain management solutions and back-end technology services, but in current years engineering and industrialization were both gaining more weight with-

in the mix of their services. These activities were well supported by Videoton Holding's industrial estates and significant industrial property portfolio.

A few years after privatization, Péter Lakatos together with Ottó Sinkó and Gábor Széles bought all the shares of the company. Since then Péter Lakatos has been the CEO of the holding. The holding is the largest industrial corporate group in the Hungarian private sector and the 27th globally in the ranking of the American trade magazine Manufacturing Market Insider, which compiles the list of the first 50 EMS companies in the world each and every year based on their turnover figures. Videoton is not only a stable player among the top 30 companies in the world, but has also belonged among leading European suppliers for more than 10 years now in this global and dynamically growing industry.

Figure 3. Videoton Holding's Total turnover



Source: HVG and Videoton database

In 2013, the consolidated revenue of the VIDEOTON Group augmented to HUF 110 billion, 10% higher than last year's figure. This revenue is the highest ever achieved over the history of the company. Since 1992, the company has increased its total turnover 10 fold to 2013.

The process of innovation and the dynamics of firms' entry and exit are closely associated. Schumpeter coined the notion "creative destruction" for the latter, concisely and precisely describing the two inseparable sides of fast technical progress. It is easy to appreciate happy arrivals in the business world, especially if they appear in the form of successful innovators. But there is no fast progress without the sad events of bankruptcies, business failure, exits, and the accompanying bitter phenomena of lay-offs and unemployment (Kornai 2010, pp. 25-26).

Videoton management took very hard (perhaps the hardest) decisions in reflection to the recent global financial crisis in the form of the dismissal of almost 1200 Videoton employees (see Table 2). But since then, the average statistical headcount of the group has increased from 7200 to 8200 employees. According to Xavier Pavie[3], innovation care is a new concept, which goes beyond responsible innovation. It shows how it is possible to take care of someone, or take care of many people or even a city, a region, or an industry. Péter Lakatos proved that from Hungary it is possible to take care of a wide range of business activities through massive management innovation.

Table 2. Top 9 Hungarian dismissals after the collapse of Lehman Brothers

Name of the company	Reduction of staff 2009/2008	
	No.	%
Trenkwalder Kft.	2476	30
Alcoa-Köfém Kft.	1976	42
Magyar Suzuki Zrt.	1863	33
Flextronics International Kft.	1676	21
FIH Europe Kft.	1670	83
Sanmina-SCI Magyarország Kft.	1463	57
GE Hungary Kft.	1452	11
Videoton Holding Plc.	**1199**	**15**
Elcoteq Magyarország Kft.	1050	30

Source: HVG 2010/46

Besides, Videoton is the largest industrial company group in Hungarian private ownership; its operation is characterized by a year by year increase in revenue and an increasing demand for operating capital. The stable financial background is ensured by the EUR 260-million capital, an annually increasing profit, a positive cash-flow and the creditability generated by successful operation. Péter Lakatos created profitable companies, which were exemplary in their efforts towards social responsibility.

Research & Development & Innovation are very important to the company, which received a business award for a new package of an innovative crossover. In response to escalating market needs, the holding has built-up its own central development team that is comprised of some 40 professional staff members and is performing a number of various tasks:

[3] Pavie (2012): http://councilonbusinessandsociety.com/perspectives/videos/xavier-pavie-the-importance-of-responsible-innovation-and-the-necessity-of-/.

- technology-development for internal and third-party customers (functional testers to the automotive industry, development and building of automated manufacturing equipment);
- product development in the following areas:
  a) cooperation with Philips and Braun in the development of various kitchen appliances;
  b) projects associated with the practical applications of laser-based photo-acoustic measurement principles;
  c) design of new-generation cut out circuit breakers, development of light-therapy devices for the treatment of allergy, development of electronics for battery management devices.

Videoton Holding has 4 innovation oriented subsidiaries (Hilase, Rhinolight, Holografics and VHRD). Hilase Ltd, a spin-off company of the University of Szeged, was founded in 2004. It develops and manufactures laser based gas detection instruments for the natural gas and biogas industry as well as for environmental monitoring. It also offers its services for measuring gas permeability parameters of polymer membranes, sheets and tubes.

Besides the daily duties as CEO of the holding (ensuring that the company is financially solid, customer-oriented, competitive and innovative) Péter Lakatos takes part in social activities like fulfilling the role of Vice President at the Confederation of Hungarian Employers and Industrialists, being a member of the Aschner Lipót Group and a member of the Club of Loving Hungary. Péter Lakatos and his wife received the Summa Atrium Prize for renovating and reopening the public a film theatre in Budapest. This social and cultural centre was also a good example for innovation care. They not only paid a fortune for this purpose, but invested a lot of their spare time for preparing the business plan of the theatre. He also established the Sándor Csibi-scholarship for talented engineer students. Péter Lakatos argues (Lakatos 2013, p. 58) that there is a need for change in the mind of Hungarian citizens regarding their attitude (towards honesty, cooperation, self-providence, communication and open-minded thinking). Unless doing so, the country will get left behind by its competitors in the region.

3.2. Gábor Bojár, President of Graphisoft SE, Graphisoft Park Se and Aquincum Institute of Technology, Budapest

Gábor Bojár is a physicist and the founder of the Hungarian high-tech company Graphisoft.

The inventor–innovator Gábor Bojár, a former senior fellow in an academic research institute, developed a software-package for three-dimensional design targeted for utilization mainly by architects. While not unique in the field, compared with other products his software was elegant, efficient, user-friendly and therefore

commercially successful in several countries. Bojár's company markets the product worldwide. All that is a classic example of a Schumpeterian entrepreneurial career (Kornai 2010, p. 21).

In 1982, dissatisfied with the life-options that a centrally planned economy could offer, Gábor Bojár decided to become an entrepreneur and set up a private company. Graphisoft quickly found a niche in the global software industry, focusing on 3D architectural design. With the fall of the Iron Curtain, the world really changed, and by the turn of the millennium, Gábor Bojár found himself chairing a public company listed on the Frankfurt and Budapest stock exchanges.

Gábor Bojár said: *"It's not that we make any secret of being Hungarian, but our nationality is simply not relevant. That's the essence of the information age – no one cares about the origin of the product, just how well it works*" (Arnold 2002). So the country was building up a formidable reputation for technological innovation.

2007 marked an important milestone in Gábor Bojár's career. He was awarded Entrepreneur of the Year by Ernst & Young and he sold Graphisoft SE. Gábor Bojár's ambition was completed in 2007 when Graphisoft was acquired by Europe's leading player in our sector. Graphisoft has been a part of the Nemetschek Group since its acquisition in 2007. Graphisoft is famous for its software for architects called ArchiCAD®, which is a building information modelling (BIM) programme. Graphisoft continues to lead the industry with innovative solutions such as its revolutionary BIMcloud®, the world's first real-time BIM collaboration environment, EcoDesigner STAR, the world's first fully BIM-integrated "GREEN" design solution and BIMx®, the world's leading mobile app for BIM visualization. The company's mission is to bring BIM into common practice for the design and realization of buildings by enabling model-based workflow integration through innovative IT solutions.

Gábor Bojár always opposed and questioned the bureaucratic functions of the state, which hinder the competitive mechanism of the market (Bojár 2005). He has also refused any kind of financial state subsidies (Bojár 2014a, 2014b). He said: *"I do not like direct support; I don't expect the government to give me money. They should focus on giving me a reliable framework, in which to do business, and most of all, should put money into the education system, so we get the best people out of universities"* (Arnold 2002).

He has invested his capital from selling Graphisoft to establish the Aquincum Institute of Technology Budapest, which is an international institution of tertiary education earmarked to demonstrate the viability of a high-quality, research-intensive educational operation. AIT Budapest is based on a business model which focuses on its primary client-cohort of international colleges and universities with a global commitment and outreach, offering a unique experience of studying abroad for its students. AIT Budapest has learnt the most important lessons of the Graphisoft venture: a good product needs demanding customers just as much as it needs dedicated producers. The main areas of the emerging institution are design, IT entrepreneur-

ship, mathematical foundations, and computational biology. And these areas are the most relevant where the achievements of Hungarian researchers and entrepreneurs have perhaps been the most remarkable. One of AIT's unique features is that global players of ICT and biotech industries are involved in its planning and management. More importantly, AIT consciously builds upon country-specific entrepreneurial experiences to provide added value for its students (Bojár 2007).

Table 3. Global members of the Graphisoft

Graphisoft Group	Location	Date of foundation
GRAPHISOFT SE	Budapest	1983
GRAPHISOFT Deutschland GmbH	Munich	1988
GRAPHISOFT North America Inc.	Boston	1989
GRAPHISOFT Japan Co. Ltd.	Tokyo	1994
GRAPHISOFT UK Ltd.	London	1997
GRAPHISOFT Brazil	Sao Paolo	1999
GRAPHISOFT Singapore	Singapore	2011
GRAPHISOFT Hong Kong Ltd.	Hong Kong	2011
GRAPHISOFT Beijing Rep. Office	Beijing	2012
GRAPHISOFT Mexico	Mexico City	2013

Source: Graphisoft home page

AIT Budapest is hosted in Budapest's leading third-generation science park that grew out of an initial real-estate project of Graphisoft. An independent public company, Graphisoft Park is the result of a major revitalization project of a historic industrial site on the banks of the river Danube.

Leading businesses – especially those operating in R&D and other creativity-demanding fields – know that their success depends on attracting, motivating and retaining the best professionals. Because once you get the best people working for you, winning in the marketplace is easy. The race to attract the most talented workforce is just as fierce as the battle against competing firms in the market. And, just as offering the cheapest price for your product does not guarantee that you will beat the competition, offering the highest salaries is no guarantee that you will get the best talents. Because the best are interested in more than just money. They are interested in challenges, in high performance, and in being recognized for their achievements. Moreover, the working environment makes a big difference to them. The site of the old industrial monument now hosts the local headquarters of about 40 R&D companies including world leaders such as Microsoft, SAP, Servier, AMRI, ThalesNano and Canon. It is also very important to mention that the Graphisoft Park is the model for ELI's (Extreme Light Infrastructure) science park, which is under construction in Szeged, and which is said to officially be a responsible innovation project.

Gábor Bojár is a member of the club "I love Hungary". Gábor Bojár received the Award for Excellence of The Institute of International Education (IIE) in 2013 in recognition of his pursuits, results and impact in promoting closer educational relations between the United States and Europe by establishing a highly competitive school of information technology for an international student body. Not necessarily because of that award, but there exists an interesting process: the so called reversed brain-drain. It means that talented people do not go from the poor country to the rich but on the contrary: the rich country's citizen go and work in a poorer country. Some of AIT Budapest's students, after receiving their degrees, come back to Hungary.

Gábor Bojár is the board member of the European Institute for Innovation & Technology (EIT), which institution's main activities are the follows:

- Knowledge and Innovation Communities (KICs), which perform the following:
  a) they are integrated structures that inter-link the higher education, research and business sectors;
  b) focus on priority topics with major implications for society;
  c) bring people with different specializations together to work in teams at 17 locations ("co-location centres") across Europe;
  d) implement specific projects, educational programs, funding schemes, etc.
- Entrepreneurship (EIT aims to create the right conditions for a flourishing entrepreneurship culture by):
  a) encouraging a cultural shift in the way entrepreneurship and risk-taking are perceived;
  b) supporting entrepreneurship through activities such as the EIT Roundtable of Entrepreneurs and EIT Award.

3.3 Ádám Somlai-Fischer, "the Prophet of Zoom"

Ádám Somlai-Fisher is an architect and a media (electric)-artist. He was nicknamed as "the Prophet of Zoom" (Kester 2011, p. 33) by inventing a software tool for creating memorable presentations called *Prezi*, and which allows users to zoom in and zoom out in presentations. How did Ádám Somlai-Fischer invent this tool? He could never squeeze all the pictures and ideas into individual slides – which according to him – were the things that were related and needed a good storyline. He needed somehow to float those things together alongside one good storyline. Ádám Somlai-Fischer's solution was to invent and write a computer programme that enabled him to zoom in and out of a large map of pictures, all located on just one frame.

Many people said after using the program that they liked it, and they would like to invest in it. "*All of us became quite an entrepreneur. (...) We had no idea what to do, so we went to Wikipedia, and we understood that we needed a co-founder if we wanted something big. So we set out for a search. Eventually this became very important, because this is why we did not lose, and are where we are to-*

day. We understood that it was a really useful communication format. It had a potential to everybody on this planet. We might we fail, but in theory, it could work. So we were already happy and successful with what we did, so we wanted to change the world with this tool. We wanted to find a CEO who would feel that this power was a means to achieve that change. Sadly, because I come from Hungary, most people, who become CEOs in companies, they just want to make money, and they think power is the goal. And that really sucks, I think. So luckily he[4] *was not at all like that. (…)And we sat down and started a company. And we decided to create a world class product from Hungary. (…) We wanted to have something in Budapest because it was our home actually. We wanted to prove where Hungarians came from. Yes, you can build a globally successful company from Hungary, even if most people do not believe that. So, why not?"* (Somlai-Fischer 2013). A co-founder helped distribute the program, which has a unique integration of non-linear brainstorming and linear storytelling, and helped the company to reach the 30 millionth user and still continue to fuel its growth by two million new users every month.

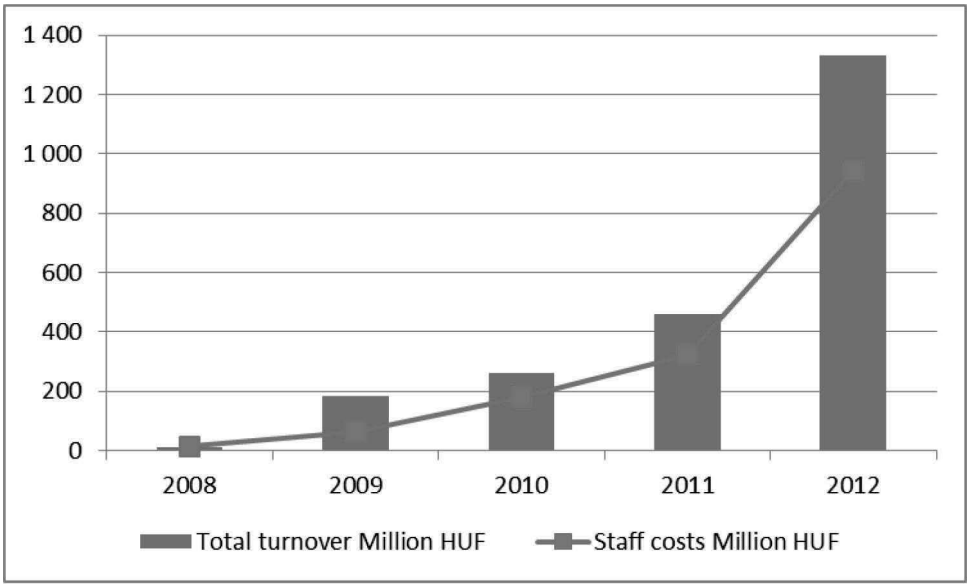
This company has recently been the locomotive of Hungarian innovation. Ádám Somlai-Fischer and co-founders won the Europas Awards, one of the most prominent European start-up prizes, in the category of *"Best Start-up Founder or Co-founders"*. The reason was that the company had changed how people presented and learnt information and took on the might of Microsoft PowerPoint. According to the chairman of the jury, in the case of Prezi.com, "*the founders not only built up a wonderful corporate culture, but also showed how a company can have 40 million users in such a short time. Such success stories are rare to be found in Europe and we wanted to emphasize this great achievement with this award"*.[5]

The business model of the Prezi operates as follows: the company uses a so-called 'freemium' model – granting access free to anyone, provided they do not mind sharing their designs on the Prezi website. Anyone wanting confidentiality has to pay for it. Somlai-Fischer insists that it is a "viral" product, with many customers migrating to business accounts as they discover its value (Kester 2012).

[4] Péter Árvai, CEO of Prezi.com Plc.

[5] Dailynews Hungary (2014): http://dailynewshungary.com/hungarian-software-developer-prezi-wins-tech-startup-award/.

Figure 4. Prezi.com Plc's total turnover and staff related costs



Source: Prezi.com Plc database

"*We are here to crack visual communication globally. This is really hard; nobody really knows how to do it. I mean, we have some idea, but this is not a trivial job, so we need many creative people, and creative people have their special needs. I will talk about these specialties. So first of all, let us go back to power being a means, not a goal. These people are happy because of what they do, and they are not here for the money. I mean they get paid nice money to make a nice living, but the main motivation is the creativeness and the vision"* (Somlai-Fischer 2013).

Once one 70-year-old Canadian firefighter (not the typical web2.0 person) wrote the following e-mail: "*Hi guys, thank you for doing Prezi. I felt being creative again!*" This letter explains the effect of this software. Prezi has become very popular in the education sector. In the United States, Prezi will provide $100 million in Edu Pro licenses for high schools and educators across America through the ConnecTED initiative.[6] In Hungary, Prezi provides and mentors free courses to 18-year-old girls to learn from the basics how to code and how to write a programme. The IT world is quite masculine, but the potential salary is much higher than the average. The Coding girls project gives an emancipatory chance for some young girls to become professional coders of the future.

[6] Garg–Sanders (2014): http://www.whitehouse.gov/blog/2014/03/02/helping-more-schools-be-future-ready.

Prezi also has a lot of programmes to help young people to get in entrepreneurship, and see what it looks like in the United States of America, why it works better there. They want to change the notion of entrepreneur, which, in Hungary, has become a word synonymous to a shady person who drives a big black car and is only interested in making money (from the state of the Union). Ádám Somlai-Fischer is the talent ambassador of the National Talent-helping Agency this year.

4. Summary

Despite the modest ranking of Hungary in the composite index of innovation, the companies Graphisoft, Videoton Holding and Prezi are motivating and spectacular examples of Hungarian mathematical, technical and innovation skills. The world successes of these Hungarian companies were due mainly to their innovators who imagined the future and managed their dreams – Gábor Bojár, Péter Lakatos and Ádám Somlai-Fisher.

Building a strong, value-centred organisational culture starts by hiring employees with shared values and to be a role model for them. There is a great difference among their points of views, but they all agree on the fact that despite its very narrow manoeuvring options, if Hungary wants to become a prospering country, the attitude of its citizens needs to be reformed.

