

Exploratory Study of Responsible Innovation: Toward a Holistic Approach to Sustainability

Completed Research

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Abstract

The Information Systems (IS) community has been called to address the important challenge of sustainable development, but progress continues to be slow. Elsewhere, responsible innovation (RI) has emerged as a framework to support the integration of sustainability considerations into the innovation process. The aim of this paper is to explore how organizations operationalize the main RI principles – anticipation, inclusion, responsiveness, and reflexivity. Based on a qualitative exploratory study, this paper develops insights into practices taken by organizations to address sustainability issues through their IS innovation processes. Our findings suggest that organizations operationalize RI principles highly or partially under the influence of five factors. A new understanding of the RI principles operationalization and its applicability to IS innovations is developed, which can serve to direct further research and guide organizations aiming to enhance their sustainability performance.

Keywords

Responsible innovation, IS innovation, sustainability, green IS.

Introduction

Information Systems (IS) innovations can contribute to addressing different social and environmental issues in addition to being a source of economic prosperity for present and future generations. IS scholars have engaged in many areas that contribute to sustainability (Cherki El Idrissi 2017; Lee et al. 2018). For example, IS research has investigated the use of IS platforms to address the energy challenge (Ketter et al. 2016), explored the social complexity of green IS projects (Trid et al. 2019) and studied the potential of IS in sustainability reporting and performance (Seethamraju and Frost 2019). Still, the community lacks a holistic approach to achieving the triple bottom line (TBL) of sustainability.

Responsible innovation (RI) is a framework that could help to integrate sustainability considerations into the IS innovation process. The RI framework is based on four principles: anticipation, inclusion, responsiveness, and reflexivity. The suitability of the RI framework for IS research has been established (Stahl et al. 2013); however, studies focusing on this concept and its applicability to IS innovations are scarce. The literature suggests integrating RI within the IS field is a challenge for many reasons. First, integrating RI within IS innovation processes requires effort to tailor RI goals and definitions according to the objectives and values of the specific contexts where the organizations operate (Macnaghten et al. 2014). Second, organizations across many sectors are not yet familiar with RI concept and do not know how to apply it to their innovation processes (Gurzawska et al. 2017). Third, the IS literature concentrates mostly on the role of IS for environmental sustainability (Pernici et al. 2012). Thus, integrating RI in IS

innovations requires a shift in our conceptualization of IS as a solution for all dimensions - economic, social and environmental - of sustainability.

The goal of this paper is to contribute to the application of RI in IS innovation processes. We set out to answer the following research questions: how can organizations operationalize RI principles, and what factors facilitate the operationalization of RI principles? To answer these questions, we take an exploratory perspective to study the sustainability practices of seventeen organizations engaged in IS innovation. We find that the four RI principles are implemented in varying degrees depending on five facilitating factors. This study contributes to the efforts of the IS community to achieve a holistic approach to sustainability. This paper is structured as follows. Next, we present the RI framework as the theoretical foundation for the research. Then, we describe the methodology and follow with a presentation of the results and discussion of the facilitating factors of RI. We conclude with contributions to research and practice.

Theoretical Background

A sustainable innovation is defined as a “radically new or significantly improved technical, organizational, business-related, institutional or social solution that meets a triple bottom line of economic, environmental and social value creation” (Fichter and Clausen 2016). The discourse on sustainable and responsible innovation (Owen et al. 2013), along with the developments in stakeholder and innovation management literature (Freeman and Auster 2015) call for a values-based reframing of innovation theories and concepts to better meet critical future challenges. This is where RI comes into play, as a comprehensive approach that can provide solutions to issues throughout the innovation process and in the innovation outcomes.

