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The Institutionalisation of a New Paradigm at Policy Level

Stephanie Daimer, Hendrik Berghäuser, Ralf Lindner

Fraunhofer Institute for Systems and Innovation Research ISI, Breslauer Str. 48, 76139 Karlsruhe, Germany, tel. +49 721 6809-385, email stephanie.daimer@isi.fraunhofer.de

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Introduction

The debate on Responsible Research and Innovation (RRI) has undergone a dynamic evolution since the term's early conception more than two decades ago. Beginning with debates primarily related to the responsible development of nanotechnologies in the early 2000s, RRI has achieved remarkable attention in the academic discourse on the governance of science and innovation (Rip 2014). Most notably, RRI (or more precisely, a particular conception of it developed by the European Commission) was taken up by the European Union and actively promoted in its framework programmes. The high point of this policy journey thus far came with the establishment of RRI as a cross-cutting theme in the EU's Horizon 2020 framework programme (2014-2020) and with its broad embedding within the Science with and for Society (SwafS) funding scheme (Lindner and Kuhlmann 2016, Macnaghten 2020). The rise of RRI as a concept providing novel normative guidance in the governance of science, technology and innovation (STI) is closely intertwined with the emergence of a new and highly influential policy paradigm in the field of STI policy: instead of solely targeting the improved performance of research and innovation systems in order to increase economic growth and competitiveness, the new paradigm is primarily concerned with addressing so-called grand societal challenges. This strategic reorientation represents a "normative turn" (Daimer et al. 2012) in STI policy, as it entails the articulation and growing importance of the directions research and innovation should take (Lindner et al. 2016, Edler and Boon 2018, Breitinger et al. 2021). While not replacing the STI paradigm focused on economic objectives, the new paradigm has clearly exercised a significant impact on the STI strategies of the EU and of many individual countries, and is currently being pursued through the concept of mission-oriented innovation policy (Kuittinen et al. 2018).

In many ways, RRI complements the quest for directionality (or solution-orientation) in STI as it targets societally desirable long-term impacts. The concept attempts to better align STI processes and outcomes with the needs and expectations of society. It offers a set of operational, practical and process interventions for STI and addresses both institutional transformations and the behavioural change of researchers and innovators by promoting specific virtues such as reflectivity, inclusion, anticipation and responsiveness. RRI promotes a set of interventions for STI processes and provides guidance on how research and innovation processes and practices need to be transformed

in order to reach high levels of directionality consistent with societal needs and values. As such, it can be defined as a new policy paradigm per se.

Research question

Yet, despite favourable conditions at the level of the broader policy landscape for RRI becoming firmly institutionalised within the European Union (EU) research and innovation funding system, particularly in the framework programmes, it may be concluded that the attempt to mainstream RRI has by and large not succeeded (Novitzky et al. 2020). This paper aims to shed light on the reasons for this incomplete institutionalisation of the RRI paradigm. What are the relevant mechanisms and supporting and hindering factors that help to explain the limited success of RRI mainstreaming?

To this end, we draw on and adapt the conceptual framework of *Deep Institutionalisation* (DI), originally developed to study organisational change, with the aim of reaching a better understanding of the complex processes for interpreting, translating, contextualising and ultimately concretising the RRI paradigm into policy practice (Randles et al. 2014, 2016, Randles 2017). While established frameworks such as multiple streams (Béland and Howlett 2016) or the advocacy coalitions approach (Sabatier 1998) are instrumental in explaining policy (paradigm) change, they fall short of unlocking the black box on how a newly established policy paradigm becomes firmly embedded in actual policy practice and implementation. It is here that the institutionalisation perspective appears particularly promising, as it provides an analytical lens for uncovering how, between the high-level EU regulation on H2020 and its implementation at the level of funding research and innovation projects, RRI policy has spread, unfolded and been put into practice.

Theoretical framework

Institutions, institutionalisation, and deep institutionalisation

In the literature on political science, "*institutions*" is understood as an umbrella term for different concepts and mechanisms which shape the behaviour of actors and their interactions: norms (formal and informal), (political) processes, organisational structures (hierarchies), etc. According to neo-institutionalism, the whole of society is seen as a structure made up of multiple institutions.

Institutions reduce complexity and insecurity by providing a certain order to everyday life and establishing guidelines for social interaction. As a result, institutions have a regulating effect with a simultaneous critical undertone. They are perceived as predetermined and regulate interaction without consideration for individual preference, thereby somewhat restricting the individual's freedom of action. Non-compliance with behaviour-regulating norms is often sanctioned; compliance is demanded or rewarded (Scott 1994, 203).

