



Relevance and Characteristics of Responsible Innovation Assessment Tools

11

Carla Caldeira, Diana Pereira, José Duarte Santos,
Cristina Guimarães, and Fernando Almeida

11.1 Introduction

The growing importance of innovation for competitiveness is widely recognized both in academia and science, as well as in business. There are several authors such as Lichtenthaler (2016), Roach et al. (2016), and Tavassoli and Karlsson (2016), who have explored the need for organizations to innovate to achieve sustainable success in the markets in which they operate or even to reinvent such markets. Formulating goals and plans and implementing actions and monitoring their execution are activities that companies need to undertake to remain competitive. Therefore, it is up to the organizations to ensure that this process is correctly conducted so that it is possible to achieve the intended goals. Furthermore, it is important for an organization to evolve over time, otherwise it runs the risk of disappearing. Thus, the current strategic guidelines are increasingly based on innovation. By developing new technologies, products, services, processes, and systems in a sustained way, the organization creates much more value and differentiates itself in the market (Meissner & Kotsemir, 2016; Pozo et al., 2019).

C. Caldeira (✉) · D. Pereira
ISPGAYA, Vila Nova de Gaia, Portugal
e-mail: ispg2019102354@ispgaya.pt

J. D. Santos
CEOS.PP and ISCAP/P.PORTO, Porto, Portugal

C. Guimarães
INESC TEC, Porto, Portugal

F. Almeida
ISPGAYA, Vila Nova de Gaia, Portugal

INESC TEC, Porto, Portugal

In a world faced with socio-environmental problems, the combination of innovation with sustainability becomes increasingly necessary. Besides being a way to preserve the environment, it is also a path to achieve new market opportunities (Andrade, 2017). With the increasing concern of the market with socio-environmental aspects, it is necessary to re-evaluate the performance aspects of companies. From this perspective, innovation is seen differently, which leads to the idealization of sustainable innovation (Kneipp et al., 2019). Innovation and sustainability are increasingly interconnected, since for the development of a sustainable product, process, or service, it is essential to use innovation as a driving force, and these two terminologies are the foundations of the construction of a sustainable innovation context for the advances and evolution of companies.

It is in this context that the concept of responsible innovation emerges in the market intending to promote a more responsible development of innovation in terms of inclusion of a wider society and so that the results of innovation are ethically acceptable, sustainable, and socially desirable (EC, 2011). Responsibility in research and innovation is driven by global concern for the planet, its natural resources, as well as a just and inclusive society. This concern concerns governments, which can act through policies and regulations, even if they are still in the developmental stage (Scherer et al., 2006). However, responsible innovation is also a concern of the private sector with the aim to align R&D activities with society's values, needs, and expectations (Burget et al., 2017).

Knowing the concept of responsible innovation and how to apply it is relevant in the business context, but insufficient if there are no ways to measure it that can be standardized and comparable. This study addresses this challenge by identifying, categorizing, and exploring a set of responsible innovation assessment tools (RIATs) that can be used to measure responsible innovation. The manuscript is organized into five main sections. In the first phase, an introduction to the theme is given, followed by a theoretical framework of the concepts related to strategy, innovation, and responsible innovation. After that, the methodological process in the identification and evaluation of RIATs is described. Next, the results obtained are presented and discussed considering their technical and scientific contributions. Finally, the main conclusions of this study are listed.

11.2 Background

11.2.1 The Relevance of Strategy

As markets are increasingly competitive, managers must accept the challenge of applying strategic thinking and the skills of an effective leader, i.e., it is necessary to go beyond the efficient planning, organization, execution, and control of business activities. The definitions of the concept of strategy are quite numerous, the literature on strategic management defines strategy as a multifaceted concept, with different dimensions, such as: strategic thinking, strategic process, and strategic change (Meyer et al., 2012).

According to Pasquale (2012), to achieve the objectives it is necessary to determine which strategy to adopt. Therefore, strategies consist of the actions that the organization must take to achieve its goals, these are established based on the objectives to be achieved and influenced by the mission, vision, beliefs and values, micro-environment, and situation of the organization. In environments of constant change, it becomes common to carry out restructuring processes for survival and competitiveness. As discussed in Balogun (2007) and Srivastava and Mushtaq (2011), strategic restructuring can be organizational, financial, but also of products and services offered in the market.

The strategic management process is based on the shared importance of strategy development and strategy in action. In this sense, the phases of implementation and strategic control will be fundamental to achieve the proposed objectives (Chung et al., 2016). Strategic management requires the manager's ability to monitor and interpret the reality of organizational environments, both inside and outside, to use them in the development of the company's strategic posture, translated through the statement of values, vision, mission and strategic objectives. From this point on, it will be possible to challenge the overall business strategy and subsequently propose specific objectives and actions. Consequently, strategic alignment throughout the process is understood (Bora et al., 2017).