These reforms might be the social respect of entrepreneurs and the denial of direct state subsidies for innovation projects. Péter Lakatos, Gábor Bojár and Ádám Somlai-Fischer are not separate role models, they are also good examples for responsible entrepreneurs and innovators who have a collective responsibility concerning how they try to inspire others, their employees and the wider society. Their success depends on the future.

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From the principles of responsible innovation to the UGO Certification standards

Massimo Chiocca[1]

The paper aims at developing some ground principles around the idea of a possible governance of Responsible Innovation in the organizations. In particular the paper works around a standard named UGO (in opposition to the usual name of management system that are almost alphanumeric string) developed by CISE (Center for innovation and Economical Development) whose goal is to help every kind of organization in projecting, developing and managing any innovation that was targeted to the improvement of quality of life of people that will use that innovation.

The paper consist of two parts: the first one about the consequence of the application of an ethic to the concept of innovation, that suggest the need to temper the concept of limit (imposed by an ethic, whatever, and the consequent responsibility that stems from) and the idea of innovation (limitless by nature); the second about the governance of innovation that, assuming as true the Dilemma of Collingridge ,focuses mainly for the need of a governance system that, mixing static elements (the usual requirements of a management system) and dynamic ones (the continuous relationship with the stakeholders), and considering the precautionary principle, could lead to control the critic step between the basic research and the effective production of an innovation, where an effective responsible governance could be applied.

Key words: Responsible Innovation, ethics of Innovation, Governance of Innovation, UGO Standard, Precautionary Principle

1. Why does innovation has to be responsible? The origin of the approach

In the last decades many responsibilities have been assigned to the word "innovation". First of all, it has been appointed responsible to find a new path which would help humanity to overcome the serious crisis affecting contemporary world economy, through the creation of new products, services and even markets. Secondly, it has been assigned the responsibility to re- innovate (innovate again) our society and institutions, to make our life-style more sustainable, efficient and right. Finally, the innovations originated by the scientific and technological research are

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expected to offer us a better and longer life. Thus, innovation is considered as primarily responsible of our future.

From an exclusively economic point of view, the debate is focused on the role that innovation could play in increasing enterprises' competitiveness. In fact, it is clear that businesses operating in extremely "competitive" contexts, such as markets, assign primary relevance to competitiveness, as well as it is natural for them to perceive the ability to make innovations as an element qualifying and improving businesses' performances.

However, today, non-economic factors seem to ever more influence purchase choices of enterprises, institutions and customers. New findings resulting from a Nielsen Report (2012) survey of 28,000 consumers from 56 countries around the world, clearly revealed, for example, that the 46% of respondents, regardless to contemporary international crisis, said to be willing to buy products and services from companies which have implemented programs intended to give back (in different ways) part of the produced income to society.

Also Amartya Sen's work, who received the Nobel Prize in Economic Sciences, focuses on this very topic: he clearly proves that economic development does not simply leads to the increase of disposable income, but in fact it is every day more often associated to the idea of people's better quality of life.[2] The ability to perceive these expectations, in addition to its primary ethical and social significance, plays an important role also from a mere economic perspective.[3] However, apart from the expectations for this field, at least at a national level, no attention is being paid to the kind of innovation necessary to build a better future.

The UGO Standard, developed by CISE[4], have been created in the belief that innovations, able to allow the realization of such a goal, have to be "responsible", in other words, they have to be able to improve the quality of life of their users, as well as to give competitive advantage to the enterprises which produced them, complying

[2] See his latest publication, Sen (2010).

[3] Other recent research have clearly demonstrated that responsibility applied to business, rather than a do-gooding intuition, is more similar to an event able to impact real economy. For example, in two articles published in the "Working Papers" series, edited by the Harvard Business School, Eccles et al. (2011) unquestionably confirmed two aspects of the phenomenon, so far doubted. In the former article they proved that a positive relation actually exists, for example, between enterprises which adopt responsible management practices and the possibility to obtain credits from banks: out of the confront of thes e enterprises with a large group of businesses, conducted over a long period of time (16 years), it has emerged that the former could easier obtain credits or larger amount of money than the other ones.. In the second onme, referring to the findings of a sample survey conducted on 180 enterprises which adopted responsible and sustainable behaviours, they explained that these enterprises had better performances that their competitors, keeping them unchanged over time, especially in those sectors where there is a direct connection between producers and consumers (Ioannou–Serafeim 2011).

[4] CISE is the Special Agency of the Chamber of Commerce of Forlì-Cesena (Italy).

with some ethical obligations. Boundless and undefined innovations, in fact, do not represent the most appropriate subject to contribute to the progress of our society

At this point, it is necessary to better specify what does an ethics for innovation means and which goal it has to be aimed at, in order to be considered responsible, at least according to the UGO Standard, even if, from an economic point of view, this is not enough. The UGO Standard addresses, first of all, those organizations[5] producing those innovations which enter citizen's life. In their opinion to innovate means giving new or more efficient answers to meet market's needs. This practice can be described recurring to concepts such as risk, promptness and competitiveness, concepts significantly influencing corporate policies. This is the reason why we need an active governance of innovation, able to manage the process in a clear, inclusive and dynamic way, in order to satisfy society's expectations for innovation. This would need an instrument of government allowing enterprises to acquire or maintain over time a success depending on long-lasting factors, which, at the same time, could generate (and/or recreate) people's trust in the economic system. More details on the topic will be presented in the following pages.

"Responsible innovation" is a concept involving several knowledges and

imposes an approach which, starting from the realization of new ideas and then proceeding with the consideration of their impacts, will allow us to design the future the entire society is dreaming of and make our life reaching that quality we have always desired.

However, it presents several difficulties because of the need to promptly face problems, requiring rapid solutions and preventing us from appropriately reflecting even on fundamental questions for our society; in this case, I think, nothing can better explain this situation than the starting lines of one of the most beautiful children's stories: «Here is Edward Bear, coming downstairs now, bump, bump, bump, on the back of his head, behind Christopher Robin. It is, as far as he knows, the only way of coming downstairs, but sometimes he feels that there really is another way, if only he could stop bumping for a moment and think of it» (Milne 1994, p. 1).[6]

[5] Here the word "organization" is used in its etymological acceptation of "group of people linked by connections established with the aim to reach one or more common goals that separately they would not have been able to reach". For this reason, public administration as well, may be included in this definition, with no intention to reduce the difference existing between institutions, legislative organisms, appointed to issue rules intended to guarantee a peaceful coexistence, and civil society's economic organizations, operating in compliance with the rules established by institutions.

[6] Quoted from Milne, A. A. (1994): The complete tales of Winnie-the-Pooh.

2. Ethics of innovation

Putting the modifier "responsible" before the noun "innovation" means adding an ethical meaning to the innovation process. Innovation in itself represents a morally neutral act[7]; in fact, its ethical dimension depends on the reasons determing its future implementations. Although, philosophy literature does not univocally accept this position. According to Natali C. (1999): Aristotele: Nicomachean Ethics (1135a 15-1135b 11), for example, no action can be completely neutral from a moral point of view, as any action expressing an act of will would appear as morally connoted, being it the actualization of a will and of its goals. It is clear that, if considered from this perspective, the moral evaluation would appear as inseparable form any human action, suggesting that no mortally neutral activity could ever exist. However, in order to evaluate acts or actions from a moral perspective (if not totally acknowledging ethical relativism), it would be necessary to refer to a principle allowing consistent evaluations in similar Conditions.[8] Moreover, even in case there would not be any reference (Hare 1968), we could affirm that any act, from a knowledge, first, and then moral point of view, would remain neutral. An example of what stated above is contained in the following Kantian aphorism (Kant 1970 [1785], p. 91): «Act in such a way that you always treat humanity, whether in your own person or in the person of any other, never simply as a means, but always at the same time as an end». This is a moral rule applicable to each man and in each situation, which is not influenced by anything, neither a prize, for example, nor negatively by a feeling for a behaviour that does not correspond to what indicated in the principle.[9]

Then, defying innovation as "responsible" means identifying the principle referring to which it could be defined as a "positive" (effective) one. Nevertheless, the discover of an innovative field theoretically creates the conditions for the production of ethically acceptable applications, as well as of absolutely aberrant ones.

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[7] The words "ethics" and "morality" significantly overlap as both define the same semantic area, though the former has a Greek origin while the latter has a Latin one. Thus, in this text we will use them as synonyms. Nevertheless, from a closer analysis, a difference between the two terms exists, if considering morality a body of social norms defining the behaviour to adopt and ethics (seen as a branch of philosophy) as the discipline which studies the structures of this very body.

[8] The identification of those situations, where the moral principle could be appropriately applied, or of that hierarchy, according to which one has to apply principles and pursue regulations in each situation, represents the core of any moral theory which describes the human behaviour. Hauser's research (2007) on the genetic origin of the moral behaviour at the basis of social coexistence has proved that, even if men are able to instinctively adopt morally-oriented behaviours, the contingent situations in which they make such evaluations significantly influence their choices. Thus, judging these situations from a moral perspective seems to acquire a cultural significance.

[9] Kant 2001 [1787], § 4, p. 16.

As for responsibility, it is a concept belonging to the semantic domain of any definition trying to construct or refer to (one or more) ethics.[10]

From an historical point of view, the concept of responsibility appears for the first time in philosophic and legal literature at the end of the XVIII century. As for philosophy, the English Empiricists[11] were the first who used it to demonstrate the impossibility to associate the concepts of "absolute need" and "absolute freedom" to any form of moral judgement[12]; in fact, responsibility limits absolute freedom's fields of action, confining it within the borders imposed by the prediction and the following identification among one's own behaviours of possible unacceptable effects, determined by a specific action. Thus, partially limiting the exercise of an absolute freedom in the development of any kind of innovation, represents the funding limit and opportunity at the basis of the UGO Standard; it establishes that any innovation, in order to be considered as ethically correct (as above described), has to aim at «increasing human beings' quality of life».[13] We have to underline that here the word commitment has a positive acceptation, as suggested by Douglas Hofsdadter: it is considered as an element able to create opportunities, as commitments make people taking the most advantage they can from their own creativity, to the point to increase their chances to make innovation.[14] Improving

[10] There are, in fact, come scholars, such as Jonas H. (1990) or Weber M. (1970 [1934]), who seem to be trying to create a kind of special Ethics, the Ethics of responsibility, in the attempt to prove that Ethics has a specific domain associated to responsibility, a domain characterized by unique features. As long as responsibility derives from the Latin word respondere and, from a philosophical point of view, being responsible could be interpreted as promising to answer, to somebody or to oneself, for one's own actions as well as for the consequences deriving from them, thus it is not clear why an Ethics, based on rational (in a wide acceptation) prerequisites, even if deontological, could not be responsible. Nevertheless, Jonas has been the one who affirmed the need to pay, in contemporary age, extreme attention (that is responsibility) to the implications that scientific and technological development could have on the future, though distant from now, which turns, then, into an horizon to consider during the exercise of responsibility, even if unknown.

[11] See for example Hume (2008 [1740]). Particularly interesting is the Book III, which contains the formulation of Hume's law on the impossibility to logically derive moral principles from the mere descriptions of facts. «In every system of morality, which I have hitherto met with, I have always remarked, that the author proceeds for some time in the ordinary ways of reasoning, and establishes the being of a God, or makes observations concerning human affairs; when all of a sudden I am surprised to find, that instead of the usual copulations of propositions, is, and is not, I meet with no proposition that is not connected with an ought, or an ought not. This change is imperceptible; but is however, of the last consequence. For as this ought, or ought not, expresses some new relation or affirmation, it is necessary that it should be observed and explained; and at the same time that a reason should be given; for what seems altogether inconceivable, how this new relation can be a deduction from others, which are entirely different from it» (ivi, pp. 496-497).

[12] For more details on the philosophical meaning of the concept of responsibility see Abbagnano–Fornero (2005).

[13] UGO Certification Standard, version 1.1 2012: Definitions.

[14] As for the concept of commitment and the creative potentiality that commitment, in an apparently counterintuitive way, see in particular Hofstadter (1987, 1996). The relation between creativity and the

human beings' quality of life represents, then, the UGO Standard's corner stone and its final aim as well, also from a logical point of view. Considering the quality of life as the core element of the Standard's logical construction could lead to its possible inclusion in the group of the so-called "common goods". Obviously, here we do not refer to natural common goods (forests, atmosphere, water and so on), but to cultural and social goods and/or to those allowing our society to function. In fact, if we adopt the classic acceptation of "common goods" «which all enjoy in common in the sense that each individual's consumption of such a good leads to no subtractions from any other individual's consumption of that good» (Samuelson 1954, p. 387), the concept of "quality of life", as defined in the UGO Standard, seems to perfectly match this definition. The Standard, in fact, defines "quality of life" as «that dimension of existence that, in the constant and dynamic intertwining of relationships, finds the conditions necessary to guarantee free spaces to individuals and community, in compliance with ethical obligations, those guiding obligations that – originated from a rational agreement existing between social actors – aims at distinguishing good from bad, the acceptable from the unacceptable».[15]

Notwithstanding the different theories regarding the nature and usability of common goods, there is the possibility and, according to us, the probability that the concept of quality of life belongs to the domain of common goods (see for example Ostrom 2006). Regardless to the acceptation given to them, common goods present, from a theoretical perspective, some unique features: they are inclusive and commonly owned and their preservation is a priority for society. In other words, the quantity of common goods should have to be increased, if possible, or, at least, keep unchanged and possibly never be reduced.[16] This statement, apparently irrational from a strictly economic point of view, is explained by the fact that the decision to reduce the general value of common goods because of economic choices, taken in the name of an alleged rapid profit, would cause to the present and future society collective and probably immeasurable costs of social, environmental and economic nature. An example of the above, is represented by air pollution and the resulting health damages which occurrence leads to some obligations imposed to society, mainly at the expenses of the national health service, then to community itself; a second example consists in the limited access to water for basic needs, as proved by the famous "Water War" which have recently taken place in Bolivia, causing

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creation of innovation, terms identifying different phenomena, clearly reveals even if not mechanistically determined. This explains why extending the meaning of commitment beyond the moral dimension of taking on responsibility, the meaning it assumes in this context, it seems to be also relevant with regard to innovation.

[15] UGO Certification Standard, version 1.1 2012: Definitions.

[16] The UGO Standard, in fact, introduces responsible innovation as an element able to improve the quality of life.

substantial costs at the expenses of community, involved enterprises and institutions.[17]

Therefore, it is economically reasonable, besides morally appropriate, to preserve the total quantity and quality of the available common goods in the medium and long run.

Citizens, in fact, are now able to clearly distinguish opportunistic behaviours, which endanger common goods, and have started to support ever more often those subjects, who pay attention to those very elements. Then, it will be particularly unwise for enterprises not to include the latter in their corporate policies and strategies.

The foregoing statements are also true as for life quality, which could serve as a synthetic concept able to express the quantity of available and accessible common goods in a specific context.[18]

Analysing the definition of "quality of life" presented in the UGO Standard, we can highlight four ethically relevant points:

1. the need to refer to a rational agreement;
2. the identification of a demarcation principle;
3. the assumption of a dynamic and evolutionary perspective;
4. a long-lasting and effective relation with stakeholders to be established by innovating enterprises.

The first point suggests that adopting inclusive approaches, resulting from a rational agreement[19] among the subjects asked to construct and define the innovation, is the essential prerequisite to a responsible innovation. The concept of rational agreement have extensively been analysed by political philosophy, with the

[17] In 1990 the American company Bechtel Corporation privatized water services in Cochabamba, the third-largest city in Bolivia. W ater prices tripled, it became necessary to buy a license to access water resources and a licensing system for collecting rainwater was also introduced. After a year, 55 percent of local citizens had not yet obtained the access to water. In April 2000, hundreds of thousands marched on the streets of Cochabamba to protest against the Government, and forced it to revoke the W ater Privatisation Law. The contract with the multinational company Bechtel was terminated and the water service concession re- advertised. The conflict, known as the "Cochabamba W ater W ar'', became symbolic of the struggles fought to protect common rights, proving that popular participation could have a major influence on decision making in regard to the management of public services.

[18] Evidences of the fact that similar concepts have started to be fully included in the analysis of the different scenarios of economic development are contained in the recent OECD Report (OECD/OCSE 2011) on how to measure society's well-being, as well as in the Stiglitz et al. Commission's famous Paper (2008) on the identification of alternative measures of GDP to use in order to represent contemporary society's conditions.

[19] As for rational agreement in contemporary moral philosophy, see Rawls (1994), accomplishing the statements started in Rawls (1982).

aim to identify the main elements of a fair (and rational) society.[20] Interestingly, in philosophic studies the term "agreement" (even when not accompanied by the modifier rational) has often acquired a meaning close to the concept of knowledge; agreeing on something requires a certain knowledge of the very object of the agreement, as stated by Antoine Arnauld and Pierre Nicole (1683), who edited the so-called Port Royale Logic[21], or John Locke.[22]

Then, we will intend rational as a modifier which identifies a process able to lead to an agreement (and create knowledge), only in case it is a free and justified process and every subjects who accept the agreement – reciprocally depending on one another but still keeping their own freedom – prove able to fulfil their own goals. The above described situation would result from a moral condition of mutual respect, based on the impartial acknowledgement of each ones' rights and interests.[23]

The second point introduces the possibility to identify a demarcation principle[24], helpful in distinguishing a moral innovation (the one we are interested in) from a morally-neutral or immoral one. This principle reveals extremely interesting because of its ontological implications: in order to correctly trace the demarcation line, necessary to distinguish responsible innovations from irresponsible ones, it is important to refer, not to a meaning criterion, but to a "knowledge criterion" which proves helpful in identifying responsible innovations among the wide range of the existing ones.[25]

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[20] Again we have to underline that any rational preference is not a priori a moral preference too: it has to meet additional criteria, such as universality and impersonality, meaning that it has to be, at the same time, unanimously acknowledged and independent from the different conceptions of good (Veca 1986).

[21] «After things have resulted from our ideas, we compare these very ideas and, finding out that some agree and other ones, instead, disagree with each other, we connect and disconnect them, that is confirming or denying, in other terms, judging them» (Log II, 3).

