Routledge
Taylor & Francis Group

Journal of Responsible Innovation

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/tjri20

Reconceptualising responsible research and innovation from a Global South perspective

Kutoma Wakunuma, Fabio de Castro, Tilimbe Jiya, Edurne A. Inigo, Vincent Blok & Vincent Bryce

To cite this article: Kutoma Wakunuma, Fabio de Castro, Tilimbe Jiya, Edurne A. Inigo, Vincent Blok & Vincent Bryce (2021): Reconceptualising responsible research and innovation from a Global South perspective, Journal of Responsible Innovation, DOI: 10.1080/23299460.2021.1944736

To link to this article: https://doi.org/10.1080/23299460.2021.1944736

Published online: 28 Jul 2021.

JOURNAL OF RESPONSIBLE INNOVATION
https://doi.org/10.1080/23299460.2021.1944736

Routledge
Taylor & Francis Group

RESEARCH ARTICLE

OPEN ACCESS Check for updates

Reconceptualising responsible research and innovation from a Global South perspective

Kutoma Wakunuma [a], Fabio de Castro [b], Tilimbe Jiya [c], Edurne A. Inigo[d,e], Vincent Blok [f] and Vincent Bryce [g,h]

[a]Centre for Computing and Social Responsibility, De Montfort University, Leicester, UK; [b]CEDLA, University of Amsterdam University, Amsterdam, The Netherlands; [c]Centre for Sustainable Business Practices, University of Northampton, Northampton, UK; [d]Communication, Philosophy & Technology, Wageningen University, The Netherlands; [e]Management, University of Deusto, Business School, San Sebastian, Spain; [f]Philosophy Group, Wageningen University, Wageningen, The Netherlands; [g]Centre for Computing and Social Responsibility, De Montfort University, Leicester, UK; [h]Horizon Centre for Doctoral Training, School of Computer Science, University of Nottingham, Nottingham, UK

ABSTRACT

The concept of Responsible Research and Innovation (RRI) has been developed in the Global North with little reference to what RRI or RRI-like practices mean in the context of the Global South. We discuss the contextual factors driving the emergence of responsible innovation practice and ways in which they can inform efforts to develop an inclusive and global conceptualization of RRI. Findings show that some activities in the Global South are comparable to those of the Global North, although important differences exist in motivations and structures. We go beyond prior framings to propose a reconfigured, inclusive theoretical framework that accounts for trans-regional differences by looking at three cases to illustrate international differences and to demonstrate an RRI continuum. Netherlands represents a more Global North concept of RRI; Malawi a Global South RRI concept and Brazil sits between these two extremes and assimilates RRI concepts from both ends of the continuum.

ARTICLE HISTORY
Received 9 October 2020
Accepted 14 June 2021

KEYWORDS
Global South; Global North; North-centric; responsible research and innovation (RRI); responsible innovation (RI)

Introduction

RRI is heavily debated in Europe among the Science and Technology Studies academic community; however, a broader contextualization to other regions is still in its infancy. Although the European Commission has been its main advocate, efforts to practice RRI are not limited to this part of the world. There has been increasing interest in promoting RRI globally through a trans-regional network, including for example the United States of America, South Africa and China (Chatfield et al. 2017, 2). However, in order to build a more global perspective, a more elaborate inclusion of the Global South is needed. A large range of RRI-like initiatives that are flourishing and consolidated

CONTACT Kutoma Wakunuma kutoma@dmu.ac.uk linkedin.com/in/drutoma-akunuma @KWakununa

in the Global South has been underrepresented in the research and innovation literature. The formalization of 'keys' or 'domains' based on a Northern perspective, for instance, may lack elements relevant to the promotion of RRI in a global arena. We therefore argue that a focus on RRI-like initiatives in the Global South can help fill this gap and support the elaboration of a multi-cultural perspective of RRI to align science and society in ways that include potentially under-represented stakeholders and practices.

The relevance of the Global South in the RRI debate is not new. Vasen (2017) looked at RRI in the Global South through the prism of Science, Technology and Innovation policy while Hahn and Ladikas (2014) focus on RRI and Technology Assessment methodologies from a global perspective. In these initial efforts to conceptualize RRI beyond Europe, there is a strong focus on technology assessment with a view on science policy and the meso-level. Although the inclusion of non-European contexts has improved the way RRI is framed and conceptualized, such considerations have tended to lean on technology-oriented, scientific-based knowledge systems (Macnaghten et al. 2014) while social-oriented, informal knowledge-based systems have received less attention. In this article, we build on these initial attempts by adding a micro-level perspective of RRI-like practices emerging in different locales based on non-technological innovations. The aim is therefore to explore the diversity in conceptualisations of RRI in the Global North and Global South[1] in order to unpack the factors influencing these differences, and to propose a more encompassing perspective for a global RRI.

We call for a reconceptualization of RRI that allows for the inclusion of a range of practices observed in the Global South that tend to be underrepresented in this debate. As an initial exploration, rather than provide a detailed empirical accounting, our ultimate goal is to develop a broader model that can shed light on this debate and guide future research. In addition to comparable activities in the Global North and Global South, we hold an assumption that emerging differences which speak to the different cultural and socio-economic contexts require a more inclusive conceptualization, framing and practice of RRI. In order to formulate an RRI continuum, we use three country case studies that represent different positions in the Global North–South categories. The Netherlands and Malawi are illustrative examples of Northern and Southern RRI perspectives, respectively, while Brazil is presented as an intermediary context that combines elements of RRI from both perspectives. The three cases are intended to highlight relevant characteristics of RRI and RRI-like practices according to their cultural and socio-political context, and how social drivers and barriers stimulate and hinder RRI practice. We believe that highlighting such characteristics will be central in building a conceptual framework for RRI which fully includes the Global South context and will help in answering the research question on 'How can RRI be re-conceptualised to be inclusive of both the Global South and Global North?'. With the aforementioned, the paper presents a more refined conceptual framework of RRI that allows for a more informative and in-depth understanding of RRI beyond the dominant Eurocentric conceptualisations that can now include lesser-known and less discussed RRI and RRI-like aspects from the Global South which would have otherwise remained invisible. We will conclude the paper by bringing to light aspects of capital-oriented versus livelihood-oriented RRI, the former being more relatable to the Global North and the latter to the Global South. With this, we will therefore end by arguing that if innovation practices are looked at not only from a capital-oriented perspective but also from a livelihood-oriented

perspective, RRI scholars will be able to identify more of the relevant varied aspects of RRI and not that of a one-size-fits-all. These should include bottom-up grassroots community-based RRI, a hybrid-type of RRI encompassing not only capital-oriented elements of RRI but livelihood-oriented RRI with local community co-production RRI-practices, and industrial technological innovation while still recognizing that RRI is bound to specific keys and domains as demonstrated by the Global North capital-oriented RRI.

Towards an integrative RRI conceptual framework

Recent years have seen RRI emerge as a discourse with the potential to align science with society (von Schomberg 2012), mobilize diverse interests in tackling ethical and political challenges (Ribeiro, Smith, and Millar 2017), and engage industry in tackling broader societal problems (Lubberink et al. 2017; Schroeder and Kaplan 2019). This debate, however, has raised some challenges linked to conceptual coherence (for example Rip 2016; Blok and Lemmens 2015), technology fixation (von Schomberg and Blok 2018) and the presumption of a linear model of innovation (for example Macnaghten et al. 2014, Dreyer et al. 2017; MacNaghten 2020). A focus on technology development and industry agency makes a large range of innovation and research grounded on non-western science and social practices invisible because such practices lack the vocabulary of RRI as seen in the Global North.

Whether Responsible Research and Innovation[2] is viewed as a policy initiative, or a more deeply-rooted discourse arising from the development of Science and Technology Studies, the history of the RRI discourse (for example Owen and Pansera 2019) indicates that it is built on a foundation of Global North perspectives, such as social desirability, ethical acceptability and a techno-economic orientation. While convincing evidence for cross-country differences in RRI practice has been presented in the European context (Mejlgaard, Bloch, and Madsen 2019), the need to reimagine RRI from a Global South perspective has only recently gained attention. Macnaghten et al. (2014), for instance, explore the tensions, paradoxes and possibilities identified in greater depth. de Hoop, Pols, and Romijn (2016) highlight additional risks in international contexts including power differences and diverging interests in biofuel development in India. Schroeder and Kaplan (2019) consider alternative definitions of RRI from an international perspective and relate these to more widely-used concepts of inclusive innovation to conclude that RRI can and should 'go global'. In two recent special editions, Doezema et al. (2019) review a globally diverse sample of case studies to articulate the need for 'transduction' rather than translation of RRI practices, and identify differences in civic epistemologies as well as historical, cultural, economic, and political factors as relevant to the context-shaping of responsible innovation practices. Pandey et al. (2020) present case studies that 'articulate the mismatches' between RRI's Western foundations and localized responsible innovation, highlighting epistemological empowerment, narrow framings of responsibility, deficit models of science communication and hegemonies of formal expertise as acute challenges in the context of Indian biogas projects.

