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Consensus report on globalisation/regionalisation priorities for innovation

Margret Engelhard, Doris Schroeder, Benjamin Schrempf, Stephan Lingner, David Coles

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Executive Summary

To link ongoing innovation and funding policies with major societal questions, European policies rely on the advancement of Responsible Research and Innovation (RRI). This concept incorporates ethical acceptability, sustainability and societal desirability into, for example, funding and innovation policies. However, the third aspect– societal desirability – is an especially underexplored aspect of RRI.

The difficulty in defining societal desirability derives from unanswered questions: Who decides what is of benefit to society at large and for future generations? The market? The government? Powerful interest groups? Even if a more democratic approach were chosen, how would it be implemented? How could one ensure that society at large benefitted from research and innovation in order to be able to say that the third principle of RRI, societal desirability, had also been achieved?

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These questions have not yet been answered and they are not easily answerable. What can be maintained however, is that **the most societally desirable research and innovation would have the potential to benefit *all* of humankind without discrimination. One possible way of achieving this idea of societal desirability would then be tackling Grand Challenges through research and innovation**.

The ProGReSS project undertook a major fact-finding mission to compare research and innovation strategies in Europe, the US, China, India, Australia and South Africa. Funding and innovation strategies worldwide were investigated and analysed to see whether one can observe any development towards more responsible research and innovation. This report focuses on the question of how Grand Challenges are incorporated into innovation policies around the world. ‘

The overall finding was that Grand Challenges are implemented in innovation politics in all countries analyzed. However, depending on the country, different subfields are emphasized. While middle income countries have an emphasis on concrete measures that change the daily life of its people, in high income countries more global Grand Challenges such as climate change are emphasized.

Convergence on Grand Challenges
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It should be emphasized that convergence should not be an end in itself. Whilst convergence at the level of combatting Grand Challenges of humankind is desirable and noticeable, as reported above, innovation strategies are best tailored to specific political, cultural and geographic situations.

Innovation policies are framed by the special needs of the relevant countries. **This contextual presentation of the application of those policies leads us to conclude that innovation policies from all major continents do converge, in the sense of driving research and innovation towards tackling Grand Challenges, thereby focusing on the societal desirability criterion of RRI.**

Link to Previous Project Work and Main Aim

The ProGReSS project[1] undertook a major fact-finding mission to compare research and innovation strategies in Europe, the US, China, India, Australia and South Africa. Funding and innovation strategies worldwide were investigated and analysed to see whether one can observe a development towards more responsible research and innovation (RRI). The project focused on three principles of the von Schomberg[2] definition of RRI: ethical acceptability, sustainability and societal desirability. Two matrixes - one for funding policies and one for innovation policies - were developed to analyse further the information and data collected.

This report builds on the above work and analyses whether it is possible to speak of a convergence of innovation policies when using the lens of Grand Challenges.

Introduction

The European Union is confronted with major societal questions. Questions include:

> What will the world look like in 2025? How can creativity be fostered in economy and society? What compromises are necessary to preserve the environment? Which policies can better help feed the world? How will climate change affect the regions of Europe? Are security policies threatening freedoms and rights? How to combine national, European and other cultural and political identities? *or* Are high rates of unemployment among young people unavoidable? [3]

To link ongoing innovation and funding policies with major societal questions, European policies rely on the advancement of Responsible Research and Innovation (RRI). This concept incorporates ethical acceptability, sustainability and societal desirability (see Table 1) into funding and innovation policies.

Table 1 – Interpretation of von Schomberg definition of RRI

RRI Principle	Definition	Identifiable through:
Ethical acceptability	Research and innovation which respects fundamental values during its conduct and through its outputs	Codes of conduct, ethics guidelines and sustained public engagement efforts.
Sustainability	Research and innovation which meets the needs of the present without compromising the ability of future generations to meet their own needs.	Environmental protection and health & safety.
Societal desirability	Innovation which may benefit all without discrimination.	For instance, tackling Grand Challenges.