[22] Locke (2004 [1690], IV, 1 § 2) defines knowledge as «the perception of the connection of and agreement, or disagreement and repugnancy of any of our ideas».

[23] This perspective is based on the concept of "social contract" developed by Rousseau (2008 [1762]) and further updated from a theoretical point of view by John Rawls.

[24] As for the demarcation principle in science philosophy, see Popper (2009) and Laudan (1979).

[25] Popper (1972) introduces this concept with the aim to establish a demarcation principle distinguishing scientific theories from non-scientific ones. He uses the term "demarcation principle" to define a principle helpful in distinguishing «empirical sciences' assertions from all the other assertions, religious as well as metaphysical, in other terms, pseudoscientific ones» (ivi, pp. 70-71). Popper proposes the application of the falsification principle in science: «Please, pay attention to the fact that I propose falsification as a demarcation principle and not as principle of knowledge» (Popper 1970, p. 22, note 3); then added that: «falsification separates two kinds of actually relevant assertions: the ones which can be falsified and those which cannot. It traces a line within the language and not around it» (ibid.). The latter meaning of the demarcation principle is the one we actually are interested in, as able to establish a border, even if a fuzzy one, however clearly identifiable and able to distinguish responsible innovations from all the other possible forms of innovation (Popper 1970). We will neither consider here some problems of strictly logical nature caused by falsificationism, nor the debate on such a principle's effectiveness, also from a knowledge perspective, originated by some authors.

Therefore, both the need to derive from a rational agreement and the identification of a demarcation principle result into a "deontological" approach to innovation, in the name of the binding and unchanging principles applied.

The deontological ethics of Modern Age derived from Immanuel Kant's work define an action or a behaviour as necessary simply because "good in itself".[26] The analytic philosophy of the XX century describes them as ethics which measure morality not referring to results but to a specific principle.

The third and the fourth points of the definition contained in the UGO Standard, instead, refer to teleological characteristics: the acquisition of a dynamic dimension continually evolving, able to establish a long-lasting relationship among the interested parties to the innovative process.

The second part of the definition refers to a concept which played an important role during the definition of the UGO Standard's structure. We are referring to interested parties participation into the processes intended to establish the guidelines to be followed in the scientific and industrial research.

However, further clarifications, regarding that part of the definition referring to the acquisition of a dynamic dimension are here required. Because of the nature of innovation, a phenomenon trying to cast light on still undiscovered knowledge areas (even if not totally imaginable)[27], exclusively imposing the adoption of an ethics which only refers to deontological principles, from a moral perspective could have proved, at least, to be a questionable choice.

As opposed to deontologically ethical theories, the teleological ones tend to «make the right, the obligatory, and the morally good dependent on the non-morally good» (Frankena 1996, p. 64), in other words, to judge moral consequences referring to non-moral consequences, such as happiness, pleasure and usefulness.[28]

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[26] In the Groundwork of the Metaphysics of Morals Kant (1970 [1785]) defines the concept of categorical imperative (= moral imperative) as the obligation to realize an action that, being good in itself, reveals as objectively necessary. The categorical imperative differs from any other obligations for three main features: it cannot be influenced (it does not help to reach a goal); it applies to every men in every situations (as it does not depend from any specific action or behaviour); it expresses a pure will (not conditioned or conditionable by contingent events), that is the will to accomplish an action requiring no explanation.

[27] Johnson (2011) introduces the concept of "adjacent possible" as the only source of innovation which could be, at the same time, conceived and transformed in applications which can be used by society. In order to explain the concept, the Author provides the example of a series of doors and rooms: opening the first door, we enter a room in which there are other several doors leading to other rooms. The adjacent possible is what we find in the first room and that we can, immediately, turn into innovative applications useful to society. Even though people, in some cases, can open several doors one after another, in consequence of which knowledge will make remarkable progresses, unfortunately in these situations it will be difficult to be able to transform the acquire knowledges into innovative applications, as often there lack the necessary technological or social conditions (or both).

[28] As for the differences existing between deontological and teleological ethics, see Abbagnano–Fornero (2005) who provide a definition of the two terms. Another possible distinction between the two

Thus, these two principles make the first two dependent on contingency: the application of the former could not theoretically exclude the possibility that an innovation, even if developed in compliance with the above mentioned deontological principles, could anyway determine undesired effects[29], even though the first two principles, at least in theory, could be totally independent from contingency. Paying attention to people's different opinions during every phases of the innovation process, as well as knowing and being willing to understand their relevance, results into a reciprocal relation connecting innovation-makers and innovation-users or those people undergoing its effects, that is an ethically-relevant relationship. It is clear that only a dynamic approach, based on the acknowledgement and adoption of some principles, continuously paying attention to and analysing organizations' activity, could lead to such a result.

This is the reason why the four points listed in the definition of quality of life, presented by the UGO Standard, continually move to and from the deontological and the teleological dimension, trying to offer a possible and reliable moral guide to the innovative process taking place in contemporary society.

The aim of this strategy, in fact, consists in giving birth to a kind of method, or "moral language" in Richard M. Hare's words, which can also be followed as for the development of the UGO Standard[30] itself.

3. Governance of innovation

The adoption of the above mentioned "moral language" represents the prerequisite to the construction of a governance system able to create and manage innovation dynamics within organizations, according to the principle stating that innovation has to be guided towards the improvement of people's quality of life. In practical terms, this implies the possibility to establish management strategies intended to guarantee that, when analysing innovation's impacts, attention will be paid, not only to

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approaches to ethical theories is presented by Rawls: he defines the first category as the one including those ethics which put the right before the good, while the second one as that including those ethics which put the good before the right.

[29] Nevertheless, it appears to be pragmatically impossible to support the existence of a clear distinction, between the above described groups of ethical theories, actually identifiable in human behaviours. Therefore, contemporary moral philosophy tries to preserve the principles (deontological approach) and, at the same time, to pay attention to the results derived from their application (teleological approach).The methodology followed to define the basic principles characterizing the concept of quality' of life and, then, the UGO Standard conform to that underlying belief.

[30] In Hare's opinion (2006) moral thought's objectiveness does not consists in the transformation of moral questions in practical ones, as this would lead to a relativism binding us to specific cultures and languages. On the contrary, it derives from the generally normative nature of that moral language which could be adopted by different cultures and ages.

economic criteria, but also to other elements which may be labelled as social and environmental ones.[31]

Analysing the question from a mere logical-pragmatic point of view, the first thing to do consists in deciding in which phase of the innovation process would it be more appropriate to exercise this form of control. For the first time in 1980 an English researcher, David Collingridge, asked himself whether it had actually been possible to exercise a form of "social control"[32] on the consequences of innovation, especially on those innovations which effects on society could play a leading role in the evaluation of their actual success (or insuccess), with regard to the established goals, giving birth to the phenomenon known as "Collingridge's dilemma". This theory could briefly be explained as such: «attempting to control a technology is difficult, and not rarely impossible, because during its early stages, when it can be controlled, not enough can be known about its harmful social consequences to warrant controlling its development; but by the time these consequences are apparent, control has become costly and slow» (Collingridge 1983, p. 40). The scientific literature agrees with Collingridge as for the huge difficulties met in trying to effectively operate during the innovation process's first stage; in fact, during that phase, which can be defined as "creative", researchers and decision-makers have very few instruments (with limited effectiveness and efficacy) at their disposal to use, in order to identify the possible negative effects that innovation, in its early stages, could determine. In this regard, one of the most important available methodological operators, also adopted by the UGO Standard, undoubtedly is the Precautionary Principle.[33]

Here we will try only to in-depth examine one of its most critical elements: we will try to identify the conditions which could lead to its application to decision-making processes. The complete (or sometimes partial) lack of knowledge in decision-making processes could, at least in theory, assume four different connotations as shown below:

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[31] While planning and making innovations, paying attention to such variables represents an important step to take in order for any organization to adopt a responsible approach to innovation.

[32] We can define social control as a process including all those activities intended to conform people's behaviour with the aim to make them complying with collective regulations and satisfying collective expectations. Here, the reference group is represented by society and, then, the expectations to be considered are those deriving from it. Referring to what already stated in the first part of this contribution, the hypothesis, here considered as preliminary, states that life quality improvement could be included in the group of social expectations, and adds that society itself, according to the definition of social control above reported, could try to influence and guide organizations' behaviour towards the creation of innovations which could contribute to this goal.

[33] For more details on the origin and the evolution of the precautionary principle, see Comitato nazionale per la bioetica (The National Bioethics Advisory Commission 2004), Sisiti–Olivato (2010), Wynne (1992), Hunyadi (2004).

1. decisions under conditions of risk;
2. decisions under conditions of uncertainty;
3. decisions under conditions of ignorance;
4. decisions under conditions of indeterminacy.[34]

As for decisions to take under conditions of risk we refer, for example, to a contingency in which we know both the impacts and the probability for such impacts to occur; then the decision to take, on the basis of essentially known information, regards the level of risk that one is willing to take on. Obviously the acceptability of these risks will be conditioned, apart from by social variables, also by economic considerations based on a cost/benefit analysis.

In case of decisions to take under conditions of uncertainty, we know its possible effect, although we ignore both the probability for the phenomenon to occur and the forms it could take.

In case of decisions to take under conditions of ignorance, instead, we neither know the possible negative events nor whether and how the latter could eventually occur.

Finally, in case of decisions to take under conditions of indeterminacy, apart from ignoring all the aspects listed in the previous lines, we neither know the socio-cultural context which will be affected by the effect caused by decisions, nor we know the future expectations on the variables to consider; in other words, we are not able to evaluate the acceptability of any impact. If this analysis is right, the Precautionary Principle comes into play in cases of uncertainty and ignorance (2 and 3); on the contrary, it could prove not much effective when making decisions under conditions of kind 1, while it reveals completely ineffective, as any other method or predictive instrument, under conditions of kind 4.

The UGO Standard defines the Precautionary Principle as «a standard of conduct intended to identify the point of compatibility between technical- scientific development, necessary to humanity, and the management of the revealed or assumed menaces brought along by such development». This definition, which also tries to analyse the principle from a cognitive perspective, presents as the first element able to guide research approaches, especially those adopted in the initial phase of the innovation process. However, being it an instrument applied in conditions of uncertainty or ignorance, its chance to responsibly guide the innovation process present well defined limits. At its best, once identified possible areas of uncertainty or ignorance, the application of the Precautionary Principle could contribute to determine possible conducts to assume, in case a possible situation realizes. Moreover, as the only application of this principle is not able to make the above described situation real, it is necessary to implement complementary

[34] For more details on the meaning of this taxonomy see Wynne (1992), who first suggested it.

measures, intended to speed up research and to decrease the degree of uncertainty which prevents responsible innovation to realize. In fact, if on the one hand the innovation process usually reveals unquestionable, with regard to economic reasons, on the other one, it is not as such when taking into account ethical reason and final users' opinions. Therefore, it is necessary to find a dynamic balance between these opposed positions, as underlined by the Precautionary Principle too.

At this point, it still remain unsolved the problem consisting in the implementation of a system able to manage the second phase of the innovation process, when the innovative applications created spread in society, causing non-considered or non-conceivable impacts.

This lead to two necessary actions to take: managing those externalities determined by the innovation process and promptly and effectively contributing to the decisions intended to spread the produced innovations on the market.

As for the first action, we are focusing on the problem represented by the acceptability of science and of its products by society, which assures that innovation's possible impacts have been appropriately and correctly evaluated. In this situation, extremely important reveals the concept of "independent research"[35], which identifies a research method that each organization would have to adopt in every phases of the innovation process: it would give the possibility to access in many different ways knowledges and different opinions, unconditioned or conditioned by the success (on the market or in society) of the created innovations.

As for the second action, instead, we have to consider two more aspects. The first one consists in the collection of data thanks to which it would be possible to classify those elements, playing an important role in externalities management; then, the second one, consists in the possibility for these elements to effectively influence the decision-making processes which lead to the development and/or possible correction of the applications deriving from the created innovations.

The UGO Standard identifies the construction of a structured and long- lasting relation with stakeholders as the necessary starting point for the creation of an effective control system able to manage externalities. Simone Arnaldi's contribution (compare supra) has highlighted that, when there is no relationship, then no dialogue, with stakeholders, innovations risk to be rejected by society: he suggests

[35] The UGO Standard explicitly mentions the concept of "independent research" in case it is necessary to apply the precautionary principle in one of the field undergoing innovation (requirement 4.1 D). More in general, this concept could refer to every phases of the innovation process, as the possible benefits deriving from it, also in economic terms, acquire extreme importance for some reasons: 1. the reduction, from the very beginning, of the possible risks determined by ignoring some relevant points of views, opposing the main perspective adopted by the organization during the innovation process; 2 though economically challenging in the short-term, taking into account the possible negative consequences and the externalities that could take place, at the expenses of organisations, in case this approach is not adopted, it will reveal extremely advantageous in a long-term perspective.

that the absence of any form of communication between innovation-makers and innovation-users would «give the impression that there is something wrong in technology itself». In this regard, extremely important reveals the role played by organizations in the spread of information among stakeholders, regarding the very innovations being developed or spread; in fact, this could «rise their awareness of the actual of possible consequences which could be determined by the introduced innovations».[36] Therefore, apart from containing the above mentioned possible negative effects, organizations could increase their chances to receive from parties feedbacks on the actual or perceived impacts – originated by the application of the introduced innovation –, based on an objective background and not only deriving from a priori or ideological stances.[37]

Moreover, it is important to give start to this process from the very early stages, in order to guarantee the promptly application of corrective actions, which, in turn, would avoid to pay exorbitant amount of money for their implementation, as it happens in case innovative applications start spreading before a similar relation and control system has started to work.[38] Though these actions are necessary to produce responsible innovations, they cannot guarantee it on their own; in fact, in order for corporate government model to effectively contribute to the above mentioned goal, strategical and operative decisions have to "actually" be influenced by the information given to stakeholders and the relationships established with them; moreover, these decisions have to be "perceived" by society as deriving from the very relations established among stakeholders and organizations.

In fact, there exists a huge difference between the exclusively informative involvement of stakeholders and their active participation to innovative processes. For informative involvement we refer to all those unidirectional activities (from

[36] UGO Certification Standard, version 1.1 2012, requirement 5.8.

[37] The possibility to have a grounded critical judgement directly depends on the knowledge of the very object to be evaluated. In other words, in order to judge something, it is necessary to, at least, partially know it. This explains the need to spread the information regarding a specific phenomenon recurring to the widest range of possible methods and forms. Obviously, there are different kinds of information regarding the produced innovations and it is important to exactly know the difference existing between the ones to spread and those, instead, not to disclose, as referring to specific technical features identified in corporate environments as trade secrets. Nevertheless, there have to exist other solutions in the in-between space separating the two poles (total information and zero information), able to help stakeholders to form their own opinions. In his latest work James S. Fishkin (2009), who has been studying the dynamics through which citizens express grounded judgements on public policies, proves that groups of citizens, chosen on a statistical base, are perfectly able, recurring to the deliberative polling, to not only understand the topics involved, but also to analyse the scenarios and then take grounded decisions even in those cases requiring an in-depth and topic-specific knowledge.

[38] Though it reveals actually difficult to implement effective control systems during the creative phase of the innovation-making process, it is possible, at least in theory, to adopt a managing system since the very beginning of the so-called applicative phase, able to guarantee the production of actually responsible innovations.

innovation-makers to possible innovation-users or people undergoing the effects of their applications), consisting in presentations, publications (of sustainability reports, for example), the opening of debates, on-line forums etc., mainly occurring when «the decisions as for the adoption of a specific innovation have already been taken» (Pellegrini 2010, p. 306). On the contrary, we define participation as the possibility for people involved in innovative dynamics to directly contribute to the debate which is developing on a specific technical-scientific question [...]; in other words, the term participation implies the entrance in the debate of different points of view, others than technical ones, such as ethical, social and economic ones, which could be taken into consideration during the decision-making process regarding technological-scientific innovations (ibid.).

In this regard, the UGO Standard asks organizations to identify the most important areas in the activities undergoing innovation and to adopt methods allowing to constantly verify whether the goals they autonomously established meet stakeholders' expectations in these very sectors.[39]

The UGO Standard governance system also includes some specific performance requirements to be satisfied by certified organizations during the implementation of a control system regarding the application and spread of responsible innovations. They require to invest every year, at least, 5% of the added value produced by the organization in research activities and, in case the Precautionary Principle is applied, to invest, at least, 1%[40] of the turnover obtained thanks to the production of products or services, which have required the application of this Principle to the independent research, aimed at reducing the uncertainty and ignorance characterising some of the above mentioned decision-making processes connected to innovation.[41]

The foregoing requirements, together with a set of indicators (describing the specific domains interested by innovation and its applications), a government model (able to interpret and keep under control these indicators[42]), an effective methodology (allowing to spread relevant information and to listen to stakeholders' opinions and consider them in decision-making processes[43]) give birth to a complete

[39] UGO Certification Standard, version 1.1 2012, requirement 5.4 and 5.5.
[40] Ivi, requirement 4.1.
[41] As already affirmed, the UGO Standard asks organizations to prove their attempt to take relevant actions aimed at collecting information, which will prove useful when making decisions regarding innovative policies. Thus, investing in activities giving helpful indications in the decision-making process, especially in those case when the Precautionary Principle have been applied, or in research or development activities, is an important step to take. Obviously, the amount to invest in both cases have been calculated taking into considerations some sector-specific benchmarks and on the basis of non-rigorous mathematical calculations, but rather recurring to "good sense".
[42] UGO Certification Standard, version 1.1 2012, requirement 5.3, 5.4 and 5.7.
[43] Ivi, requirement 5.8.

system able to guarantee an effective and responsible governance of innovation , thanks to a continuously operating action-feedback mechanisms.

This can happen thanks to the possibility, given by such a system, to promptly and effectively correct or eliminate undesired externalities which could accidentally originate.

