Chapter 13
Managing the Responsibilities of Doing Good and Avoiding Harm in Sustainability-Orientated Innovations: Example from Agri-Tech Start-Ups in the Netherlands

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13.1 Introduction

Responsible innovation (RI), also termed Responsible Research and Innovation, has emerged due to increasing concern over how to integrate ethical and societal values into research and innovation policy and governance (Von Schomberg 2013), in response to questioning of the societal role of science as well as populist resurgence in some countries (Long and Blok 2017a). Within a RI approach, innovators must consider three dimensions of responsibility, including the dimensions of (1) 'avoiding harm' to people and the planet, (2) 'doing good' through the offering of innovations that foster sustainable development, and (3) the development of facilitative global governance schemes (Voegtlin and Scherer 2017).

Programs to enhance the alignment of research and innovation objectives with sustainability development and societal benefits are evident in jurisdictions such as the USA and EU. Within in the EU, RI has been pursued as a priority across through the H2020 program, with nearly €80 billion allocated during the funding period 2014–2020. This commitment to RI will remain for the forthcoming Ninth Framework program through a focus on Open Innovation, Open Science and Openness to the World (3 O's).

In spite of the resources employed towards implementation, RI has experienced a range of difficulties (Novitzky et al. 2020). Chief amongst these are low levels of awareness of RI in general and especially in relation to industry. For instance, research on the industry focused 'Leadership in enabling and industrial

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technologies' (LEIT) H2020 program found only sporadic evidence for RI (Tabarés et al., 2021). RI's importance within industry settings centers on the role that industry plays in the diffusing and embedding of research and innovation into society.

The current low awareness and take-up of RI in industry contexts raises the question of how to boost RI adoption within industry settings. To tackle this question, draw on literature on sustainability orientated innovations (SOIs) that offers guidance in terms of how sustainability concerns – primarily 'doing good' – can be incorporated, as industry actually has experience with these types of responsible practices. At the same time, it is less clear how to extend industry responsibility to incorporate 'avoiding harm' as well as ethical concerns into research and innovation processes (Adams et al. 2016; Geradts and Bocken 2019; Schaltegger and Wagner 2011). To illustrate how 'doing good' can be combined with 'avoiding harm' and ethical concerns, to produce RI outcomes, we explore the case of agri-tech start-ups and their development of smart farming innovations. Exploring an example of RI within industry helps us to consider the question of how RI can then be facilitated and supported within other industry contexts. Our cases focus on the development of smart farming SOIs, such as drones, artificial intelligence, the internet of things or gene editing technologies. We argue that the nature of these SOIs means that the dual consideration of benefit and harm is required for their successful diffusion and to ensure the 'right' impacts.

Consequently, we build a framework for RI in industry by combining the strength of the concepts of SOI with RI and explore its dynamics in empirical cases. We first highlight how 'doing good' can be combined with 'avoiding harm', before exploring options of how to enhance RI uptake within industry contexts. We go on to propose a combined bottom-up and top-down policy formula, and in so doing, contribute to the Voegtlin and Scherer's (2017) third dimension of responsibility, that of governance-responsibility.

13.2 Literature Review

13.2.1 Responsible Innovation in Industry Contexts

The concept of RI has roots in different disciplines, from science and technology studies, management science to the philosophy of management and innovation (Burget et al. 2017). All framings however involve harnessing the power of innovation for the solving of societal challenges, while acknowledging the potential for unintended, negative consequences and the harms that can occur (Voegtlin and Scherer 2017; Von Schomberg 2013).

While innovation is undertaken by a wide set of actors, industry in particular is highlighted as having a particular role to play (Voegtlin and Scherer 2017), due to their resources, 'scope for action', and special role in societal diffusion and embeddedness of innovations. We use the conception of RI offered by Voegtlin and Scherer (2017), which presents successful RI – innovation which contributes to the solving

of societal grand challenges and UN Sustainable Development Goals – as being dependent on three dimensions of responsibility. A responsibility to 'do good', a responsibility to 'avoid harm' and lastly, a 'governance-responsibility' (Voegtlin and Scherer 2017). The responsibility to 'do good' incorporates scholarship and practice such as sustainable entrepreneurship, social innovation, or shared value approaches (Lubberink et al. 2018; Schaltegger and Wagner 2011). The responsibility to 'avoid harm' highlights the use of codes of conduct or risk management frameworks (Owen et al. 2013), which link to conceptions of RI, such as the AIRR framework and its dimensions of anticipation, inclusivity, reflexivity, and responsiveness (Stilgoe et al. 2013).

While research on both 'do good' and 'avoid harm' approaches exists separately, few cases in practice successfully incorporate both dimensions of responsibility while also ensuring ethical considerations are taken into account so as to manage user adoption (consumer, psychological, stakeholder) and sufficient market appeal (investor, economic). In order to explore how to increase the uptake of RI in industry we take the practice of SOI as a point of departure as it is a relatively more established practice in industry.

13.2.2 Sustainability Orientated Innovations and Their Prominence in Industry Contexts

SOIs are innovations that seek to create social and environmental value, in addition to economic returns, via alterations to the philosophies and values behind their development (Adams et al. 2016). We will explore SOI literature to consider the extent to which it could help enhance uptake of RI in industry contexts, improving societal outcomes and the chances of technology success.

Sustainable entrepreneurship provides evidence of the positive effects that RI could have (Hart et al. 2005; Markman et al. 2016), yet fails to incorporate considerations of unintended impacts or consequences need to 'avoid harm'. While 'avoid harm' approaches are overly risk focused, potentially at the expense of creativity and ingenuity.