11.2.2 The Relevance of Innovation

Innovation has been widely regarded as the core process that drives economic growth and sustainable competitive advantages of both companies and nations, besides driving global sustainable growth (Chen et al., 2018). This has undoubtedly become an important issue in economic and social development, all developed economies are aware that only innovation can continuously stimulate new economic growth, while developing countries are also pushing to continuously upgrade their industrial structure through innovation to improve their national competitiveness (Acs et al., 2017).

Innovation is crucial for companies' profitability and long-term survival because it allows a company to adapt to the dynamic needs of the market (Hauser et al., 2006). Innovation is not only based on the development of new products, but it also helps to promote new business models, offers new services, and improves processes to make people's lives easier. But above all, it makes sure that these processes reach those who need them. Another important factor of innovation is encouraging the emergence of collaborative knowledge networks by exploring the concept of open innovation, which becomes particularly relevant for companies with less installed capacity (Almeida, 2021; Oduro, 2019).

It is important that innovation is valued and properly recognized and, instead of being seen as an expense, be understood as an investment. To this end, society must be open to new ideas and developments and take advantage of the opportunities that are offered to improve the quality of life (Aguirre et al., 2021). It is also important to encourage new scientific skills and the acceptance of new technologies,

something that requires the commitment of all governments, industries, schools, and universities (Morawska-Jancelewicz, 2021).

Innovation, always present in society, is one of the priorities of industrialized countries and can dictate the difference between organizations and economies. It is through it that organizations can build the foundations of their development and growth in a sustainable way. Innovation is an extremely relevant factor for a successful modern economy, providing high levels of return on investment and leading to economic growth, the creation of high-quality jobs and the acquisition of a higher standard of living (Gupta, 2008).

11.2.3 The Need of Responsible Innovation Practices

Long et al. (2020) state that, innovation leads to new products, business models and even changes in socio-economic systems. However, innovation must have the 'right impacts', so responsible innovation can help achieve this. An innovation is therefore defined as responsible when it generates relevant and sustainable value for all stakeholders: society, users, and shareholders. Responsible Innovation (RI) is about delivering value to all stakeholders, the issue of managing these stakeholders with integrity must be treated with care.

RI can be defined according to Von Schomberg (2013, p. 19) as "a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society)".

RI offers a way to support innovation processes in a way that builds stakeholder trust (Sutcliffe, 2011), and a method to make innovations more effective. This is because RI should enable more and better connections to be made with people who can enrich the innovation process by increasing demand articulation and improving forecasting and anticipation (Long et al., 2020). However, the adoption of RI also has its drawbacks and one of the main ones is the lack of unity, recognized approaches, and professional standards for implementing and evaluating RI.

RI is also synonymous with sustainable innovation and both concepts cohere. Innovation is looked at as a crucial approach to address present and future sustainability challenges. In Tello and Yoon (2008) sustainable innovation is seen as the development of new products, processes, services, and technologies that contribute to the development and well-being of human needs and institutions while respecting natural resources and regenerative capacities. This view is further explored by Bos-Brouwers (2010) who explains sustainable innovation by defining it as innovations in which the renewal or improvement of products, services, technological or organizational processes not only provides improved economic performance, but also social performance, both in the short and long term, have the capacity to generate positive social and environmental impacts. A sustainable approach to innovation should guide all business choices regarding products and services as well as the new

business and organizational models that need to be adopted (Boons & Lüdeke-Freund, 2013).

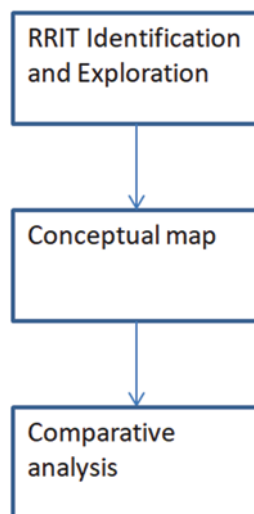
An innovation can be seen as responsible when the value created benefits not only shareholders and customers, but also society, in a lasting and sustainable way. An innovation that destroys value for society, for consumers, or does not generate economic profit for shareholders is unlikely to be sustainable (Dreyer et al., 2020). RI encompasses multiple dimensions that seeks on the one hand to avoid causing harm, also to do good, without forgetting that it must be motivated by responsible governance (Bacq & Aguilera, 2022). Through RI, companies can effectively use resources more efficiently, reducing costs, or develop a product that gives them a competitive advantage (Almeida & Wasim, 2022).