Although these authors claim to include other sources of knowledge, business models, societal actors and social interactions, a more elaborated articulation of how RRI-like

initiatives from the Global South can fit in a global conceptualization of RRI is still missing. The relevance of local institutions, traditional practices, and cultural context in shaping effective responsible innovation remains an open question. Countries and regions present clearly different climates and contexts for responsible innovation. RRI in the Global North, for instance, is typically based on western-scientific knowledge and focuses on products and technology developments that are purported to address broad societal challenges. In the Global South, on the other hand, RRI is often characterized by knowledge co-production in which indigenous knowledge plays an important role (Jauhiainen and Hooli 2017; Torri and Laplante 2009). Thus, relevant innovations in this region also include new social practices, institutions, designs and technologies emerging from local needs in the context of social exclusion and inequality. Such social arrangements, comprising creative grassroots solutions based on new social relations, are well conceptualized in social sciences as social innovations (see Moulaert et al. 2014), and have recently been integrated into innovation studies as 'social technology' (see van der Have and Rubalcaba 2016). However, this aspect of innovation has received comparatively little attention in the RRI literature (Khumalo and Baloyi 2017). The apparent prevalence of a 'North-Centric' approach to RRI raises major questions about how it is conceptualized and the implications of top-down implementation in other regions. It does not only underplay the relevance of social innovations and post-capitalist perspectives in the RRI debate but also limits recognition that the Global South can provide valuable lessons to other regions as to how RRI can be shaped and performed.

National differences in customs and culture are just two strands of the 'spaghetti' that constitutes innovation practice (Bessant 2013) and indicate the complex web of forces that constrain or enable responsibility in innovation. Van de Poel et al. (2017) distinguished environmental and organizational factors affecting implementation, with type of technology, level of certainty, innovation pattern, market structure, and level of public scrutiny as the most relevant conditioning factors. The RRI-Practice project identified policy structure, policy culture and RRI focus as points of differentiation between country case studies (Wittrock et al. 2020). Schönherr, Martinuzzi, and Jarmai (2020) identified cultural setting, legal framework and funding regime as important external drivers. These framings are both helpful and limiting, and may inherit the unconscious Northern bias that is a feature of the RRI studies they are based on. They provide us with a basis for theorizing, but presume a narrow set of actors as indicated by references to 'company' and 'firm' and are not necessarily inclusive with respect to the diversity of contexts in which innovation may take place. Innovation in the Global South is often part of everyday life struggles. Many marginalized social groups face structural constraints rooted in histories of exclusion, inequality, poverty, vulnerability and injustice, and many local innovative solutions – from co-production of new social practices to development of new technologies – emerge to address these issues. For example, 'entrepreneurial action' in the Global South is better understood as 'the nexus of individual and exogenous factors in complex relationships' (Yessoufou 2017), and takes place within different political and power dynamics (Macnaghten et al. 2014) and in contexts where science-society relationships are shaped by different histories (Reyes-Galindo, Monteiro, and Macnaghten 2019). In rural settings, local communities or trade collectives may provide a vital medium for responsibilization of innovation, including

decisions on whether or not to innovate and the kinds of practices or technologies to adopt (Valkenburg et al. 2019). For instance, in China, deliberative discussion of responsibility may reflect country-specific public concerns of technology monopoly and the potentially more significant opportunities for firms to shape laws, standards and national policy in a developing country context (Gao, Liao, and Zhao 2019).

The Global South, however, is by no means homogeneous. It is characterized by a high inter- and intra-regional contextual diversity. A re-conceptualization of RRI, therefore, must start from the unpacking of fundamental differences between contextual and dimensional factors of RRI practices observed in the Global North and Global South, in order to inform the elaboration of an integrative RRI global framework. In the remainder of this article we will carry out this exercise by looking at three case studies, namely, the Netherlands, Brazil and Malawi.

Method

In order to address the differences and potential contributions to RRI of the Global South, an exploratory-interpretive multiple case study approach (Alkraiji, Jackson, and Murray 2013; Yin 2011) was carried out. The selection of cases was based on a maximum variation sampling approach, aiming to include a representative case from a developing economy (Malawi), an emerging economy (Brazil) and a developed economy (Netherlands), countries that present different features in terms of socio-economic and research and innovation systems. We do not claim that these countries represent the distinct cultural, economic and social diversity of countries often classified as developing, emerging or developed; however, as noted in Table 1, they present contextual indicators that are paradigmatic of each category, and indicate heterogeneity across the cases in the research and innovation systems.

As observed in the table, Malawi and the Netherlands present extreme differences in most indicators, while Brazil presents a mixed profile, overtaking the Netherlands in publications per million inhabitants, for example, but closer to Malawi in most socio-demographic indicators except gross domestic product per capita and gender gap. Therefore Brazil, despite often being described as being in the Global South, sits in-between the

Table 1. Contextual indicators of the case studies (extracted from GoSpin database, UNESCO).

	Item	Malawi	Brazil	Netherlands
Input indicators	R&D personnel per million inhabitants	257.9	2,367.7	11,206.8
	Global expenditure on R&D (percentage of GDP)	No data	1.17%	2.00%
Output indicators	Publications in Scimago per million inhabitants	18.4	1,934.7	1,443.4
	Patent grants per million inhabitants	1.14	34.60	135.30
	High technology exports (% of total manufacturing exports)	2.2%	13.5%	17.8%
	Global Innovation Index	23.5	33.1	63.4
Education indicators	Government expenditure on education (% GDP)	4.8%	6%	5.5%
	Enrolment in tertiary education	No data	6.277	20.378
Socio-demographic indicators	GDP per capita (USD)	300.3	8,650	45,637.9
	Gini Index (inequality), World Bank estimate	54.0	51.3	29.3
	Government effectiveness (rank)	50	51	98
	Control of corruption (rank)	47	57	97
	Global Gender Gap Economic Participation and Opportunity Subindex (score)	0.80	0.64	0.66

two extremities when it comes to responsible innovation or practices that may be construed as RRI.

Data were collected as part of Responsible Research and Innovation Networking Globally (RRING), an EU-funded research project. The RRING project aims to develop and foster open access to a global knowledge base on RRI (RRING 2018). The authors took part in the RRING project's activities aimed at exploring, understanding and interpreting RRI practices in different contexts across global regions. The project collected data from different world regions, but in order to address the differences and potential contributions to RRI of the Global South, the qualitative data collected from three countries (Malawi, Brazil and the Netherlands) was selected to observe and make sense of *de facto* RRI practices and to analyze the contextual drivers and barriers that comparatively stimulate and hinder RRI practices in the Global South. The data collected included secondary data about RRI and research and innovation systems, including a regional document (policy documents extracted from GO-SPIN) and project review – including local projects in each area that address grand challenges, sustainability-oriented innovations or science for and with society – and examination of the main contextual factors through data from the UNESCO Global Observatory of Science, Technology and Innovation Policy Instruments (GO-SPIN), one of the most comprehensive databases and repositories about national research and innovation systems. With GO-SPIN being developed by one of the main partners in the RRING project, UNESCO, the data and research documents in its repository were used from the beginning of the project to identify relevant country case studies. In addition, interviews with focal agents of the research and innovation systems (researchers and innovative businesses), as well as other supporting agents such as policy-makers including non-governmental organizations (NGOs), industry organizations, and citizens were carried out. In total, there were a total of 16 interviews which included 8 from Brazil, 4 from The Netherlands and 5 from Malawi as illustrated in Table 2:

These interviews focused on the RRI-like practices which these agents implemented, and were designed using an interpretative approach, whereby the interviewees did not need to be familiar with existing conceptualisations of RRI (such as the six keys or the AIRR: Anticipation, Inclusion, Reflexivity, Responsiveness framework). Rather, respondents were asked to elaborate on the practices they developed in terms of addressing grand challenges and integrating stakeholders in research and innovation processes. These helped to inform the interpretation of the secondary data to understand the institutional context in each of the case countries. These data were used as a basis for the sensemaking process that the authors carried out as part of the research process.

The method used in this paper consists of two phases focusing on the observation of *de facto* RRI practices through the data collected in the RRING project, followed by a sensemaking process of the authors' research experience and acknowledgement of the interpretation of reality carried out by the researchers in the context of this project

Table 2. Case study interviews.

	Brazil	The Netherlands	Malawi
Research	2	1	1
Industry	1	2	3
NGO	3	1	1
Government	1		

and previous research experiences on the matter in the three countries. Firstly, the exploratory phase involved a consideration of the implementation of RRI-like practices by actors in their socio-cultural and economic contexts – in three global regions – and understanding these considerations without providing conclusive results. We started with a general idea of exploring what RRI-like practices entail. As a result, rich insights were generated, leading to theory building and a clear research agenda (Walsham 1995). The interpretative phase was carried out through sharing and contrasting of observed meanings of RRI-like practices among the researchers, followed by an interpretation and a critical discussion of the findings and their relevance to the research question on 'How can RRI be re-conceptualized to be inclusive of both the Global South and Global North?' (see Figure 1). This was reinforced by a literature review of practices that may benefit the theoretical conceptions of RRI and RRI-like practices in the case countries (cases) representing the Global North and South perspectives.

For each case country, we offer a description of the country-specific context, and highlight the RRI related practices as noted during the two phases of the research illustrated in Figure 1. We then focus on the countries' innovation practices or related practices to analyze and discuss these practices based on the literature.