Approaches to the management of SOI can broadly be split into those with a more internal orientation, based on research focused on the relationship between SOI and financial performance, capabilities, and knowledge management (Del Giudice et al. 2017; Teece 2010); versus those, with an external focus, which focuses on stakeholder and network perspectives (McVea and Freeman 2005).

Internally focused approaches to the development and management of SOIs include techniques such as life cycle thinking, triple bottom line approaches and environmental management systems. These techniques are used to include sustainability criteria into innovation processes to produce SOIs. For instance, life cycle thinking expands consideration of impacts beyond just the production or use phase, to cover the whole life cycle, whereas triple bottom line approaches broaden the

criteria considered during the innovation process (Long et al. 2015; Matos and Hall 2007). Higher level strategies are also evident, such as strategic niche management, which seeks to enhance the early development of innovations through the generation of protective spaces or 'niches'. This helps overcome issues with slow development times or initially unfavourable market conditions (Kemp et al. 2000; Kivimaa and Kern 2016). Business model innovation is a further approach, highlighting the key role that business models play in the success or failure of product and systems innovations (Bolton and Hannon 2016). There is a vast literature focused on business models, and how this impacts SOI performance (Bocken et al. 2014; Boons and Lüdeke-Freund 2013). This literature takes an almost exclusively value creation perspective on doing good via SOI's (Evans et al. 2017), where the consideration of potential harm is often not addressed (see for exceptions Bocken et al. 2013; Long and van Waes 2021; Yang et al. 2017).

SOI development is heavily influenced by external relationships and the wider network of the innovator (Williams et al. 2017). The importance of 'user' values and societal involvement for successful SOI is well established (Baldassarre et al. 2017; Cillo et al. 2019; Nielsen 2020). Within agri-food systems, SOI processes and their outputs have been influenced by societal representation and power relations, often to the detriment of sustainability aims and marginalised communities (Bronson 2018, 2019); it is argued that the complex nature of agri-food challenges and the wide impacts they have mean societal 'stakes' in SOI processes are even more critical (Rose and Chilvers 2018). However, within SOI contexts, inclusion is often employed in a narrow sense, including only socio-economic or technical perspectives to the exclusion of broader societal or ethical perspectives. This means issues related to smart farming SOIs likely to impact their successful development, such as avoiding harm and more explicit ethical aspects, are still left unincorporated.

We have shown that SOI approaches offer guidance of how some aspects of RI, such as 'doing good', can be applied in practice. Yet we find that SOI lacks the explicit consideration of more ethical components. The incorporation of RI principles within SOI would involve the explicit consideration of societal and ethical criteria and concerns. This would include the inclusion of, and deliberation with a broad set of societal stakeholders in order to explicitly consider the potential for harm and incorporate ethical concerns that can help mitigate these issues.

The focus on inclusion and deliberation in RI is based upon the ethical and epistemic potential of engaging with multiple stakeholders. On the one hand, ethics can be seen as embedded in the social relation between multiple stakeholders (Blok 2019). On the other hand, it is argued that multiple sets of views have to be incorporated into innovation processes in order to facilitate social desirability and ethical acceptability (Stilgoe et al. 2013). Much of this thinking links to ideas and debates concerned with the democratisation of innovation and research processes. Innovators, including those within industry contexts, are seen as key enablers of this process. The inclusion of a wide set of stakeholders, reciprocity between stakeholders, as well as diverse and well-formulated viewpoints and arguments are necessary requirements for a legitimate and effective inclusivity efforts (van Mierlo et al. 2020). These requirements however can create challenges, especially when dealing

with cutting edge technological innovations, such as artificial intelligence or genetic modification (Buhmann and Fieseler 2021). In these contexts, it is questioned whether the public and other stakeholders are sufficiently informed of the issues at hand. Within industry contexts, there are the additional challenges of the tensions between transparency and competitive advantage (Brand and Blok 2019). Faced with these challenges, inclusivity, and deliberation within RI in industry contexts may need adjusting to take account of what is possible.

As such, for SOI approaches outlined above to be consistent with RI, and fully contribute to sustainable development, including in terms of societal desirability and ethical acceptability RI principles must be integrated. For example, the dimensions found within the AIRR framework, including anticipation, inclusivity, reflexivity, and responsiveness (Stilgoe et al. 2013), would enable SOI to both 'do good' while also 'avoiding harm'. This would be achieved first through the integration of anticipation to combat the unpredictable nature of (SO) innovation. Anticipation requires that 'what if…' questions are posed and seeks to ensure that innovators are open to a myriad of possibilities and think systematically about possible impacts. The inclusivity dimension seeks to ensure that a wide set of societal stakeholders are involved and included in deliberative discussions concerning the aims and potential impacts of the innovation. Stakeholders must be informed of innovation aims, whilst also aiding innovators in understanding societal desires and potential concerns. The reflexivity dimension is more focused on questioning and examining the moral boundaries and roles of innovators. This includes self-critique of any assumptions held by the innovators as well as reflection on how the innovation and related issues are framed. The fourth dimension, responsiveness, focuses on responding to any issues raised through the articulation of the other dimensions. This includes ensuring that there are necessary resources and capabilities to respond in an adequate manner.

By envisaging the combination of SOI and RI, we highlight how the responsibilities of 'doing good' with 'avoiding harm' can be combined. This provides a first step to understanding how RI can be practiced within industry settings. Next, we explore this question empirically, highlight the challenges that exist in combining these responsibilities and the policies (governance-responsibility) that can be enacted to support further industry uptake. In the discussion, we then consider the specific the strategies and governance modes of managing these responsibilities.