As for its general structure, the UGO Standard presents a static component, including structural requirements which impose some limits which corporate innovative activities have to respect, and a dynamic one, including the relationships established with stakeholders and the ability of these relationships to significantly influence organizations' innovative choices. The uniqueness of the approach introduced by the UGO Standard consists in the fact that the dynamic component plays a significant role also in determining the static component, or better, in identifying some of the established requirements. The static component, instead, represents the reference framework able to assure a dynamic and creative innovation process, putting some limits to its development, in order for it to responsibly contribute to the established goal (to improve the "quality of life") and requires to pay attention to stakeholders' opinions (the actual dynamic activity).[44]

Extremely helpful in understanding this concept reveals the asbestos cement industrial production history. The construction industry has been extensively using asbestos cement, this mixture of asbestos and cement characterized by high insulating capacities, since the beginning of last century. In medical literature, for the first time in 1906 the asbestos dust was linked to lung cancer and in 1930 in the United Kingdom medical research fist proved that the exposure to asbestos could increase the risk of mesothelioma, findings which led to the introduction of a compensation laws for workers suffering from asbestos-related diseases. Although the Italian law, together with many other countries all over the word, eventually introduced a prohibition regulation banning the use of asbestos in any form, because of its dangerousness, only in 1992! If the UGO Standard had been adopted by the enterprise which produced asbestos cement on a large scale, first of all it would have had to invest in independent research aimed at better analysing the connection existing between the production and use of asbestos cement and asbestos-related diseases (as some suppositions had already been made), and then it would have imposed a requirement (Static Component), demanding to pay attention to stakeholders' opinions, in order to obtain some information on the impacts determined by the innovation produced. The collection of feedbacks (Dynamic Component) would have probably make the enterprise reconsidering its industrial strategy and, on the basis of the above described continuous interaction with parties,

[44] As for the relevant role played by constraint in creative processes compare supra, note 15. It refers to the fact that the UGO Standard does not show organizations how to describe the innovation process, but asks them to highlight the domains and to provide the indicators able to better describe this process; nevertheless, also these actions require to responsibly act.

the corrections made would have led to a new constraint, put on production and controlled by stakeholders.

Unfortunately, during the large-scale production of asbestos cement in Italy (from 1907 to 1986) very few information had been spread, allowing the enterprise to long keep in secrecy the risk of mesothelioma deriving from the inhalation of asbestos dusts. A similar behaviour would not have been possible today, thanks to the extensive use of different technologies able to widely spread information, as well as to people's solid and well-established opinions.

This situation has made the adoption of an approach, similar to the one introduced by the UGO Standard, ever more compelling, also from a strictly (and we could add cynically, with regard to the previous presented example) economic point of view. In fact, because of legislative evolution, in curt the principle of restoration of starting conditions is ever more often applied in those cases when the ecosystem in which the enterprise operates has been endangered (as it happened in the above described case); moreover, ever more importance has started to be given to the compensations for damages to be paid to those people who have suffered the effects caused by possible negative externalities, resulting from organizations' activities; unfortunately, this could never compensate neither for the victims of asbestos-related diseases nor for the problems caused to their relatives.

Therefore, we can consider this approach able to contribute to solve the "Collingridge's dilemma", thanks to the possibility to control the effect determined by innovation on society. The English researcher defined the phase during which innovative applications spread as the one in which it would be possible to more effectively apply an audit system, able to manage the possible externalities produced by this very process.[45] The UGO Standard, though paying attention to the creative and theoretical development[46], focuses on innovative application government strategies, asking organizations to establish, control and reconsider their goals on the basis of the feedbacks collected among stakeholders, in order to contribute to the creation of responsible innovations (responsible with regard to the extensively analysed goal). This represents a desirable and verifiable situation for society. This, in fact, also explains why CISE decided to create the UGO Standard as a voluntary Certification, issued by independent third parties, according to the management standard systems, usually adopted by organizations. The UGO Standard approach, in fact, is characterized by «the choice to ascribe its action to the sphere of behaviors adopted, on a voluntary basis, by companies and belonging to the so called "soft law

[45] In order to solve those problems which make it difficult to control the applications originated by the innovation process, the decision-making process originating them has to acquire «flexibility, controllability, corrigibility or insensitivity to error» (Collingridge 1983, p. 40).

[46] See the above reported discussion on the application of the Precautionary Principle.

regulation"», and by «the adoption of the principles and categories of management systems implemented by organizations».[47]

Finally, we could argue that the UGO Certification summarizes apparently opposed concepts. Some examples of the latter are represented by the already mentioned dyad static-dynamic, which describes the standard general structure, or the formal opposition existing between the deontological and teleological approach, presented at the beginning of this contribution when taking about general ethical theories. Another interesting conceptual dyad contains the terms innovation and responsibility, as the latter (in the name of a goal to achieve) tries to limit the former, though impossible to be limited by its nature.

Therefore, it emerges that, together with a declared goal, the improvement of the "quality of life", the UGO Standard also tries to achieve a second aim: the search of balance. The importance of the latter though, could not be understood at a first sight, as it would not lead to measurable results: it consists in the attempt to create a new approach to knowledge, able to take into consideration the complexity of that knowledge which originates innovations, including notions, not only deriving from the technological- scientific or economic domain, but also from the moral and social ones.[48]

In conclusion, the UGO Standard is based on a difficult challenge and an ambitious programme. Nevertheless, we believe that the funding idea which originated this project presents evidences proving its appropriateness and relevance, as well as its strategic and economic importance in the long term.[49]

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[47] UGO Certification Standard, version 1.1 2012, Foreword. This choice has been based on mere practical reasons, as these instruments, because of their specific features and application, could be better understood and adopted by organisations.

[48] Morin (2012) claims that the complex concept at the basis of contemporary society always consists in the union of two opposed concepts. In his last work the French philosopher- sociologist affirms that the bigger are the situations, the more relevant are the reactions to them. Notwithstanding the fact that pessimism is what clearly emerges from contemporary contingent situation, the relevance of the reactions to this tough moment generates optimism.

[49] Apart from that contained in the already mentioned strategical documents produced by the OECD and those by the French Presidency, we can also report here the definition of responsible innovation given by the European Commission: «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» (European Commission 2011, p. 9); then, that of social innovation given by the Bureau of European Policy Advisers (BEPA 2011, p. 33): «we define social innovations as new ideas (products, services and models) that simultaneously meet social needs (more effectively than alternatives) and create new social relationships or collaborations. They are innovations that are not only good for society but also enhance its capacity to act». However, more relevant have proved the innumerable sectoral or transversal initiatives, conferences and publications organized on the topic during last years, mainly at an international level, proving the contemporaneity and urgency of the topic itself.

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Innovative method of regional sustainable energy strategies

László Dinya[1]

This article aims to increase knowledge and find the best practices on how sustainable energy management (SEM) can be boosted and implemented at a regional level. It presents the main results from the RESGen (RES Generation – From Research Infrastructure to Sustainable Energy and Reduction of CO_2 Emissions) project (subsidized by the EU in 2009-2012) and the procedure developed within the project, which aims to support regionally comprehensive implementation of SEM involving all the main stakeholders. Physical prerequisites to support the transition of the energy sector towards SEM exist. The renewable energy sources (RES) potential is vast, the economics, especially regional impacts, are feasible, general perceptions are positive, technologies are evolving and the majority of stakeholders support this agenda. There are however barriers slowing the process. The RESGen procedure provides a structured and strategic approach for the shift towards SEM.

Keywords: sustainable energy management, renewable energy sources, regional implementation process

1. Introduction

This article aims to increase knowledge and find the best practices on how sustainable energy management (SEM) can be boosted and implemented at a regional level. The main approach for this has been through developing comprehensive regional strategies, which integrate all the main stakeholders (authorities, industry, R&D bodies) into regionally rooted programmes. This paper presents the main results from the RESGen (RES Generation – From Research Infrastructure to Sustainable Energy and Reduction of CO_2 Emissions; EU Regions of Knowledge; 2010-2012) project within which a documented 'RESGen procedure' was prepared and used.

SEM descends from the idea of sustainable development, which has several different interpretations, including more than three hundred definitions within environmental management (WCED 1987, Johnston et al. 2007, Chichilnisky 2011). SEM interlinks with all the other aspects of sustainability, which depend on the

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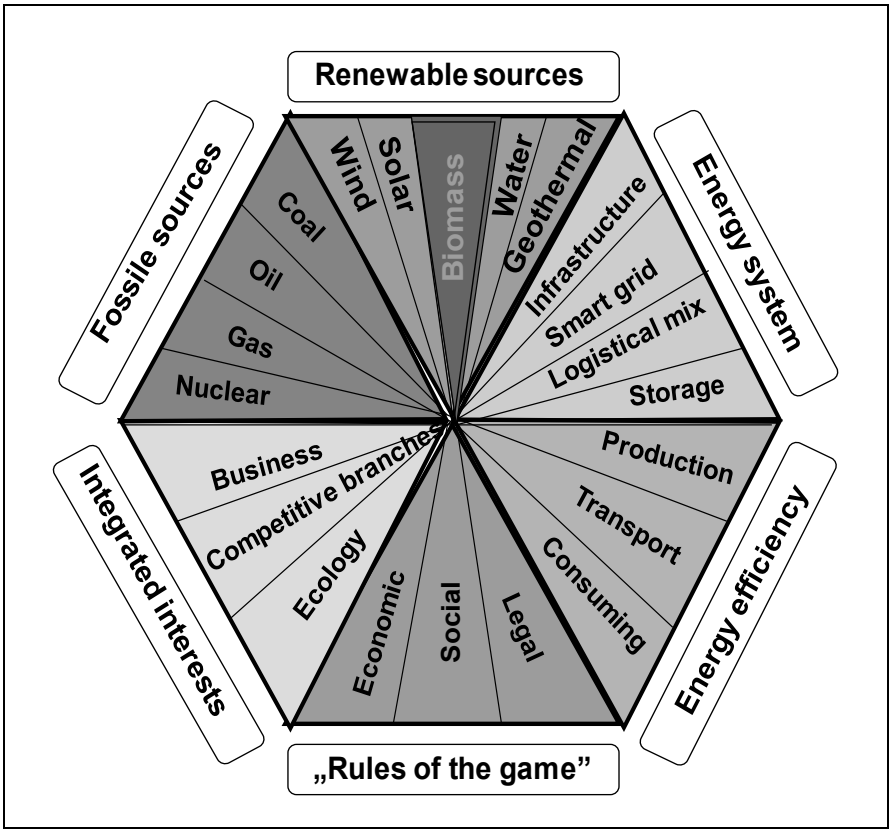
secure operation of energy supplies. Comprehensive understanding is necessary in developing SEM (Figure 1). The complex model of SEM is elaborated, defined and tested by us based on an evaluation of wide range of literature (Dinya 2009). We use abbreviations (buzzwords) above or below because of sparing with the space.

There are a number of technologies for rational use of energy (RUE) and RES, the integration of which is the key to creating complete alternative solutions with different degrees of regional energy self-sufficiency. SEM is necessary to avoid adverse impacts and careless use of RES in the name of SEM (Peura 2013). In developing the RESGen procedure this approach has been applied regionally.

Figure 1. The concept of sustainable energy management



Source: Dinya (2009)

The main objectives and research problems in this paper were:

- To construct a documented procedure for assisting implementation of SEM regionally.
- To test and analyse the procedure in the Northern Hungarian region, questioning:

1. Can the procedure help create commitment and trust among stakeholders?
2. Is the procedure helpful in implementation of SEM?
3. Is the procedure suitable for a more widespread use?

The need for SEM is based on the following reasoning:

- Deterioration of the environment is a threat to the whole of humankind and caused by discharge and overconsumption of natural resources. Humankind's ecological footprint reached an overshoot of 44 % in 2006, resulting in an ever-growing sustainability gap and causing reductions in natural buffers for self-purification abilities (Weijermars 2011). The cost for remedies has been estimated to exceed 14 trillion Euros and a 7% loss in global GDP in 2050 (EC 2008). It has been widely accepted that the problems are real and caused by human activity.
- Energy production has been one of the core issues concerning humankind's environmental impacts, whilst also having significant economical and societal impacts. That's why "*climate policy is principally…energy policy*" (Huberty–Zysman 2010, p. 1027). All thinkable fossil energy sources are becoming scarce and more expensive (Smalley 2005, Jefferson 2008, Hall–Day 2009), and the transition to SEM will be among the most important components in comprehensive global change (Peura 2013).

There is a vast literature about humankind's environmental impacts, population dynamics, limits of existence and natural resources (Peura 2013). Summarising, the world will face comprehensive changes and the transition towards SEM can be an integral part of them. "*... sustainability in a fundamental sense is connected to the survival of our species*" (Chichilnisky 2011, p. 126). It is important to develop SE in line with 'normal' business criteria. SEM is however not normal business and cannot be understood merely as economic transactions and 'business as usual' based on the following reasoning:

The construction of energy infrastructure has been subsidised by public funding. It has become more of a commercial activity following the privatisation of power plants and networks (originally publicly subsidised). However privatisation has not led to free markets based on equal competition, which would be a precondition for classical economic decisions "*...without a 'constraint' for sustainability*" (Chichilnisky 2011, p. 127). The development of energy infrastructure is still led by political decisions and the general rules define what can be profitable in the energy sector. Today most regulations still support the prevailing actors, and there are a number of structural barriers for any newcomers trying to introduce SEM to the market. For instance, in 2011 subsidies to fossil fuels were $523 bn globally, but only $83 bn to RES (IEA 2012).

Energy safety and self-sufficiency have national strategic implications, and there are important regional impacts. The money presently flowing to oil producing

countries, for instance, would have significant benefits if it stayed 'at home'. Therefore decisions to support the development of SEM are essentially strategic ones, and they are directed towards creating a stable business environment.

It is essential however that any new power plant is feasible. All operations take place in real time markets and concurrence cannot be avoided. "*... unsustainable practices have become a problem (...) because we are using world resources to the limit*", but the constraints involved by sustainability criteria "*... do not exist in neoclassical decision criteria*" (Chichilnisky 2011, p. 128). Therefore, "*we need new economic foundations that update classical economic thinking*" (Chichilnisky 2011, p. 128).

Today there are a number of positive drivers for SEM. However, the diffusion of SEM has been slow and there are many barriers. To make the dynamics understandable, the main drivers and barriers have been briefly reviewed in Chapter 2.

2. Drivers of and Barriers to Sustainable Energy

Over the last two decades there has also been increasing awareness and aspirations to see more widespread use of RES. The main reasons for this have included the following:

- *The RES potential.*
  Empirical material from Europe and globally demonstrates that there is realistic and easily mobilized potential for RES to enable energy self-sufficiency. Even 100% RES systems have been planned in practice (Peura–Hyttinen 2011).
- *The economy of RES technologies.*
  The business case for RES solutions is often already feasible and investments in RES technologies have performed well (Masini–Menichetti 2012). The benefits beyond business profitability can be significant. This regional added value (Hoffmann 2009; monetary aspects, reduced costs, increased purchasing power, new employment, tax income, social, ecological and ethical aspects, improved vitality) would be remarkable. RES also generates more jobs than conventional energy.
- *General perception and policies.*
  Development of a positive perception has prepared the ground for social acceptance of SEM, which has been high since early 1980s (Wüstenhagen et al. 2007). Policies and other support frameworks were established in 118 countries by early 2011 (REN21 2011). RES has moved to the top of the international political agenda, the institutionalization of SEM is occurring globally, and SEM has become the key concept in reforming the energy sector.
- *Technical evolution.*

Technical evolution is in early development phase, but new solutions are being developed on constantly. The strong spatial diffusion of RES technologies worldwide, despite their low market share, indicates a high overall potential for further diffusion to cover 60% of produced energy in 2050 (Lund P. D. 2010).

Despite strong signs of progress, the expansion of SEM has been far less than, for instance, the increase of world coal production (Jefferson 2008). There are a number of reasons for this:

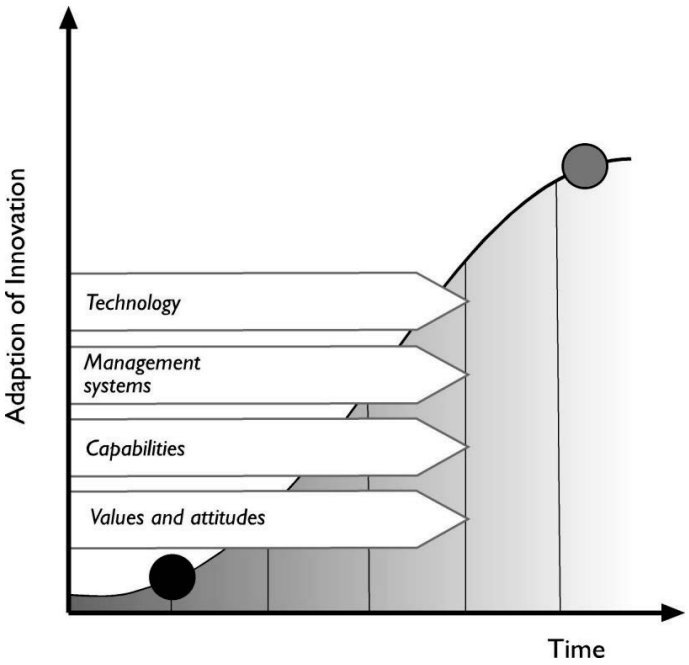
- *Institutional opposition.*
  The prevailing large actors tend to prevent any development that does not support their own business (Lund H. 2010). This also means that RES based solutions are fighting against existing energy structures.
- *Diffusion of RES based technologies.*
  SE and RES based systems require often a total change from fossil fuels to new raw materials. The shift towards these structures, different from the prevailing system, will be a long-term process. Technology and innovative institutional frames (Leszczynska 2011, Wolsink 2012) are necessary. As is the case of any innovation, institutional lock-ins preventing acceptance by key actors must be 'unlocked':
  1. Key social actors must accept the innovation.
  2. The process must be 'structured' so that laws, regulations and other institutions support them, or do not oppose them.
  3. Innovations must evolve technically.

  RES solutions are in early phase of diffusion, but concurrence takes place in real time markets, where the opponents are at the opposite end of diffusion. Thus, they are competing against technologies with many years of technical evolution, where investments have been repaid, supportive social structures are in place and the benefits of mass production and established value chains exist. As illustrated in Figure 2, RES technologies can be located to the left and lower down the diffusion curve, whilst the prevailing technologies are to the right and higher up the curve.
- *The process.*
  Change towards SEM will be a long evolutionary process, which needs to involve the majority of people. There will be a huge number of decision-makers, from individual citizens, families, farmers and businesses, to the public sector. Its success depends primarily on how the crucial stakeholders approve it (Wüstenhagen et al. 2007).