[1] http://progressproject.eu/

[2] von Schomberg, Rene. 2013. "A Vision of Responsible Research and Innovation." In Responsible Innovation edited by Richard Owen, John Bessant, and Maggy Heintz, 51-74, London; John Wiley.

[3] "New societal challenges for the European Union New challenges for social sciences and the humanities Thinking across boundaries Modernising European research", European Commission, 2009, http://ec.europa.eu/research/social-sciences/pdf/booklet-new-societal-challenges_en.pdf, accessed: 1.11.2014

However, especially the third aspect – societal desirability – remains an underexplored aspect of RRI.

In the project's previous work[4], we found that at the level of funding, RRI is not established to a great extent at any funding organisation we looked at globally, except at the level of compliance with ethical acceptability and sustainability. Especially societal engagement is highly underrepresented in funder requirements and no significant discussions are taking place about what societal desirability might mean and how one could achieve it with research and innovation funding.

In three major definitions of RRI societal desirability is integrated at different levels.

First, Rene von Schomberg (2013) makes this point most strongly since he defines societal desirability as one of the three building blocks of RRI alongside ethical acceptability and sustainability.

Second, the flagship funding initiative of the European Union, Horizon 2020, includes this aspect at the level of funding policy by noting that the *outcomes* of responsible innovation must be aligned better with the values, needs and expectations of European society[5].

Societal Desirability
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Third, Richard Owen et. al. frame Responsible Innovation as "a collective commitment of care for the future through responsive stewardship of science and innovation in the present". This requires that "a framework for responsible innovation must then not just include consideration of products, but also *purposes*, not just what we do not want science and innovation to do, but what do we want them to do"[6].

This report will discuss further the principle of societal desirability to ascertain whether a convergence of RRI at the global level can be observed in innovation policies' emphasis on tackling Grand Challenges. Doing so, the report will refine and deepen work undertaken earlier, as noted previously, to analyse whether Grand Challenges drive globalisation/regionalisation priorities for innovation.

[4] Schroeder D et al (2014) Funder Reports - How innovation is driven towards societal desirability through funding requirements, Report for FP7 Project "Progress", progressproject.eu.
[5] Science with and for Society unit: http://ec.europa.eu/programmes/horizon2020/en/h2020-section/science-andsociety, our emphasis.
[6] Owen Richard, Jack Stilgoe, Phil Macnaghten, Mike Gorman, Erik Fisher, and Dave Guston. 2013. "A Framework for Responsible Innovation." In Responsible Innovation edited by Richard Owen, John Bessant, and Maggy Heintz, 27-50, London; John Wiley, p.34, our emphasis

Societal Desirability and Grand Challenges

To refine what societal desirability means, it is important to fill the term with content *and* to separate the principle from its allies; ethical acceptability and sustainability. What has already been covered by the first two principles? First, do no harm to research participants and ensure that outputs do not transgress fundamental values (ethical acceptability). Second, limit the negative impact on the future (sustainability). In essence, the first two principles impose limiting conditions on the conduct of research and innovation. Research ethics and risk management have mostly done so for decades; however the concept of societal desirability inverts this perspective.

The Owen et al. understanding of RRI is illuminative here. They note that "the first and foremost task for responsible innovation is then to ask what futures do we collectively want science and innovation to bring about…?"[7] The movement is from reactive frameworks which focus on avoiding the negative consequences of innovation, to a more visionary approach towards encouraging research and innovation that will bring about benefits for society. Societal desirability then summarizes the effort to conduct research and innovation undertaken for the benefit of society at large.