11.3 Data and Methods

Responsible innovation is an emerging field of research that has been framed in multiple scientific research domains. It is a pertinent topic for all research domains and its philosophical discussion on its importance is unequivocal as recognized in Chen et al. (2022), Stahl et al. (2019), and Tjldink et al. (2021). Several tools for measuring responsible innovation have emerged in recent years. These tools do not measure responsible innovation in the same way, and consequently it is important to recognize and synthesize the various dimensions of responsible innovation considered in this study. In this sense, this study follows a methodology design based on an exploratory qualitative approach. Exploratory research seeks to explore a problem to provide information for a more precise investigation. This approach aims to get closer to the topic, which can be built on hypotheses or intuitions. It is a qualitative, unstructured process that uses literature searches and case studies as data collection (Saunders et al., 2009). This approach offers several benefits such as an early and timely analysis of the relevance of the subject being discussed, allows for a sense of the need for new research and new joint areas to be explored, and helps maintain focus on the topic (Silverman, 2010). This study is composed of a literature review and a comparative analysis of the various tools for assessing RI. The choice of this methodological model has to do with the very nature of the study, insofar as it aims to understand an issue and not exactly measure the object of study. In this sense, the accounting of the data has only comparative purposes.

Figure 11.1 visually presents the three fundamental phases of this process. Initially, the goal is to identify responsible research innovation tools (RRITs). Generic platforms with potential for application and measurement of RI were considered, even if this was not their initial design focus. Tools were also considered regardless of their application in specific RI sectors. Finally, frameworks and tools were also considered, even if some of these approaches are excessively conceptual and without a technical implementation framed in a software solution (e.g., web application, excel, etc.). However, proprietary frameworks of companies with commercial objectives were not considered, such as workshops launched by these organizations. After this, a conceptual map of the dimensions for analysing RI was built,

Fig. 11.1 Phases of the methodological process



which allows for generic information about the various dimensions that RI covers. Finally, the last step explicitly seeks to assess comparatively the similarities and differences between the various tools. Each tool is analysed according to the previously identified dimensions, which allows the identification of the most common and least common dimensions.

11.4 Results and Discussion

The presentation of the results begins with the identification of RRITs. Table 11.1 presents this list and a brief description of each tool's objective. The data are organized alphabetically, in which each tool is identified by its acronym. The description of each tool highlights its unique characteristics, the main objectives, and the author that supports it. In total, 18 tools were identified. Most of these tools were launched in the last 3 years, which shows a high concern of the scientific and business community in finding ways to measure RI. We also found tools that emerged in specific business sectors such as health, but whose potential applicability may be broader. The role that European projects have played in the emergence of these initiatives is also noted. These European projects have also been essential to promote a closer relationship between the scientific community and the business fabric, through the launch of technology transfer projects (Deloitte, 2020). It is worth highlighting the emergence of proposals for measuring RI that result from the reuse of existing networks of European projects funded under FP-6, FP-7 and Horizon 2020 and that have allowed expanding the area of action of these consortia and maintaining transnational collaboration networks. It is also evident that addressing the challenges of measuring RI is not specific to a given economy, and across the board all countries are faced with the challenge of effective and sustained growth in the future. As

Table 11.1 List of RRI Ts

Tool	Description
Exploring Natural Capital Opportunities, Risks and Exposure (ENCORE)	ENCORE is a tool that allows users to visualize and understand the impact of environmental change on the economy. It explores how business activities impact nature and looks at how dependencies and impacts can also pose a risk to business (ENCORE, 2022).
Environment and Social Impact Assessment (ESIA)	The goal is to assess and predict potential adverse social and environmental impacts and develop appropriate mitigation measures, which are documented in an Environmental and Social Management Plan (Dreyer et al., 2020).
Four Dimensions of Responsible Innovation Framework (F4-RIF)	The four dimensions of RI (anticipation, reflexivity, inclusiveness, and responsiveness) provide a framework for raising, discussing, and responding to questions such as the purposes, motivations, social and political constitutions, trajectories, and directions of innovation (Stilgoe et al., 2013).
Ethical Matrix (EM)	This tool is a structured approach to analyze the impacts of technologies according to stakeholder groups and the ethical principles of justice, autonomy, and well-being (Kaiser & Forsberg, 2001).
Health Technology Assessment (HTA) Core	It offers many opportunities for different types of comparison between health technologies. It considers ethical, cultural, social, legal, and regulatory issues in the form of a list, and has a high degree of transparency (Thorstensen, 2019).
KARIM	It serves to help companies reconsider their business model, develop new products and services, new technologies, or even improve their production processes. It combines a self-diagnostic tool with a summative analytical grid composed of 24 criteria (Hin et al., 2014).
Life Cycle Assessment Anticipatory (LCAA)	Tool to support environmentally RI. It seeks to provide environmental criteria for R&D decision-makers to broaden the range of values used in formulating hypotheses and experimental research agenda and thus support RI of emerging technologies (Wender et al., 2014).
Monitoring the Evaluation and Benefits of responsible Research and Innovation (MoRRI)	Develops a list of RRI indicators for proper measurement of research and innovation responsibility, which could serve as KPIs (Gurzawska, 2021).
ORBIT Self-Assessment Tool	Its goal is to spark ideas for actions that will help put RRI into practice. It provides innovators with a series of questions organized in a 4 × 4 matrix: Process, Product, Purpose, People × Anticipate, Reflect, Engage, Act (Lehoux et al., 2020).
PRISMA	It aims to help companies implement RRI in their innovation and social responsibility strategies. It is a toolbox composed by a self-assessment survey, a 5-criteria impact analysis, 10 KPIs, and a roadmap template (Lehoux et al., 2020).
Product Impact Tool (PIT)	It was developed with the aim of raising awareness of the possibility of influencing behavior through design. Its function is analysis and design support, both applicable to RI, in terms of identifying key issues and impacts and in terms of improving impacts, for example through design changes (Long et al., 2020).