Institutionalisation refers to the process of the formation of institutions. It initially takes place when experienced actions are reciprocally typified. Customs, routines and habits are thus internalised through processes of socialisation and develop into institutions (Berger and Luckmann 1967, 53). Institutional development can be described as continuity and change within an institutional form. While reinstitutionalisation represents the change from one institutional form to another, deinstitutionalisation may take place, for example, by means of regulatory change such as legislative amendments, as well as through normative and cognitive changes (Jepperson 1991, 152). Deinstitutionalisation, then, occurs when social support for certain institutions decreases and the foundations for objectification and sedimentation start to erode (Tolbert and Zucker 1996, 181). Usually, institutional change comprises simultaneous institutionalisation and deinstitutionalisation processes (Randles and Laasch 2016, 60).

According to organisational theory, institutionalised structures, techniques, policies, and programmes sometimes function as myths, and many complex organisations adopt them ceremonially, even if they conflict with efficient criteria or with de facto organisational action (Meyer and Rowan 1977, 340). Organisations build up these formal structures to conform to the institutional environment and to gain legitimacy. These structures subsequently have little connection to the organisation's core activities and mainly serve as a facade created for stakeholders outside the organisation (Boxenbaum and Jonsson 2008, 78). In contrast, DI is the opposite of what neo-institutionalists call shallow institutionalisation or window dressing. The concept of DI was developed by Randles et al. (2014, 2016, Randles 2017) to better analyse processes of institutional change in organisations, their barriers, and their drivers. Randles et al. (2016) applied this concept to analysing forms of the deep institutionalisation of Responsible Research and Innovation (RRI). Here, DI is characterised by its long-term and resilient nature, including tendencies towards socio-technical lock-in and irreversibility. DI has an interdependent, systemic nature, comprising integrated and mutually supporting infrastructures of social norms and routines, governance tools, and economic and ideological logics. It can be defined as the internalisation of normative orientation and a collectively shared value system expressed in practical demonstrations (Randles et al. 2014, 32). Randles et al. therefore developed a framework of four elements to analyse the DI of responsibility in research and innovation:

1. Evolution of dominant narratives: new understandings of responsibility sediment over existing ones. Dominant narratives correspond to different dominant institutional logics, thus theorising a small and distinctively different number of "ideal types" with distinctive characteristics and profiles. In reality, these ideal types coexist and structurally overlap.

2. Maturation process: the maturation process involves gradual embedding into the routines, everyday practices, systematised techniques, methodologies, procedures, and incentive structures and performance metrics of actors. It can be evaluated according to different levels of graduation – "emergence", "maturity" and "resilience".

3. Systemic consolidation: systemic consolidation refers to a situation in which mature practices and forms of responsibility are not merely localised experiments within the organisation, but instead widely shared routinised techniques, norms, standards, governance and regulatory instruments as well as structures, organising practices and inter-organisational exchanges. Forms of responsibility are mutually accepted and understood, and shared by different professional groups within the organisation. Randles further describes the systemic "overflowing" character of "deep institutionalised" forms of responsibility as a set of virtues that characterise the ecosystem in which an organisation operates, i.e. a mutual understanding that characterises partnerships (Randles 2017, 29).

4. Vertical multilevel alignment: this fourth element of DI considers the coherence of the organisation's activities with its external environment and with different levels of governance, bearing in mind that powerful organisations have the scope to influence and shape their own external environment.

Randles et al. (2016) developed this concept to study value-based organisational change and organisational transformation processes. The effectiveness of transformation towards particular normative goals can rarely be evaluated ex ante. One has to wait and look back with the benefit of hindsight to make an ex post evaluation of "success". The concept has been used to study the institutionalisation of RRI in research-performing organisations (Randles 2017; Berghäuser and Daimer 2018). These first empirical applications suggest that DI is a long-term process, taking several years if not decades. It is also non-linear in the sense that, instead of new institutions gradually and smoothly replacing existing ones, there is a process of back and forth, where new normative claims and new practices challenge existing ones, and where "battles" between conservators

of the status quo and change-oriented institutional entrepreneurs lead to an iterative and experimental developmental process. Moreover, empirical observations point to a temporal dimension to these layers, meaning that one might first expect change at the level of narratives and discourse, followed by (initially experimental) changes in practices based on this, and subsequent systemic consolidation and proliferation.

Deep Institutionalisation: an attempt to apply the approach to analysis of the policy level

Since the DI concept was originally developed for studying organisational change, it requires a degree of adaptation for application to policy analysis. We argue that the concept can indeed be utilised in this way and provide support for the four elements of institutionalisation with concepts from policy analysis and implementation literature.

→ **Evolution of dominant narratives**: in policy theory, the concept of discursive institutionalism encapsulates the axis of questioning existing narratives and creating new counter-narratives. Discursive institutionalism represents a dynamic approach to policy change in which change is possible through ideational processes and policy discourse (Kangas et al. 2014, 73–74).