The difficulty in defining societal desirability further derives from unanswered questions: Who decides what is of benefit to society at large and for future generations? The market? The government? Powerful interest groups? Even if a more democratic approach were chosen, how would it be implemented? How could one ensure that society at large actually benefitted from research and innovation sufficiently to be able to say that the third principle of RRI, societal desirability, had also been achieved? These questions have not yet been answered and they are not easily answerable. What can be maintained without further research is that **the most societally desirable research and innovation would have the potential to benefit all of humankind without discrimination.**

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In our previous work[8] we therefore defined societal desirability as tackling Grand Challenges to allow a comparison of otherwise vastly different policy landscapes. The attempt to guide innovation towards resolving humanity's challenges functioned as a common denominator. One conclusion from the *Innovation **for** Society* report[9] was that achieving societal desirability is the aim of many innovation programmes world-wide, but its actual implementation is far from being concrete and understandable.

[7] Ibid. 37.
[8] David Coles et al (2014) RRI Country Requirements Matrix - Nanotechnology, Synthetic Biology, ICT - Report for FP7 Project "Progress", progressproject.eu
[9] David Coles et al (2014) *Innovation **for** Society* - How innovation is driven towards societal desirability through innovation policies, Report for FP7 Project ProGReSS , progressproject.eu.

We are not saying here that tackling Grand Challenges is the only way to achieve societal desirability. Our position is that processes to define societal desirability at the national and even the global level are not sufficiently refined, or even available, and that in this vacuum, one can venture that achieving benefits for society at large can be done through tackling grand societal challenges, which affect everyone. Starting from this position, we are asking whether – using the above definition of societal desirability – **a global convergence of innovation policies can be detected.**

Would one not need to assume that the way in which Grand Challenges are defined will differ globally? Indeed, this would not be surprising as many societies have different cultural, environmental, security and political perspectives. However, this would not invalidate the claim that focusing innovation policies on Grand Challenges might show a convergence towards the RRI criterion of societal desirability. We have already shown that this is the case in our *Innovation **for** Society* report, where we concluded that the vocabulary of Grand Challenges is common around the world and therefore suitable for a global dialogue on RRI.[10] What we want to ask in this report is whether there is also a convergence on the substance of which Grand Challenges are being tackled through domestic innovation policies.

In Europe, Grand Challenges have been defined in a harmonized manner through the *Lund Declaration*.[11] To see whether there is convergence, this report compares the Grand Challenge focus of innovation policies from Europe, the US, China, India, Australia and South Africa.

This report summarises the innovation strategies of governments and funders on a global scale in the context of RRI and *Grand Challenges*. Grand Challenges are one of the most prominent goals of innovation policies worldwide and can serve as a good comparator for innovation policies and a good marker for any possible convergence.

[10] Ibid.

[11] *Lund Declaration*. (2009) Conference: New Worlds – New Solutions. Research and Innovation as a Basis for Developing Europe in a Global Context. Lund, Sweden, 7–8 July 2009. http://www.vr.se/download/18.29b9c5ae1268d01cd5c8000631/New_Worlds_New_Solutions_Report.pdf

Grand Challenges as Globalisation/ Regionalisation Priorities for Innovation Policies

Grand Challenges of individual countries can be practical entry points for the formulation of national innovation policies. In this way, innovation can contribute to the solution of specific societal and environmental problems at regional levels as well as provide unique options for individual countries to develop further for the benefits of their people. Corresponding innovation policies could then be judged to be "societally desirable", as Grand Challenges are likely to affect all of society. The tackling of Grand Challenges can therefore be seen as "pointers" for responsible innovation and related policies.

As we are interested in how innovation policies converge globally, our comparative analysis of national innovation policies was guided by the lens of Grand Challenges. To undertake this comparison systematically, we used the *Lund Declaration*[12] as a basis. The *Lund Declaration* formulated six overarching challenges and development goals:

1. Supply of energy, water and food
2. Pandemics prevention
3. Public health
4. Coping with global warming
5. Addressing ageing societies
6. Security

Are innovation policies converging globally on Grand Challenges of humankind?

Picture from: abetterworld

The following analysis investigates whether country-specific innovation policies address the *Lund Declaration*. If so, one could speak of some kind of convergence. One proviso: clearly, the *Lund Declaration* was formulated by and for European societies. One could therefore argue that the result of our analysis, if there were convergence, could point towards more Euro-centrism rather than true, balanced convergence.