The conclusion drawn is that physical prerequisites for SEM exist. A shift towards SEM and away from fossil fuels will presumably be on the global agenda in

the near future. The majority of stakeholders wish to see this agenda move forwards, but there are barriers slowing the process. Also the role of economics is problematic: Market penetration and competition against powerful prevailing structures is difficult, but along with the diffusion, the prerequisites and feasibility of SEM are expected to improve. Conscious strategies and programmes can boost this development, which has been the focus in constructing the RESGen procedure.

Figure 2. Diffusion of innovation and capabilities



Note: RES technology: bottom left, conventional technology: top right
Source: Rogers (1995)

3. Methology

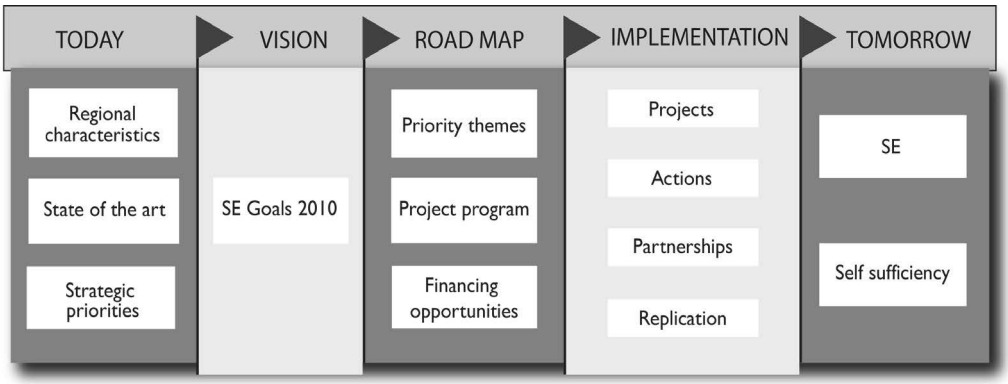
The underlying idea was to boost SEM by developing a replicable common approach and methodology, the RESGen procedure. In the project it resulted in a regional roadmap for implementing SEM. The Roadmap was clearly defined by practical project programmes based on regional strategy, for which stakeholder commitment is crucial. Figure 3 illustrates an overview of the procedure and its phases:

- Development of regional strategy based on the regional characteristics (regional SEM, capacities and capabilities) and priorities.
- Development Vision and Roadmap 2020.

Regional characteristics formed the starting point, i.e., the current energy mix and future perspectives of SEM. The analysis aimed to identify alignment and complementarity between the regional SEM R+D supply, demand and policies. Collecting of information was based on two different focus-groups or panels (16 – 16 selected members from the experienced stake-holders of the region) as follows:

- SEM – state of play;
- current energy overview;
- situation and perspectives: workshops, interviews, analyses;
- SEM policies;
- directories of SEM R+D demand and supply, basic regional information (2008);
- companies' R+D: employees, turnover, expenditures, international presence, main fields of activities, funding sources.

Figure 3. Overview of the RESGen procedure



Source: Dinya et al. (2014)

The data was further elaborated in a regional SWOT analysis for defining the regional priorities. Information attained through questionnaires and workshops were organized into a matrix (Figure 4), which enabled the definition of strategic steps:

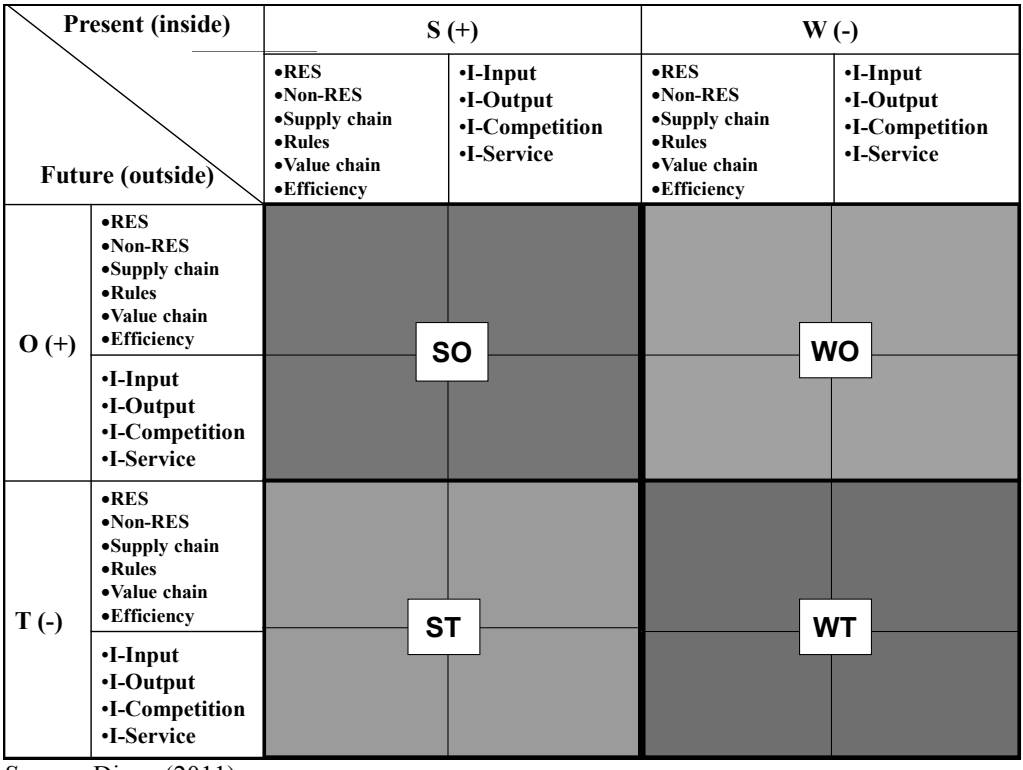
- 'SO': exploiting opportunities, based on strengths;
- 'WO': eliminating weaknesses, exploiting opportunities;
- 'ST': avoiding threats, based on strengths;
- 'WT': avoiding threats, eliminating weaknesses.

The matrix was used as follows: each S,W,O and T was collectively defined and given numbers (S1, S2....T1, T2 etc.), which were placed into the matrix. Every cell was a combination of S-O, S-T, W-O or W-T. The SWOT panel participants gave scores to each cell according to how important they considered each combination (S1-O1, S1-O2...W1-T1, W1-T2 etc.) on a scale of 0-5 (0 = no relevance, 1 = very

little relevance…5 = very important). The collective opinion was the sum of all scores and those combinations that received the biggest scores were considered the most important ones.

Then, the region has defined its Vision 2020 and Roadmap. Regional panels outlined the most likely future scenarios for the Vision, defined the priority themes and project ideas; these were further developed by emails and discussions. A series of regional workshops were organized to guide the region. The Delphi method (Linstone–Turoff, 2002) was used to attain a collectively defined Roadmap. In the final workshop the results were discussed and the participants could comment on the earlier results.

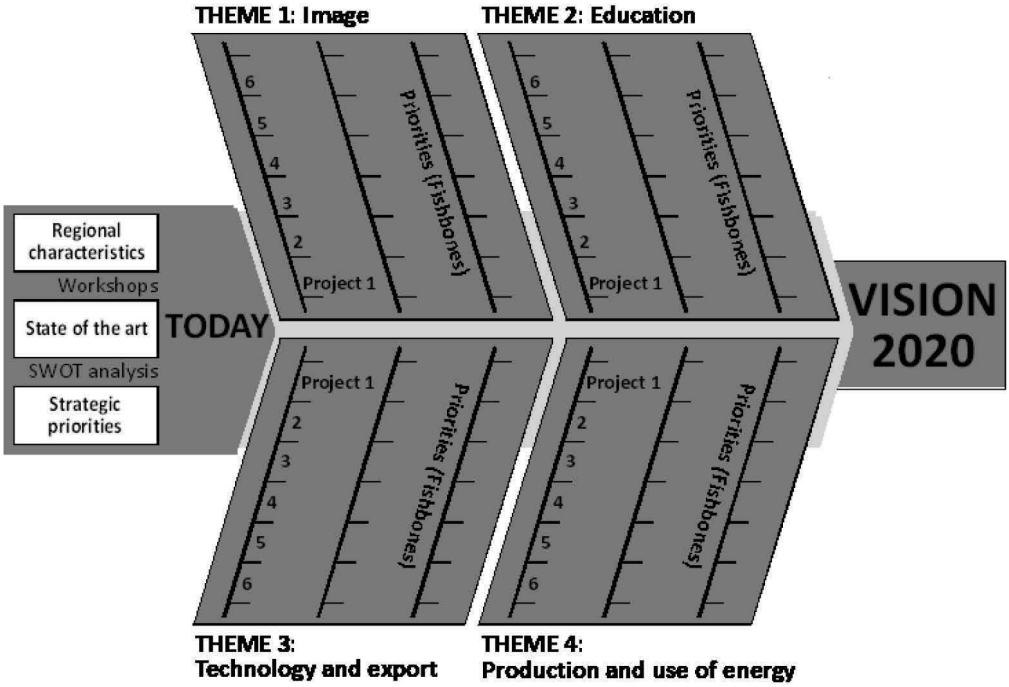
Figure 4. The SWOT matrix



Source: Dinya (2011)

Each participant received an email including the proposed themes and project ideas for scoring, instructions and Excel-templates to be filled in. The overall scores were considered as the regional collective opinion. This organization resulted in the "fishbone" structure, which was the Roadmap for each region. In the fishbone (Figure 5) the themes are the four blocks, the priority areas the fish bones and the separate projects the actions.

Figure 5. The regional roadmap as the fishbone structure, presents the final priority themes and projects



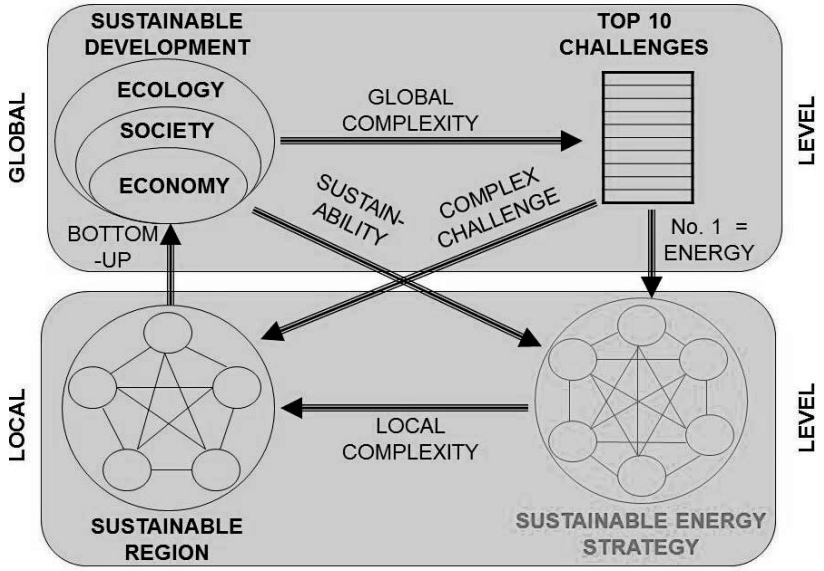
Source: Dinya et al. (2014)

4. Applying the RESGen Procedure – experience of the Northern Hungarian region

The starting point was the complex system of global sustainability challenges, which was applied at the regional level (Figure 6). Selected actors (forming a Regional Strategic Committee; RSC) tested this model in Northern Hungary. The RSC had an open geographical, sector-wide and functional representation of the regional stakeholders.

The RSC elaborated the regional SWOT matrix and provided the regional energy (Figure 7) and RES-innovation profiles (Figure 8). Based on these the present situation and the future potential of the energy sector and RES related innovation capacity in Northern Hungary were defined (Figures 9 and 10). The work resulted in the following vision: "*The Northern Hungarian region will work towards energy independence by achieving the highest possible RES-ratio and effectiveness of energy production and consumption by 2020.*"

Figure 6. The SEM regional model applied in Northern Hungary

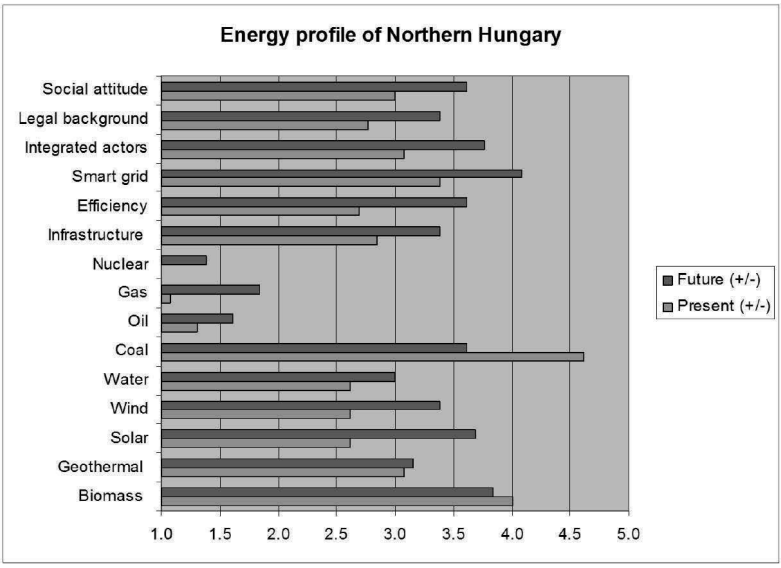


Source: Dinya (2011)

The RSC outlined the regional RES-strategy with the most important actions as follows:

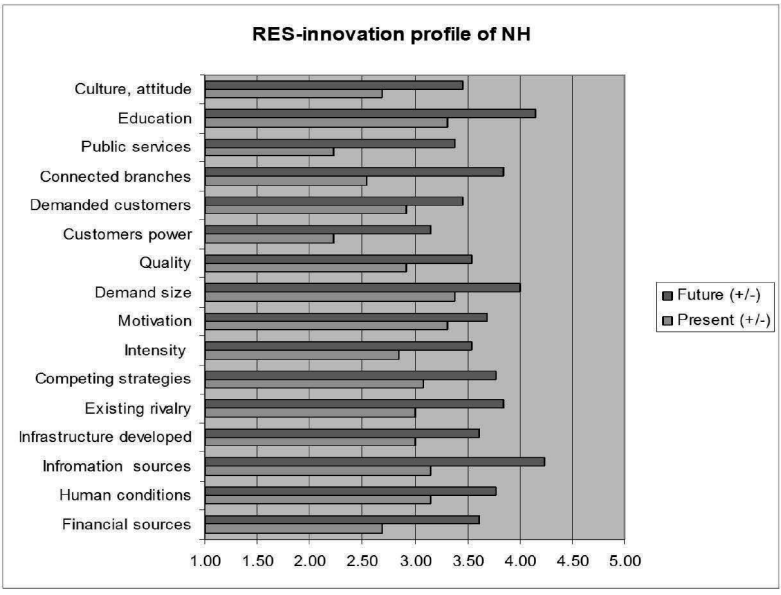
1. Developing integrated local systems based on the bioenergy potential and pilot systems.
2. Introducing zero-emission technologies into the exploitation of coal reserves and subsidizing the co-firing of biomass with coal.
3. Serving the increasing innovation and education needs through the regional bioenergy knowledge centre and involving solar energy.
4. Intensive dissemination of successful RES-projects to drive innovation and RES-investment and to exchange the culture and attitude of energy consuming and to establish the social basics of SEM.
5. Providing knowledge services for RES-projects outside the region based on developing regional RES-innovation capacity especially in bioenergy and distributed energy systems.
6. Establishing RUE programs using the knowledge services of regional innovation centres.
7. Implementing consultation programs to involve the public sector (local governments, hospitals, schools, etc.) in SEM.
8. Elaborating innovative solutions for the private, public and NGO-sectors to help them in starting successful RES-projects.

Figure 7. The regional energy profile of Northern Hungary



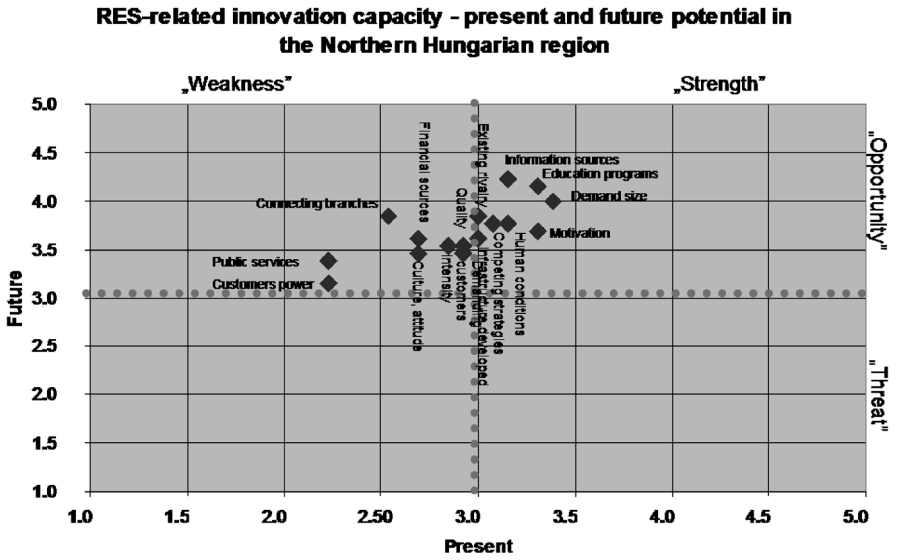
Source: Dinya (2012)

Figure 8. The regional RES-innovation profile of Northern Hungary



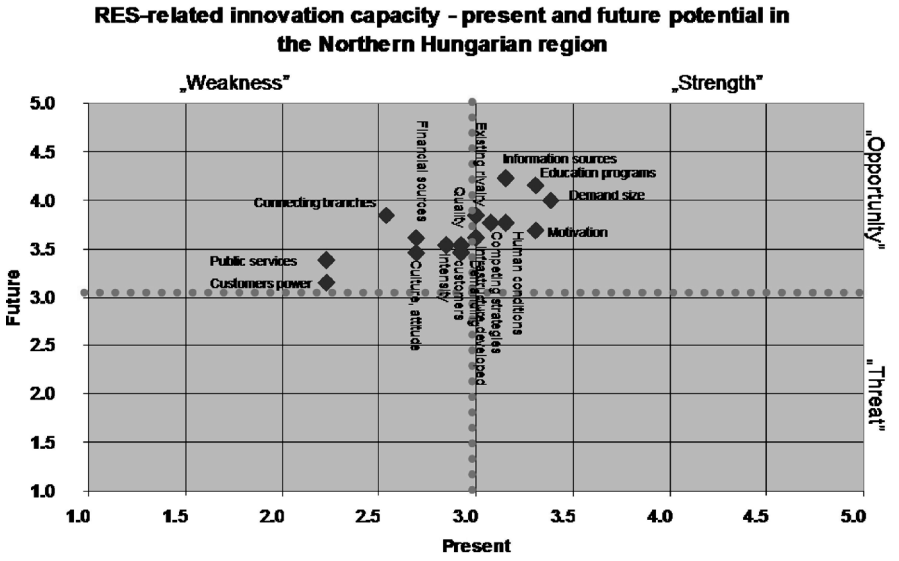
Source: Dinya (2012)

Figure 9. The present and future potential of the energy sector in Northern Hungary



Source: Dinya (2012)

Figure 10. The present and future potential of innovation capacity in Northern Hungary



Source: Dinya (2012)

5. Summary

Results from the regional strategy and the main features are included in the following:

- The region followed the RESGen procedure and defined its own priorities based on regional characteristics, which caused differences in details of the procedure.
- Stakeholder involvement was high, and all main actors were represented in the roadmap. This created excellent commitment and base for implementing the roadmap.
- In Northern Hungary the roadmap focus was establishment of regional systems and creating regional energy self-sufficiency.
- Embedding the sustainable energy strategy and the innovation strategy into the regional development strategy (that is a combination of them) is a very useful approach to solve the complex problem.