→ **Maturation process**: the mechanisms of maturation described for organisations may be equated to policy learning. Among the various conceptions in the literature, we follow the structure provided by Bennett and Howlett (1992) which differentiates between three levels: government learning by state officials learning about processes in policymaking and generating organisational change; lesson-drawing by policy networks learning about policy instruments and generating policy programme change; and social learning by policy communities learning about ideas and generating policy paradigm shifts (Bennett and Howlett 1992, 289, Borrás 2011, 727). While social learning is defined along similar lines of argumentation as discursive institutionalism, the aspect of lesson-drawing might be an interesting one to focus on in the context of our analysis.
Furthermore, the literature on policy experimentation has discussed mechanisms which also follow the logic of maturation processes in the DI concept. Policy experimentation has been defined as "the process of iterative adaption to new circumstances and experiences that entails a certain idea of progress and improvement but no teleological end-point," (Huitema et al. 2018, 146) and "a temporary, controlled field-trial of a policy-relevant innovation that produces evidence for subsequent policy decisions" (McFadgen and Huitema 2018, 164).

→ **Systemic consolidation**: in the policy context, and particularly in the context of the EUs Framework Programme for Research and Innovation, the systemic consolidation of a new policy priority would mean either the implementation of new instruments or the operationalisation of new policy guidelines of a horizontal nature as cross-cutting issues. Literature on policy implementation is broad and in fact often focuses on new instruments and the issues that might arise for specialised implementation agencies and authorities in the context of implementation. Thematic foci in the implementation literature are knowledge, learning and capacity in implementation, the processes of implementation, the role of actors and agents in implementation, and bureaucratic discretion in implementation (Schofield 2001, 253).
In connection with the horizontal nature of RRI, the literature on "whole-of-government" approaches (WGAs) provides some additional insights. WGAs were first introduced in the UK (under the term "joined-up government") as a reaction to the "pillarisation" of the public sector following New Public Management reforms (Ross et al. 2011, 134). "Whole-of-government denotes public services agencies working across portfolio boundaries to achieve a shared goal and an integrated government response to particular issues.

→ **Vertical multilevel alignment**: at the policy level, the fourth element of DI is excellently captured in the concepts of policy transfer and policy diffusion. Policy transfer has been defined as the "process in which knowledge about policies, administrative arrangements, institutions

and ideas in one political setting (past or present) is used in the development of policies, administrative arrangements, institutions and ideas in an-other political setting." (Dolowitz and Marsh 2000, 5). Policy diffusion has been characterised by the following elements: a process by which a (policy) innovation is communicated through certain channels over time among the members of a social system (Zito and Schout 2009, 1108, citing Rogers 1983, 10). Marsh and Sharman (2009, 270) have specified the difference between the two in the following way: "work on diffusion tends to emphasize structure while those writing on transfer tend to privilege agency", highlighting the fact that in the end both elements are relevant foci of analysis. Moreover, if one follows neofunctionalism as the most classical theory of European integration, one can expect policy spillovers from the European to the national and regional levels (Scholten and Scholten 2017, 927).

Data and methodological approaches

We apply the adapted DI concept to the efforts to mainstream RRI in the context of the H2020 European Framework Programme. We did not collect our own primary data for this. Instead, we draw on the rich evidence generated by relevant RRI projects.

The empirical question we want to answer focuses on the relevant mechanisms and supporting and hindering factors that help explain the limited success of RRI mainstreaming in Horizon 2020. We have argued that translating the DI concept to the policy level promises to add value when it comes to questions of policy practice and implementation, thus complementing studies which seek to explain policy change or the rise of new policy paradigms. Consequently, we aim to understand whether the mainstreaming of RRI across all parts of the Horizon 2020 programme followed the logic provided by the third element of Randles' DI model, "systemic consolidation" (Randles 2017). Given our understanding of the DI concept as a sequential model, where new narratives are first manifested and new practices subsequently experimented with before consolidation or mainstreaming take place, we attempt to trace these elements empirically, too. We additionally provide empirical insights into the fourth element – vertical multilevel alignment – and how this may have evolved despite the observation that RRI mainstreaming in H2020 by and large failed.

Empirically, we approach the four DI elements on an illustrative basis with each of the four elements supported by different sources.

There are two major empirical studies that we use for illustration purposes: the NewHoRRIzon project and the MoRRI study. In the NewHoRRIzon project, so-called Social Labs are at the core of the work. Their goal is to provide a socially based, experimental and systematic approach for addressing complex social challenges related to RRI. Each Social Lab is dedicated to a different section of Horizon 2020. For every section of H2020, different stakeholders gathered in a Social Lab to define the social challenges at stake and develop social experiments (= pilot actions and activities) to overcome them. The Social Lab process was prepared following diagnosis of the state of RRI in each programme section after three years of H2020 (at the end of 2017). Cross-sectional analysis of the diagnostic reports has been conducted to provide a broad picture of the state of RRI implementation within H2020 (Novitzky et al. 2020). The MoRRI (Monitoring the evolution and benefits of Responsible Research and Innovation in Europe) study programme began with an initial scoping of the RRI dimensions (gender equality, public engagement, science literacy and science education, open access, ethics, and the overarching dimension of governance). A data collection at the European Union Member State level included more than 36 indicators. Testing the data results for robustness and significance led to identification of core indicators and a clustering of EU countries (Mejlgaard et al 2018).