We are more optimistic, though, and intend to present the challenges in a more inclusive way to take into account non-European traditional lifestyles and social, cultural and political variations. For example the Grand Challenges identified by the Chinese Government – as presented in an earlier report[13] - are: wealth distribution; poverty; education; and rural-urban inequalities. Although these may at first sight appear very different to those of the *Lund Declaration* there are many situations where equivalence of the resultant priorities can map across from one Grand Challenge to another. For instance, improving wealth distribution and tackling poverty are especially likely to have a significant impact on public health and pandemics prevention.

[12] Ibid.

[13] David Coles et al (2014) *Innovation **for** Society* - How innovation is driven towards societal desirability through innovation policies, Report for FP7 Project ProGReSS , progressproject.eu.

The results of the comparative analysis of different innovation policies are displayed in Figure 1. A closer look at the table reveals that – indeed – the country policies differ significantly with regard to addressing the *Lund* Challenges. China's policy seems to be a special case as it mainly addresses a focus on the rich-poor gap, which is not explicitly covered by the *Lund* challenges. However, the *Lund Declaration* applies to the other countries' policies as follows:

Supply of energy, water and food: This challenge is addressed by most countries investigated– but with quite different foci: *Energy* is an explicit issue in five of the seven investigated policies in both high and middle income countries with strong relations to economic development and environmental quality. *Food production* is either directed towards subsistence at the national level (India) and/or as an export factor (Australia, UK). *Water supply* is a specific challenge mentioned in India and the USA innovation policies.

Pandemics prevention is a typical necessity for *low and middle income countries* in (sub-)tropical regions, where infectious diseases are prevalent due to climatic and sanitary conditions. Strategic plans to improve the sanitary conditions in India and South-Africa are seen as crucial for more resilience against pandemics.

Public health is a more *general goal* than pandemics prevention, but in the same area. It is a prominent issue in most countries. Among them, enabling *broad public access* to health care is seen as essential (distributive aspect). However, the USA focus more on *technology-driven improvements* of medical therapies (R&D aspect), rather than distributive aspects.

Ageing societies are clearly country-specific problems. However, they are not restricted to high income economies, as China is facing considerable problems due to the combination of better health in old age with the legacy of the one child policy. Specific mention of ageing societies in innovation policies is found in Germany, the USA, and implicitly in the UK.

Picture: Thaivisa

Global warming affects and challenges many countries but in different ways. Consequently, it is an issue in five of the seven country policies investigated. Germany is less affected but takes responsibility for *climate protection* in its policies. Australia and the USA are more affected by climate change and global warming and are thus more eager to drive innovation with regard to *adaptation* to regional climate impacts. India and China – although also affected – are more passive on this issue. South Africa by contrast is engaged in *climate research* as part of its innovation strategies.

Security is also a prominent feature of several country policies with different national characteristics. The topic can mean building safer communities (South Africa), securing economic activity e.g. against cyber-attacks (USA, Australia) or offering marketable security solutions (Germany). Corresponding foci respond to country specific *options and vulnerabilities*.

Apart from addressing the *Lund* Challenges, there are also other national policy goals, which could be named as "societally desirable". In the innovation policies investigated, this applied to the effort to achieve more *inclusive participation* in society and the economy, especially in the middle income countries (South Africa, China, India) as well as to the improvement of *education* (USA, Australia, India, China, South Africa).