The innovation of the RESGen procedure was two-fold. It integrated new approaches and methods with well-known tools (SWOT) into an easily applicable system, and it was applied in a novel branch for a bottom-up strategy and implementation of SEM. Systematic management is essential, as the anticipated SE reform is a social process involving all stakeholders. The procedure provided regional stakeholders with a 'platform' for structured discussion and commitment. This contributed to the fact that the project was nominated among success stories in EU projects in 2012. It also contributed to the '3S' (Smart Specialization Strategies; Foray et al. 2009, EC 2010) definition to include SE.

The main conclusions are the following:

- The procedure worked well, with some requirements to improve user-friendliness. The application has demonstrated the flexibility of the method.
- Public awareness, attitudes and trust, stakeholder commitment and functioning of the decision-making system are vital for successful implementation of SEM.
- Regional stakeholders were motivated to develop their own strategy, aiming at SEM.
- The procedure can reveal facts that are not known or expected. It may also reveal institutional opposition and negative attitudes against SEM, thus making the barriers and bottlenecks visible. These and the new strategic tool enable realistic development.
- There is a call for 'rules of the game', in order to reduce uncertainty of the business environment for SEM. Conscious development through comprehensive regional strategies and structured programmes will be important. The RESGen procedure is an attempt towards SE development integrating local and regional implementation, national and international policies, smart specialisation and general progress.

The RESGen procedure provided a systematic tool enabling unified development for all regions. The experiences suggest that the procedure could be fit for a more widespread use. The existence of this kind of tools encourages regional programmes and thus promotes the implementation of SE.

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Good Practices in Responsible Innovation

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Innovation has the potential to drive economic growth, to promote sustainable development and to improve health, lifestyle and well-being. However, negative consequences of development, brought awareness that it is not only important to innovate, but also to innovate responsibly. Thus, during recent years, the concept of Responsible Innovation (RI) has gained increased attention and become embedded in the development endeavours of the European Union. As a result of this focused effort and attention on the topic, high quality theoretical knowledge is available accumulated in project documents, publications and policy recommendations. Despitethegrowing interest of responsible development models and findings of framework conditions and elements, limitations and obstacles persist in the application of the theoretical frame in practice. Thus, the practical application of RI is still an undiscovered area.

The goal of this study is to review and shortly systematize the most important points of theoretical knowledge regarding RI as a base for practical implementation and also to connect these findings with specific examples. Presenting projects, practices and endeavours which were designed for the conscious implementation and testing of RI will fill in the gap currently existing in the application of RI models. As a result, a comprehensive picture will be available about nature and the embedded potential of Responsible Innovation.

Keywords: Responsible Innovation, Mutual Responsibility

1. Introduction

The concept of Responsible Innovation (RI) and the need for responsible management of innovation have emerged over recent decades as a result of concerns (originated from the tendencies, change patterns and challenges in the innovation space) surrounding the products and purposes of innovation activity among scientists, politicians, the civil sector and the lay public. RI tries to exceed the traditional limits of innovation governance by making it adaptable to the new environment (WC 1987) and opening up the innovation process to build in new elements (such as stakeholder

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engagement or public dialogue). Also, it tries to underpin the concept with purposes and values. Although there is a vast literature of RI including the analysis of its main values, important elements and necessary framework conditions, the application of this knowledge in practice is absent in most European countries. From the appearance of the concept till its practical use, Responsible Innovation went through a long journey. During this journey milestone after milestone was reached continuously levelling up, approximating the application of RI in innovation practice. The aim of this study is to briefly sketch the theoretical principles of RI, present the most important milestones of the journey towards practical application and reveal some good practices in its implementation.

2. Definition, Elements and Framework Conditions of Responsible Innovation

Defining the purpose of innovation is truly a hard task, mostly because it varies depending on the perspective of the viewer. However, by finding the *basic values* on which we expect innovation to reflect, we will be able to sketch a picture about the purpose of innovation. RI is intended to serve society, by being responsibility-driven and assuring the *right impacts,* which are beneficial to society and guarantee a *good quality of life*. Defining these highlighted concepts is not easy. Nonetheless, in the context of the European Union, the normative anchor points of these concepts are described in relevant paragraphs in the Treaty of the European Union (EU 1992) as sustainable development; quality of life, high level of protection, human health and environment; competitive social market economy; promotion of scientific and technological advances and promotion of social justice, equality of women and men, solidarity and fundamental rights.

The chosen definition of RI aims to reflect on these basic values. As Rene Von Schomberg (2013, pp. 51-74) defined: *Responsible Research and Innovation is 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).*

The concept of RI covers a wide range of elements (von Schomberg 2013, pp. 51-74) some interconnected, some sector specific. Among them, we particularly focused on those that are of prime importance regarding the practical examples presented later. Thus the most important characteristics are the *dimensions of responsibility and main areas of interest* (von Schomberg 2013, pp. 51-74): RI shows a commitment towards the future by covering specific areas of interest – ethical, social and environmental aspects – during the innovation management of the present. The *environmental-conscious* or, in other words, sustainable approach is the most popular dimension among all the participants, which is reflected also on a certain

level in the regulatory and policy principles. It is suggested as a key expectation to modern development and innovation as a result of the peak-availability of the natural resources and destruction of the natural environment by human activity.

The *social aspect* of responsibility represented by RI is complex. It can be easily understood by taking a look at the contradictory relationship between technological development and employment. The tendency shows that the development of technology and innovation is accompanied by a decrease in the number of workplaces. So the technological and innovation advances bring about unwanted social effects. The key aspect here is to find and maintain the balance between the benefits of development and social disadvantages. Therefore, the main goal of RI undertakes the responsibility to ensure that our quality of life does not compromise the chance for future generations to enjoy – at least – a comparable quality of life.

The most controversial aspect is *ethical responsibility*, which is based on the common and traditional value set of every society. Every once in a while new technological and innovation advances come to a point where scientists and innovators see the necessity of transgressing and re-evaluating the traditional value set in the name of development and possible advantages. Experience shows that the importance of the ethical aspect varies according to the level of development of the territorial context. In less developed areas satisfying basic needs draws more attention rather than concerns about the ethical aspects of development. During RI management, the ethical responsibility is undertaken in a way that assures that the satisfaction of the basic needs is guaranteed in every territory. Moreover, ethical concerns of the sector-specific or controversial science and innovation areas are revealed and brought to discussion among RI participants.

As we approach the practical implementation, corner stones should be defined for the *practical framework* around the two future-oriented dimensions of responsibility, which allow us to reflect on the emerged concerns. A framework built on the dimensions of *care* and *responsiveness* urge us to answer 2 important questions (Owen et al. 2013b):

1. What do we want innovation to do? This question seeks to understand what areas of public value can be achieved, what challenges can be faced and how the future can be shaped with innovation. It will help the participants to find the value and the benefits in RI.
2. What are the risks? The second question tries to answer what the risks of achieving this future are and how the effects of innovation can be foreseen, managed and controlled. So this area aims at reducing the unpredictability and strengthening the responsibility dimensions.

Therefore, the first task is to enhance the capacity to make the RI framework *reflective, deliberative, anticipatory* and *responsive* (Owen et al. 2013a).

Reflective: Acting reflectively means reflecting on the underlying purposes, motivations and exploring the assessed effects and impacts of RI and also discovering the underlying ones.

The main goal of the actors and stakeholders belonging to the RI framework is to help the participants of the RI space to find out what sort of agendas RI needs to bring to achieve responsible development. Their role is to integrate the EU principles with national, regional and local realities as a basis for discussion about the values, agendas and benefits of RI. Through the constructive discussion, the goal is to define which unique values RI is built around and to create a basis, which is able to reflect on the grand challenges of the regions and countries implementing RI. It is essential to consider the questions and dilemmas, assumptions and areas of ignorance, which are expected to emerge.

Deliberative: *Inclusively opening up visions, purposes, questions and dilemmas to broad, collective deliberation through processes of dialogue, engagement and debate, inviting and listening to wider perspectives from the public and diverse stakeholders.*

RI is a complex phenomenon with ethical, social, economic and even political aspects. To understand the concept of RI and to be able to develop it constantly, collective deliberation should be assured. This deliberation should happen through the interaction and engagement of the public and diverse stakeholders to open discussions, raise dilemmas and also provide an open-space to find answers and create solutions. Moreover, public and stakeholder involvement can represent the social needs of society and assure the embedding of the fundamental values and rights (e.g. privacy, safety, etc.). In an RI process the stakeholders' necessary satisfaction and engagement can be achieved when they are used as co-creators of innovation. RI challenges each actor in the innovation process to play their part and it explores when and how best to involve the stakeholders appropriately and effectively in their particular part of the process.

Anticipatory: Being anticipatory means describing and analysing those intended and potentially unintended impacts that might arise, be these economic, social, environmental or otherwise.

To cope with the concerns about unpredictability and negative side effects of innovation, there is a need for a policy environment that seeks to deeply understand the effects of innovation with technology assessment, foresight and scenario development. Moreover, enhancing and rewarding the use of the anticipatory approach beyond regulatory expectations is a key factor to achieve the attitude change in the RI process. So there is a double role. First, the key is to embed the anticipatory approach to the policy principles and, secondly, to encourage the participants of the RI space to interactively use, develop and embed its tools to their innovation activity.

Responsive: Using this collective process of reflexivity to both set the direction and influence the subsequent trajectory and pace of innovation. This should be an iterative, inclusive and open process of adaptive learning, with dynamic capability.

Making the framework of RI reflective, deliberative and anticipatory is essential but these conditions are not enough to drive the change if their conclusions, findings and results are not taken into consideration and are not applied during the decision and policy making processes. So there is an urge to build up a dynamic capacity (Teece et al. 1997) that is able to continuously collect and build the obtained inputs into the policy principles of innovation, the activity of the RI participants and into the mentality of the public.

3. From Concept to Practice

Various theories have spread about the concept of Responsible Innovation, which have coincided in the main values and goals of the new, more responsible approach required in innovation management and science. Based on these theoretical roots, *public discussion* has evolved concentrating on dilemmas and concerns raised by the enhanced responsibility dimension in innovation. The forms of public deliberation were conferences, interactive workshops and round table talks involving innovation experts, policy makers, scientists and also representatives of the business sector and the lay public. The *EISRI (European Intersectoral Summit on Research and Innovation)* initiative clearly reflects the process and purpose of the dialogue. EISRI is a European meeting organised by the Atomium Culture every eighteen months dedicated to research and innovation. It aims to create a platform for intersectoral and interdisciplinary discussions between the key stakeholders and to address RI related concern, future agendas and assessment measures. The two most important general goals are the following:

- define the role of research and innovation in the development of a strong and competitive knowledge society;
- discuss the relationship between science and society.

Highlighting elements of Responsible Research and Innovation, the various EISRI editions focus on specific areas on every event. In 2013, the influence of communication and media on Responsible Research and Innovation and the design to create a unique opportunity for intersectoral and interdisciplinary discussions appeared as the main topic of the conference. The EISRI conferences bring together all different kinds of stakeholders involving key representatives of research institutions, businesses, the media, NGOs, policy makers and professional science communicators and also present high-level speakers including former heads of state and key representatives of the European institutions and national governments as well as

leaders from leading research institutions, businesses and the media. The tools to address and discuss the issues are workshops dedicated to reflect the key issues in this area and to promote "out of the box" thinking and participatory processes. As Responsible Innovation aims at closing the gap between society and innovation to make the social factor relevant in the innovation process, the involvement of the societal actors in the innovation decisions and the proper information transfer to these actors are essential.

Following this line, the conference addressed 6 key elements, which support Responsible Innovation: Engagement – "Choose together"; Gender equality – "Unlock the full potential"; Science Education – "Creative learning fresh ideas"; Open Access – "Share results to advance"; Ethics – "Do the right "think" and do it right", Governance – "Design science for and with society".

Other successful initiatives to engage the public with the topic of RI was the series of events that went under the title of *L'Innovazione Responsabile* (Responsible Innovation). In 2011, in cooperation with the Fondazione della Cassa dei Risparmi di Forlì (bank foundation), the Romagna Creative District and a number of local authorities, including the two local scientific and training hubs of the University of Bologna, the Chamber of Commerce of Forlì-Cesena launched this event. The first event was held on September 09th and 10th 2011, and the second took place on May 17th and 18th 2013. The format of the event included conferences, seminars, workshops, exhibitions and shows. The idea was to resort to a variety of events to disseminate the concept/s and practices of responsible innovation to a wide audience, including all relevant stakeholders – enterprises of all sizes, citizens of all ages, public authorities, associations, schools and universities, etc. Discussion within the different events varied from philosophical to hands-on, with craft-workshops. Each event included, in the two-day main event, addressing RI as a comprehensive concept or approaching it from a specific point of view (e.g. social or environmental, business or consumer, etc.). For two days and one night the city of Forlì hosted – on both occasions – some 50 events, with about 950 people taking part in the events and about 20,000 visiting the city centre to enjoy the open-air events (pop-up organic restaurants, gigs in abandoned public spaces, music concert powered by people riding their bikes, etc.).

As a result of public discussion and focused attention from the European Union, the basics of practical application were designed in the form of *practical tools* to assess the implementation conditions and to develop measures and methods of practical RI principle use. The *KARIM (Knowledge Acceleration and Responsible Innovation Meta-network)* project aimed at facilitating knowledge transfer across North West Europe (NWE). The theoretical background of the project was the economic growth potential embedded into innovation, which requires turning research into new and better services and products. The target audience were small and medium sized enterprises and the goal was to make them capable of accessing high value innovation support and technology. The first goal of the project was to take down

the obstacles experienced by SMEs and to make the technology and innovation support available to them. The second goal was to create a transnational model aimed at broadening technology transfer opportunities of universities and SMEs. The third goal of the project was to make SMEs capable of coping with Responsible Innovation principles and of getting access to technology and innovation support on a transnational level. This 5-actioned activity included the development of a Responsible Innovation Diagnostic Tool which is of prime importance from our perspective. The Responsible Innovation Diagnostic Tools aim at monitoring the step by step implementation of RI principles into the life of organizations.

Table 1. Multi-criteria set of RI Flash Diagnostic

Environmental	**Social**	**Economic**	**Approach**
Water management	Health *(Prevention, Screening, Treatment, Toxicity)*	Development of territory / field / sector	Stakeholders management
Materials management	Safety of employees, users and residents	Employment	Anticipation *(legal requirements, market, tendencies, technologies)*
Energy management	Well-being and comfort in life and at work	Public services efficiency / public interest	Project risk management
Pollution (water / air / land)	Social cohesion / Solidarity	Economical performance and consequences on the market	Development of a sustainable value chain
Greenhouse gas	(In)formation / Skills / Culture	Economical consequences for the user, the citizen	Transparency of offer / communication
Biodiversity			Global approach in the design of responsible products / services
Waste management			Sustainable development strategy in the organization

Source: KARIM webpage

The second analysis has a more sector specific approach focusing on ICT features. The flash diagnostic tool has multi-criteria analysis methodology based on questioning. The set of criteria is visible in the following table (Table 1).

The first responsibility dimension to appear in this best practice is the anticipatory ones. It is visible in the activities of the RI Diagnostic Tool and the implementation of RI principles in the research activity. These measures support the creation of indicators to measure RI performance and also serve to minimise the embedded risks into the activity and achieve a more sustainable and safe activity. The reflective dimension appears in the importance of the social, moral and environmental factors. Improving research activities at the universities and finding new ways to

make the research more focused to the need of society to boost life quality is truly an example to follow. The embedded RI principles also cover the concept of moral responsibility and they also include the efforts to make innovation financing an ethical system. The environmental factor is represented by the most efficient and sustainable usage of resources. The project also considers the importance of involving every possible participant of the innovation environment to create the final output. Expert support is gained by universities and enterprises and decision makers are also involved to approximate the policy environment and the practice from the beginning.