While the NewHoRRIzon diagnosis will serve to illustrate the third DI element (systemic consolidation), the MoRRI study provides information on the fourth element (vertical multilevel alignment).

For the first axis of the paradigm shift, we present a summary of the current academic debate for illustrative purposes. There is no significant research available on policy experimentation in the context of RRI or Horizon 2020, which may point to a potential shortfall in policy practice. Hence, for the section on maturation, there is little material to be discussed.

The following table provides an overview of the conceptual and empirical application of DI to RRI policy practice and implementation within Horizon 2020.

Table 1 DI elements at the policy level and empirical illustrations of RRI within Horizon 2020

Expectation regarding DI of RRI at the policy level	Empirical illustration of RRI in Horizon 2020
The evolution of dominant narratives regarding RRI which do not replace but gradually sediment over existing ones. Expectations: presence of normative claims calling for the RRI approach in the funding programme; coexistence of existing and new narratives; explanation of relation of new normative claims to existing ones.	Relevant arena of discourse: contributions by European-level actors, in particular the Commission as owner of the programme; contributions by stakeholders of the programme, e.g. (potential) beneficiaries, members of the advisory groups and programme committees, evaluators etc. Empirical sources: among others. Timmermans and Blok (2018) on four concepts of responsible innovation (RI) and their relation to the dominant techno-economic innovation paradigm
Maturation processes regarding RRI, involving gradual embedding into the routines, everyday practices, systematised techniques, methodologies, procedures, incentive structures and performance metrics of actors. Expectations: experimental embedding into funding schemes, KPIs etc. of the programme (trying out new practices, incentive structures for certain parts of the programme, etc.); policy learning (lesson-learning) about the programme.	Empirical sources: no major studies available. We are also not aware of policy experiments related to RRI in the framework programme. The small number of RRI projects in H2020's predecessor programme FP7 (Science in Society work programme) can be seen as very limited experimentation.
Systemic consolidation of RRI, describing a situation where mature practices are not merely localised experiments, but instead are extensively shared by different professional groups, as well as "systemic overflowing", meaning that projects are built on a mutual understanding based on the newly emerged values. Expectations: mainstreaming into programme (e.g. implies moving from ad hoc localised experiments to extensively shared	Empirical sources: NewHoRRIzon diagnosis of the implementation of RRI within the 19 programmes (Novitzky et al. 2020).

routinised techniques, practices, standards, norms and governance, regulatory instruments); formal and informal approaches by the implementing agencies towards developing an integrated response; training of public servants.	
Vertical multilevel alignment of RRI. Expectations: mechanisms of policy transfer and policy diffusion to the national, subnational and global level.	Proliferation into national and subnational level R&I policies. Proliferation at global level. Empirical sources: MoRRI study on the adoption of RRI in EU member states (European Commission 2018) and evidence from projects funded under the SwafS programme.

Results and Discussion

The evolution of dominant narratives

Several authors have either contributed to the discourse on RRI (von Schomberg 2012, Stilgoe et al. 2013, Owen and Pansera 2019) or have analysed it (e.g Timmermans and Blok 2018, Strand 2019). On the one hand, they find RRI being rooted in the classic techno-economic or techno-fix paradigm, meaning that technology is seen as a means to generate jobs and growth, and that technology as such brings huge benefits for society. Within this logic, RRI offers certain tools or practices to mitigate the unintended consequences of technological progress. This is represented by the concepts put forward by the European Commission and to some extent also by von Schomberg (2012).

On the other hand, analysts of the discourse have distinguished separate emerging narratives related to RRI. One narrative, for example, builds on the need to enhance the performance of research and innovation by putting forward a systemic argument (Strand 2019): increasing specialisation in knowledge production has intensified the emergence of silo structures and thinking. Networks and boundary-spanning are increasingly needed to address the multifaceted global environmental and social challenges of our times. Here, engagement is central, and RRI can be seen as one of the various means to introducing boundary-spanning interdisciplinarity and the integration of new perspectives (non-academic, user, societal).

Others have formulated this narrative of RRI far more radically by setting it in contrast to the narratives of the freedom of science and of excellence. Freedom of science, or, "what Michael Polanyi called the 'republic of science' makes it easy for scientists to offload responsibility. Polanyi's science is self-organising and devoted to the pure pursuit of knowledge" (Stilgoe 2014, see also Randles et al. 2016). This in turn leads to a bias towards valuing disciplinary research and defining excellence within disciplinary boundaries (Rafols et al. 2012). Thus, while scientific and technological advancements achievable in mono-disciplinary academic approaches blossom in the republic of science, "wicked" social problems that would require transdisciplinary approaches to address them are systematically discouraged as mediocre. Furthermore, von Schomberg (2019, 21) criticises competitive science as a closed context, whereas addressing social problems would require open research systems.