Country cases

Following our methodological approach described above, we present in this section a short description of national context, RRI perspective (concepts and practices) and illustrative RRI initiatives for three countries in different positions in the Global North–South continuum. We do not aim to generalize these features but to highlight how RRI is conceptualized and shaped in each country and identify commonalities and differences between them.

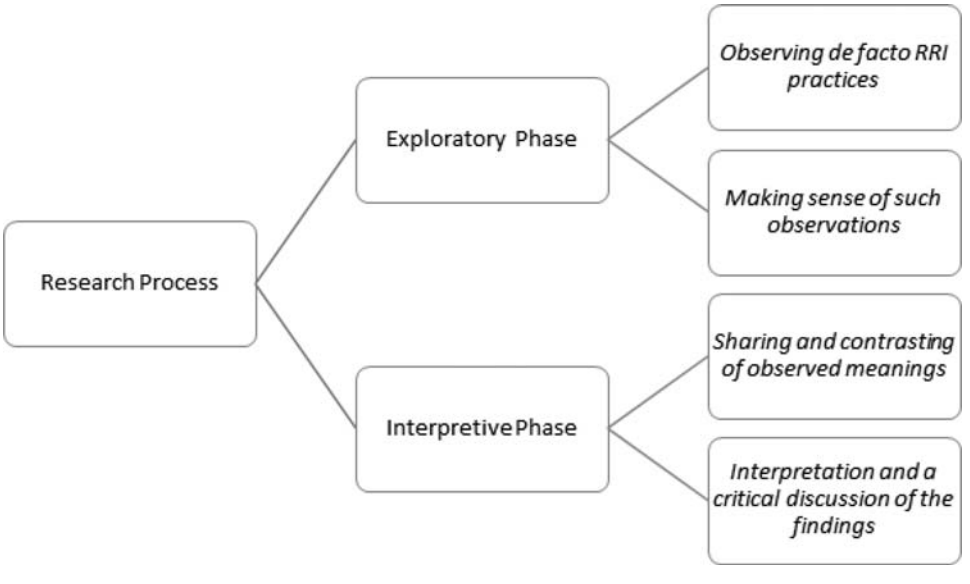

Figure 1. Method summary.

The Netherlands – Global North perspective

The Netherlands is a founding member of the European Union, which develops the major frameworks for research and innovation for its affiliates (among many other relevant policies in the socio-economic sphere). Despite its relatively small size in terms of land and population, the country is one of the major exporters in the region, and often ranks as one of the top innovators in the European Innovation Scoreboard, scoring very highly in the Global Competitiveness Index (Lukovics et al. 2017). The country has a high standard of living both by European and global standards, with high indicators on education, life satisfaction and perceived safety (OECD 2020), and a solid and productive research and innovation system (see Table 1).

Grounded in a strong research and innovation system, the country is gradually moving from the triple helix model of collaboration – academia, government and the private sector – to a quadruple helix model (inclusion of civil society) (Carayannis and Campbell 2009). The quadruple helix model is increasingly referenced in the Netherlands, as well as across the European Union, and as a consequence of this stakeholders beyond the traditional focal actors of research and innovation are increasingly participating in policy-making, drafting research agendas, and the development of research and innovation processes. This is carried out through participatory technology assessment, knowledge valorization panels or inclusive policy design (Popa, Blok, and Wesselink 2020).

Such an innovation system is backed up by strong and stable institutions and several supporting national organizations such as the Netherlands Organization for Scientific Research (NWO). This national context sets the stage for solid socio-ethical and participatory principles embedded as requirements for funding projects by promoting, for instance, multi-stakeholder knowledge valorization panels as part of funded projects, and allocating funds for participatory and sustainability-oriented innovations, or designing calls for further development of RRI research and practice (Lukovics et al. 2017). This agenda, however, is directed mainly to technological innovation – along with commerce – which has been an important driver of the national economy. As a result, the most relevant actors are the private sector, including transnational corporations and SMEs that are the backbone of the economy.

These developments are often carried out in close collaboration with academic institutions and supported through funding of the public sector (through subsidies and, most often, competitive projects). In particular, Dutch companies and universities have been central players in the field of the bio-economy, which also links up with sustainability aspects such as the circular economy (e.g. Van Buren et al. 2016). Following a technology-focused approach, The Netherlands' innovation program strategy is based on ecological modernization principles; that is, the view that the economy may benefit from a shift towards environmental stewardship. In particular, the agricultural sector – including machinery and seeds – is a major source of economic development in the country, and sustainable agriculture is a major driver of technological innovation. As part of the European Union, the Netherlands has both influenced EU wide policy-making, and been affected by the European schemes, regulations and recommendations for research and innovation. In fact, the country is one of the main intellectual contributors to RRI (Timmermans 2017). As a result, the RRI framework has often been criticized for being mostly tailored after the Northwestern European socio-economic context – a

democratic political system with a strong market economy and a focus on technological and industrial innovation. This framework is more challenging to apply in Southern and Eastern Europe contexts (Buzás and Lukovics 2019). The country's RRI practice aligns with European frameworks, placing high value on inclusion, according to the democratic model. In addition, anticipation and reflection practices align with the precautionary principle embedded in European policy and previous programs for the inclusion of social, ethical and legal concerns in research and innovation (van der Molen et al. 2019). Integration of socio-ethical values into product design is translated into technical requirements, which is often mirrored in Europe Union-wide RRI policies.

While practices consistent with both RRI and open innovation have been more widespread (due to the early implementation of triple helix models and their alignment with the development of a competitive advantage), RRI uptake by the private sector remains limited. There is still a large gap in the application of RRI principles between the recipients of competitive funds – mainly academic institutions, or industry collaborating with academic institutions – and actual permeation of the practices among businesses. However, efforts to implement RRI practices may be observed in particular in the development of novel technologies such as technology assessment, anticipatory and precautionary standards, and ethical, social and legal risk assessment; (e.g. van Wezel et al. 2018).

Collaboration with academia and other enterprises to develop new technologies are frequent, whereby research institutions provide basic research that is developed into marketable products by business. Therefore, the driving force of the industrial research and innovation system in the country is responding to business opportunities grounded on social and environmental demands, particularly in domains like the bio-economy, agri-food and engineering, as illustrated by global powerhouses such as New Holland (agriculture), Unilever (food and other consumer products) and Phillips (home and medical appliances, lighting). Another example of such a model of research and innovation is the creation of consortia such as PEFerence, aimed at the development of bio-based, sustainable polymers. Led by the Dutch renewable chemical company Avantium, the consortium was formed by several European companies interested in the development (e.g. Avantium) and use (e.g. Lego) of sustainable, bio-based polymers. Funded by the European Horizon 2020 program (PEFerence 2017), the program covers the large-scale research necessary to develop marketable products, while fulfilling public interest for sustainable development and RRI practices.

In sum, RRI theory and practice in the Netherlands stands out as a North-centric perspective with a strong foundation supported by robust formal institutions and a clear techno-economic approach to research and innovation. Mainly implemented through top-down[3] policies, development of practices driven from the bottom-up, particularly in the private sector, is however in its infancy. This picture is in stark contrast with Malawi where RRI emerges as part of everyday life practices in informal contexts, described in the next section.

Malawi – Global South perspective

Malawi is located in Southern Africa, and is one of the poorest countries in the world. According to the OECD, Malawi is a least developed country and it epitomises most of the characteristics of a developing economy in the Global South. The country has

continually faced economic challenges and also has seen its innovation initiatives compromised by poor governance, corrupt political regimes and high illiteracy levels among its populace. Such pressures have posed major challenges for the country with respect to research and innovation. Poor governance and steering mechanisms have added to the challenge for research and innovation in Malawi; corruption at every level of government is rampant compared to many countries in the Global South. As can be seen from Table 1, Malawi scores low in the 'Control of corruption' ranking compared to the other two countries described in this paper.

The country has a small non-diversified economy based on agriculture, with fragile governance in both public and private sectors (World Bank 2020). This can be deduced from the very low output indicators and poor ranking in government effectiveness shown in Table 1. Cultural barriers, including those based on ethnic conflicts, inhibit the development of a collective innovation agenda. The country's relatively small pool of researchers reflects the absence of any explicit human resources policy for science and engineering. As such, there is low research and innovation productivity, which is resultant of a small Science, Engineering, Technology and Innovation (SETI) demand sector and an inadequate set of operational policy instruments to link the SETI demand and supply sides.

Malawi's context of limited institutional capacity and budgetary constraints is in sharp contrast with the Netherlands. It is characterized by an over-dependency on erratic donor support, demographic constraints, adverse effects of climate change, low participation of the business/enterprise sector in R&D and most importantly erratic energy supply and ICT connectivity. However, new opportunities are emerging from growing divergence in productivity, and governance reforms to advance research and innovation in the country. In the last ten years stable governments and smooth transitions have allowed for some continuity of the existing research and innovation environment despite the shortfalls that it faces. According to the recent GO-SPIN UNESCO report, Malawi is experiencing positive long-trends in human development and relatively high scientific productivity over time.