(continued)

Table 11.1 (continued)

Tool	Description
Responsibility Navigator (RN)	It serves to support strategic-level reflections on ways to promote different accountability-related goals throughout the organization. It is important for addressing how innovators working in large organizations can be adequately supported by higher level managers to implement RRI at the operational level (Lehoux et al., 2020).
Responsible Innovation COMPASS self-check tool	Developed with the intention of helping SMEs determine to what extent their practices align with IR principles, how to improve their innovation processes and outcomes, and how they compare to other companies (Gurzawska, 2021).
Responsible Innovation in Health (RIH)	This tool directs the attention of policymakers “upstream,” where they can promote innovations that can address significant system-level challenges and support more equitable and sustainable health services. This generates an overall accountability score that can be used to compare the respective value of different innovations (Silva et al., 2021).
Responsible Management of Innovation (RMoI)	It aims to provide innovators with a systematic way to identify and consider socioethical risks and opportunities. It is administered through a workshop and incorporates three distinct stages (Long et al., 2020).
RRI Maturity Model (RRI-MM)	The model proposes a combination of the maturity levels with the activities, processes, or artifacts that are associated with each level. Three categories are listed as purpose, process, and product (Stahl et al., 2017).
ROSIE Responsible Innovation Toolbox	Tool designed to support SMEs and other organizations to understand, assess and implement RI (Interreg Central Europe – ROSIE, 2020).
SDG Compass (SDG-C)	The objective of the SDG compass is to guide companies in the process of aligning their corporate strategies with the sustainable developing goals of the United Nations. Furthermore, it gives indications on how companies can measure and manage their contribution to the SDGs (SDG Compass, 2015).

argued in Balland et al. (2019) and Schütz and Strohmaier (2022), European countries need to enhance their active presence in international innovation and competitiveness networks, with all the consequences in terms of impact on their economic and social matrix. Moreover, European projects have also made significant contributions to the development of the Global Sustainable Development Goals (SDGs) through their collaborative and social transformation potential (Moczek et al., 2021).

For each RRIT tool, a set of dimensions were identified that they use to categorize RI. An attempt was made to group synonyms within the same dimension, such as transparency with visibility. This approach allowed the identification of 16 dimensions as shown in the conceptual map presented in Fig. 11.2. Studies indicate that RI cannot be segmented, and the various dimensions should be interconnected, even as Voegtlin and Scherer (2017) state that economic, environmental, and social perspectives are associated with the sustainable development paradigm. This view is also adopted in Landeweerd et al. (2015) when advocating the interconnection

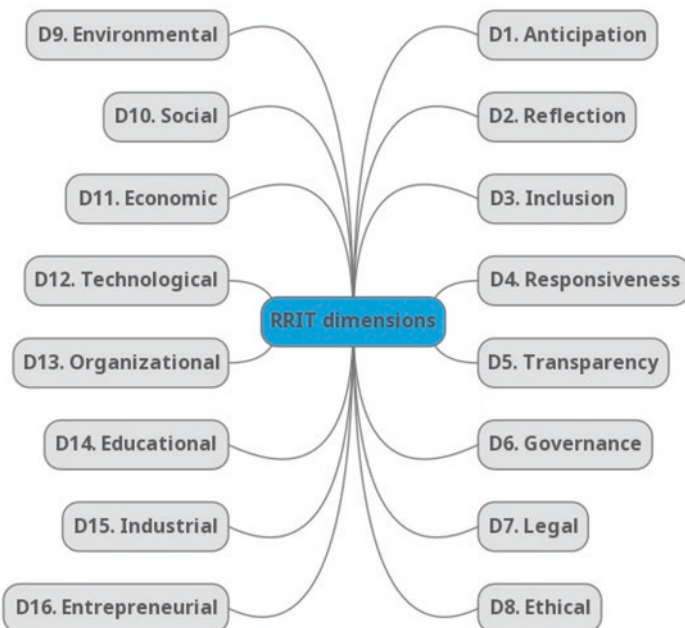


Fig. 11.2 RRIT dimensions

and incorporation in the governance of science and innovation. The dimensions identified in the conceptual map can be mutually reinforcing (e.g., greater reflexivity tends to promote greater inclusion, and vice versa). However, they can also be in tension and generate conflicts (e.g., anticipation can generate greater participation, but can also be resisted by scientists seeking to defend their autonomy, or their prior commitments to particular innovation trajectories). Making such tensions visible and bringing them into negotiation are important steps in making RI responsive. In short, it is a matter of integrating the dimensions and strategies for RI into a coherent and legitimate governance approach.