Another emerging RRI narrative challenging this also has very radical potential, since it sets out to deinstitutionalise not only established research and innovation practices, but also the way in which research is measured. In particular, the directional element of steering STI towards addressing the "grand challenges" of our time has a very radical potential, as it calls for RRI interventions that support "upstream" modulation as well as anticipation, reflexivity and shared priorities (Owen et al. 2013, Stilgoe et al. 2013, Owen and Pansera 2019). The DI concept suggests that institutionalisation of RRI at the policy level cannot work well if there is no normative discussion, i.e. no narrative of change offered. The above shows that the normative discourse on RRI has been and still is very intense. The discourse is characterised by the radicality of the RRI narratives offered and by the at times dogmatic way in which they are presented by critics of the EU approach. The European Commission's five (six) RRI keys' approach has been criticised as being too shallow, risking serving as mere window dressing with no real shift in policy paradigms achieved. However, the proponents of the more radical RRI narratives themselves barely engage in explaining how their own RRI approach connects to the existing excellence, growth and techno-fix paradigms, something which is left to academic analysis, as Timmermans and Blok (2018) have shown.

Maturation by way of experimental embedding

Experimental embedding of a new paradigm at the policy level would mean testing new elements in funding practice by integrating these new elements into selected parts of a funding programme, e.g. a subprogramme or a specific call for proposals. One would further expect mechanisms that foster policy learning to arise from this experimentation.

RRI has become a cross-cutting issue in Horizon 2020. Cross-cutting issues are meant to promote linkages and interfaces between the specific priorities of Horizon 2020.[1] The programme provides incentives for actions that address cross-cutting issues (e.g. EU Science & Innovation 2014).

Inclusion as a cross-cutting issue in H2020 does not mean experimental or gradual implementation. Instead, it means full roll-out across the programme, a top-down one-size-fits-all approach. No efforts have been undertaken to develop practices within individual parts of the programme that are adapted to the specific characteristics of the parts and incorporate knowledge from practitioners.

Under the Science with and for Society (SwafS) programme, several projects were funded to expand the knowledge base for mainstreaming RRI. SwafS could therefore have been the experimentation arena for furthering full mainstreaming. In point of fact, SwafS projects were funded in parallel, and their results came too late for the vast majority of H2020 calls. Experiments like the New HoRRIzon Social Labs in particular could have helped generate practice-oriented experimental knowledge across all programme lines if the project had taken place before RRI was rolled out to the whole funding programme. The NewHoRRIzon project set up these so-called Social Labs in order to create spaces for bottom-up experimentation with RRI and adaptation to the needs of the individual H2020 programme parts.

Earlier RRI studies funded under H2020's predecessor FP7 or the MoRRI study might have been able to deliver initial insights at an experimental level about the implementation of RRI in the funding schemes of the EU's framework programme, but were not treated as such. The MoRRI study was cited in H2020 calls as a reference framework for expected impacts, without taking into account the fact that the MoRRI indicators were developed at a national not project level.

Furthermore, the ex post evaluation of FP7 concluded that the time was not ripe to integrate RRI as a guiding principle throughout H2020. This observation included a more general criticism of the approach to cross-cutting issues in the framework programmes in general, which in many cases does not allow for an effective embedding into the calls and proposal templates (European Commission 2015, 70), and is thus not well suited to fostering systemic consolidation (see next section). For certain elements of RRI, in particular gender equality, there were about 20 years of experimentation and fostering of action in the framework programmes, which in turn led to an integration of gender equality aspects as a cross-cutting issue in Horizon 2020. However, in contrast to other cross-cutting issues, gender became an integral part of the excellence section in the proposal template, which is seen as a more successful move from experimental embedding to systemic consolidation. Nevertheless, this does not alter our observation that while there has been at least a partial maturation process of some elements of the RRI concept (in particular gender equality), the whole concept as a package has not been tested in an experimental way that would have allowed for maturation.