The country's rich biodiversity and natural resources are at the core of a promising research and innovation ecosystem. Although science, engineering, technology and information are still in its infancy, indigenous knowledge that evolved collectively in Malawian communities through generations in response to local environmental, political and economic challenges, could propel the country's research and innovation further (Gorjestani 2004; Moyo and Moyo 2017). It is promising to see that despite the present level of neglect, there is increased recognition of its potential. To that effect, there are policy instruments to protect indigenous knowledge and strides are being made to include communities and to tap into indigenous knowledge as a way forward.

Although RRI is conceptualized as a new idea, RRI-like practices in Malawi are not necessarily new phenomena. The central principles of RRI, including a commitment to the democratization of innovation, and deliberative forms of governance which then incorporate stakeholder and public engagement can be deciphered within the Malawian ecosystem. Instances of the emergence of interest in responsible innovation discourse in the sub-Saharan region and particularly Malawi are gaining ground. For example, Hartley et al. (2019) offer an analysis on the importance of RI in directing low technology innovation towards addressing global challenges in countries in Global South countries such as Malawi. In their analysis, they demonstrated that RI facilitates

a structured discussion and creates space for anticipation, reflection and engagement with stakeholders who are involved in low technology innovation in the countries.

Another take on the prevailing discourse regarding RRI-related initiatives is seen in efforts towards emerging Science, Technology and Innovation (STI) approaches in sub-Saharan Africa, including Malawi, which could support policy-making (Manyuchi and Mugabe 2018) and the attainment of the Sustainable Development Goals (SDGs). This is a direction that policy drive and public opinion in the country is heading towards. Of late, several initiatives are focusing on empowerment, governance, community engagement and sustainable innovation that are being implemented through local effort and with some support from the Global North (Nyirenda et al. 2018; Khalid et al. 2019). One example of these initiatives is BASEflow.

BASEflow, a digital innovation company founded in 2017 and part of the Climate Justice Water-Futures Program funded by the Scottish Government, illustrates this process. The organization aims to improve the sustainability of groundwater sources in rural Malawi through innovative water resourcing. The organization plays a strategic role for an ambitious mapping venture that will see every water point mapped across Malawi. Approximately a third of water points in the country are consistently non-functional therefore limiting access to safe water to approximately two-thirds of the population (BASEflow 2020). It is involved in the protection of catchment areas to revitalize the environment through understanding the drivers of deforestation and finding economic incentives to improve household incomes, create employment and sustain the environment. It also supports capacity building through a collective realization of the role it plays in promoting strong governance, which is crucial to providing quality water services. BASEflow, in conjunction with the government, has invested time and resources in building the capacity of stakeholders to do their jobs better, and to enforce service delivery standards and hold service providers accountable, where necessary. The organization is using science and technology to model and pilot alternative service models that are proactive, rather than reactive, and are informed by principles of demand and supply that are contextually appropriate. Lastly, it promotes social enterprise through leveraging business partnerships and, the participation of households in supporting access to clean drinking water, thereby providing an alternative income stream.

All in all, at the core of BASEflow's activities is the acknowledgement and realization of how to deal with responsible innovation issues within the Malawian ecosystem through community participation. Thus, BASEflow represents common practices that are illustrative of the Malawi-context and are evident in other social innovation initiatives across the country such as community involvement, knowledge sharing (including indigenous knowledge), social contribution, community empowerment and stakeholder involvement. These are at the helm of responsible innovation and development in Global South countries such as Malawi. These practices are common and very important because they support social innovation and development in contexts where there is a combination of weak regulations, lack of community awareness and information, and disenfranchisement of vulnerable individuals. Empowering communities enables them to share their knowledge and ultimately contribute to innovative efforts that are vital for their society. Hence, one distinctive feature of the RRI-like practices in the Global South is their community-based arrangement and bottom-up engagement of local communities to realize their benefits.

Although perspectives on the Netherlands and Malawi reveal a clear contrast in conceptualization and practice, they do not represent the full diversity of contexts, arrangements and practices of RRI. Many countries are characterized by a combination of features observed in both countries, which supports hybrid RRI arrangements. In the next section, the case of Brazil is used to illustrate this picture.

Brazil – hybrid perspective

Brazil is an emergent economy that combines features of both the Global North and the Global South. The country is among the world largest economies, has undergone an industrialization process during the mid-twentieth century, and occupies one of the highest positions in the number of patents registered in Latin America. High economic growth combined with progressive governments in the early 2000s created a window of opportunity for the implementation of a wide range of socially inclusive policies, research and innovation programs, and technology development initiatives. These features, which are more in line with the Netherlands, contrast with Brazil's global position as one of the world's most unequal countries, characterized by high levels of corruption and weak democratic institutions (Table 1). Similar to Malawi, Brazil has experienced high economic and political instability, illustrated by a steep drop in economic growth, presidential disruption as the result of a questionable impeachment process, and corruption scandals in the last decade (see e.g. Valarini and Pohlmann 2019).

This ambiguous position is reflected in the way research and innovation has been shaped over the last decades. R&I programs have been promoted by a solid S&T institutional apparatus based on national and state agencies. Some of them are in line with the RRI Northern perspective which guides research programs such as rigorous ethical procedures, support for open access publications, and promotion of partnerships between academic institutes and other societal actors. Formal programs, however, prioritize technology development while a wide range of research and innovations driven by marginalized societal actors have received less attention. They include small-scale technologies and social innovations addressing livelihood challenges based on grassroots solutions grounded on social capital and local knowledge, as observed in other Global South countries.

Innovations addressing sustainability are a case in point. The country houses one of the largest biodiversity hotspot in the world where traditional populations have lived for generations (Balee 2015). Territorial attachment and natural resource-based livelihoods have enabled the development of numerous sustainable production initiatives that have been overlooked in the RRI debates. At the same time, technological innovations for large-scale extractive industries have been targeted in innovation research. However, development of seed biotechnology, agro-energy, and water-based energy has involved low levels of citizens' participation, anticipation and reflexivity and high levels of social and environmental impacts with local and global consequences (Pereira et al. 2020). In contrast, engagement of local communities in innovation with NGOs, social scientists and private businesses has been vital for the development of innovations that address different societal challenges (Cipolla and Moura 2011). These RRI-like initiatives include institutional and social innovations such as community microcredit and startup grants to small-scale technologies as

well as sustainable production practices such as seed banks, agroforestry systems, and community-based practices undertaken by marginalized populations. This process has been supported by a range of social policies that promote civil engagement such as formal recognition of cultural rights, participatory procedures, and ethical guidelines.

Collective action and partnerships are key driving factors of this process. Activist researchers, practitioners, and socially engaged industries partake in innovations addressing societal needs through local empowerment and co-production of knowledge and sustainable supply chains. NATURA, which ranks as one of the largest cosmetic enterprises of Latin America, illustrates this process. The company contrasts with most competitors by having broader guidelines – Sustainability Vision Plan – addressing several RRI principles. According to the company's research director, this Plan is meant to replace conventional sector-based corporate social responsibility (CSR) principles by a value-based, transversal model for responsible research and innovation. NATURA pursues close collaborative research with local communities, farmers' cooperatives and other grassroots organizations to replace raw material from conventional large-scale monocrop systems by agroecological and agroforestry systems. Based on transdisciplinarity and active participation, the company and local farmers share equal positions in the design and experimentation of different farming models (Castro and Futemma under review). Engagement of non-profit organizations in innovation with local communities is also commonplace in Brazil. World Transforming Technology (WTT), founded in 2012, supports impact-oriented innovators addressing social and environmental challenges to bring their solutions to market.[4] Entrepreneurial researchers and marginalized communities are brought together to co-produce sustainable – and livelihood-oriented innovations. WWT supports startups to overcome the 'innovation valley of death' by bringing private investors to socially relevant technologies during the initial phase of the product development when market access is still limited.

RRI practice in Brazil illustrates the co-existence of high-tech, export-oriented, large-scale, private-based innovations in line with North-centric perspectives, and low technology, livelihood-oriented, small-scale, collective-based innovations in line with Global South perspectives. This hybrid arrangement raises questions regarding the contrast between RRI as top-down procedures and as bottom-up practices in the Global North and Global South. In addition, it also reveals how both perspectives may co-occur but are treated differently at the policy level. The procedural perspective to RRI conceptualized by the Global North emphasizes guidelines for industrial, large-scale, technology innovations and are framed as pathways to address national and global societal challenges. Although this top-down North-centric perspective can influence industries to revise their practices, it does not address the potential of RRI-like practices emerging on the ground and undertaken by marginalized actors to address local and regional challenges. The relevance of innovations based on social arrangements are not limited to the Global South. Therefore, a more encompassing conceptualization of RRI can help countries focusing on technology innovation to combine social innovations in their development path.

Discussion

The short descriptions addressing RRI in the Netherlands, Malawi and Brazil reveal two contrasting RRI perspectives: capital-oriented and livelihood-oriented (Table 3).