13.3 Methods

This research aims to explore how start-up firms manage the dual responsibilities to do good and avoid harm in relation to smart farming SOIs for agri-food challenges. To do this we used an inductive research approach. This allowed existing concepts and frameworks to be drawn upon to help understand and explain the empirical data obtained, while also allowing space for the data to 'speak'. This was an iterative process, involving the reapplication of theory to empirical results and vice versa,

where we develop theoretical insights through the language and meanings of the actors within the study.

We integrated qualitative data from three rounds of data collection: a first exploratory round of 18 interviews, followed by workshops with 10 start-ups and follow-up interviews with 9 of them. The workshops and follow-up interviews formed part of a tool the authors developed to help start-up firms identify societal and ethical issues related to their technological innovations. This data was used to substantiate the method of the tool, which is reported in Long et al. (2020). The content of the workshops and follow-up interviews are combined with a set of interviews for the purpose of this paper.

Our sample consists of agri-tech orientated start-ups conducting innovation within the context of smart farming. We defined agri-food start-ups as young, innovative firms in search of sustainable and scalable businesses, who utilised new technology or used existing technology in new ways for the solving of agri-food system challenges (Dee et al. 2015). We set the study within the context of the Netherlands.

From the outset, we instigated a non-probabilistic purposive sampling strategy. Participants were primarily identified through internet searches and co-nomination, then approached – with respondents from phase one, being invited to then participate in subsequent rounds. The research participants had to have senior-decision-making responsibilities for how the SOI was being developed. Table 13.1 provides an overview of the data sources, while Fig. 13.1 provides an overview of the phases and their focus. For all interviews a semi-structured interview technique was chosen (Taylor et al. 2015), as this allowed respondents freedom to express their experiences, and structured so that the data could be collected and compared.

13.3.1 Phase 1: Exploratory Interviews

To start we felt it necessary to gain an understanding of the various ways the smart farming SOIs had the potential to do good and or cause harm and start to explore the ways these were being managed. As such, this formed the focus of the first round of 18 interviews. Additional information included the history of the start-up and how they currently managed their responsibilities.

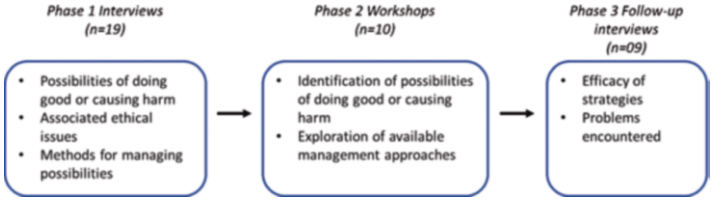

Fig. 13.1 Overview of data collection phases and their focus

13.3.2 Phase 2: Development and Implementation of Ways to Manage Responsibilities

During the workshops 10 start-ups were engaged in formal exercises to better understand the ways in which the smart farming SOIs had the potential to do good or to do harm as well as exercises to develop and implement ways to manage them. Many start-ups had been attempting to manage their innovation responsibilities already, and as such, some cross-over in the data collection between phase 1 and 2 is evident in terms of identification of how these responsibilities were managed. By the end of the workshop both existing and new ways of managing their responsibilities had been identified. The workshops lasted for between 2–4 hours, and were audio recorded. These were then transcribed and analysed.

13.3.3 Phase 3: Follow-Up Interviews

The final phase involved follow-up interviews three to six months after the workshops were completed. These interviews focused on how the implementation of different ways of managing their responsibilities, whether they were successful and why or why not. In total, there were 9 interviews in this third round.

The data generated took the same form in all rounds: transcripts produced from audio recordings of either semi-structured interviews (phases 1 and 3) or workshops (phase 2), containing the thoughts, opinions, and knowledge of the participants. While each phase was initially coded independently, due to overlap in some topics covered meant that data from phases 1 and 2 were combined. This decision was made to have as much data as possible available to answer the research question. An example of the potential for overlap between phases 1 and 2 concerned the nature of smart farming SOIs and the potential that they could do good or lead to harm in relation to agri-food system challenges.

The same coding process was applied to all phases. Initial broad codes were generated focused on any information that seemed relevant to the answering of the research questions to generate themes (Corbin and Strauss 1990). These were slowly altered to the first order codes. We then searched for similarities and differences within the initial codes, and where codes related or overlapped, the codes were condensed, consistent with the axial coding approach. This initial part of the process is ‘informant’ led, seeking to maintain the ‘voice’ and meanings given by the interviewees themselves. Following the development of the codes, concepts were developed to represent the different ways the smart farming SOIs had the potential do good or cause harm of the SOIs on the one hand, and how these different responsibilities were managed on the other, as well as what factors seemed to influence the success of the different management approaches. Where possible, triangulation was attempted using company websites, which were read to gain additional understanding of the innovations and any actions undertaken to manage the potentials of doing good or causing harm.

13.4 Results

In this section we show our empirical results of how start-up firms balance the process of 'doing good' and 'avoiding harm', while complementing it with ethical considerations. Our analysis also uncovered the barriers they face while attempting this balancing act.

13.4.1 The Management of Dual Responsibilities

Having characterised the different possibilities of doing good and/or avoiding harm and the challenges SOI's may face in this regard in the previous sections, we now detail how the start-up firms managed the dual responsibilities to do good and avoid harm. An overview of the coding structure can be found in Table 13.2.

The first method that emerged from the data was 'balancing demands', which included codes 'It's about balance' and 'Its ok to make less money if we help solve the grand challenge'. Both approaches focused on accepting that tackling for agri-food system challenges involved a trade-off, as illustrated by quotes from respondents 03 and 01.