Finally, the Table 11.2 in [Appendix](#) performs a comparative analysis of the RRIT tools. The most common dimensions identified in the RI frameworks are the social and educational dimensions. It is argued that the proposal of new products and services must be aligned with user needs but must also have the potential to alleviate social and environmental challenges. Consequently, RI necessarily has to look at social innovation with the aim of developing solutions to the sustainability challenge (Dacin et al., 2010; Phillips et al., 2015). While social innovation is pursued by organizations or individuals with pro-social motivations, it is recognized that companies must have a corporate social responsibility (CSR). The concept of CSR is related to companies' commitment to society. A socially responsible company should trace its actions in an ethical and transparent management. To do so, it needs to involve issues such as the quality of life and well-being of the company's internal public, the relationship with stakeholders, and the reduction of negative impacts on the community and the environment (Sheehy & Farneti, 2021).

The educational dimension is also relevant from two perspectives: science education and learning. In Bhaduri and Talat (2020), it is recognized that a public dialogue between academia and science can help increase the understanding of innovations and their positive effects. This would increase the likelihood of market acceptance of a product or service. Companies can collaborate with universities and other educational institutions, attend public events, participate in discussion forums, etc. There is a relevant set of initiatives, short and long term, that can be promoted to bring companies and academia closer together. In another perspective, learning is a core element of RI. The goal is for companies to improve their processes and make them more efficient and sustainable. Technological evolution has helped build sustainable development. However, the exploitation of one innovative technology is insufficient. RI practices should also look at organizational processes and make the company learn throughout this process by adopting sustainable products and practices (Bianchi et al., 2022).

11.5 Conclusions

In an ever-changing world, organizations must quickly respond and adapt to the constant changes perpetuated in the surrounding environment. Organizations must have the ability to create, acquire and transfer knowledge, so that they can modify their behaviour to reflect new knowledge and ideas. Innovation assumes the challenge of presenting something new or improved by an organization, through the different possible types of innovation and in all areas of the business, and which has as its main objective to transform this novelty into something with recognized value, for all its possible users and preferably for society in general. Innovation should be consequently responsible and generate relevant and sustainable value for all audiences (e.g. society, users and shareholders). In this way, innovation can have the right impacts with the help of RI, as this is a framework that enables the governance and evaluation of innovations concerning their potentially harmful consequences and positive contributions to societal challenges.

There are several tools for measuring RI. However, given the emergence of the topic, there is no single tool that allows for a complete and comprehensive measurement of all their dimensions. This study identified 18 RIATs and found a total of 16 dimensions. The social and educational dimensions stand out as the most relevant considering the number of different frameworks that incorporate these dimensions. It was also possible to conclude that RI dimensions cannot be seen in isolation since there is a strong interconnection between them.

This work presents some limitations that it is important to address. First, the identification of the frameworks resulted from an exploratory qualitative research process. It is relevant to systematize this process by conducting a systematic literature review to understand in greater depth the characteristics of these tools and their scientific framework. It is also relevant to explore the applicability of these tools considering several activity factors. The health field was highlighted as an important activity sector for the application of these tools, but there are potentially other activity sectors in which RI is also a priority.

Appendix

Table 11.2 Comparative analysis of RRIT tools

Tool	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16
ENCORE									X							
ESIA							X			X				X		
F4-RIF	X	X	X	X												
EM		X			X		X	X		X						
HTA							X	X		X	X		X			
KARIM						X			X	X	X					
LCAA		X				X	X			X		X		X		X
MoRRI			X		X	X				X				X		
ORBIT	X	X	X	X	X	X		X		X				X		
PRISMA					X	X		X		X				X		
PIT						X						X				
RN		X	X	X	X	X	X			X				X		X
COMPASS			X		X	X		X		X				X		
RIH									X		X		X			
RMoI	X	X	X	X	X	X										
RRI-MM	X	X	X	X	X			X						X		
ROSIE			X			X	X	X	X	X	X	X		X	X	
SDG-C			X			X	X	X	X	X	X	X		X	X	
<i>Count</i>	4	7	9	5	8	8	6	8	5	11	5	4	2	10	4	2