Capital-oriented

Capital-oriented RRI is characterized by a procedural, formal, top-down strategy driven by private investments and public funding to generate technological innovations and scientific knowledge. It tends to address national and global, urban challenges and is typically based on the promotion of multi-stakeholder spaces that often include policy-makers, academia and industry. There is also a drive to include civil society which is often seen to be representative of the general public. There is also less emphasis on rural, grassroot considerations, perhaps because there is a drive for civil society inclusion instead. However, civil society is broad and can include specific interest groups who may not always be representative of the general public or less privileged community groups. Rainey, Wakunuma, and Stahl (2017) argue that there is a lack of clarity and coherent focus on what civil society organizations (CSOs) actually are. As a result, this may render CSO inclusion in research and innovation ineffective. Therefore, rather than being inclusive, RRI in this respect may actually exclude certain sections of society. This may also be seen in terms of who the drivers are of the RRI practices, narratives and discourse. For the most part, RRI in the Global North is driven by policy-makers who are generally funders of RRI processes. This sort of drive may not always have buy-in from certain quarters of the population particularly when RRI funding is competitive and calls for particular research and innovation expertise which may not always be readily available or accessible to the general public.

Livelihood-Oriented

Livelihood-Oriented RRI is normally context-based, informal and encompasses bottom-up strategies driven by non-profit and grassroots organizations and, in some cases, inclusive policies, to co-create social innovations and transdisciplinary knowledge. This type of RRI addresses more localized rural-oriented challenges and is shaped by (often marginalized) citizens' collectives such as communities, associations and

Table 3. Potential differentiating dimensions for innovation in the Global South.

Contextual dimension of Responsible Innovation	Features associated with Global North	Features associated with Global South
Main drivers	Capital	Livelihood/subsistence-driven
Primary locus of innovation	Multi-national corporations / higher education institutes	Community / social innovation
Top-down vs. bottom-up policy	Typically top-down frameworks	Greater emphasis on bottom-up initiatives
Public vs. private enterprise	Public funding often important at early-stage innovation	Less visible role for public funding
Rural vs. non-rural orientation	Less emphasis on rural	More emphasis on Rural
Responsible innovation-related practices	Emphasis on formal engagement and deliberative practices	Less formal
Focal aspects for responsible innovation	May be well defined e.g. EU RRI keys, US STI agenda	Country-dependent
Knowledge generation	Typically science oriented, top down and formal	More visible role for indigenous and other forms of knowledge
Types of organisation	Private organisations and higher education institutions	Increased emphasis on social enterprise, community organisation and SMEs
Decision-makers vs Civil Society Organisations/NGOs push	Decision-makers	Civil Society Organisations/NGOs
Policy Drivers	Government policy	Government policy vacuum (however may be driven by political interest when appropriate)

cooperatives in which external actors are invited to collaborate in order to achieve sustainability in RRI. The informal nature of this type of RRI or RRI-like practices mean that there are more opportunities for community organizations and small and medium enterprises (SMEs)/CSOs to tailor the RRI agenda to specific community needs. The policy vacuum in RRI-led practices also means that there is little dependency on government policy guidance on how to shape the narrative and discourse of RRI which may not always be appropriate should it come top-down.

The case for a conceptual integration of the two extremes

The above RRI concepts (capital-oriented and livelihood-oriented) clearly demonstrate differences, particularly in terms of scale, societal challenges and governance arrangements. This divide between RRI perspectives calls not only for more attention to the diversity of RRI practices observed in the Global North and Global South, but also for hybrid forms of RRI that can emerge, which is observed in Brazil as it embraces elements of both capital-oriented and livelihood-oriented RRI perspectives. For the case of Brazil, its embrace of a hybrid type of RRI is unsurprising. As a BRICS country, this position appears to be appropriate; on the one hand, it enjoys high economic growth, while on the other it includes large regions that experience underdevelopment and inequalities in its communities.

As such, the RRI debate in its current form appears to overlook the realities of countries like Brazil and Malawi that have stark inequality differences between regions and which as a result experience unequal distribution of development. Such inequality results in massive underdevelopment in mostly rural areas compared to more affluent urban areas. Thus, the differences in development mean that the aspect of inclusion and engagement for instance, as espoused by a North-centric RRI perspective, may not be present, or may be characterized by exploitative power dynamics. Whereas the principles of RRI in its current form can in some senses (such as the encouragement of anticipatory activity and 'engagement') imply a top-down, triple helix approach that calls for the inclusion of stakeholders such as policy-makers, industry and academia and to a lesser extent attempts to engage CSOs/ NGOs in RRI, the Global South approach to RRI is more local and community driven with CSOs/NGOs playing a bigger role than policy-makers and academia.

The minimal presence of stakeholders like policy-makers and academia in RRI in the Global South is unsurprising due to the weak institutions and lack of political will to put in place stringent policies on RRI which in turn could create an impact on RRI in academia. Further, the lack of adequate public funding in research institutions in the Global South means that there is very limited leeway to drive more stringent North-centric RRI characteristics such as ethics in technology driven RRI. Nevertheless, countries like Brazil occupy an intermediary position in this regard as state funding programs for research and innovation are well established, and socially-conscious researchers have been actively engaged in citizen-driven research. In particular, over the last two decades public universities have implemented special extension programs in which researchers are entitled to use part of their contractual time to meet demands of research and services from local communities. This case provides a very different approach to social-ethical concerns put forward in The Netherlands, where, while citizens are

involved in a consultative manner in research projects, research agendas for publicly funded projects – and the socio-ethical concerns to be considered or tackled – are defined mostly by the research funding institutions or the researchers.

Instead of addressing societal demands from marginalized citizens, universities and industries are required to adhere to formal ethical procedures, while little attention is given to promoting the provision of (academic) services to local communities. European research councils, for example, play a significant role in ensuring that responsibility in RRI processes is realized through the stringent ethical demands that are pushed for any funding to be approved. Such structures are supported by strong democratic institutions which allow for the formulation of stringent and robust RRI policies that are binding and that speak to countries' democratic values. This is at odds with countries like Malawi where publicly funded research bodies and policies around effecting socio-ethics consideration in technology-driven RRI are minimal or absent. Further, the fact that Malawi relies on international donor support has meant that its interests have been less on pursuing socio-ethical considerations of RRI and more on survival and eking out a livelihood for its populace. As Kamwendo (2006) discusses, frequent food shortages, corruption, lack of fiscal discipline as well as the withdrawal of donor support in the early 2000s, left Malawi with a fragile economy which has had a negative impact on academic freedoms including academic funding opportunities.

Brazil follows some of the features of the Northern countries with regard to socio-ethical considerations, where ethics committees and formal procedures have been gradually implemented over the last two decades for a range of aspects of research and innovation (Novaes, Guilhem, and Lolas 2009). At the same time, the country follows Malawi with regard to weak democratic institutions. Recent political changes in Brazil, for example, have led to the dismantlement of RRI-related programs and policies such as sustainability (see e.g. Fernandes et al. 2017).

Our results show that limited governmental support to marginalized communities and vast swathes of underdeveloped regions does not prevent the development of RRI practices, but good government support is arguably beneficial. Countries like Brazil and Malawi are cradles of bottom-up local community initiatives especially in rural areas. Such an RRI approach often includes CSOs/NGOs who step in where policy-makers have failed. For instance, Mercer and Green (2013) point out that CSOs are often involved in pro-poor policies to assist with development and to hold governments to account. Such activities see CSOs bridging the gap between under-developed communities and policymakers, thereby allowing the engendering of trust and legitimization of RRI processes where there has been little to no governmental support. Scholz (2005) highlights the important role that NGOs have played in sustainable and bottom-up development strategies in the Brazilian Amazon. NGOs in Brazil have also emerged among corporations to address responsible business challenges. One notable example is the Ethos Institute which has successfully convened over 1000 members of business organizations to discuss new models of corporate responsibility in the national context, including issues related to reform of the state, corruption, environmental sustainability and urban challenges. According to Raufflet (2008), 'open-endedness makes Ethos resemble a social movement, more than a typical business-related organisation' (105).

In cases like the Ethos Institute, local community initiatives become more amenable to working with private sector organizations that allow and value the inclusion of local community initiatives which in turn allows for a more localized and robust sustainable and equitable approach. Consideration of indigenous knowledge allows greater cultivation of the understanding of the peculiarities of local communities that facilitates the flourishing of these alliances. In some cases, they have become widespread and politically strong enough to influence policy. The innovative Food Acquisition Program implemented by the Brazilian government in the early 2000s, for instance, has provided market access to local farmers to become suppliers of agroecological products to a range of public establishments such as schools and hospitals all over the country (Nehring and McKay 2013). Among several societal challenges, this program addressed job opportunity, food and health security, sustainable production, social inclusion, and empowerment of marginalized actors. Although in line with North-centric RRI principles of engagement and inclusion, RRI-like initiatives observed in the Global South emerge from engagement demands from marginalized groups.

The RRI concept in its current form as seen in The Netherlands case is immersed in liberal values which are driven by strong democratic processes. Although there is concern about the social good, liberal values and democratic principles foster RRI practices that work within the context of individualism, which are concerned with individual freedoms such as privacy, anonymity, and autonomy. These are in stark contrast to countries in the Global South where highly unequal societies, asymmetric power relations, and strong social and community ties are commonplace. As a result, efforts from the Global North to seek the realization of the social good in RRI take forms that are not in line with the Global South context. At the same time, hybrid forms of RRI – as observed in Brazil – shed light on the dynamic process of continuous reshaping and re-scaling processes of RRI practices. National policies and programs are aligned with North-centric perspectives while a range of local initiatives emerge to address livelihood-oriented demands. With this, the naivete of the expectation that RRI can be defined by pre-established 'keys' and 'domains' and applied worldwide, becomes apparent. While a North-centric RRI approach appears to favor a broader based approach to RRI, a Global South based approach – as evidenced in the cases of Brazil and Malawi – appears to be more focused and narrow in its community and localized approach, favoring co-production with respect consideration of indigenous knowledge in development processes of RRI.