> So, the [potential of doing good] is now having to balance with the business and economic aspect. (03)

> We are willing to make less profit, if that increases the environmental and social impact of our product. (01)

It was recognised that to have a sustained impact on agri-food system challenges involved generating revenues and a viable business. The need to balance demands extended to information, as well as business versus sustainability value. For instance, respondent 18 developed an insect-based food product. This provided a protein rich food source without the ethical or environmental issues linked to the industrial production of beef or chicken. However, the novelty of using insects meant that the start-up firm felt responsible to fully inform consumers. However, this had to be done within the competitive contexts of a retail environment. This meant the information had to be consistent with marketing the product and making it seem attractive. This involved balancing competing demands.

> There is more guidance needed because it is a new product, but not too much, as they won't read it. (16)

The next broad approach was 'openness and engagement'. This included specific codes, such as 'including people', 'communicating challenges' and 'I need to be transparent'. This approach involved reaching out and making sure that key issues were expressed to stakeholders. For instance, respondent 18 had experienced problems due to the use of hemp in their product, which was often associated with the drug cannabis. Overcoming these perception issues included testing different narratives and explanations with consumers, through a process of 'including people'.

Respondent 4 noted an alternative approach, while developing a new technique for breeding potatoes. They faced the risk that their process would be compared to GMO and experience similar controversy. They included specific stakeholders in their development process, such as experts, who could help to understand the issues around the potential of causing harm and signal the involvement of non-profit making research orientated actors in the project.

> So, we know that even though a technology might be powerful, there are issues of how you bring it to market and how you inform people. Fortunately, we have cooperation with the [research institute], as well as cooperation with the [University]. (4)

'Being transparent' was a less proactive approach, enabling stakeholders to see the key processes, and potential tensions, within an SOI and business. For instance, respondent 15 ran a community orientated container farm, producing leafy greens, whilst engaging the local community. The 'lab' like nature of the operation was thought to seem contrary to the sustainable aims of the SOI, so being open and letting stakeholders engage with and explore the (shipping) container was a way of managing this issue.

> It kind of looks like you're working in a lab, but it's more for hygiene because the produce that comes out of the container is not being washed. So, you need to take care... But I'm being transparent for that, I think you need to let your customers see. (15)

'Integrative approach, through ambition and design' represented a set of codes that highlighted how the respondents indicated that achieving social and environmental objectives involved aiming to 'have it all' as well as using design to incorporate what can appear to be contradictory aims. For instance, respondent 2, during their efforts to develop a renewable energy system that could share land with agricultural production and that minimised the use of unsustainable inputs, such as rare earth metals, highlighted that the aim from the start had been to have an environmentally, socially, and economically sustainable business. This uncompromising vision was viewed as essential – 'if you do not try, how can you succeed'.

> We work on the concept that sustainable energy production is not only renewable, but also socially acceptable as well. And be economically viable at the end. So basically, if you want to build a sustainable business – all three aspects, people, planet, profit – should be taken care of. (2)

With a vision, the technology, value proposition and accompanying business model could be designed to incorporate these aims. For instance, respondent 2, in attempting to incorporate and avoid clashes between environmental and social issues (in this case, renewable energy technologies occupying agriculturally productive land in food stressed regions), specifically sought a technology to fulfil these needs.

> [O]ur technology was developed with the idea that we could in the future, combine food production with electricity production on the same piece of land. (2)

The final approach was 'separation', which included the codes of 'separate the profit and not-for-profit parts', 'separate the products' and 'first the grand challenges, then the business'. This was a common approach, used or planned to be used

by respondents 2, 3, 13 and 17. The principle behind all these approaches was to manage challenges through separation, with different ways of separation, either physically, temporally or via alternative business models. This was most commonly used to overcome business society tensions. Separation of the profit orientated part of the business and the not-for-profit (or environmentally or socially orientated aspects) involved either creating two businesses, or one business and an adjacent 'foundation' or charity, with the profit-making entity supporting the non-profit-making part financially. Where two businesses were created, the products were the same, but aimed at different target groups (which distinguishes this code from 'separate the products').

> So, this would be the social bit of our business, and probably a non-profit part. This would be in such a way so that they could maintain it themselves and give them access to the rest of the world. The second part would be the profit part (1)

Separation of the products involved the development of two different products for different markets. This enabled a profitable, market orientated product, to have greater success in commercial contexts. This success could then be used to support a product specifically designed for social or environmental value creation. For instance, respondent 4, developed potato varieties for the commercial market, focussing on taste and texture, as well as a potato for food security contexts.

> So, at that point of time, we tried to balance the two objectives. Let's call the MacDonald's potato, and all the work we do for Europe and the US 'luxury' and everything else we call 'life'. (4)

The other separation method involved focusing on and achieving objectives sequentially – meaning that the challenges could be separated temporally. Respondent 3 noted how they first started by focusing on the environmental and social problems they tried to solve. Once these aspects had been planned and assessed, efforts where then switched to explore how to create value for customers, in turn, making the initial social and environmental efforts viable.

> We always started with the [environmental] problem. But now my investors are starting to push a little for starting with the problem for the customers. Not the problem of the [environmental impact]. So, now the challenge is to shift and think about the value for the customers. (3)

13.4.2 Barriers to Successfully Managing Dual Responsibilities

The second set of results focuses on the barriers that inhibited the management of dual responsibilities of doing good or causing harm. An overview of the coding structure can be found in Table 13.3.