RI builds on governance approaches and innovation processes that take ethical and social concerns into account from the start to post-launch of the innovation (Pavie and Carthy 2015). Stilgoe et al. (2013) presented a framework based on four principles: anticipation, inclusion, responsiveness, and reflexivity. The principle of anticipation involves a systematic thinking about the potential effects of the innovation aimed at increasing the resilience of organizations by encouraging them to consider what could possibly happen throughout the innovation process and after the launch of the innovation (Stilgoe et al. 2013). The principle of inclusion consists of taking innovation beyond profit objectives to a level that reflects what is socially desirable by all stakeholders, starting at the beginning of the innovation process (Owen et al. 2013). Responsiveness involves the dynamic capacity to change the direction of the innovation processes and outcomes according to stakeholders’ values (Stilgoe et al. 2013). The reflexivity principle means that all innovation stakeholders should critically assess their own perceptions to be able to reflect upon the impacts of the innovations they undertake or adopt (Stilgoe et al. 2013).

The extant literature on RI is growing, but still lacks extensive empirical investigation due to the relative novelty of the RI framework (Koops et al. 2015). Studies of RI have highlighted its impact in different fields, such as bio-entrepreneurship (Bolz and Volkmann 2019), social innovation (Bolz and de Bruin 2019), responsible entrepreneurship (Vallaster et al. 2019) and health IT (Bessant et al. 2017), without clearly advancing our knowledge on concrete methods of operationalization. Furthermore, a recent review of papers on RI between 2003 and 2016 showed a rise in research papers after 2013 (Thapa et al. 2019), most of which focuses on RI tools, followed by RI outcomes, drivers, and barriers. Moving in the same direction, some have studied the development and diffusion of innovations based on RI (Kobeissi and Damanpour 2003; Schlaile et al. 2018). Although these efforts offer interesting insights on how RI contributes to better innovations, RI remains rooted in political and academic contexts. This poses a challenge for RI integration in business organizations, as the preoccupations in academia are different from the traditional business context (Burget et al. 2017). Knowing that there is no structured way yet to help organizations evaluate the extent to which their practices align with RI, a recent study of RI allows a better understanding of RI measures and suggests a maturity model of RI integration (Stahl et al. 2017). Similarly, a recent study shows that organizations may already be operationalizing some RI practices without labeling them as so (Auer and Jarmai 2018). This motivates our study in identifying those practices and depicting the factors that facilitate RI operationalization.

Methodology

We chose a qualitative approach for this study because it provides the possibility to focus on events that occur in natural settings and are related to new phenomena (Miles et al. 2013). The concept of RI is still emerging and has not yet been extensively applied or used in IS research (Maric et al. 2015); however, enough is known about its principles and prior applications in other fields (Zahinos Ruiz 2016) to help inform the research. The research process is outlined in Figure 1.

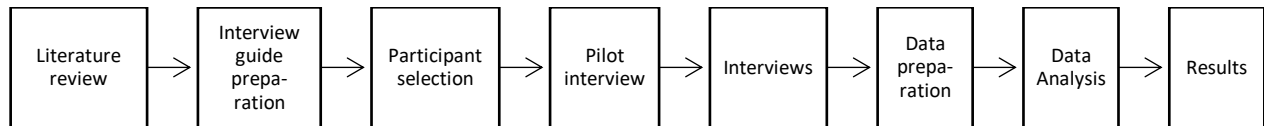


Figure 1 Research process

The primary data source consists of semi-structured interviews. The participants worked as managers, and operational staff involved in IS innovation processes for organizations with sustainability goals. Participants were contacted through their organizations' websites or social media pages. A snowball approach was also used, wherein each participant was asked to refer other individuals who may be interested in the study. The choice of these participants is justified by several arguments. First, their experience helps us get a closer look to the innovation processes their organizations adopt. Second, the exploratory nature of the study and the state of advancement of knowledge in this area required diversified perspectives. In total, 17 interviews with 19 participants (895 minutes in total) were conducted between August 2017 and January 2018 (see Table 1). Thirteen interviews were conducted face-to-face in participants' everyday work settings, while four were done through video-conference or phone calls. We stopped conducting interviews when theoretical saturation was reached, meaning no substantial new information was provided by the next participant (Miles et al. 2013). Before collecting the data, two pilot interviews were conducted to test the structure and process of questioning and the validity and relevance of the questions to the study context. The interview guide was inspired by the RI project KARIM (Hin et al. 2015). KARIM is the Knowledge Acceleration and Responsible Innovation Meta-network, "a European project aimed at developing transnational connections between universities, innovation-support agencies and Small and Medium-sized Enterprises (SMEs), with a focus on RI" (Hin et al. 2015). Interviews were conducted in French and English. Each interview was audio-recorded and transcribed verbatim after participant's consent. Publicly available sustainability information and other relevant documents made available by the respondents to the researchers were also analyzed and used for data validation.