We can summarize the case study differences as tentative axes for differentiation of innovation contexts that are more sensitive to local variation in Table 3.

These necessarily involve very broad comparisons. Distillation of the case examples and dimensions illustrated in Table 3 based on the preceding discussion, provides the basis for understanding an RRI framework that describes and explains differences in responsible innovation contexts as illustrated below in Figure 2.

Due to the different and varied concepts of RRI, it is unsurprising that in different world regions beyond that of Europe, its definition, conceptualization, application and understanding will be varied and as such will therefore call for a better understanding of RRI which ought to be inclusive at a conceptual and practical level and not be seen as a top-down one size fits all approach based on North-centric concepts. To the

extent to which RRI focusses on industrial technological innovation and assumes that research and innovation are rational and encompasses apolitical processes, it risks to be seen as a Global North-centric concept. While RRI may take place in the Global South – under different terms and in different contexts – lack of sociological or political scientific perspectives in the RRI debate to engage the Global South mean that such practices may remain unrecognizable and even viewed as insignificant. As demonstrated in Table 3, various aspects in which differences occur are evident. Specifically, we note that the normative content of RRI should not be prescribed when looked at from a Global South perspective. While RRI in the Global North seems to be bound to specific keys and domains for it to be considered acceptable and therefore functional, the same cannot be said of the Global South when one looks at countries like Brazil and Malawi. With countries like Brazil and Malawi, factors such as levels of development and policy concerns imply different normative priorities. In this respect, Brazil, for instance which inhabits an intermediary position in its development, appears to operate in what can be considered a hybrid RRI context where certain aspects of North-centric RRI related to capitalism may be valid while local community co-production of RRI processes driven by local indigenous knowledge and the support of CSOs/NGOs constitute a different, but equally valid process of aligning innovation to societal expectations. Malawi, on the other hand, which is still a developing country and inhabits a space that is dependent on CSO/NGO support and international donor support, exhibits a manifestation of RRI that appears to be entirely driven by local community support and CSOs interested in advancing the development of the country, as policy makers make little concerted effort to develop socio-ethical policies within which RRI can flourish. This spectrum of the conceptualization of RRI is missing in the current RRI debate and should be included in it.

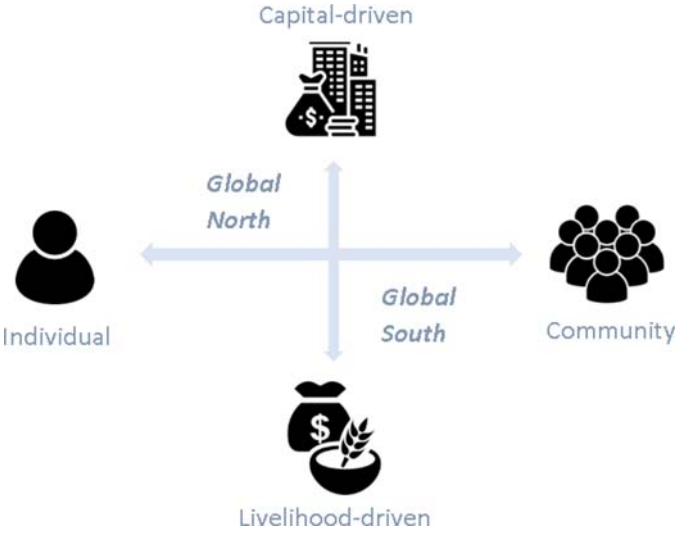

Figure 2. Contextualisation of global North-South differences in innovation emphasis.

Conclusion

This paper has explored avenues within which RRI could be considered from different global perspectives. There are clearly marked differences in terms of how RRI can be considered between the Global North and the Global South and as such its conceptualization deserves a new analytical lens. This new analytical lens has helped us to answer our research question 'How can RRI be re-conceptualized to be inclusive of both the Global South and Global North?'. Our answer lies in our analysis which shows that if RRI is to be viewed as truly global it should be seen as a continuum from techno-economic characteristics steeped in procedural and formal strategies, to more informal RRI informed by local community bottom-up strategies. In the middle of this spectrum is an RRI that encompasses both characteristics. These differences are pertinent in how we move forward into the future when we look at RRI, especially if we want and expect RRI to be truly global. As such, a lot can be shared and learnt from a binocular, Global North and Global South perspective on the discourse of RRI. As we have seen, the orientation of the Global South is less techno-economic and more community oriented and embraces a bottom-up grassroots community-based RRI knowledge co-production to foster a truly inclusive understanding of RRI which is one that should be welcome. Similarly, the Global North capital orientation of RRI, based on strong democratic principles and strong social and ethical values is one that can also be advantageous to the Global South. Mutual learning across regional and sector boundaries appears to be key to an open, fluid, internationally inclusive RRI approach that can be adapted to global contexts and towards an integrated conceptual framework of RRI moving forward into the future. Findings from the RRING project (2018) indicate that this mutual learning can occur through:

i bringing responsibility to the world through promotion of mutual learning and collaboration in RRI;
ii the creation of a global community which will see the development and mobilisation of a global open access RRI knowledge base and
iii the alignment of research and innovation to the United Nations Sustainable Development Goals.

Therefore, as we move forward into the future, consideration of the role of informal localized community RRI-like based practices developed through co-production and co-creation of grassroots knowledge needs to be part of the vocabulary of RRI and its practitioners. Further, the distinction between conceptions focused on technology-oriented, scientific based versus. social-oriented, informal knowledge based deserves further debate and clarification, as it can be a useful way to highlight limitations of current RRI frameworks and demonstrate that a whole universe of practices outside of this framework are left out completely or are silenced, in particular those reflecting non-European or non-Northern realities and practices. These considerations should set the agenda for the development of a globally inclusive RRI discourse.

Notes

1. In this paper Global North refers to countries with a developed economy (e.g. The Netherlands) and Global South denotes countries with a developing economy e.g. Malawi and

countries with an emerging economy e.g. Brazil. This is with reference on the Organisation for Economic Cooperation and Development statistical definition (OECD 2006).
2. While a distinction can be made between a policy-driven, top-down concept of Responsible Research and Innovation and a broader Responsible Innovation narrative, both terms emerged in parallel and share common features (Owen and Pansera 2019) and will be used interchangeably in this paper.
3. In this paper, we use the term top-down within a policy context. For instance, the six RRI keys are a top-down approach which were designed and developed within a policy context.
4. https://wttventures.net/en/home/.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This work was supported by European Commission [grant number 788503].

Notes on contributors

Dr ***Kutoma Wakunuma*** is Associate Professor Research and Teaching in Information Systems at De Montfort University while she works within the Centre for Computing and Social Responsibility. Her research interests are in understanding the social and ethical implications of ICTs and the role that emerging technologies play in both the developed and developing world. In particular, her research work has focussed on RRI, ethics, ICT for development and gender – areas she has published widely in. In addition to projects funded by other agencies, she has also been involved in several EU funded projects focussed on emerging technologies, ethics and RRI. She is also Programme Leader for MSc Computing and Deputy Subject Group Leader for the IS group within the School of Computing Engineering and Media. Her teaching involves the area of ICT for Development, Computing Ethics as well as RRI in ICT. She also supervisors a number of PhD students.

Dr ***Fabio de Castro*** is Senior Lecturer at the Centre for Latin American Research and Documentation at the Department of Humanities of the University of Amsterdam. He is a political ecologist specialized in Environmental Governance in Latin America. His research interests include sustainability and development in Brazil and has published extensively on sustainable production, rural development, environmental justice, community-based management, and social innovation.

Dr ***Tilimbe Jiya*** is a Programme Leader for Project Management BSc (Hons) Top-up and a lecturer in Project Management in the Faculty of Business and Law at the University of Northampton. He is also a member of the Centre for Sustainable Business Practices (CSBP) at the University. Before joining the University of Northampton, Tilimbe worked at De Montfort University as a Research Fellow where he was highly involved in several international EU funded projects. He has facilitated several workshops across Europe and presented at national and international conferences. Tilimbe's research interests are in the areas of project management, responsible research and innovation, information systems, and sustainable development.

Dr ***Edurne A. Inigo*** is an Assistant Professor at Deusto Business School, San Sebastian, Spain. She was a postdoctoral researcher at Wageningen University, where she conducted research leading to this manuscript focusing on responsible innovation in business. Her research focuses on the relationship between responsibility, ethics and sustainability in innovation, with a particular emphasis on the design of transitions towards sustainable systems. She has published in *Technological Forecasting and Social Change*, *Industrial Marketing Management* and *Journal of Cleaner*

Production, among others. Before joining academia, she worked as a consultant for governance, business and legal aspects related to sustainability for the public and private sectors.