The first barrier identified is *moral orientation* of the start-up, that is the extent a start-up primarily looks at the net outcome (in an ethical way) or also to the process. In some instances, the wider aim of the innovation to tackle an agri-food system

challenge was used as a justification to limit further reflection on the possibilities of doing good or causing harm linked to the SOI – 'the ends justified the means'. So, while awareness of smaller and often process related ethical issues was raised, this awareness was often downplayed as irrelevant and not morally significant, in the name of the greater challenge.

> The aim is on sustainability, so not ethics. It's more about sustainability rather than ethics. Ethics is broader. And we are more focused. (1)

> So, for me, I am a practical guy, I am not a theoretical guy. It is not important for me; I just want to build a prototype. I am pushing technology. (9)

The level of *complexity* of the possibilities of doing good or causing harm was also found to inhibit their management. This operated by impacting the ease of understanding around an issue as well as the availability of potential solutions. For instance, respondents noted that often there was not a simple or quick fix to manage the potentials or responsibilities.

> While it is good to be aware, this isn't enough. It's only a first step. I need a clear plan and targets. (13).

Stakeholders were noted repeatedly as being a barrier to successful management approaches. For instance, often stakeholder perspectives did not align with the start-up and their attempts to manage the responsibilities of doing good or causing harm. This was often the case where there was too much distance between the start-up and the stakeholders. For example, in high distance relationships or highly contested contexts the approaches focusing on collaboration becomes less effective.

> I think they are very focused on economics and processes. So, a little less on ethical aspects. (3)

Technological factors potentially prevented the start-ups from providing the service or managing the identified potential for doing good or causing harm. For instance, testing may not provide the expected results, or the assumed capabilities of a technology may not actually exist.

> So, we realised that the measurements we want to do with the smartphones, well, it seems that the current smartphones are still not capable of doing the accurate measurements. (17)

The *speed and nature of the innovation and start-up process* emerged as a barrier. For instance, the innovation process was highlighted as fast-paced and time constrained. This meant that there could be little time for thinking about the potentials of doing good or causing harm according to the respondents. Sourcing finance, developing business plans, or prototyping could all change rapidly making previously identified issues defunct and introducing new issues quickly, changing the approaches enacted. As these factors are intrinsically related to the business development process, they represent a profound and challenging barrier.

> *While as a start-up, you iterate quite fast, and what you offer may now change quite a lot in a month. So, there is a trade-off in how much time you give up to this kind of abstract thought around the impacts and societal point of view.* (*17*)

> There is a balance in trying to learn from this, versus being viable and successful. To make a good choice. (15)

13.5 Discussion

Our results highlight how start-up firms, within an agri-food context, approach the challenge of managing the dual responsibilities of 'doing good' and 'avoiding harm', and the challenges they face. In doing so, we shed light on broader questions of how to enhance levels of RI within industry. Previous research had explored the issue of possible harm and ethical challenges in relation to smart farming, however, these contributions only identified the challenge as one of a lack of RI, primarily the exclusion of society and stakeholders (Eastwood et al. 2019). We go further to specify how RI can be enacted, the challenges involved as well as discussion of what policies could be used to enhance uptake.

While we highlight that a range of approaches are available and present a framework for managing RI in industry, the question still remains as to how to stimulate the uptake of RI approaches in similar start-up contexts, and more broadly in industry.

Recent research has highlighted that there is a lack of clarity and understanding regarding RI among key stakeholders. In addition, the top-down approach taken within EU funding programs, driven by the RI agenda set by the European Commission, has not born fruit (Novitsky, 2020). Given our results, we argue for a mix of top-down and bottom-up approaches. By top-down we mean the development and implementation of processes and policy from top-level executive positions. Within the context of RI in agri-food systems, this has included deployment through H2020 and mandates that RI approaches be included in funding applications, for example. In bottom-up approaches, by contrast, we refer to the emergence of practices from a community of innovators. Within our cases, this is demonstrated by the RI approaches we see emerge within start-ups, often due to intrinsic factors and motivations, such as innovators feeling that they have a wider responsibility (rather than a top-down mandate) to undertake RI.

Our argument that there needs to be both top-down policy, accompanied with bottom-up action is based on several advantages to such an approach. It should also be noted that we build our arguments from an innovation management and business ethics perspective, rather than one based on policy. First, it would represent a more progressive approach. The failure of current top-down approaches highlight the need for change (Novitzky et al. 2020), and the inclusion of bottom-up approaches would build on the responsibility orientation already evident in the start-up firms in our sample. We see that the start-up firms are already intrinsically motivated to enact RI approaches, and so this would complement top-down support. For instance, our sample shows that start-up firms (industry actors) are willing to invest in RIs themselves yet may require guidance and additional support (and motivation) where tensions between business and society remain. Policy requirements and guidance

may for instance be necessary additions to persuade reluctant investors or other stakeholders that additional investments in time or capital are justified to find RI solutions. Firms are often willing to take responsibility but may need policy interventions by the state to safeguard responsible practices where market tensions arise (Tempels et al. 2017). Indeed, this is where top-down action may be necessary, mandating RI practices in order to access funding or acquiring licences for pilots etc. Economic or information based regulatory approaches could also offer possibilities, such as public support for stakeholder engagement efforts (reducing costs). Several of the challenges highlight structural limitations to RI within competitive settings (Brand and Blok 2019). A potential example can be seen in measure to encourage carbon measurement, reporting and reductions by corporations, which were supported through information-based policies in the UK (HMG 2019). Arguments over costs and lost competitive positions were overcome through policy that mandated listed company report their carbon emissions, which in turn leveraged reputational drivers to enact reductions to carbon emissions (Long and Young 2016).