Systemic consolidation – mainstreaming

In order to assess the degree and quality of the institutionalisation processes of a policy paradigm, it is essential not only to study the level of codified policies and their depiction in relevant documents. While the inclusion of the policy objectives and the interventions to reach these objectives are a necessary condition for policy institutionalisation, the declaratory level of strategic policy needs to be sufficiently followed-up by and translated into the processes of implementation (Peters et al. 2018, Kroll 2019). The systemic consolidation of a policy paradigm thus unfolds in at least two main dimensions: (1) the extent to which the substance, the purpose and the intervention logic of a policy are in fact broadly shared and represented across all relevant policy subdomains. With regard to H2020, this "mainstreaming" of a policy is indicated by the extent to which the ambitions and goals of RRI are firmly embedded in the policy documents of the 19 thematic funding schemes of the framework programme. Empirically, this embedding should be observable in the respective work programmes and call texts of the funding schemes. (2) The second important dimension of systemic consolidation relates to the actual implementation of the policy. How and to what extent are the intentions and prescriptions of policy meaningfully translated into the practices of governance? Have shared understandings, routines, norms, and standards emerged on the part of those implementing the policy that are conducive to policy intentions? In the context of the European framework programmes, if we wish to assess the translation of policies codified in the work programmes, we can examine the information provided to potential applicants, the call texts and proposal templates, changes in the criteria by which proposals are evaluated, the training of the evaluators of proposals and external experts reviewing ongoing projects. Finally, the way ex post evaluations of H2020 funding schemes are designed can also be an important signifier of the extent to which systemic consolidation has been achieved.

Analysis of RRI mainstreaming in H2020 suggests that efforts have fallen short of achieving satisfactory results (Novitzky et al. 2020). At the level of the Horizon 2020 legislation RRI is defined as a cross-cutting issue, granting RRI a high priority in all 19 of the H2020 funding schemes. However, even at the level of the 19 subthemes, RRI elements are only well represented in a few of the work programmes. In most cases, references to RRI are superficial at best. Between the declaratory policy level of the H2020 legislation, where RRI is well established, and the individual work programmes a notable discrepancy becomes apparent. Thus, right from the first dimension of systemic consolidation of a policy paradigm, a rather patchy and shallow embedding of the new paradigm in the relevant policy subdomains has been identified. Turning to the second dimension

of systemic consolidation of a policy paradigm – the translation of policy objectives into implementation and practices – the findings suggest an even greater translation failure than in the first dimension. Judging from the empirical data available, RRI was not systematically integrated into call texts and was largely absent in proposal templates and evaluation criteria for proposals.

The incomplete systemic consolidation of RRI as a policy paradigm within H2020 can be ascribed to insufficient translation both at the level of the policy subdomains and at the level of policy implementation. Arguably, the translation appears to have failed because the programme owners and policy officers of most of the 19 funding schemes continue to align their policy formulation and implementation actions with normative orientations that are largely not part of the RRI paradigm. This suggests that insufficient care was taken by the promoters of RRI at the strategic policy level to establish processes and conditions that are conducive to embedding of the RRI narratives at the level of the policy subdomains (Braun et al. 2019). Given the high degree of heterogeneity of the 19 subdomains of H2020 in terms of funding objectives, addressees, funding mechanisms, disciplinary cultures etc., a procedural and discursive approach allowing for the modulation of RRI aspirations according to the needs of the respective policy subdomains would most likely have been more promising for creating the necessary broad ownership.

Moreover, the Research Executive Agency of the European Commission itself, responsible for the management of H2020 programs, has pointed to weaknesses of the programme's "cross-cutting issues" as an instrument for systemic embedding, since the way in which they feature in the programme varies. Only a few of them were consistently translated into all the work programs, into the calls and then on into the proposal template and evaluation criteria (European Commission 2020, 21ff).

Vertical multilevel alignment

Assuming that European-level discourses have the power to affect national policy debates and policy practice, it is worthwhile briefly reflecting on national R&I strategies and operational policies. Furthermore, since the SwafS programme funded organisational change aimed at embedding RRI practices, one might expect to observe experimentation with RRI-type approaches in research-performing and research-funding organisations within and outside the EU.

In the MoRRI project (Monitoring the evolution and benefits of Responsible Research and Innovation in Europe), various analytical steps were taken to facilitate measurement or monitoring of RRI at the country level. In a cluster analysis, four country clusters were identified based on country scores for eleven retained factors or empirically founded dimensions of RRI out of a total of 36 RRI-indicators.[2]

In a second step, the characteristics of the four clusters were analysed. The radar plot below shows how well each of the four groups of countries have embraced the eleven RRI dimensions used for the cluster analysis. For ease of presentation, each RRI subdimension is normalised to a value from 0 to 1, representing the full range from minimum to maximum possible effort, attention or performance within the respective areas.

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[2] For closer information about the methodological approach and the data used for the cluster analysis, see European Commission (2018).