References

- Acs, Z. J., Audretsch, D. B., Lehmann, E. E., & Licht, G. (2017). National systems of innovation. *The Journal of Technology Transfer*, 42(5), 997–1008. <https://doi.org/10.1007/s10961-016-9481-8>
- Aguirre, J. C., Peralta Zuñiga, M. L., Mora, P., & Blanco, F. (2021). Innovative entrepreneurship and quality of life. The case of Ecuador. *Academia Revista Latinoamericana de Administración*, 34(1), 143–164. <https://doi.org/10.1108/ARLA-04-2020-0076>
- Almeida, F. (2021). Open-innovation practices: Diversity in Portuguese SMEs. *Journal of Open Innovation: Technology, Market, and Complexity*, 7(3), 1–19. <https://doi.org/10.3390/joitmc7030169>
- Almeida, F., & Wasim, J. (2022). Eco-innovation and sustainable business performance: Perspectives of SMEs in Portugal and the UK. *Society and Business Review*, 18, 28. <https://doi.org/10.1108/SBR-12-2021-0233>
- Andrade, V. (2017). *Como promover inovação com foco na sustentabilidade?* <https://blog.waycarbon.com/2017/06/inovacao-com-foco-na-sustentabilidade/>
- Bacq, S., & Aguilera, R. V. (2022). Stakeholder governance for responsible innovation: A theory of value creation, appropriation, and distribution. *Journal of Management Studies*, 59(1), 29–60. <https://doi.org/10.1111/joms.12746>
- Balland, P. A., Boschma, R., & Ravet, J. (2019). Network dynamics in collaborative research in the EU, 2003–2017. *European Planning Studies*, 27(9), 1811–1837. <https://doi.org/10.1080/09654313.2019.1641187>
- Balogun, J. (2007). The practice of organizational restructuring: From design to reality. *European Management Journal*, 25(2), 81–91. <https://doi.org/10.1016/j.emj.2007.02.001>
- Bhaduri, S., & Talat, N. (2020). RRI beyond its comfort zone: Initiating a dialogue with frugal innovation by ‘the vulnerable’. *Science, Technology and Society*, 25(2), 273–290. <https://doi.org/10.1177/0971721820902967>
- Bianchi, G., Testa, F., Boiral, O., & Iraldo, F. (2022). Organizational learning for environmental sustainability: Internalizing lifecycle management. *Organization & Environment*, 35(1), 103–129. <https://doi.org/10.1177/1086026621998744>
- Boons, F., & Lüdeke-Freund, F. (2013). Business models for sustainable innovation: State-of-the-art and steps towards a research agenda. *Journal of Cleaner Production*, 45, 9–19. <https://doi.org/10.1016/j.jclepro.2012.07.007>
- Bora, B., Borah, S., & Chungyalpa, W. (2017). Elaborando objetivos estratégicos: examinando o papel da visão de negócios e declarações de missão. *Órgão Gerenciar*, 6(1), 1e6.
- Bos-Brouwers, H. E. J. (2010). Corporate sustainability and innovation in SMEs: Evidence of themes and activities in practice. *Business Strategy and the Environment*, 19(7), 417–435. <https://doi.org/10.1002/bse.652>
- Burget, M., Bardone, E., & Pedaste, M. (2017). Definitions and conceptual dimensions of responsible research and innovation: A literature review. *Science and Engineering Ethics*, 23(1), 1–19. <https://doi.org/10.1007/s11948-016-9782-1>
- Chen, J., Yin, X., & Mei, L. (2018). Holistic innovation: An emerging innovation paradigm. *International Journal of Innovation Studies*, 2(1), 1–13. <https://doi.org/10.1016/j.ijis.2018.02.001>
- Chen, J., Nichele, E., Ellerby, Z., & Wagner, C. (2022). Responsible research and innovation in practice: Driving both the ‘how’ and the ‘what’ to research. *Journal of Responsible Technology*, 11, 1–5. <https://doi.org/10.1016/j.jrt.2022.100042>
- Chung, C.-C., Chao, L.-C., Chen, C.-H., & Lou, S.-J. (2016). A balanced scorecard of sustainable management in the Taiwanese bicycle industry: Development of performance indicators and importance analysis. *Sustainability*, 8(6), 1–21. <https://doi.org/10.3390/su8060518>
- Dacin, P. A., Dacin, M. T., & Matear, M. (2010). Social entrepreneurship: Why we don’t need a new theory and how we move forward from here. *Academy of Management Perspectives*, 24, 37–57. <https://doi.org/10.5465/amp.24.3.37>