We found that the start-ups in our sample had to balance the values of the innovators, societal stakeholders and (economically driven) investors. This was especially applicable to business and society tensions, or tensions existing between environment and/ or societal objectives. Within the context of SOI smart farming innovations seeking to address climate change, the 'soft push' of the Paris agreement and associated national policies is significant, clearly signalling wider intent and providing legitimacy. Where this was deemed insufficient, additional measures, such as mandatory reporting of engagement efforts or inclusion of RI approaches within reporting guidelines, could offer one example of how top-down approaches could support RI update in industry. This shows how policy and market interventions can supplement bottom-up action that may not be sufficient to overcome market barriers. Indeed, this combination is likely to harness industry motivation to act to avoid additional regulation (May 2005) in conjunction within the intrinsic motivation to do good. A role for bottom-up approaches to RI is also evident in our results on integrative approaches, which first use ambition, for example, seeing the problem and having the ambition, and intrinsic motivation, to solve it directly (Lubberink et al. 2018); and second, the use of design to overcome the issues related to the potential to do good or avoid harm.

Some may be unreconcilable, in which case stakeholder engagement and acceptance approaches should be used. Innovators within the sample highlighted how being open and inclusive helped to diffuse potential conflicts and issues and could even help with the identification of ways to overcome challenges. Inclusivity and deliberation here can be seen to operate in two ways. Where an unreconcilable issues is genuine and intractable, for example, where a smart farming innovation has a range of beneficial impacts but leads to an unavoidable change in how a farmer undertakes his duties. Inclusivity and engagement would operate as a tool to reduce mistrust or misunderstanding, better inform impacted stakeholders and would act as a way to mitigate the impacts of undesired impacts (Garcés-Ayerbe et al. 2019). Where the unreconcilable issue is not intractable, stakeholder engagement and

inclusivity acts similar to processes highlighted in open innovation, facilitating the input of new, previously unconsidered view points and solutions, leading to a change in the design and/or implementation of the smart farming innovation(Bogers et al. 2020; Long and Blok 2017b). This could include change to the technology nullifying the negative impacts on farmers duties. This illustrates the potential of bottom-up approaches, enacted through intrinsic means by innovation, to RI to lead to deliberative and responsive innovation approaches which are able to incorporate both 'do good' and 'avoid harm' aspects. In either case, where inclusivity and deliberation are ineffective, state (political) action, in the form of more direct rules or regulations.

The final approach identifiable within our sample is that of separation, where the different components of a challenge are separated. This could include, for instance, the use of different business models or different products for different target groups. Business model or team separation was especially relevant in contexts where an SOI could have multiple uses – for instance, if they could be on the one hand targeted at mass conversional markets, and then with small alterations, used to target agri-food challenges (Baldassarre et al. 2017; Bocken et al. 2014; Bohnsack et al. 2014).

We identify and discuss the bottom-up strategies, such as separation, integrative approaches, or balancing demands, used to implement the dual responsibility dimensions, balanced with economic interests. These are however subjected to barriers which limit their efficacy and so ability to the dual responsibility of 'doing good', while 'avoiding harm'. For example, we found that some innovators suffered from a lack of moral orientation, including where process related sustainability elements were side-lined in the name of final goals. This often limited 'avoid harm' actions taken within processes in the name of 'doing good' in the end. Top-down policies could help tackle this challenge by formalising RI processes, helping to ensure that moral orientation is maintained. Similarly, formalised processes encouraged from above could help tackle the issue of complexity, which impacted the ease of understanding around an issue as well as the availability of potential solutions. Top-down requirements regarding formalisation could help some innovators mitigate complexity with set routines and methodologies.

Other challenges included the potential for a lack of stakeholder support in integrating RI principles. For example, investors could see these RI principles are superfluous and unnecessary, and as a drain on economic returns on their investment. Top-down support or even mandated RI policies would provide innovators with arguments for why RI should be integrated in these circumstances. While challenges such as the limitations of technological factors and the speed and nature of entrepreneurial processes could both be mitigated via top-down RI policies by altering investment dynamics. For instance, both challenges encompass temporal aspects, highlighting how a lack of time within innovation processes can limit the potential of integrating both 'do good' and 'avoid harm' dimensions of responsibility. Top-down support, in terms of financing or support could signal to other stakeholders, including investors, that additional time is needed. In these ways, top-down policies can complement the bottom-up measures we find in our sample, and help innovators overcome the challenges that they face., for instance by creating a level playing field.

By highlight the potential of bottom-up, often intrinsically driven, RI practices and also the complementing role that top-down measures could play, we show how

governance arrangements (the key third dimension) could also operate (Voegtlin and Scherer 2017). Indeed, the top-down measures may be needed in many instances to overcome, or at least mitigate, the challenges that we find that innovators face. In detailing these approaches, we also show how ethical acceptability and societal desirability can be integrated into the SOI process through a combination of bottom-up action and top-down support (Baldassarre et al. 2017; Cillo et al. 2019; Liedtke et al. 2015; Nielsen 2020).

The results highlight that agri-food start-ups may need to improve their ability to recognise and correctly frame issues around the potential to do good and avoid harm which can be achieved through stakeholder support as well as taking a more critical and reflexive stance to their own practices.

In summary, we develop a framework of how RI is managed in start-up enterprises where we further propose that the context of a SOI influences the specific potentials of doing good or causing harm, which then necessitates management approaches for successful SOI development. Further, we highlight that successful development is predicated on a range of barriers, linked to factors such as levels of moral orientation, complexity, or supportive stakeholders. We illustrate this visually in Fig. 13.2 to provide a visual overview of the key results and their basic interaction.