Number of participants	Number of interviews	Operational / Management staff	Female/ Male	In person/ Remote	Total interview minutes
19	17	7/12	8/11	13/4	895

Table 1 Summarized profile of participants

Initially, the data analysis process involved deductive techniques using a pre-defined list of codes (derived from the literature). Then, we used inductive techniques to allow important constructs and meanings to emerge from the data, according to Miles, et al. (2013). Conceptually clustered matrices were used to facilitate finding evidence and identifying themes. We engaged a second coder to ensure coding validity (inter-rater agreement was 83%), while analysis and findings have been reviewed and discussed among the three authors.

Results

Operationalization of RI Principles

Regarding our first research question, our analysis suggests that organizations operationalize RI principles to varying degrees and using various tools (See Table 2), as described below.

Principles	Example of tools of operationalization
Anticipation	Research and Development (R&D); University chairs; Stage-gates; Life cycle analysis; Calculations of environmental impacts Data privacy risks analysis.
Inclusion	Stakeholders' collaborations; Research partnerships; Open innovation; Fab Labs (the fabrication laboratory); Stimulus committees.
Ethical Reflexivity	Values examination; Training on sustainable development; Self-evaluation of values
Operational Reflexivity	Performance monitoring; Project goal evaluation; 4-week reflection sprints.
Responsiveness	Response to incidents; Surveys and proactive identification of stakeholders needs; Data sharing on demand.

Table 2 Overview of tools to support operationalization of RI principles

Anticipation principle

Anticipation is operationalized along two continuums. The first is based on the level of issues covered: social (e.g., safety, security, data ethics), environmental (e.g., toxic substances), and economic (e.g., impacts on job security) issues. The second continuum is based on the degree of structure of the anticipation activities: highly structured (e.g., using specific tools) and informal (e.g., using brainstorming or critical thinking). Seven participants revealed that their organizations engaged in partial or high operationalization of the anticipation principle. High anticipation corresponds to engagement in activities purposely designed to identify and address potential impacts of an innovation on social, economic, and environmental aspects. Partial anticipation corresponds to the integration to some extent of anticipation efforts that may not cover all three areas of sustainability and may not be done purposefully by the organization.

Two participants described high anticipation. For example, P1 explained that his organizations' introduction of smart meter technology would have had two negative impacts: causing the lay-off of 800 people and potential health issues for customers. However, by anticipating this negative social impact, the organization was able to put in place proactive strategies to reengage the people whose jobs were at risk because of this technological shift. With regard to the potential health issues on customers, the organization conducted research internally and with research partners to anticipate any negative impacts.

“There was a meta-analysis based on external studies on radio-sensitivity versus smart meters ...To ensure that we are not deploying something on a large scale that causes cancer in 5 years, to the general population” P1.

Partial anticipation was reported by five participants, whose organizations focused anticipation activities on only one area of sustainability impact. For example, P9's organization focused on social aspects. This organization specializes in digital innovation and their anticipation processes focused primarily on helping its clients to anticipate different threats related to data ethics.

Inclusion principle

Thirteen participants identified inclusion processes within their organizations. Inclusion operationalization occurred at two levels, 1) consultation, which is to simply identify the stakeholders' values that the innovation outcomes have to respect, and 2) co-constructing, which means to build the innovation with internal and external stakeholders, such as what happens during open innovation contests and collaborative activities (Pellé and Reber 2014). Six organizations engaged in high inclusion that consisted of purposely identifying and engaging a variety of relevant stakeholders in dialogues to enhance the innovation process. For instance, P12 identified a large range of stakeholders in her organizational innovation process, where inclusion is operationalized to the greatest extent possible, ensuring deliberations are part of it.