- Deloitte. (2020). *A quick guide to EU Funding 2014–2020*. https://www2.deloitte.com/content/dam/Deloitte/cy/Documents/finance/CY_Finance_EUFunding2014-2020Guide_Noexp.pdf
- Dreyer, M., von Heimburg, J., Goldberg, A., & Schofield, M. (2020). Designing responsible innovation ecosystems for the mobilisation of resources from business and finance to accelerate the implementation of sustainability. A view from industry. *Journal of Sustainability Research*, 4(3), e200033. <https://doi.org/10.20900/jsr20200033>
- ENCORE. (2022). *Exploring natural capital opportunities, risks and exposure*. <https://encore.naturalcapital.finance/en>
- European Commission (EC). (2011). *Horizon 2020 – The framework programme for research and innovation*. EC.
- Gupta, P. (2008). *Inovação empresarial no século XXI*. Vida Económica.
- Grzawska, A. (2021). Responsible innovation in business: Perceptions, evaluation practices and lessons learnt. *Sustainability*, 13(4), 1826. <https://doi.org/10.3390/su13041826>
- Hauser, J., Tellis, G. J., & Griffin, A. (2006). Research on innovation: A review and agenda for marketing science. *Marketing Science*, 25(6), 687–717. <https://doi.org/10.1287/mksc.1050.0144>
- Hin, G., Daigney, M., Haudebault, D., Raskin, K., Bouché, Y., Pavie, X., & Carthy, D. (2014). *Introduction to responsible innovation criteria*. https://www.nweurope.eu/media/1118/guide_online.pdf
- Interreg Central Europe – ROSIE. (2020). *About Rosie Ri toolbox*. <https://www.ciseonweb.it/progetti-europei/rosie/>
- Kaiser, M., & Forsberg, E. M. (2001). Assessing fisheries – Using an ethical matrix in a participatory process. *Journal of Agricultural and Environmental Ethics*, 14(2), 191–200. <https://doi.org/10.1023/A:1011300811590>
- Kneipp, J. M., Gomes, C. M., Bichueti, R. S., Frizzo, K., & Perlin, A. P. (2019). Sustainable innovation practices and their relationship with the performance of industrial companies. *Revista de Gestão*, 26(2), 94–111. <https://doi.org/10.1108/REGE-01-2018-0005>
- Landeweerd, L., Townend, D., Mesman, J., & Van Hoyweghen, I. (2015). Reflections on different governance styles in regulating science: A contribution to ‘responsible research and innovation’. *Life Sciences, Society and Policy*, 11(8), 1–22. <https://doi.org/10.1186/s40504-015-0026-y>
- Lehoux, P., Silva, H. P., Oliveira, R. R., & Rivard, L. (2020). The responsible innovation in health tool and the need to reconcile formative and summative ends in RRI tools for business. *Journal of Responsible Innovation*, 7(3), 646–671. <https://doi.org/10.1080/23299460.2020.1844974>
- Lichtenthaler, U. (2016). Toward an innovation-based perspective on company performance. *Management Decision*, 54, 66–87. <https://doi.org/10.1108/MD-05-2015-0161>
- Long, T. B., Blok, V., Dorrestijn, S., & Macnaghten, P. (2020). The design and testing of a tool for developing responsible innovation in start-up enterprises. *Journal of Responsible Innovation*, 7(1), 45–75. <https://doi.org/10.1080/23299460.2019.1608785>
- Meissner, D., & Kotsemir, M. (2016). Conceptualizing the innovation process towards the ‘active innovation paradigm’ – Trends and outlook. *Journal of Innovation and Entrepreneurship*, 5(14), 1–18. <https://doi.org/10.1186/s13731-016-0042-z>
- Meyer, J. V., Pascucci, L., & Mangolin, L. (2012). Gestão estratégica: Um exame de práticas em universidades privadas. *Revista de Administração Pública*, 46(1), 49–70. <https://doi.org/10.1590/S0034-76122012000100004>
- Moczek, N., Voigt-Heucke, S. L., Mortega, K. G., Cartas, C. F., & Knobloch, J. (2021). A self-assessment of European citizen science projects on their contribution to the UN Sustainable Development Goals (SDGs). *Sustainability*, 13(4), 1–18. <https://doi.org/10.3390/su13041774>
- Morawska-Jancelewicz, J. (2021). The role of universities in social innovation within quadruple/quintuple helix model: Practical implications from Polish experience. *Journal of the Knowledge Economy*, 13, 1–42. <https://doi.org/10.1007/s13132-021-00804-y>
- Oduro, S. (2019). Examining open innovation practices in low-tech SMEs: Insights from an emerging market. *Journal of Science and Technology Policy Management*, 10(3), 509–532. <https://doi.org/10.1108/JSTPM-03-2019-0036>
- Pasquale, P. P. (2012). *Comunicação Integrada de Marketing – a Teoria na Prática*. Elsevier.