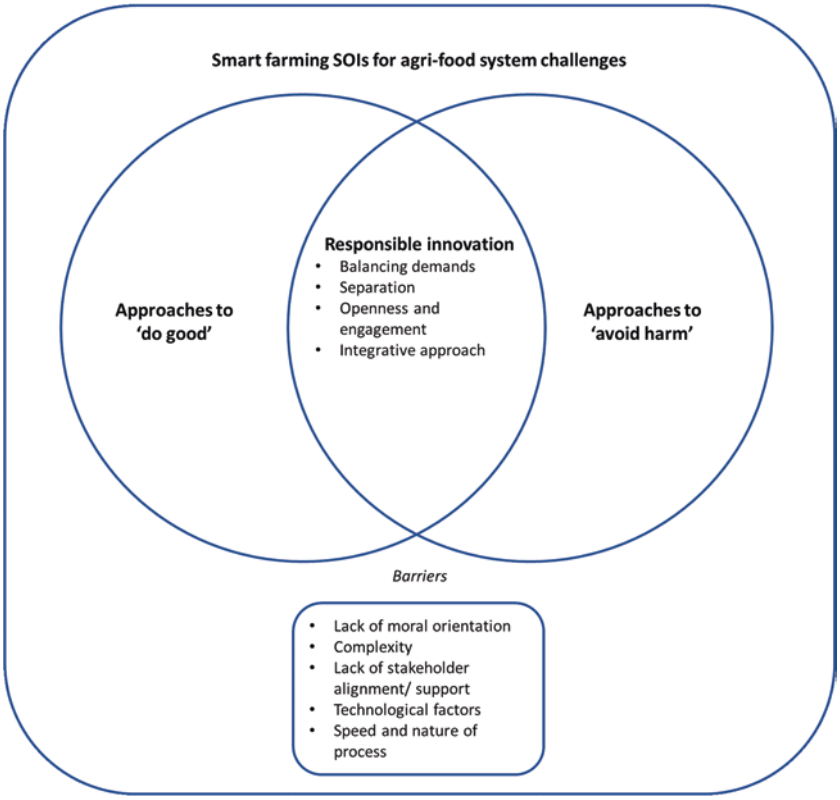

Fig. 13.2 Management of the responsibility to do good and avoid harm by start-up firms developing SOIs

13.6 Concluding Remarks

By analysing data from Dutch start-ups innovating for agri-food system challenges, we provide an initial exploration of how start-up firms manage the dual dimensions of responsibility of doing good and avoiding harm in relation to agri-food system challenges; these include 'balancing demands', 'openness and engagement', 'integrative approach', and 'separation'. These results lead us to highlight how bottom-up RI processes may play a key role in driving RI in industry settings and could help mitigate the current weak implementation of top-down approaches seen to date. While current top-down approaches have had disappointing results, we highlight how they are likely to play a key role in complimenting and bolstering bottom-up approaches. Such top-down additions could include legislative guidance in case of tensions and trade-off as well as actions to create level playing fields by making unsustainable and non-desirable business practices less competitive.

We contribute to RI literature by adding detail about how start-up firms manage the dual responsibilities of doing good and avoiding harm. In doing so, we inform debates focused on how to boost RI take up in industry.

This research was exploratory in nature, based on a limited sample and undertaken from an innovation management and business ethics perspective. The country focus of the Netherlands may impact the types of possibilities of doing good or causing harm faced and the different management approaches used. Our sample also focused on early-stage start-up firms. It is possible that larger, more established business face different types of challenges and as such may require adjusted approaches to deal with them. Future research should validate our results through larger samples, including countries not included in this research, and/or explore these questions from a policy or other disciplinary perspective Further possibilities also include taking a more quantitative approach, to explore the prevalence and character of challenges, as well as the longer-term impacts they potentially have on performance.

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Appendices (Tables 13.1, 13.2 and 13.3)

Table 13.1 Overview of research participants

#	Nature of start-up firm and SOI	Phase 1: Exploratory interview	Phase 2: Workshop	Phase 3: Follow-up interview
1	Algae-based foods. Using algae as a nutritional additive in common foods. Incorporate social project. 1–10 employees. Founded 2014.	X	X	X
2	Renewable energy system. The product integrates into agricultural production systems, using these systems to generate power. Can provide power for irrigation or other machinery. 10–50 employees. Founded 2009.	X		
3	Process for making agricultural waste into products for food and pharmaceuticals industry. Waste is removed from farm, heat treated and made available for industrial applications. 1–10 employees. Founded 2012.	X	X	X
4	Enhanced plant breeding technique. Enables faster non-GMO based experimentation and variety generation. Included development of varieties for famine environments. 10–50 employees. Founded 2006.	X		
5	Meatless food products produced using hydrated vegetable fibres, from raw organic sources. 1–10 employees. Founded 2006.	X		
6	Insect based food products. Produce both semi-finished and finished food products to restaurants and supermarkets. Use insect protein in 1–10 employees. Founded 2014.	x		
7	Bio-based chemicals, using previously unproductive inputs (trees). Chemicals can be used to protect surfaces and are substitutes to more harmful substances. 1–10 employees. Founded 2016.	X		
8	Vegetable production using fortified water. Produce organic, community orientated produce with higher nutritional values. 1–10 employees. Founded 2015.	X		
9	Autonomous farm vehicle with renewable electrical power source. 1–10 employees. Founded 2012.	X	X	X
10	Standalone water salinity regulator. Decreases salinity of surface and ground water, preventing negative impacts. Founded 2014.	X		
11	Manure nutrient recovery system, focusing on recovery of phosphate, nitrogen, micronutrients, and organic matter in an environmentally and economically friendly manner. Founded 2015.	X		
12	Smart farming technology. Low cost and accessible sensor and analysis software. Founded 2014.	X	X	X
13	Indoor growing system, using vertical hydroponic systems that work with micro-climate control. In contrast to many existing hydroponic systems, it uses natural light and provides water and energy efficiency improvements. Founded 2011.	X	X	