Figure 1 Radar plot showing the characteristics of the four country clusters Source: European Commission (2018, 28).
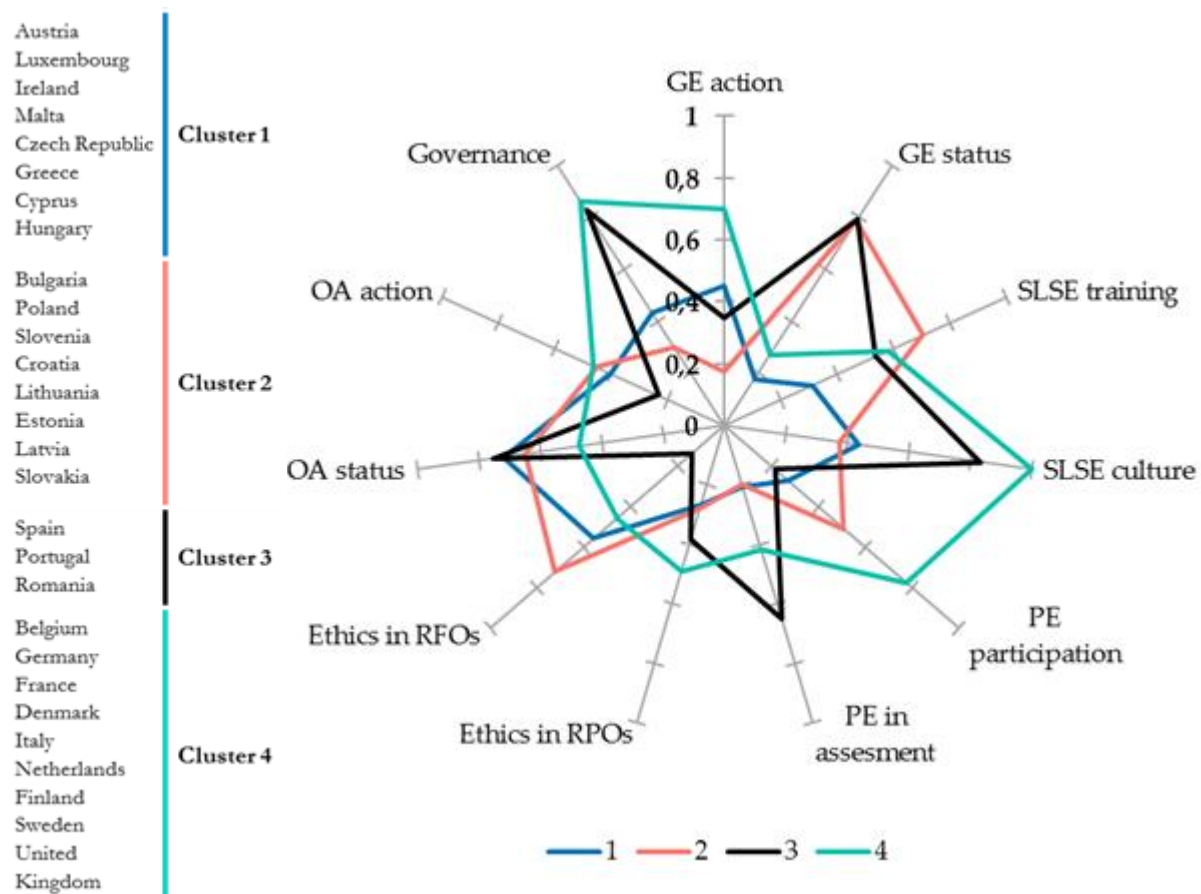
The results of the cluster analysis demonstrate a significant diversity across the European landscape regarding RRI. Efforts, attention, and priority-giving across the 11 RRI-related subdimensions are unequally distributed across the countries. The roots of this diversity are not discernible from the graphics and require a better understanding of country-specific historical development of the science-society relationship, research and innovation policy approaches, as well as longstanding civic and political culture.

At the operational level of actual R&I policies and instruments, some countries have been found to "experiment" with RRI (Mejlgaard et al. 2018). In the UK, the Engineering and Physical Sciences Research Council (EPSRC) became the first agency to adopt an RRI framework in 2013. Analysing the proliferation of RRI in twelve European and non-European countries, the RRI-Practice project concludes that some countries have now adopted RRI in principle for their national R&I policies (Owen et al. 2017). Within the UK Research Council, for example, other agencies have followed the EPSRC's lead. The Dutch Research Council (NWO) operates a funding initiative and platform for RRI, and the Research Council of Norway also engages intensively with the RRI concept. A major investment is the RRI Hub approach with its strategic initiative for digital life.

With reference to the DI framework, these embeddings into national funding represent policy spillovers or vertical multilevel alignment. However, in most EU member states RRI is not deeply institutionalised or entrenched as a guiding principle or core value in the governance and practice of national research and innovation policies.

The European Commission has planted further seeds to encourage this, with H2020's SwafS programme funding a number of projects that foster the embedding of RRI into national research-funding and research-performing organisations (RFO and RPO). SwafS has also aimed for similar impacts at the level of its beneficiaries. According to a recent inventory of SwafS achievements, at least 238 documented institutional changes were achieved among organisations who were either recipients of SwafS funding or the focus of organisational change projects under its auspices (European Commission 2020, 84). Within the framework of DI, the categories assembled under the headline of institutional changes appear to be a mixture of experiments with new practices and of systemic embeddings into organisational routines or structures. It is too early to assess whether these institutional changes will eventually lead to a DI of RRI. Finally, there are developments outside Europe sometimes explicitly referring to the European approach (e.g. in China or Australia) and sometimes building on other, similar bases (e.g. ELSA approaches in the US). Once again, SwafS programme funding has supported this proliferation[3], but it remains to be seen whether these efforts develop into self-sustaining practices once the funding has ended.