The example of the *Socio-Technical Integration Research (STIR)* project also shows how the principles of responsibility can be applied in science and innovation. The reason behind the project's existence is the fact that science and technology policies around the world are placing new pressures on laboratories to address the broader societal dimensions of the work. Despite longstanding collaborative initiatives between natural and human scientists to reach this goal, neither the capacity of laboratories nor the important role of interdisciplinary collaborations has been well understood or supported on an empirical base. Thus, it was of prime importance to overcome these limitations for designing, implementing and assessing effective programs aimed at responsible innovation. In the framework of the STIR program a coordinated set of 20 laboratory engagement studies was conducted to assess and compare the varying pressures on – and capacities for – laboratories to integrate broader societal considerations into their work. During the project a core group of ten doctoral students each conducted two paired laboratory studies. During these studies the doctoral students tried to engage researchers in semi-structured interactions designed to enhance reflection upon research decisions in light of broader considerations. During the assessment studies a protocol was used developed by Pi Fisher. So the most important results of the project were a set of techniques which are publicly available for use in designing, conducting and assessing effective collaborations with scientists and engineers that are aimed at responsible innovation.

As the concept of RI started to embed into the scientific and innovation environment, there was a need to transfer the accumulated and existing knowledge to scientists in different forms of *education and training.* There are several universities worldwide where RI is part of the curriculum or is included among the research principles of the institution. This is the case at the 3TU Federation in which three universities of technology (TU Delft, Eindhoven University of Technology and the University of Twente) from the Netherlands work jointly to embed RI principles in research. At Arizona State University students can even obtain a Certificate in Responsible Innovation in Science, Engineering and Society. This certificate is designed for scientists, engineers, research managers, technology officers, public administrators, and policy officials to confirm their RI knowledge and through that obtain benefits on the job market. But there is no need to look for foreign examples as at the University of Szeged, RI is also included in the curriculum in the form of a project modelling course.

4. Good practices

As seen, the different theoretical concepts, the evolved public discussion, the practical tools and the integration of RI into education paved the way for practical implementation. There are several initiatives within Europe, which reflect the enhanced responsibility dimension of the RI concept. However, in the following section we will analyse a Good Practice outside of Europe. This example was chosen as it includes all the responsibility dimensions and the main characteristics of the necessary approach towards RI.

Both examples have their roots in Grameen Bank (GB). GB developed an unconventional banking practice by removing the need for collateral. It also placed its banking system on new, special characteristics which are mutual trust, accountability, participation and creativity. The target audience of the bank is the poor layer of the rural areas of Bangladesh. The banking system and the credit which can be granted through it is seen as effective means against poverty and unlimited potential to achieve overall social and economic development of the local population. Muhammad Yunus is the founder of the GB banking system who won Nobel Peace Prize for his activity and the innovativeness of his theory. The coverage in the traditional banking system focuses on people with huge amounts of accumulated financial resources. However, based on the new approach the financial resources should be made available to the poor as well, by changing the conditions of banking to fit the needs of the neediest. The application of the new approach brought about remarkable success. In October of 2011 GB has 8.349 million borrowers (97 percent of whom are women) and 2,565 branches; their services were available in 81,379 villages (covering more than 97 percent of the total villages in Bangladesh). Grameen Bank's positive impact on the affected parties has been documented in many independent studies carried out by external agencies (e.g. World Bank, the International Food Research Policy Institute, the Bangladesh Institute of Development Studies).

The generally used financial approach is completed with social and moral considerations aiming to achieve an attitude change of the borrowers focused on responsibility. The so called “16 decisions” is a program which underpins the whole system indicating the 16 main principles that the borrowers should follow in order to improve their financial and social situation. Also, every year GB staff evaluates their work and check whether the socio-economic situation of GB members is improving. GB evaluates the poverty level of the borrowers using ten indicators. The most important element is the credit delivery system.

So the credit delivery system completely differs from traditional ones and has some special features that shall be presented below.

GB focuses special *attention on the people most in need.* This means that in the selection of the clientele they establish clear eligibility criteria and try to adopt

practical measures to screen out the people who do not meet those. Also, regarding the financial situation of borrowers, they take into consideration gender issues.

Most of the credits are assigned to women, the group that enjoys fewer privileges traditionally. Besides the selection, credit delivery is also tailored to meet the diverse socio-economic conditions of the target audience.

The *borrowers of GB are organized into small, homogeneous groups* to facilitate the integration of the members based on group solidarity and participatory interaction. The GP system operates in a way that it is coordinated by centres, which include the smaller groups. The aim of this system is to organisationally strengthen the integration of members as well as improve their capacity to plan and implement development decisions at micro level. The Centres are linked to GB on a functional level, the workers of GB regularly attend meetings at the centres.

There are *special loan conditions*, which provide the basis to the whole banking system. The loans are given in small amounts without any collateral and their repayment is in weekly instalments. The granting of subsequent loan depends on the repayment of the first loan. The supervision activities of credit are delivered by the group of borrowers and the banks staff as well. The transparency is also important element which is ensured mostly by centre meetings. Finally, there are special safeguards as compulsory and voluntary savings to minimise the risks.

Besides taking into consideration the indicators included in the traditional banking systems, there is special focus on the *social development agenda addressing the basic needs of borrowers*. This is the "sixteen decisions" framework, which serves as a guideline, which borrowers should follow in their everyday life. The aim of this element is to pay focused attention on women of the poor households as they are key players in the development of the family. It also contributes to the strengthened monitoring activities of social and physical infrastructure projects (education, family planning, housing, etc.). The enhancement of social and political consciousness of the groups is also essential aspect.

GB aims at continuously designing and *developing the organizational and management systems* capable of delivering programme resources. The system has evolved gradually through a structured learning process that involved trials, errors and continuous adjustments. A major requirement to operationalize the system is the special training needed for the development of a highly motivated staff. In this way decision making and operational authority is gradually decentralized and administrative functions are delegated at the zonal levels downwards.

Also, its loan *portfolio is extended* compared to the traditional banking system. The general credit program serves as an introduction where the borrowers can get familiar with the rules of the system. Later on, other loan programmes are introduced to satisfy growing social and economic development needs of the clientele. Such programmes include credits for building sanitary latrines, for installation of

tubewells, for seasonal cultivation to buy agricultural inputs and for leasing equipment (i.e. cell phones).

The example of the Grameen Bank showed it is not an impossible proposition to lend money to the people with scarce financial resources; on the contrary, it is a responsible financial innovation which can set an example for European countries too.

The second example also appeared in a rural context of Bangladesh. The source of the problem is that about 70% of the population in Bangladesh does not have access to electricity. Grameen Shakti (Green Economy Coalition webpage), grants small loans that enables poor households to buy solar power system. The average price of the system is about $135, but villagers usually pay in instalments as they don't have enough financial resources. The role of solar power systems is to help to reduce the biological footprint of the households by replacing polluting kerosene-fuelled lanterns and enhancing the reduction of deforestation. Local jobs and income opportunities are also created related to the activities. The innovation has beneficial impacts as some women have doubled their income and become energy distributors as a result of electricity. About 10,000 new household solar energy systems are being constructed every month. Currently about 2.5 million people can benefit from the energy systems the organization plans to reach a lot more in the future.

5. Summary

Responsible Innovation appeared as a possible answer to the emerging challenges of the changed innovation context characterized by risk, uncertainty and ignorance. With the enhanced innovation dimensions focusing on the social, ethical and environmental aspects of the outputs and process of innovation, it will be able to express commitment towards the future with appropriate stewardship of innovation management in the present.

The accumulated theoretical knowledge paved the way for RI to be implemented in practice applying a dynamic capacity which is reflective, deliberative, anticipatory and reflexive, thus is be able to adapt to the continuously changing features of innovation space.

The first milestone leading towards broad practical application was embedding RI into public discussion. The open platforms, conferences, workshops and training session enabled the actors of innovation space to improve their RI knowledge and form their own perspective regarding the topic. This included the questions and dilemmas about RI becoming an integrated part of present-day innovation management. New initiatives were undertaken assessing the initial conditions and the possible integration of RI principals (KARIM, STIR) into day-to-day innovation management. The results were a set of indicators and new approaches; tools

which will put in practice RI principles. New forms of educational and training activities also emerged concentrating on the elements of RI to satisfy the need of providing human resources with high-quality RI knowledge. Scientific institutions are on the way to integrate RI into the research and innovation initiatives and practices, as well as integrating RI knowledge into their curriculum.

This focused attention made the appearance of projects and initiatives possible, which were created and delivered fully adapting to and capitalizing on the main values of RI (Grameen Bank, Grameen Shakti). From these initiatives it is clearly visible that RI has immense opportunities to overcome the present challenges related to innovation and development. However, the broad application of RI in science, innovation and everyday life requires a change in attitude from the actors of the innovation space and the lay public. The goal should be to reveal the benefits of RI taking into consideration that RI related measures will bring about positive changes in the future, but require sacrifices in the present.

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Generations of Science Parks in the Light of Responsible Innovation

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Nowadays, knowledge becomes more and more important in the economy. Its increasing importance has placed knowledge-creating institutions in the focus of economic development strategies. Among these institutions, special attention is paid to universities because they ensure qualified workforce and provide the basis of new knowledge and innovation which are necessary for the long-term competitiveness of a company. Moreover, these factors could be the main drivers of the development of a territory. This is particularly important for lagging regions with universities because these regions can build upon universities to connect the regional economy to the processes of knowledge-based economy. The tools of economic development initiatives have also broadened with university-based development tools which contain the science parks as a subtype.

In addition to the above, as another important megatrend, the European Union is paying increasing attention to the subject of Responsible Research and Innovation (hereafter: "RRI"), which is not only one of the flagships of the 2014-2020 programming period but, in our opinion, has a major influence on the future level of success of science parks.

The aim of this study is to review the subject of science parks – primarily from the point of view of the role of universities in defining and walking these parks' professional routes. We wish to pay special attention to how responsible innovation can be introduced and consciously managed in the professional work carried out in science parks.

Keywords: science parks, responsible research and innovation, knowledge transfer, local economic development

1. Introduction

The forces driving the economy have undergone significant changes by our days. The former, cost-advantage-based competition between economic players has been replaced by a new type of competition, which is based on technology change and innovation. While the economy earlier used to be built on natural resources and cheap

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labour, we now see an economic structure that builds on *knowledge a new production factor.* Accordingly, the performance of both business organisations and regional and national economies is increasingly determined by their ability to create, disseminate and adapt new knowledge. This statement is true even if we are aware that, in many instances, new knowledge, new recognitions and new innovation results bring about unforeseen impacts on society. It is these unforeseen impacts that the European Union would like to keep on a manageable track through one of its most recent flagship concepts, Responsible Research and Innovation.

The increasing importance of knowledge, owing to its nature, has differentiated the economy also on a regional basis. In the proximity of knowledge creating centres, knowledge-based economic activities have become concentrated in a geographical sense. As a result, *knowledge-creating organisations have been placed in focus by many economic development interventions,* and of these organisations universities have aroused the keenest interest. Research projects have found that, of universities' impacts on the local economy, those related to universities' output – education and research activities – seem the most significant: it is these output related impacts that can bring dynamism to the local economy in the long term. The utilisation of these impacts is especially important in regions that give home to a university but are relatively underdeveloped: such lagging regions can become part of the processes of the knowledge-based economy if they rely on these institutions. Meanwhile, universities have become active shapers of their region's economy by enriching through the expansion of their traditional set of missions. In turn, *the set of economic development interventions has also significantly grown and now also include means that build on universities* – one such means being science parks.

It seems obvious from the above that well managed science parks as spaces of innovation – which pave the way for the establishment of connections between universities' knowledge base and economic players – can do a lot to put the concept of responsible innovation into practice as they gather a given region's highly significant research and innovation results and players. Therefore, it seems purposeful to examine how the system of science parks and the concept of responsible innovation[3] can be put in each other's service in a synergic way, paying special attention to the role of universities.

[3] For the purposes of this study, the term 'responsible innovation' carries the following meaning: *Responsible Research and Innovation is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products* (von Schomberg 2013, pp. 51-74).

2. Science Parks

There is no uniform concept description of "science parks" in professional literature. *What initiatives are labelled by science and development policies with this term changes from country to country*. Extremely different development policy means (e.g. technopolis, business parks) are often also put under the "science park" umbrella term – incorrectly. Due to the large number of definitions and the difficulties around offering an accurate description, this study does not select any particular definition. Instead, we compare the most often used definitions and try to identify their points of intersection. According to a research carried out in 2010, *the definitions most often used in professional literature* are supplied by three organisations, which specialise in science parks (Albahari et al. 2010): the United Kingdom Science Parks Association (UKSPA), the Association of Universities and Research Parks (AURP) and the International Association of Science Parks (IASP). It seemed self-evident that we should use the concept definitions of these three organisations to get a more accurate understanding of science parks: the definitions applied by them seem to be suitable to get to know the main ideas related to science parks through the eyes of the actors working on the practical side (Table 1).

Based on the definitions examined, we can distinguish four elements that are present – explicitly or implicitly – in all of the definitions: the importance of geographical proximity and the (physical) environment; partnerships with knowledge-creating institutions, universities; encouraging knowledge/technology transfer; encouraging the creation of new businesses (incubation services). Science parks provide these abovementioned benefits along with an active managements support for their clients in order to fulfil their main purpose: facilitating innovation-oriented enterprises (Buzás 2002). Using these as a starting point and building on the research results of Capello and Morrison (2009), we can define the fours functions which a science park can fulfil in its region's economic system. These functions are the following: (i) the *technology transfer function,* i.e. mediating advanced technologies and supporting their dissemination, (ii) the *knowledge creating function,* i.e. the encouragement of the innovation activity, (iii) the *„seedbed" function,* which plays a decisive role in the creation of a special environment, and (iv) the *incubation function,* i.e. the encouragement of the creation of new technology-intensive businesses. Which of these functions is more dominant is strongly determined by the profile of the given science park and the identity and motivations of its owners. The abovementioned authors highlight the fact that *science parks, as understood in the traditional sense* (i.e. a real estate development in a given geographical region, where enterprises, research centres and universities are gathered), *can fulfil all of these functions at a high level, with the exception of technology transfer* (Capello–Morrison 2009). Buzás (2003) argues that the contradictions between formal technology transfer and geographical proximity could be resolved by well managed business services in the park. A science park could be a good location for new businesses but new

technology-based firms are generally not able to utilize all of its advances without the help of the park management. Thus, the factor of successful technology transfer inside a science park resides in well managed business services.

Table 1. Summary of the Different Definitions of Science Parks

Author	Definition
UKSPA[1]	A Science Park is a business support and technology transfer initiative that: - encourages and supports the start-up and incubation of innovation-led, high-growth, knowledge-based businesses, - provides an environment where larger and international businesses can develop specific and close interactions with a particular centre of knowledge creation for their mutual benefit, - has formal and operational links with centres of knowledge creation such as universities, higher education institutes and research organisations.
IASP[2]	Areas of innovation, of which science, technology and research parks (STPs) are a highly specialised type, play a key role in the economic development of their environment. Through a dynamic and innovative mix of policies, programmes, quality space and facilities and high value-added services, they - stimulate and manage the flow of knowledge and technology between universities and companies, - facilitate the communication between companies, entrepreneurs and technicians, - provide environments that enhance a culture of innovation, creativity and quality, - focus on companies and research institutions as well as on people: the entrepreneurs and 'knowledge workers', - facilitate the creation of new businesses via incubation and spin-off mechanisms, and accelerate the growth of small and medium size companies, - work in a global network that gathers many thousands of innovative companies and research institutions throughout the world, facilitating the internationalisation of their resident companies.
AURP[3]	A university research park as a property-based venture, which: - master plans property designed for research and commercialization, - creates partnerships with universities and research institutions, - encourages the growth of new companies, - translates technology, - drives technology-led economic development.

Note: [1]www.ukspa.org.uk, [2] www.iasp.ws, [3]www.aurp.net
Source: Edited by the authors

In most cases, the creators and owners of science parks are universities (IASP 2012). In the beginning, the dominance of universities so much influenced the operation of science parks that the purpose of the first park generations was only exclusively to broaden universities' economic opportunities. The actual motivation behind the creation of these science parks was to force the practical application of re-

search results in the economy. Thus, it is not a surprise that comparative studies about national systems of innovation consider science parks as a technology transfer organisation (Buzás 2002).Later on, as economic and innovation processes became more sophisticated, this trend faded away and, *in our days, science parks form an integral part of their larger region* and their aims have become more sophisticated accordingly.

A more detailed overview of the history of the three generations of science parks may help us understand the relations between science parks and universities. In the beginning, most science parks were established *in the outskirts of cities,* to revitalise run-down industrial areas, or were housed by *university campuses,* and their operation was managed by one single organisation (EC 2008). Later on, however, an increasing number of science parks were established *in city centres,* relatively farther away from university campuses. Meanwhile, naturally, their management and logic of operation also underwent significant changes, together with their attitude towards innovation. Based on these aspects, Annerstedt (2006) distinguishes three science park generations.

The creation of *first generation parks* was clearly inspired by the success achieved by Stanford University (Annerstedt 2006). This science park type is characterised by being located *in the immediate proximity of universities,* in an area designated for this particular purpose. It gives home to a variety of incubation and business services and has access to external sources of financing. Such parks are *managed* exclusively by the *university,* through some foundation or self-owned enterprise, and their key goals are to *broaden universities' economic opportunities* and to support university-related business activities and communities. First generation parks are organised and operate along the linear, "science push" model of innovation. What they consider as their most important task is to get new scientific results into their practical market utilisation in the quickest and smoothest way. Owing to this linear approach, the only thing that they consider as the basis of innovation activities is research and development and the results deriving from them.

Second generation science parks can also be considered as some sort of "extension" of universities, but they are not necessarily located in the immediate proximity or operate under their exclusive supervision (Annerstedt 2006). The key driving force of their operation is the creation of innovation oriented businesses and the support of their growth, rather than the economic utilisation of the university's research results. Hansson et al. (2005) identify the difference between first and second generation parks as follows: while *the aim of the former* is to create opportunities for new businesses *for the economic utilisation of their (i.e. the universities') economic results,* the latter focus on the *creation of technologies suitable for economic utilisation* and on *making university students entrepreneurs.* Besides, in the actual operation of businesses, the latter pay more attention to the needs and requirements of businesses and, as a result, such parks offer a broad portfolio of high quality services. Management tasks are mostly performed by some privately owned business

organisation, the representatives of the academic and local government sector being involved only in certain matters, which are related to the actual operation and regulation of the park. The approach of second generation science parks towards innovation can be described with the "market pull" model (Annerstedt 2006).