Matrix: Grand Challenges and innovation policies from around the world

Figure 1

Lund Declaration Grand Challenges	 **Australia**	 **China**	 **Germany**	 **India**	 **South Africa**	 **UK**	 **USA**
Tightening supplies of energy, water and food: How to improve efficiency in consumption, as well as the recycling rate and waste reduction?	Managing food and water assets: Optimise food and fibre production, develop knowledge for sustainable water use, maximise effectiveness of food production value chain.	Not explicitly mentioned	(Clean) energy supply: transition of the energy system (energy transition).	Priority areas for National Missions in Agriculture, Water, Energy. Immediate focus on Energy and Water. Ensure food, agricultural, nutritional, environmental, water, energy security on sustainable basis.	Transition to a low carbon economy	Energy, Resource Efficiency, Agriculture and food.	Unleash a clean energy revolution, develop new sources for energy that are clean, reliable, and affordable, and improve management of water resources.
Pandemics: How to improve the prevention and management of widespread, contagious diseases to avoid considerable impact on the economy and improve social stability?	Not explicitly mentioned	Not explicitly mentioned, but directly linked to major anti-poverty aims of Chinese development and innovation policies.	Not explicitly mentioned	Implicitly mentioned in water and sanitation, affordable health care.	Strengthening the Bio-Economy with results of investments focussing on the heavy burden of poverty-related disease in the country . Improve healthcare, lifestyle, education diet, sexual behaviour etc. to fight HIV/AIDS.	Not explicitly mentioned	Not explicitly mentioned
Public health: How to provide medical care to everyone without discrimination?	Promoting population growth and wellbeing: optimise effective delivery of health care, maximise social economic participation, improve health and wellbeing of Aboriginal and Torres Strait Islander people.	Not explicitly mentioned, but directly linked to major anti-poverty aims of Chinese development and innovation policies.	Health and Nutrition: focus on peoples' needs in view of demographic change (e.g. individualized medicine, support for company health management, telemedicine).	National Mission: Health. Ensure health of the people on sustainable basis.	Quality healthcare for all (related to pandemics goal (HIV/AIDS)).	Health and Care	Drive breakthroughs in health care technology, utilize biotechnology, nanotechnology and advanced manufacturing to improve health care quality and delivery.

Lund Declaration Grand Challenges	**Australia**	**China**	**Germany**	**India**	**South Africa**	**UK**	**USA**
Ageing societies: How to address the challenges of ageing societies, which include issues of economics, but also questions of social inclusion?	Not explicitly mentioned	Not explicitly mentioned	Ageing societies: strategy of demography; includes actions on family policy, work, independent living in advanced age, growth and economic wealth.	Not explicitly mentioned	Not explicitly mentioned	Urban living, digital economy, emerging and enabling technologies, High value manufacturing.	Focus via Defense Advanced research project Agency (DARPA), National Institutes of Health (NIH), and National Science Foundation (NSF) BRAIN Initiative which works to revolutionize understanding of the human brain to find cures for disorders like Alzheimer's.
Global warming: How to improve the prevention and management of natural disasters such as flooding, forest fires, hurricanes, and dry area extensions?	Living in a changing environment: Identify vulnerabilities and boundaries to the adaptability of changing natural human systems, manage risks and capture opportunities for sustainable natural human systems, enable societal transformation to enhance sustainability and wellbeing.	Not explicitly mentioned	Climate change: support for better cooperation between industry and the financial sector to develop better instruments to support climate protection, promote energy efficiency and renewable energy. Lines of action: 6th energy research programme, framework programme on research for sustainable development, Bio-economy framework, etc.	Not explicitly mentioned	Global change science with a focus on climate change: unique geographical position of South Africa is a chance for research on climate change, poses a risk due to SA's exposition (ocean resources, droughts and floods) and an opportunity by becoming a "Green Economy".	Built environment (reducing carbon emissions).	Develop better space capabilities to warn of national disasters.