“We are often a kind of unifying banner as we engage health actors, the experts of the problem, hospitals, faculties of medicine, pharmacies, clinicsthere are students included who have time and then who are interested, who want to learn.” P12.

The other seven organizations used partial inclusion that consisted of identifying limited groups of stakeholders and where efforts of inclusion may not have integrated any deliberations. The stakeholders included were clients, prospective clients, and business partners. For example, P11’s organization included employees, clients, and shareholders in their innovation processes, but did not extend the inclusion process to final users or community members.

In both levels of operationalization, different approaches were used to create and maintain collaboration with stakeholders. The most prominent approaches are the use of innovation processes types that are by nature open and collaborative, such as Fab-Labs, bottom-up methods, client-focused brainstorming processes, co-designing, co-working, the use of innovation committees, living labs, open innovation, and research partnerships.

Responsiveness principle

Fifteen participants spoke of how responsiveness was operationalized in their organizations, making it the most often operationalized principle of RI. Eleven of 15 organizations engaged in high responsiveness operationalization that meant taking a proactive action towards stakeholders’ needs and feedback. For example, P14 described how they were proactive in defining and satisfying the needs of their stakeholders:

“We adapt the activities we develop for the youth to their needs. We ask ourselves ahead of time how this activity will be beneficial for the training of our young people, for their future integration into employment” P14.

The organizations that demonstrated low responsiveness (four organizations) adopted a response only when the need was manifested through specific incidents or particular feedback received from their stakeholders. An example of that was P1’s organization’s compliance with client complaints leading to a change in the cycle of turbines. Responsiveness was needed in this situation to create a solution for a negative environmental impact that appears only 20 days per year. This incident required responsiveness by creating new solutions that were not originally part of the innovation process:

“So there are a lot of complaints from people who see pieces of fish coming out ...and a lot of money has been spent to find ways to mitigate and to ensure that the fish are bypassing the plant rather than going directly into the turbines” P1.

Operationalizing responsiveness relied on tools that ensure an adequate response to the needs of stakeholders during the innovation process. The most common tools were user feedback, public conferences, client meetings, and user committees.

Reflexivity principle

Our analysis revealed two types of reflexivity: ethical and operational. At the highest level, ethical reflexivity is an examination of values, motivations, and purposes in conjunction with a deep examination with future impacts of innovation. Five participants spoke about how their organizations engaged in ethical reflexivity through a phase of self-questioning to figure out the mission, the values, and assumptions driving the organization. Ethical reflexivity allows organizations to take into account the challenges of sustainability such as the conflict between costs and sustainability goals, industry and personal motives, and research and practice goals. The following quote illustrates how P7’s organization engaged in ethical reflexivity:

“In fact, when we chose to make the challenges of climate change our focus, it was a controversial subject...we questioned ourselves “what’s the point? Of Fab-Labs? What is the point of our work? From there, we clarified our mission and established the course to complete it.” P7.

In contrast to ethical reflexivity, operational reflexivity is used to criticize, reflect upon, and question the efficiency of the organization at the operational level to reduce costs and use fewer resources, limiting

reflexivity to topics such as the overall performance and the work methods. Three participants mentioned engaging in operational reflexivity in conjunction with ethical reflexivity, while two participants reported being engaged in operational reflexivity only. As P9 explains, operational reflexivity allows an examination of long-term project performance through the analysis of past events, how the innovation projects are progressing, and how they could be enhanced:

“In our projects on the longer term, particularly the research platforms where we operate in development sprints of four weeks, reflexivity is there. In the sense of: did we develop the right functionality? Should we change this functionality according to the use we have to make? Here we constantly question whether this is the right thing that is developed in the right way” P9.

Both levels of reflexivity were operationalized using methods such as brainstorming, multi-stakeholders meetings, sprints, and post events meet-ups.

Factors Facilitating the Operationalization of RI Principles

Moving to the second research question, our analysis suggests five factors that facilitate the operationalization of RI principles, as summarized in Table 2 and discussed below.