- Phillips, W., Lee, H., Ghobadian, A., O'Regan, N., & James, P. (2015). Social innovation and social entrepreneurship: A systematic review. *Group & Organization Management*, 40, 428–461. <https://doi.org/10.1177/1059601114560063>
- Pozo, H., Akabane, G. K., & Tachizava, T. (2019). Innovation and technology processes in micro and small business. *Cogent Business & Management*, 6(1), 1–21. <https://doi.org/10.1080/23311975.2019.1588088>
- Roach, D. C., Ryman, J. A., & Makani, J. (2016). Effectuation, innovation and performance in SMEs: An empirical study. *European Journal of Innovation Management*, 19, 214–238. <https://doi.org/10.1108/EJIM-12-2014-0119>
- Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students*. Pearson Education.
- Scherer, A. G., Palazzo, G., & Baumann, D. (2006). Global rules and private actors: Toward a new role of the transnational corporation in global governance. *Business Ethics Quarterly*, 16(4), 505–532. <https://doi.org/10.5840/beq200616446>
- Schütz, M., & Strohmaier, R. (2022). Power relations in European RDI-collaboration networks. Disparities in policy-driven opportunities for knowledge generation in ICT. *Economics of Innovation and New Technology*, 31(3), 209–230. <https://doi.org/10.1080/10438599.2020.1799139>
- SDG Compass. (2015). *The SDG Compass provides guidance for companies on how they can align their strategies as well as measure and manage their contribution to the realization of the SDGs*. <https://sdgcompass.org>
- Sheehy, B., & Farneti, F. (2021). Corporate social responsibility, sustainability, sustainable development and corporate sustainability: What is the difference, and does it matter? *Sustainability*, 13(11), 1–17. <https://doi.org/10.3390/su13115965>
- Silva, H. P., Lefebvre, A. A., Oliveira, R. R., & Lehoux, P. (2021). Fostering responsible innovation in health: An evidence informed assessment tool for innovation stakeholders. *International Journal of Health Policy and Management*, 10(4), 181–191. <https://doi.org/10.34172/ijhpm.2020.34>
- Silverman, D. (2010). *Doing qualitative research: A practical handbook*. Sage.
- Srivastava, V., & Mushtaq, G. (2011). Corporate restructuring – A financial strategy. *Asian Journal of Technology & Management Research*, 1(1), 1–9.
- Stahl, B. C., Obach, M., Yaghmaei, E., Ikonen, V., Chatfield, K., & Brem, A. (2017). The responsible research and innovation (RRI) maturity model: Linking theory and practice. *Sustainability*, 9, 1–19. <https://doi.org/10.3390/su9061036>
- Stahl, B. C., Chatfield, K., Holter, C. T., & Brem, A. (2019). Ethics in corporate research and development: Can responsible research and innovation approaches aid sustainability? *Journal of Cleaner Production*, 239, 1–14. <https://doi.org/10.1016/j.jclepro.2019.118044>
- Stilgoe, J., Owen, R., & Macnaghten, P. (2013). Developing a framework for responsible innovation. *Research Policy*, 42(9), 1568–1580. <https://doi.org/10.1016/j.respol.2013.05.008>
- Sutcliffe, H. (2011). *A report on responsible research and innovation*. MATTER and the European Commission.
- Tavassoli, S., & Karlsson, C. (2016). Innovation strategies and firm performance: Simple or complex strategies? *Economics of Innovation and New Technology*, 25, 631–650. <https://doi.org/10.1080/10438599.2015.1108109>
- Tello, S. F., & Yoon, E. (2008). Examining drivers of sustainable innovation. *International Journal of Business Strategy*, 8(3), 164–169.
- Thorstensen, E. (2019). Responsibility for assistive technologies: Product assessment frameworks and responsible research and innovation. *Nordic Journal of Applied Ethics*, 13(1), 55–80. <https://doi.org/10.5324/eip.v13i1.2525>
- Tijdink, J. K., Horbach, S., Nuijten, M. B., & O'Neill, G. (2021). Towards a research agenda for promoting responsible research practices. *Journal of Empirical Research on Human Research Ethics*, 16(4), 450–460. <https://doi.org/10.1177/15562646211018916>

- Voegtlin, C., & Scherer, A. G. (2017). Responsible innovation and the innovation of responsibility: Governing sustainable development in a globalized world. *Journal of Business Ethics*, 143(2), 227–243. <https://doi.org/10.1007/s10551-015-2769-z>
- Von Schomberg, R. (2013). A vision of responsible research and innovation. In R. Owen, J. Bessant, & M. Heintz (Eds.), *Responsible innovation: Managing the responsible emergence of science and innovation in society* (pp. 51–74). <https://doi.org/10.1002/9781118551424.ch3>
- Wender, B. A., Foley, R. W., Hottle, T. A., Sadowski, J., Prado-Lopez, V., Eisenberg, D. A., Laurin, L., & Seager, T. P. (2014). Anticipatory life-cycle assessment for responsible research and innovation. *Journal of Responsible Innovation*, 1(2), 200–207. <https://doi.org/10.1080/23299460.2014.920121>