Lund Declaration Grand Challenges	**Australia**	**China**	**Germany**	**India**	**South Africa**	**UK**	**USA**
Security: How to improve the security of citizens within but also outside of Europe?	Securing Australia's Place in the world: improve cybersecurity, manage the flow of goods, information, money and people across national and international boundaries, understand political, cultural, economic and technological change, particularly in Australia's region	Not explicitly mentioned	Security: Protection of society and infra-strucutre from sabotage, organized crime, terrorism and others. Lines of action include: protection of a modern democratic society, development of a clear competence profile, development of security technologies, develop Germany into a lead market for civil security solutions.	Enhancing livelihood security.	Building safer communities.	Not explicitly mentioned	Develop space technologies that help contribute to national security, improve cybersecurity to protect information of U.S. citizens and businesses from cyberattacks.
Other, not matching goals	Lifting productivity and economic growth: identify the means by which Australia can lift productivity and economic growth, maximise Australia's competitive advantage in critical sectors, deliver skills for the new economy	Three challenges are defined: 1) Uneven income 2)Uneven Capabilitiy 3)Uneven Institutional Supported Rights	Communication: technological and legal advancement of internet-realted developments, global standardisation, roadmap for embedded systems. Lies of action: ICT Strategy 2010, IT summit, IT security research programme. Mobility: development of fuel cells, batteries, intelligent traffic control and completion of the Galieleo system. Lines of action: mobility and transport technologies research programme, electric mobility, etc.	Alleviation of poverty, removal of hunger and malnutrition, promotion of the empowerment of women in S&T, encouragement of research and innovation. Generation of employment and skill buildin, reduction of drudgery.	Space science and technology: making South Africa a key contributor to global space science and techology. Other goals are: creating more jobs, improving infras-tructure, building an inclusive and integrated rural economy, rever-sing the spatial effects of apartheid, improvinf the quailtiy of educ-ation, training and innovation, improving social protection, reforming the public service, fighting cor-ruption, transforming socitey and uniting the nation.	Space Applications, Transport	Improve public education in STEM fields, increase public literacy on science and technology, create a quantum leap in educational technologies as a way to help implement new education strategies and systems

The Matrix approach to mapping country-specific challenges has to be carefully interpreted with respect to the concrete handling of the *Lund* challenges within single national policies: The comparative analysis e.g. of the global warming challenge demonstrates indeed a general convergence of high income countries towards the *Lund Declaration* but it uncovers different and poorly aligned strategies for an effective response to the global warming problem (climate change mitigation vs. adaptation).

Also, Chinese President Hu Jintao in 2007 made a speech at the 17th Leaders meeting of the Asia-Pacific Economic Cooperation, of the need to "meet challenges together to promote inclusive, sustainable and balanced development".[14] "Inclusive development" and "harmonious development" are now key concepts in Chinese development policy. Innovation is clearly central to Chinese policy. For example, while there has been very rapid growth in China (much of it resulting from innovation), this has left out many groups of people who are unable to benefit from it. The government has recognised that there is a need to develop a framework for inclusive development and a shift in the current innovation model in order to achieve inclusive, sustainable and balanced development for the future.[15] Hence, whilst the Lund Declaration challenges are not mentioned in Chinese innovation policies, as analysed by ProGReSS, efforts at inclusive development are likely to have a great impact on at least public health and pandemics prevention.

Conclusion

As an overall result, Grand Challenges are implemented in innovation politics in all countries analyzed. However depending on the country, different subfields are emphasized. While middle income countries have an emphasis on concrete measures that change the daily life of its people, in high income countries more global Grand Challenges such as climate change are emphasized.

Convergence on Grand Challenges
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It should be emphasized that convergence should not be an end in itself. Whilst convergence at the level of combatting Grand Challenges of humankind is desirable and noticeable, as reported above, innovation strategies are best tailored to specific political, cultural and geographic situations.

Innovation policies are framed by the special needs of the relevant countries. **This contextual presentation of the application of those policies leads us to conclude that innovation policies from all major continents do converge, in the sense of driving research and innovation towards tackling Grand Challenges, thereby focusing on the societal desirability criterion of RRI.**

[14] http://www.ebeijing.gov.cn/BeijingInformation/BeijingNewsUpdate/t1093972.htm.
[15] David Coles et al (2014) Innovation *for* Society - How innovation is driven towards societal desirability through innovation policies, Report for FP7 Project ProGReSS, progressproject.eu.