Dr ***Vincent Blok*** is Associate Professor in Philosophy and Ethics of Technology and Innovation at the Philosophy Group, Wageningen University (The Netherlands). In 2005 he received his PhD degree in philosophy at Leiden University with a specialization in philosophy of technology. Blok's research group is specialized in Business Ethics, Philosophy of Technology and Responsible Innovation. Together with six PhD candidates and four Post-docs, he is involved in several (European) research projects. His books include *Ernst Jünger's Philosophy of Technology. Heidegger and the Poetics of the Anthropocene* (Routledge, 2017) and *Heidegger's Concept of philosophical Method* (Routledge, 2020). Blok published over hundred articles in high ranked philosophy journals like *Environmental Values, Business Ethics Quarterly, Synthese* and *Philosophy & Technology,* and in multi-disciplinary journals like *Journal of Cleaner Production, Public understanding of Science* and *Journal of Responsible Innovation*. See www.vincentblok.nl for more information about his current research.

Vincent Bryce is a PRINCE2 and MSP certified HR project manager and chartered member of the Institute for Personnel and Development with fifteen years experience in equality and diversity management, strategy and policy development, HR systems administration and analytics. He is a mature PhD candidate at the Horizon Centre for Doctoral Training in the School of Computer Science, University of Nottingham and a member of the De Montfort University Centre for Computing and Social Responsibility. Vincent's research interests are in the areas of responsible research and innovation in industry, information systems, and human resource management.

ORCID

Kutoma Wakunuma http://orcid.org/0000-0002-8236-3221
Fabio de Castro http://orcid.org/0000-0001-5197-3863
Tilimbe Jiya http://orcid.org/0000-0003-2314-7737
Vincent Blok http://orcid.org/0000-0002-9086-4544
Vincent Bryce http://orcid.org/0000-0002-7428-7118

References

Alkraiji, A., T. Jackson, and I. Murray. 2013. "Barriers to the Widespread Adoption of Health Data Standards: An Exploratory Qualitative Study in Tertiary Healthcare Organizations in Saudi Arabia." *Journal of Medical Systems* 37 (2): 9895. doi:10.1007/s10916-012-9895-2.

Balee, W. 2015. *Cultural Forests of the Amazon: A Historical Ecology of People and their Landscapes*. Tuscaloosa, USA: The University of Alabama Press.

BASEflow. 2020. *BASEflow*. Accessed January 4, 2021. https://www.baseflowmw.com.

Bessant, J. 2013. "Innovation in the Twenty-First Century." In *Responsible Innovation: Managing the Responsible Emergence of Science and Innovation in Society*, edited by R. Owen, J. Bessant, and M. Heintz. Chichester: John Wiley.

Blok, V., and P. Lemmens. 2015. "The Emerging Concept of Responsible Innovation. Three Reasons Why it is Questionable and Calls for a Radical Transformation of the Concept of Innovation." 19–35. doi:10.1007/978-3-319-17308-5_2.

Buzás, N., and M. Lukovics. 2019. "South-East European Perspectives." In *International Handbook on Responsible Innovation*. https://www.elgaronline.com/view/edcoll/9781784718855/9781784718855.00042.xml.

Carayannis, Elias G., and David F.J. Campbell. 2009. "'Mode 3' and 'Quadruple Helix': Toward a 21st Century Fractal Innovation Ecosystem." *International Journal of Technology Management* 46 (3/4): 201. doi:10.1504/IJTM.2009.023374.

Chatfield, K., K. Iatridis, B. Stahl, and N. Paspallis. 2017. “Innovating Responsibly in ICT for Ageing: Drivers, Obstacles and Implementation.” *Sustainability* 9 (6): 971. doi:10.3390/su9060971.

Cipolla, C., and H. Moura. 2011. “Social Innovation in Brazil Through Design Strategy.” *Design Management Journal* 6 (1): 40–51.

de Hoop, E., A. Pols, and H. Romijn. 2016. “Limits to Responsible Innovation.” *Journal of Responsible Innovation*, doi:10.1080/23299460.2016.1231396.

Doezema, T., D. Ludwig, P. Macnaghten, C. Shelley-Egan, and E.-M. Forsberg. 2019. “Translation, Transduction, and Transformation: Expanding Practices of Responsibility Across Borders.” *Journal of Responsible Innovation* 6 (3): 323–331. doi:10.1080/23299460.2019.1653155.

Dreyer, M., L. Chefneux, A. Goldberg, J. Von Heimburg, N. Patrignani, M. Schofield, C. Shilling. 2017. "Responsible Innovation: A Complementary View from Industry with Proposals for Bridging Different Perspectives." *Sustainability* 9 (10): 1719. doi:10.3390/su9101719.

Fernandes, G. W., M. M. Vale, G. E. Overbeck, M. M. C. Bustamante, C. E. V. Grelle, H. Godoy Bergallo, W. E. Magnusson, et al. 2017. “Dismantling Brazil’s Science Threatens Global Biodiversity Heritage.” *Perspective in Ecology and Conservation* 15 (3): 239–243. https://www.sciencedirect.com/science/article/pii/S2530064417300809.

Gao, L., M. Liao, and Y. Zhao. 2019. "Exploring Complexity, Variety and the Necessity of RRI in a Developing Country: The Case of China." *Journal of Responsible Innovation* 6 (3): 368–374. doi:10.1080/23299460.2019.1603572.

Gorjestani, N. 2004. “Indigenous Knowledge: the way Forward.” In *Indigenous Knowledge: Local Pathways to Global Development – Marketing Five Years of the World Bank Indigenous Knowledge for Development Program*, edited by R. Woytek, P. Shroff-Mehta, and P. C. Mohan, 45–55. Washington, DC: Knowledge and Learning Group, Africa Region, and World Bank, IK Notes.

Hahn, J. and M. Ladikas. 2014. “Responsible Research and Innovation: a Global Perspective.” *Enterprise and Work Innovation Studies* 10, IET: 9–27.

Hartley, S., C. McLeod, M. Clifford, S. Jewitt, and C. Ray. 2019. “A Retrospective Analysis of Responsible Innovation for low-Technology Innovation in the Global South.” *Journal of Responsible Innovation* 6 (2): 143–162. doi:10.1080/23299460.2019.1575682.

Jauhiainen, J. S., and L. Hooli. 2017. “Indigenous Knowledge and Developing Countries’ Innovation Systems: The Case of Namibia.” *International Journal of Innovation Studies* 1 (1): 89–106. doi:10.3724/SP.J.1440.101007.

Kamwendo, G. H. 2006. “Sociolinguistic Research and Academic Freedom in Malawi: Past and Current Trends.” *Southern African Review Education* 12 (1): 5–16. http://hdl.handle.net/10311/1106.

Khalid, S., M. S. Ahmad, T. Ramayah, J. Hwang, and I. Kim. 2019. “Community Empowerment and Sustainable Tourism Development: The Mediating Role of Community Support for Tourism.” *Sustainability* 11 (22): 1–14. doi:10.3390/su11226248.

Khumalo, N. B., and C. Baloyi. 2017. "African Indigenous Knowledge: An Underutilised and Neglected Resource for Development." *Library Philosophy and Practice (e-journal)*. 1663. https://digitalcommons.unl.edu/libphilprac/1663

Lubberink, Rob, Vincent Blok, Johan van Ophem, and Onno Omta. 2017. “Lessons for Responsible Innovation in the Business Context: A Systematic Literature Review of Responsible, Social and Sustainable Innovation Practices.” *Sustainability (Switzerland)* 9 (5), doi:10.3390/su9050721.

Lukovics, M., S. M. Flipse, B. Udvari, and E. Fisher. 2017. “Responsible Research and Innovation in Contrasting Innovation Environments: Socio-Technical Integration Research in Hungary and the Netherlands.” *Technology in Society* 51: 172–182. doi:10.1016/j.techsoc.2017.09.003.

Macnaghten, P., R. Owen, J. Stilgoe, B. Wynne, A. Azevedo, A. de Campos, J. Chilvers, et al. 2014. “Responsible Innovation Across Borders: Tensions, Paradoxes and Possibilities.” *Journal of Responsible Innovation* 1 (2): 191–199. doi:10.1080/23299460.2014.922249.

Macnaghten, P. 2020. *The Making of Responsible Innovation (Elements in Earth System Governance)*. Cambridge: Cambridge University Press. doi:10.1017/9781108871044.

Manyuchi, A. E., and J. O. Mugabe. 2018. "The Production and use of Indicators in Science, Technology and Innovation Policy-Making in Africa: Lessons from Malawi and South Africa." *Journal of Science and Technology Policy Management* 9 (1): 21–41. doi:10.1108/JSTPM-06-2017-0026.

Mejlgaard, N., C. Bloch, and E. B. Madsen. 2019. "Responsible Research and Innovation in Europe: A Cross-Country Comparative Analysis." *Science and Public Policy*, doi:10.1093/scipol/scy048.

Mercer, C., and M. Green. 2013. "Making Civil Society Work: Contracting, Cosmopolitanism and Community Development in Tanzania." *Geoforum; Journal of Physical, Human, and Regional Geosciences* 45: 106–115. doi:10.1016/j.geoforum.2012.10.008.