Facilitating Factors	RI Principles			
	Anticipation	Inclusion	Reflexivity	Responsiveness
Sustainability engagement		Strategic	Strategic	Reactive or strategic
Sustainability leadership			Strong	Strong
Collaboration capability		Multi-partner collaborations		Research or multi-partner collaborations
Absorptive capacity		Strong		Multi-partner collaborations
Regulatory environment	Defined			

Table 3 Summary of the factors that facilitate RI

Sustainability engagement

Sustainability engagement refers to an organization’s consideration of the three dimensions of sustainability in its overall strategy. A sustainable organization has characteristics and behaviors designed to contribute to a sustainable future for all stakeholders (Funk 2003). We identified two levels of sustainability engagement: strategic, that is the highest level of sustainability engagement as it shapes the overall organization strategy, and reactive, which is a lower level of sustainability engagement, limited to actions based on external pressures. Eleven of 17 participants said their organizations are actively involved in sustainability engagement activities, such as corporate social responsibility (CSR) projects, care of the employees by the allocation of manageable workloads, sustainable sourcing, elaboration of organizational objectives, and promotion of healthy work relationships. This strategic approach to sustainability engagement deeply influences the overall organization, starting from organizational values as explained below:

“It’s in our values here, so everything from our sourcing [...] like where we get our coffee, what are our supplies, how much garbage and recycling are we producing [...] it’s from an environmental perspective in our mind, as we are landlords and are responsible for running this building” P2.

In contrast, four organizations used a reactive approach to sustainability consisting of compliance to clients’ demands to consider sustainability issues in their projects. Being sustainably-engaged on a strategic level seems to have facilitated the operationalization of reflexivity, inclusion and responsiveness. This can be explained by the fact that organizations that are actively engaged with their communities take the time to reflect upon what improvements are necessary in those communities and search continuously

for positive impact. This process involves a deep questioning of the values of the organization and how these values align with its activity (Hynie et al. 2016).

Sustainability leadership

Sustainable leadership aims to “to keep people, profits, and the planet in balance over the life of the firm, and in so doing ensure that the business generates the social capital needed to weather downturns” (McCann and Sweet 2014). Corporate adherence to sustainability starts with sustainability leadership (Westman et al. 2019). Recent studies show a significant impact of sustainable leaders on organizational actions, including those related to sustainability (Heizmann and Liu 2018). We identified strong sustainability leadership in 11 organizations. Participants in the top management positions had leadership competencies, such as creating the leadership culture and leading stakeholder engagement to achieve sustainable engagement. Operational staff who participated in the interviews also commented on their managers’ sustainability leadership and how managers directed their work routines to focus on this aspect, as P4 explains:

“The knowledge comes from our companies and our leaders. Our role is to exercise leadership so that they can be able to properly identify the sustainability issues of a project. We ask all our partners to identify their values. We use these values to accelerate the projects and accelerate the will to collaborate...” P4.

Results show that sustainability leaders were sensitive to the needs of their ecosystem in proactive and reactive ways. Prior literature suggests that sustainability awareness about the ecosystem surrounding the organization enhances the ability of managers to address sustainability challenges (Heizmann and Liu 2018).

Collaboration capability

Collaboration capability is defined as “a recursive process where people or organizations work together in an intersection of common goals by sharing knowledge, learning, and building consensus” (Dietrich et al. 2010). We identified two levels of collaboration capability: a higher level consisting of multi partner collaboration and a lower level consisting of collaboration with research partners only. Eleven participants who described how their organizations engaged in relationships with their stakeholders mentioned collaboration capabilities. Seven of these organizations had partnerships with multiple stakeholders, such as clients and business partners in addition to community organizations and the public. In contrast, four organizations were limited to research partnerships such as mention by P1 below:

“We have collaborations with different chairs in various universities which conduct research and develop tools capable of examining all possible situations in a hundred years.” P1.

The organizations demonstrated their collaboration capabilities by engaging in different projects with their stakeholders pursuing common goals. Collaboration helped these organizations achieve better results rapidly using the skills of their collaborators to compensate for what they lacked. Six organizations did not leverage collaborative capabilities because of a strategic choice that entails a more closed approach to innovation. However, they mentioned that it could be an option in the future.