(continued)

Table 13.1 (continued)

#	Nature of start-up firm and SOI	Phase 1: Exploratory interview	Phase 2: Workshop	Phase 3: Follow-up interview
14	Mushroom producer using waste as growing medium. Growing technology is combined with community supported agriculture model. Founded 2017.	X	X	X
15	Small scale container farm utilising hydroponic system. Located in community and encourages community participation.	X	X	X
16	Insect based food producer. Founded 2017.	X	X	X
17	Mapping and software developed aimed at improving understanding of flood risk. Novel advances in terms of crowd-sourced measurement and community development approach. Founded 2017.	X	X	X
18	Hemp clothing company seeking vertically integrated supply chain to ensure full transparency of impacts. Founded 2017.	X	X	X

Table 13.2 Data structure showing first order codes and second order concepts for 'how' dual responsibilities of doing good or causing harm were managed

Illustrative quote	1st order codes	2nd order concepts
"So, the ethical aspect is now having to balance with the business and economic aspect." (3) "There is more guidance needed because it is a new product, but not too much, as they won't read it." (16)	It's about balance	Balancing demands
"We are willing to make less profit, if that increases the environmental and social impact of our product." (1) "We'd rather leave a legacy than making the money." (13)	It is ok to make less money if we help solve the grand challenge	
"Our issues are partly about perception, so we have to include people. That is important. So, the narrative association of incinerators – And see how to improve them." (18) "So, we know that even though a technology might be powerful, there are issues over how you bring it to market and how you inform people. Fortunately, we have cooperation with the [research institute], as well as cooperation with the [university]." (4)	Including people	Openness and engagement
"Consumers not wanting to eat insects should be seen as a risk, and it should be calculated. These risks are inherent in our company. And the best thing you can do is communicate." (16)	Communicating tensions	
"I am also hoping that being open will have boosted the life part of the business [the 'doing good' part of the business]. I can develop the seeds for India and China and Africa etc., but I am just 40 breeders in a building in the Netherlands. I need help." (4) "It kind of looks like you're working in a lab, but it's more for hygiene because the produce that comes out of the container is not being washed. So, you need to take care... But I'm being transparent for that, I think you need to let your customers see." (15)	I need to be transparent	

(continued)

Table 13.2 (continued)

Illustrative quote	1st order codes	2nd order concepts
"We work on the concept that sustainable energy production is not only renewable, but also socially acceptable as well. And be economically viable at the end. So basically, if you want to build a sustainable business – All three aspects, people, planet, profit – Should be taken care of." (2) "We always kept saying that we do this from the perspective that there is a waste stream. And we want to make revenue from the waste stream – That is the goal." (3)	Aim to have it all	Integrative approach, through ambition and design
"So, there are a whole range of [doing good or avoiding harm] issues involved in produced energy. Basically, the whole rationale behind our technology is that we try to solve all of these problems at once…. [O]ur technology was developed with the idea that we could in the future, combine food production with electricity production on the same piece of land." (2) "For instance, we design our sensors in such a way that they can be dismantled. So, basically, we were inspired by circular economy, you can swap components between units. That way the lifecycle impact is reduced as components are reusable" (12)	Design to incorporate diverse aims	
"So, this would be the social bit of our business, and probably a non-profit part. This would be in such a way so that they could maintain it themselves and give them access to the rest of the world. The second part would be the profit part – Something that could really add to the matrix, to the whole scope of renewable energy sources." (1)	Separate the profit and not-for-profit parts	Separation
"So, at that point of time, we tried to balance the two objectives. Let's call the MacDonald's potato, and all the work we do for Europe and the US 'luxury' and everything else we call 'life'." (4)	Separate the products	
"We always started with the [environmental] problem. But now my investors are starting to push a little for starting with the problem for the customers. Not the problem of the [environmental impact]. So, now the challenge is to shift and think about the value for the customers." (3)	First the grand challenge, then the business	

Table 13.3 Data structure showing first order codes for concept of 'barriers'

Illustrative quote	Codes
The aim is on sustainability, so not ethics. It's more about sustainability rather than ethics. Ethics is broader. And we are more focused. (1) So, for me, I am a practical guy, I am not a theoretical guy. It is not important for me; I just want to build a prototype. I am pushing technology. (9)	Lack of moral orientation
Well, I think we need to go more in-depth with the intervention. It was just an introduction. We need more depth. (9) While it is good to be aware, this isn't enough. It's only a first step. I need a clear plan and targets. (13).	Complexity
The inputs that we worked with were not up to standard, it turned out. So, we have had to find different products, other suppliers, stuff like that. (17) I think they (stakeholder) are very focused on economics and processes. So, a little less on [issues around doing good or avoiding harm]. (3)	Lack of stakeholder support/ alignment
So, the test run of the process did not go the way it was supposed to. So, we got a delay of half a year and no product that met the required specifications. (3) So, we realised that the measurements we want to do with the smartphones, well, it seems that the current smartphones are still not capable of doing the accurate measurements. (17)	Technological factors
While as a start-up, you iterate quite fast, and what you offer may now change quite a lot in a month. So, there is a trade-off in how much time you give up to this kind of abstract thought around the impacts and societal point of view. (17) There is a balance in trying to learn from this, versus being viable and successful. To make a good choice. (15)	Speed and nature of the entrepreneurial and start-up process

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