The *third generation of science parks* exists in bustling urban regions. They are the manifestation of cooperation between economic, academic and government players and the place of operation of organisations participating in global and regional innovation activities (Annerstedt 2006). The declared aim of these parks is *to improve the welfare of the local community,* through supporting efficient cooperation between the above mentioned three types of players. However, a well operating third generation park also offers a broad portfolio of innovation related services, contribute to *the development of their regions' entrepreneurial culture* and establish two-way communication between the creators and users of knowledge and technologies. Using the above as our starting point, these science parks' *innovation approach can be described* with the interactive, feedback-based innovation model. *Their management* is based upon long-term partnership between the private and public sectors. In matters of strategic importance, actors decide together – but the day-to-day management tasks of a third-generation science park are performed by a jointly owned business organisation, which has a professional team of experts.

As the reader can see from the above, the first two generations of science parks were established mainly in cities' outskirts, being, so to say, consciously separated from the region around them, while *third generation parks are an organic part of the urban regions* that give home to them (Annerstedt 2006) and their aims are not shaped to suit only a small group of players (Table 2). First-generation parks, which were exclusively built upon universities' needs and opportunities, were replaced by third-generation parks, which were more tightly suited to the opportunities and needs of their region. The initial "science push" approach was replaced by the organisation of parks along the interactive model. And with this interactive model in place and use, focus is no longer on aggressively pushing the results of universities, knowledge-creation institutions into economic utilisation: the game is now about innovation activities that are based on two-way knowledge and information flow between the players participating in the process. And the achievable level of success of interaction depends on the potential number of relations, which, owing to the higher level of concentration of players able to be involved in innovation processes, can, in turn, also be higher. And this higher level of concentration of these players is more likely in the proximity of universities. In summary, universities continue to be the key players of science parks – but the parks' *level of success now requires cooperation between the different players of their broader environment.*

Table 2. Comparison of the three generations of science parks

Aspects	First generation	Second generation	Third generation
Aim	broaden universities' economic opportunities	support the creation and growth of innovation oriented businesses	improve the welfare of the local community
Mechanism of operation	economic utilisation of the university's research results	create technologies suitable for economic utilisation encourage university students to become entrepreneurs	support A-I-G relations and interactions offer a broad portfolio of innovation services develop the region's entrepreneurial culture
Location	in the immediate proximity of the university but not in the city centre	not in the city centre	in bustling city centres
Started by	mainly universities	primarily business organisations, the minority by universities	universities, businesses and local (municipal) government together
Management	organisation created by the university	a business created by the private sector, the public sector has a smaller say	a business jointly owned by the three sectors With a professional management team
Innovation approach	science push	market pull	interactive, feedback-based

Note: A-I-G = "academic-industrial-governmental"
Source: Edited by the authors, based on Annerstedt (2006)

3. The Engaged and Entrepreneurial University Models

As the previous chapter describes, universities play a leading role in the organisation of each of the three generations of science parks. Science parks, however, are only the means and not the end of the economic development scenario related to knowledge creating institutions / universities. What role universities play in the shaping of their local economy and what background logic they work along are, thus, of fundamental importance: these aspects also determine what role universities play in the organisation of science parks, in the dissemination of the idea of 'responsible innovation' and the linking of these two concepts.

To its region, a university can appear as a *unique resource,* owing to its numerous impacts on and relations with its environment. This economic and social involvement, however, has not always been so common. Such institutions used to perform only higher education tasks and were a lot fewer in number. For these reasons, they used to have a weaker relationship with and much less influence on their local economy, compared to the modern universities of our days. With their research functions appearing, a somewhat tighter relationship began to form between the aca-

demic and industrial sectors – but even that was by no means a consciously managed process.[4]

Almost up until the end of the 1980'-s, the view ruled that universities' education and research activities ought not to be put under any financial limitation, whether or not they bring any economic benefit to society (Breznitz–Feldman 2012). However, due to the fact that most such institutions were financed from government budget, this approach began to be problematic and there was *a growing expectation that the academic sector should generate some profit for society* (Goldstein 2010).[5] With the economy starting to become knowledge-based, this expectation grew even stronger – both from the government and the private sector. Simultaneously, as government budget sources started to peter out, universities became motivated to more actively seek relations with players of the economy, with an eye to obtaining additional sources to finance their operation (Benneworth–Hospers 2007), and to consciously take part in the shaping of their region's economy and society (Goldstein 2010).[6] And these processes led to the birth of new functions for modern universities, mainly characterised by the *encouragement of interactions with economic and social players, in order to strengthen the direct economic and social impacts of the original activities,* the output side (Bajmócy 2005). This aim is described in professional literature as the *"third mission"* of universities. Universities started to complete this new mission along two different models, which can be of fundamental importance from the point of view of translating the concept of responsible innovation into the practical operation of science parks:

1. the engaged university model;
2. the entrepreneurial university model.

As the role of universities in the development of the local economy was broadening – in the *engaged university model* – new functions started to appear, in addition to the traditional education and research functions: knowledge transfer, participation in the development of policies and other economy-related initiatives by these institutions (Table 3) (Breznitz–Feldman 2012). Under the *"knowledge transfer function"* umbrella concept, the two authors collect classic third-mission activi-

[4] It is since the appearance of research functions that universities can be considered so-called "modern universities" (Goldstein 2010). Public opinion is that the first modern university model is the Humboldtian model. The primary goal of these universities is elite education and their main motivation is to achieve academic excellence – without any conscious practical approach to the utilisation of the knowledge researched and transferred and with a relatively high level of freedom in finances and operation.

[5] This basic idea contributed to the appearance of the so-called 'engaged university' model.

[6] The entirety of the processes described – supplemented with the changes in regulations on intellectual property – resulted in the birth of the 'entrepreneurial university' concept. Though this has a number of overlaps with the 'engaged university' model, Goldstein (2010) identified a number of fundamental differences between the two models.

ties, which have direct impacts – including both formal (licence sales, spin-off processes) and informal (flow of knowledge through university students and relation networks) mechanisms. Within these, two subcategories are distinguished: one is the sale of technologies, the other is the provision of business services.

Over and above the direct business utilisation of knowledge and technologies, universities can contribute to the development of their environment in other, indirect, ways (Breznitz–Feldman 2012). Since they have a very broad knowledge base and are usually among the largest employers of their region, they also play an important role in *policy development,* to which they contribute with different economic research programmes and policy related recommendations. This function can incorporate the popularisation of the responsible innovation concept among stakeholders. Besides these, *their other initiatives influencing the (local) economy are neither to be forgotten about,* of which their role in workforce development, partnership building and real estate development deserve to be mentioned (Table 3). The essence of 'the engaged university model' can be identified as harnessing university knowledge and resources for the improvement of the prosperity of the local community and economy (Goldstein 2010) – which, in itself, requires a higher level of responsibility in operation.

Table 3. Details of universities' new functions in the engaged university model

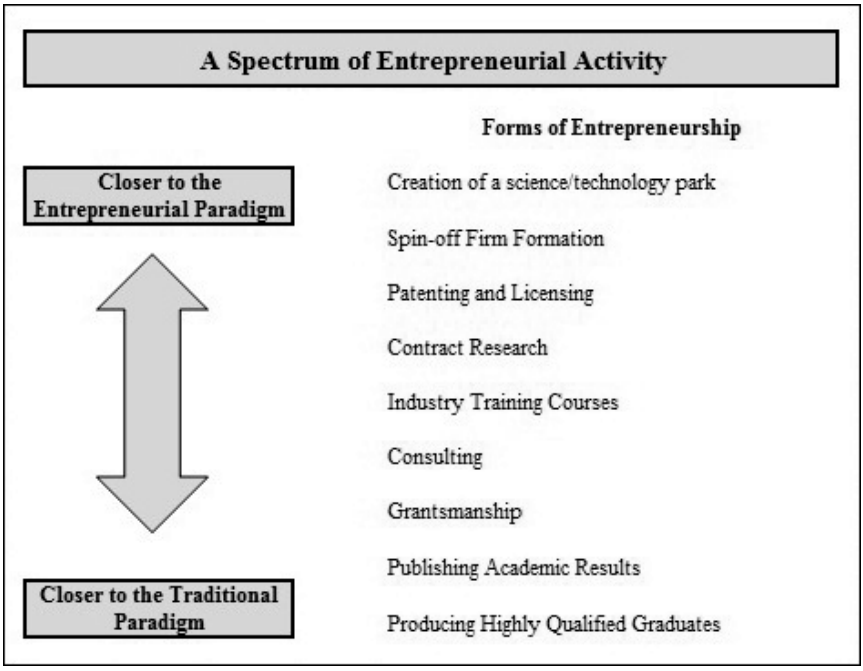
University role	Program	Characteristics
Knowledge transfer	Technology commercialization	Patents, licenses, and spinout companies transfer knowledge from the university to private sector
	Business assistance	Assistance in business education, the writing of business plans, and assistance with facility
Policy development	Economic development and policy research	Research conducted by university faculty and students provided to state and local government/s
	Policy recommendations	Using faculty expertise and research to provide policy recommendations on a variety of issues important to the economic base of the region
Economic initiatives	Workforce development	Programs to provide new skills or employment and education in workers' rights and compensation
	Partnerships	Connecting different stakeholders to the region in order to promote local economic success
	Community development	Improving local business growth and neighbourhoods through entrepreneurship
	Real estate development	Improving both residential and business (science parks, incubators) real estate in adjacent neighbourhoods

Source: Breznitz–Feldman (2012, p. 145)

Universities' third mission activity, i.e. the targeted utilisation of knowledge impacts for the boosting of the (local) economy, ought to be examined also through the *entrepreneurial university* concept: this approach can play an important role in

the practical dissemination of responsible innovation in practice. The essence of the 'entrepreneurial university' concept is that active contribution to regional and national economic performance and promoting institutions' financial success (Etzkowitz et al. 2000) are made part of universities' set of goals and, to this end, universities get involved in a broad portfolio of entrepreneurial activities (Chart 1). Similar ideas and activities also exist in the *engaged university model.* However, while for the latter the driving force of these activities is some kind of inner drive for *refunding or compensation to society* due to operating from public funds, in the case of the *entrepreneurial university, entrepreneurial motivations are more dominant* (see promoting institutions' financial success) and focus is also more on activities that support the achievement of this aim.

Chart 1. Forms of universities' entrepreneurial activities



Source: Philpott et al. (2011, p. 162)

Philpott et al. (2011) arranged universities' entrepreneurial activities along two dimensions. *Activities closer to the entrepreneurial paradigm* (creation of science parks and spin-off companies, patenting and licensing activities) have some tangible results and are more characteristic of mature entrepreneurial universities, while *activities that are closer to the traditional paradigm* (supply of qualified workforce, publication of results, acquisition of research grants) are more in line with such institutions' traditional missions and provide less tangible results. The

concept of responsible innovation is connected more closely to activities that are closer to the entrepreneurial paradigm as it is these activities that are nearer to the end of the innovation chain, i.e. utilisation on the market. Accordingly, universities can influence the widespread dissemination and successful practical implementation of the responsible innovation concept through their entrepreneurial activities.

4. Responsible Innovation in Science Parks

Through their functions described above, science parks, being the spaces of innovation, can do a lot for the translation of the responsible innovation concept into tangible practice. They collect a region's main research and innovation results, gather players needing similar knowledge elements, stimulate two-way knowledge flow (Link 2009) and enhance university students' chances for local employment, i.e. the local utilisation of special expertise. And this kind of innovation spirit can clearly play a role in adopting the practice of responsible innovation. It seems from the above that the primary roles of science parks are the collection of players (supporting the creation of knowledge intensive businesses and attracting such organisations to the given region) and the facilitation of innovation processes (stimulating businesses' innovation activities). However, the creation of new and the channelling of existing knowledge depends first and foremost on the members of science parks and, among them, primarily on universities. In summary, the concept of responsible research and innovation can be carried over to the operation of science parks and, through them, going forward, into the wider region's attitude, with the assistance of universities.

The results of studies on connections between universities and science parks scatter over a very wide range (Vedovello 1997, Hansson et al. 2005). However, none of the studies on this topic states that these connections could be ignored. Moreover, in our opinion, *it is exactly the network of relations with universities that to a great extent determines the successfulness of science parks.* As their innovation approach gets more sophisticated ("science push" being replaced by "interactive"), the efficient operation of these connections is even more strongly needed. At the same time, the nature of these relations should be clearly understood: in most cases, the main attraction to businesses is highly qualified human resources (Andersson et al. 2009) or informal relations, rather than contracted research projects or technology transfer contracts (Vedovello 1997). The spreading of novel ideas like RRI can be achieved not only as a result of universities' direct economic impacts (spin-off creation): more indirect mechanisms related to the economy (workforce development) can also play a significant role.

We ought neither to forget that science parks are *nothing more than means* to intensify universities' output-side impacts and, in turn, to contribute to the development of their region. Consequently, *the profile and level of development of a univer-*

sity can be a decisive factor in the successfulness of a science park. It makes a huge difference what field of science the institution with which the park and its businesses cooperate excels in. Base and applied research results achieved in engineering, IT, life and natural sciences are more important for the success of a science park than the performance of other fields of science (Perkmann et al. 2013). This is especially important from the point of view of responsible innovation because the majority of innovations that radically transform our everyday lives are born mainly in these areas – and, as a result, the circumstances affecting the geographical concentration of the businesses of these fields of science can also have more widespread impacts. Consequently, with a consciously managed RRI policy, science parks can be truly powerful focus points of the efforts made for responsible innovation – in which universities, being opinion leaders, take the key role.

Besides all these, there may exist a number of *internal restrictions* at universities that can potentially impede the formation of relations between these institutions and science parks/economic players. If a university lacks the commitment or motivation to support researchers'/students' business activities or if the university lays a higher emphasis on international research relations than on participation in local partnerships (Benneworth–Hospers 2007), science parks, no matter what efforts they make, will not be able to play the role expected of them. In other words, parks – being the collectors and receivers of university outputs – to a great extent depend on the university's successfulness, profile and third-mission activity. This also shows that universities play a key role in determining the extent to which responsible innovation gets manifested in a given science park's innovation practice.

It is obvious from the above that science parks, being the holders of innovation results, can play a crucial role in the dissemination and practical application of the European Union's flagship initiative, the theory of responsible innovation. We can establish that this logic is in no conflict with the framework system of all three generations of science parks or the different university models. The differences between these generations can be identified in the leaders of RRI efforts, the motivations of innovators and the dominant third-mission operating mechanism of the universities involved (Table 4).

In first and second generation parks, RRI efforts are led by the university, which also operates as such parks' scientific base. These parks do not yet have the multidimensional initiative and leadership which can already be observed in third generation parks. As a result, the first two generations of science parks can encounter the concept of responsible innovation primarily through the university's scientific base: universities can have a significant influence on science parks' members not only in the field of technology innovations but also in the dissemination of novel concepts. Consequently, the motivations of a park's innovators to learn and adapt the concept of RRI are not internal but external ones. And, in such parks, all this can result in a scenario in which the RRI concept does not get integrated into the play-

ers' everyday operation – rather, the focus is on meeting minimum requirements. For this reason, responsible innovation can also appear in the selection policy.

Table 4. Manifestation of RRI efforts in the different generations of science parks

Aspects	First generation	Second generation	Third generation
Leader in RRI efforts	university	university	University, management businesses, government
Innovators, motivation for the practical application of the RRI concept	meeting university expectations	meeting university expectations	General attitude, internal motivation, meeting university and partner expectations, positive image
Dominant university model	entrepreneurial university (activities closer to the entrepreneurial paradigm)	entrepreneurial university	engaged university entrepreneurial university

Source: Edited by the authors

By contrast, third generation science parks, which are a more deeply integrated part of their region, set the aim of improving the welfare of the local community – which cannot be limited to merely improving the financial standards of life. In this scenario, aspects other than financial matters (e.g. the improvement of efficiency resulting from innovations should not lead to a drastic decrease in employment or, if so, the company should have a predefined plan to handle such a situation) can get taken into account in the course of innovation processes, as the players' internal motivation, explicit or implicit. This is also supported by the change occurring in the third generation's innovation approach. While in the linear innovation process relations between players are practically one-way ones and are usually dominated by one of the two parties, the interactive innovation approach enables the timely detection and management of any negative impacts of innovations, through feedbacks. Owing to the players' mutual dependence and continuous communication, RRI efforts are initiated not only by the academic sector but by a wide range of players connected to the science park. In the case of third generation parks, an additional motivation can be the fact that RRI may be a positive differentiating factor for the innovator – and this positive image can also promote the diffusion of the concept within the park.

Science parks' different generations also differ in how universities' dominant third mission operates. While in the first two generations there are more universities that operate along the entrepreneurial model, the third is dominated by the engaged university model. In the beginning, parks functioned as the point of collection of universities' research results – as a kind of extension of the university structure – and that required entrepreneurial activities also on behalf of universities. Conse-

quently, in this type, promoting RRI was also a part of universities' entrepreneurial activity portfolio (in certain cases, this is integrated into the selection policy of the science park created by the university). The third generation, however, is characterised by the engaged university model, in which both the park's players and the university work for the development of their wider territory – which requires the broadening of the set of intervention tools (e.g. policy recommendations for a particular RRI or education about the RRI concept and its carryover to the park through the workforce educated on the matter). Simultaneously, however, solutions typical of the previous science park generations may also continue to exist. Simultaneously, solutions typical of the previous science park generations may also continue to exist.

5. Summary

Science parks and responsible innovation are very close to each other both as regards their theory and their practical application. Since science parks collect a given region's research and innovation results and players, their connection to the concept of responsible innovation is a very current theoretical and practical research topic.

In this area, special attention should be paid to the role universities assume in this scenario as it can be clearly proven that universities play a very important part in the operation of a given science park, independently of the type of that park. This university-science park relation network had better be examined with the role that universities play in economic development also taken into account – and, within that topic, the entrepreneurial university and engaged university functions deserve special attention. In both cases, we can identify the roles through which universities can promote the theoretical and practical application of the 'responsible innovation' concept in the park.

Universities can perform these activities in all the three generations of science parks – the difference being that in the first two generations of parks it is almost only and exclusively the university, as a scientific base, that can "orientate" the park's new members towards RRI, in third generation parks, other, sometimes internal, motivations can also be identified.

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