Absorptive capacity

Absorptive capacity is a dynamic capability that aims to extend and modify organizational resources (Dzhengiz and Niesten 2019). It is the ability of an organization to recognize value in external knowledge and exploit it internally. Absorptive capacity of an organization can be assessed on the basis of the capacity of the organization to demonstrate five dimensions: its awareness, acquisition, assimilation, transformation, and exploitation of new external knowledge (Zahra and George 2002). Activities that relate to the absorptive capacity of organizations help to create links with stakeholders and identify information that will help during innovation processes. Nine of 17 participants described activities where the main purpose was gaining knowledge from various sources and using it as expertise in innovation processes, as explained in the comment:

“Our job is to listen and evaluate stakeholders and take advantage of it in our business....Understanding their motivation is part of our job as the goal is to transfer that knowledge into business opportunities.” P10.

These nine organizations demonstrate strong absorptive capacity covering the five dimensions of absorptive capacity. In contrast, three participants mentioned that efforts of their organizations to identify valuable knowledge externally and assimilate for innovation projects. However, these efforts fail to go beyond the assimilation dimension towards transformation and exploitation of the new knowledge in a way that creates a big impact.

Regulatory environment

The level of regulation surrounding an organization and its innovation process can have an influence on the operationalization of RI principles. A regulated environment is a controlled environment that requires certain conditions to be met in the implementations of the company objectives (Blind et al. 2017). When operating in a regulated environment, an organization must follow defined rules and regulations in the execution of its plans. The steps followed in the implementation should be certified and be reproducible when needed (Dewhurst and Thomas 2003). Two participants described a defined regulatory environment relative to their innovation processes. These two participants operate in sensitive fields: electronic waste management and energy fields. Because of known threats on the safety and security of consumers, both fields are highly regulated by the government in a way that creates a specific clear frame of action that needs to be respected in all projects. P14's quote below highlights the influence of a defined regulatory environment:

"There was a legislative context, we knew that from the moment there is a program of extended producer responsibility, there is a significant concentration of equipment. So it was absolutely necessary to comply with the regulation" P14.

Fifteen participants reported that their organizations faced no particular regulatory pressures surrounding their innovation projects. This in turn allowed them a broad space of action in terms of sustainability issues. Regulatory environment seemed to be the first factor to impact the operationalization anticipation principle. In link with IS innovations, few regulations have taken place to ensure that organizations are truly responsible in their innovation process. Most defined regulations involve cyber security issues (Srinivas et al. 2019), but none has been taken to protect the youth from the overuse of electronics and social addiction around their activities (Kwon et al. 2016; Zhan and Chan 2012).

Conclusion

The analysis of the operationalization of RI principles and the facilitating factors help us build a better understanding of what practices contribute to RI operationalization. We suggest the five factors identified and discussed individually and collectively contribute to the operationalization of the different RI principles. An organization needs to take into consideration the operationalization tools and the facilitating factors in order to build a strategy that allows to implement this framework within its IS innovation processes.

This study has a number of contributions to research and practice related to responsible IS innovations. First, regarding the implications for research, this study provides a new understanding of how to implement sustainability within IS innovation processes through operationalizing RI principles. This knowledge can inform sustainable transformations and speed the rate of change. Second, for practice, this study presents organizations with a survey of RI operationalization tools, such as technology assessment or reflective brainstorming, which can support the integration of sustainability objectives in their innovation processes. These provide concrete guidance to managers embarking on the journey of RI.

The limitations of this study relate to the small number of our participants. Seventeen participants representing a range of different companies were part of study, which may hinder a complete view of the phenomenon under study. Second, although the factors that support operationalization of RI were identified inductively from data that reflects practice, they remain conceptual. Therefore, future work should attempt to validate these constructs, find relationships between the principles and evidence for their effectiveness.

Future research could investigate further these links in a participatory approach using action research settings for example, or by developing measures for quantitative evaluation. In addition, while the focus in

this study was on the organizational level, we believe that future research could investigate the role of individual skills in conducting RI to answer questions such as: how can leaders encourage more engagement in RI? It is our hope that using insights in this paper will increase the understanding RI concept, and thus ease the difficulty around applying it successfully in business contexts.

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