Conclusions and policy issues

In this paper, we argued that the concept of DI, originally developed to explain the embedding of RRI and similar approaches within organisations, can also be applied to explaining the institutionalisation of a new policy paradigm. Further, we argued that the value of this approach is demonstrated in explaining paradigmatic shifts in policy practice and implementation, while complementing other concepts explaining policy change and policy paradigm change per se. Our research question was to identify the relevant mechanisms and supporting and hindering factors that help to account for the limited success of RRI mainstreaming in Horizon 2020. To this end, we revisited existing evidence from RRI research in light of the DI concept. Based on the assumption within the DI concept that its four characteristics represent different degrees of institutionalisation and that there is also a temporal dimension to these processes – where "primary" layers of institutionalisation (narratives, gradual experimentation) come first, before systemic consolidation and vertical multilevel alignment – we examined the current state of institutionalisation of RRI at the level of policy practice and implementation.

In short, we have observed an intense policy and academic discourse about RRI at the European level, where at least three policy narratives have emerged over the course of the past twenty years that challenge existing R&I policy paradigms. What the discourse still lacks is a more pragmatic approach that paves the way for a broader paradigm shift within the European Commission and the R&I community. Here, the role of agency and institutional entrepreneurship in paradigm shifts comes into play, something that we did not consider in this analysis, since we believe it is better covered by analytical approaches examining policy (paradigm) change in more detail.

One very problematic finding from the perspective of the DI concept is that there has been no phase of experimental embedding into funding practices. Horizon 2020 defined RRI as a cross-cutting issue, aiming for its implementation across all programmes without having tested the application of the concept as a whole to the funding practice of the different programmes. Experimenting with RRI in a limited number of calls or programme parts would have made it possible to operationalise the strategic objectives of the cross-cutting themes by integrating programme-specific bottom-up knowledge. This could have included developing new practices in the form of guidelines or training for agency staff, evaluators, and applicants, as well as mechanisms for learning and cross-fertilisation with other programmes.

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[3] E.g. compare the H2020 projects RRI Practice, NULEUS, RRING, and SUPER MoRRI.

Consequently, given the shortcomings in initiating a broader discourse across EC directorates and experimenting with embedding RRI into funding practices, the preconditions for the systemic consolidation of RRI within the European framework programme were, in our view, not satisfied. The owners of the individual work programmes were not prepared to implement RRI in a meaningful way, and the instrument of cross-cutting themes has generally proven not to be well suited to advancing institutionalisation at the level of policy practice and implementation.

As for vertical multilevel alignment, we see in the UK, Norway, and the Netherlands a small number of particularly interesting instances where RRI is manifested in national R&I funding, despite the fact that the mainstreaming of the concept experienced setbacks within Horizon 2020. This observation suggests that national RRI initiatives seem to be rather loosely coupled to the associated EU policies and are thus less dependent upon successful systemic consolidation at the supranational level. Nevertheless, the DI concept does not strongly suggest a firm conditional relationship here. It seems that it is the (new) policy paradigm that is crucial for the transfer or diffusion of a policy idea and not the policy practice or implementation.

Interestingly, while RRI policy practice and implementation at the European level largely failed, the British, Norwegian, and Dutch approaches provide examples to learn from: these countries have taken very different approaches to adopting RRI into the evaluation and funding of research. However, what these countries have in common is that they have all taken experimental steps prior to broader implementation and have all chosen pathways of systemic embedding that require researchers to comply with the concept, but also offer practical guidance on how to do this. Overall, our work on the identified levers and barriers to the institutionalisation of RRI at the European level supports others who have argued that the problem does not lie with the RRI concept as such, but in the way it has been implemented (e.g. Novitzky et al. 2020). Moreover, the application of the DI concept has shed light on the important aspects of policy discourse and, in particular, experimental embedding. Our conclusion from this analysis to promote deep institutionalisation of RRI is that the experience of the setbacks in implementing RRI within Horizon 2020 are an important source for policy learning. The next framework programme, Horizon Europe, should be seen as a chance to experiment with RRI in the different parts of the programme, all the more as the mission orientation of Horizon Europe is seen as to further manifest the paradigmatic shift to challenge-orientation. It is not yet fully clear how much of the ambition of Horizon Europe to orientate research and innovation differently, will manifest in actually doing things differently. This ultimately could mean to (re)activate practices of RRI, implying also a potential further systemic consolidation of the concept and thus a further institutionalisation.

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