Moulaert, F., D. MacCallum, A. Mehmood, and A. Hamdouch. eds. 2014. *The International Handbook on Social Innovation: Collective Action, Social Learning and Transdisciplinary Research*. Cheltenham, UK: Edward Elgar.

van der Molen, F., D. Ludwig, L. Consoli, and H. Zwart. 2019. "Global Challenges, Dutch Solutions? The Shape of Responsibility in Dutch Science and Technology Policies." *Journal of Responsible Innovation* 6 (3): 340–345. doi:10.1080/23299460.2019.1603569.

Moyo, B. H. Z., and D. Z. Moyo. 2017. "Indigenous Knowledge Perceptions and Development Practice in Northern Malawi: Lessons from Small-Scale Farmers' Agricultural Practices." In *Handbook of Research on Social, Cultural, and Educational Considerations of Indigenous Knowledge in Developing Countries*, 280–302. IGI Global. doi:10.1111/geoj.12056.

Nehring, R., and B. McKay. 2013. "Scaling up Local Development Initiatives: Brazil's Food Acquisition Programme." International Policy Centre for Inclusive Growth, United Nations Development Programme, Brisilia, DF.

Novaes, M. R. G., D. Guilhem, and F. Lolas. 2009. "Ethical Conduct in Research Involving Human Beings In Brazil: Diagnosis of Research Ethics Committee." *Arq Med* 23 (4): 145–150.

Nyirenda, D., K. Gooding, R. Sambakunsi, L. Seyama, J. Mfutso-Bengo, L. Manda Taylor, S. B. Gordon, M. Parker. 2018. "Strengthening Ethical Community Engagement in Contemporary Malawi [Version 2; Peer Review: 3 Approved]." *Wellcome Open Research* 3: 115. doi:10.12688/wellcomeopenres.14793.2.

OECD. 2006. Glossary of Statistical Terms: Developed, Developing Countries (2006). Accessed March 15, 2021. https://stats.oecd.org/glossary/detail.asp?ID=6326.

OECD. 2020. How's Life? 2020: Measuring Well-Being. Accessed January 4, 2021. https://read.oecd.org/10.1787/9870c393-en?format=pdf.

Owen, R., and M. Pansera. 2019. "Responsible Innovation and Responsible Research and Innovation." In *Handbook on Science and Public Policy*, 26–48. Cheltenham/Northampton: Edward Elgar.

Pandey, P., G. Valkenburg, A. Mamidipudi, and W. Bijker. 2020. "Responsible Research and Innovation in the Global South: Agriculture, Renewable Energy and the Pursuit of Symmetry." *Science, Technology and Society* 25 (2): 215–222. doi:10.1177/0971721820902961.

PEFerence. 2017. The Project. *PEFerence*. https://peference.eu/the-project/.

Pereira, E. J. A. L., L. C. S. Ribeiro, L. F. S. Freitas, and H. B. B. Pereira. 2020. "Brazilian Policy and Agribusiness Damage the Amazon Rainforest." *Land Use Policy* 92, doi:10.1016/j.landusepol.2020.104491.

Popa, E. O., V. Blok, and R. Wesselink. 2020. "A Processual Approach to Friction in Quadruple Helix Collaborations." *Science and Public Policy*, scaa054. doi:10.1093/scipol/scaa054.

Rainey, S., K. Wakunuma, and B. Stahl. 2017. "Civil Society Organisations in Research: A Literature-Based Typology." *VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations* 28: 1988–2010. doi:10.1007/s11266-016-9816-y.

Raufflet, E. 2008. "Creating the Context for Corporate Responsibility: The Experience of Instituto Ethos, Brazil." *The Journal of Corporate Citizenship* 2008: 95–106. Accessed January 10, 2021. http://www.jstor.org/stable/jcorpciti.30.95.

Reyes-Galindo, Luis, Marko Monteiro, and Phil Macnaghten. 2019. "'Opening up' Science Policy: Engaging with RRI in Brazil." *Journal of Responsible Innovation* 6 (3): 353–360. doi:10.1080/23299460.2019.1603568.

Ribeiro, B. E., R. D. J. Smith, and K. Millar. 2017. "A Mobilising Concept? Unpacking Academic Representations of Responsible Research and Innovation." *Science and Engineering Ethics*, doi:10.1007/s11948-016-9761-6.

Rip, A. 2016. "The Clothes of the Emperor. An Essay on RRI in and Around Brussels." *Journal of Responsible Innovation* 3 (3): 290–304. doi:10.1080/23299460.2016.1255701.

RRING Project. 2018. *Responsible Research and Innovation Networking Globally (RRING) project summary*. http://www.rring.eu/summary/.

Scholz, I. 2005. "Environmental Policy Cooperation among Organised Civil Society, National Public Actors and International Actors in the Brazilian Amazon." *The European Journal of Development Research* 17 (4): 681–705. doi:10.1080/09578810500367466.

Schönherr, N., A. Martinuzzi, and K. Jarmai. 2020. "Towards a Business Case for Responsible Innovation." In *Responsible Innovation*, edited by K. Jarmai, 85–97. Springer Netherlands. doi:10.1007/978-94-024-1720-3_7.

Schroeder, D., and R. Kaplan. 2019. "Responsible Inclusive Innovation: Tackling Grand Challenges Globally." In *International Handbook on Responsible Innovation*, edited by R. von Schomberg, and J. Hankins, 308–324. Edward Elgar Publishing. doi:10.4337/9781784718862.00029.

Timmermans, J. 2017. "Mapping the RRI Landscape: An Overview of Organisations, Projects, Persons, Areas and Topics." In *Responsible Innovation 3*, 21–47. Cham: Springer. doi:10.1007/978-3-319-64834-7_3.

Torri, M.-C., and J. Laplante. 2009. "Enhancing Innovation Between Scientific and Indigenous Knowledge: Pioneer NGOs in India." *Journal of Ethnobiology and Ethnomedicine* 5 (1): 29. doi:10.1186/1746-4269-5-29.

Valarini, E., and M. Pohlmann. 2019. "Organizational Crime and Corruption in Brazil: a Case Study of the "Operation Carwash" Court Records." *Crime and Justice* 59, doi:10.1016/j.ijlcj.2019.100340.

Valkenburg, G., A. Mamidipudi, P. Pandey, and W. E. Bijker. 2019. "Responsible Innovation as Empowering Ways of Knowing." *Journal of Responsible Innovation* 7 (1): 6–25. doi:10.1080/23299460.2019.1647087.

Vasen F. 2017. "Responsible Innovation in Developing Countries: An Enlarged Agenda." In *Responsible Innovation 3*, edited by L. Asveld, R. van Dam-Mieras, T. Swierstra, S. Lavrijssen, K. Linse, J. van den Hoven. Cham: Springer. doi:10.1007/978-3-319-64834-7_6.

Van Buren, N., M. Demmers, R. Van der Heijden, and F. Witlox. 2016. "Towards a Circular Economy: The Role of Dutch Logistics Industries and Governments." *Sustainability* 8 (7): 647. doi:10.3390/su8070647.

Walsham, G. 1995. "Interpretive Case Studies in IS Research: Nature and Method." *European Journal of Information Systems* 4 (2): 74–81. doi:10.1057/ejis.1995.9.

van der Have R. P., and L. Luis Rubalcaba. 2016. "Social innovation research: An emerging area of innovation studies?" *Research Policy* 45 (9): 1923--1935. doi:10.1016/j.respol.2016.06.010.

Van de Poel I., L. Asveld, S. Flipse, P. Klaassen, V. Scholten, and E. Yaghmaei. 2017. "Company Strategies for Responsible Research and Innovation (RRI): A Conceptual Model." *Sustainability* 9 (11): 2045. doi:10.3390/su9112045.

van Wezel, A. P., H. van Lente, J. J. M. van de Sandt, H. Bouwmeester, R. L. J. Vandeberg, and A. J. A. M. Sips. 2018. "Risk Analysis and Technology Assessment in Support of Technology Development: Putting Responsible Innovation in Practice in a Case Study for Nanotechnology." *Integrated Environmental Assessment and Management* 14 (1): 9–16. doi:10.1002/ieam.1989.

von Schomberg, R , 2012. "The Quest for the 'right' Impacts of Science and Technology: An Outlook Towards a Framework for Responsible Research and Innovation." In *Technikfolgen Abschätzen Lehren. Bildungspotenziale Transdisziplinärer Methoden*, edited by M. Dusseldorp and R. Beecroft, 39–62. Wiesbaden: VS Verlag.

von Schomberg, L., and V. Blok. 2018. "The Turbulent Age of Innovation." *Synthese*. doi:10.1007/s11229-018-01950-8.

Wittrock, C., E. M. Forsberg, A. Pols, P. Macnaghten, and D. Ludwig. 2020. "Overview of National Sociotechnical Imaginaries." In *Implementing Responsible Research and Innovation*. Springer Briefs in Ethics. Cham: Springer. doi:10.1007/978-3-030-54286-3_7.

World Bank. 2020. The World Bank in Malawi. Accessed January 4, 2021. https://www.worldbank.org/en/country/malawi/overview.

Yessoufou, A. W. 2017. *Understanding Entrepreneurship at the Base of the Pyramid in Developing Countries: Insights from Small-Scale Vegetable Farmers in Benin*. Wageningen University. doi:10.18174/426783.

Yin, R. 2011. *Case Study Research: Design and Methods*. 4th ed. Fresno, CA: Sage Publications.