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Integrating the management of socio-ethical factors into industry innovation: towards a concept of Open Innovation 2.0

Special issue: Responsible innovation in the agri-food sector

RESEARCH ARTICLE

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Abstract

To create a sustainable future, innovations are needed that integrate socio-ethical issues. Responsible innovation provides a method for managing these issues, and tries to ensure that innovation is conducted for and with society. The application of responsible innovation in industry contexts, where many of these innovations are developed, is limited by challenges related to dominant business logics, stakeholder management problems and resource constraints. Open innovation is an approach more commonly employed within industry contexts, which involves activities that overlap with responsible innovation dimensions and practices. This means that open innovation could represent a way to integrate the management of socio-ethical factors into industry contexts in a less disruptive and costly way. This paper explores the extent to which open innovation and responsible innovation overlap and could be compatible. Both open innovation and responsible innovation are reviewed theoretically before an empirical enquiry is launched through semi-structured interviews (n=11) with entrepreneurs developing innovations in the context of climate-smart agriculture in Europe. We find evidence for compatibility between exploratory open innovation activities and dimensions of responsible innovation. Results indicate that the management of socio-ethical issues through open innovation requires sensitivity to ethical issues and a motivation to include ethical considerations strategically in innovation processes. These findings are incorporated into a provisional extended open innovation model for the management of socio-ethical in industry contexts – an Open Innovation 2.0.

Keywords: responsible innovation, open innovation, climate-smart agriculture
JEL code: O32, Q13, Q16, Q55

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1. Introduction

Innovations are required to address grand challenges such as climate change or food security (Tardy, 2009), which requires the integration of socio-ethical issues by creating ecological and/or societal value, and managing potential socio-ethical risks (Bos and Munnichs, 2016; Dearing, 2000). For example, the use of smart farming technologies, such as sensors, drones, and GPS, mean that farmers have greater control and enhanced resilience to extreme weather events, enabling them to adapt to and mitigate climate change. At the same time, this increased control facilitates an increase in farm size and further industrialisation of farming practices, which encounters societal resistance, as this contrasts with the expectations of society (Gray and Boehlje, 2007). Moreover, many of these technologies involve the collection of large quantities of data, which raise socio-ethical issues linked to data protection, privacy and ownership issues (Carbonell, 2016). These create socio-ethical barriers, limiting innovation adoption and diffusion (Sheldon, 2002).

Responsible innovation (RI)[1] emerged as a response to these challenges and due to calls for innovation to be conducted for and with society. It seeks to address socio-ethical issues throughout the innovation process, in a way that enhances the societal embeddedness of innovations (Owen *et al.*, 2013). To this end, RI aims to make the innovation process more inclusive and democratic so that the innovation outcomes are (ethically) acceptable, sustainable and socially desirable (Von Schomberg, 2013). Conducting innovation this way can enhance the probability that innovation outcomes address grand challenges faced by society whilst also being socially embedded in a better way (Stilgoe *et al.*, 2013). RI can be conceived of as a meta-responsibility, encouraging innovators to take additional steps and actions (Stahl *et al.*, 2017). These steps may include deeper stakeholder engagement and co-creation efforts to gauge societal values, opinions, and desires and to integrate these into the innovation process.

Several EU projects such as the Karim Network (2015), PRISMA (2016) and Responsible-Industry (2014), have been exploring how to apply and operationalise RI within industry contexts. It is still unclear, however, what RI means for industry contexts, nor how industrial RI can be characterised (Scholten and Blok, 2015). Innovations are primarily developed by for-profit organisations in industry contexts. Previous research suggests that RI in industry contexts may experience difficulties and as such be limited in its application (Blok and Lemmens, 2015). Examples of such challenges include management of the goals, expectations and values of different stakeholders, issues of asymmetric information, and tensions between commercial interests and those of responsibility (Blok *et al.*, 2015).

One method for overcoming the challenges RI faces within industry contexts would be to identify existing innovation approaches in industry that overlap with RI dimensions and practices. An example is open innovation (OI), which is becoming an established paradigm which assumes that both internal and external knowledge should be utilised for the benefit of innovation and firm's competitive advantage (Chesbrough *et al.*, 2006). In this approach, firms undertake a range of different practices and processes to maximise the utility of information flowing in and out of the firm. A dichotomy exists between inbound (outside-in) versus outbound (inside-out) flows. Practices associated with inbound OI are related to the search for useful external information, and could include buying patents and licenses, supplier innovation competitions, co-creating with customers or crowdsourcing; outbound OI is related to activities such as spinoffs, selling patents or licences, or joint-venture activities (Chesbrough and Brunswicker, 2013). These activities are undertaken to maximise the potential of innovation activities for the competitive advantage of the innovating firms.

Because OI parallels some of the concepts and practices of RI (cf. Lubberink *et al.*, 2017; Owen *et al.*, 2013; Van den Hoven *et al.*, 2012), OI may be a way to more easily introduce RI dimensions into commercial contexts. For

[1] Responsible research and innovation (RRI) and Responsible innovation (RI) are related approaches. RI focuses to a greater extent on innovation processes, whereas RRI also includes research and science, where commercialisation and application is less evident. As our focus is on the topic and process of innovation, we use the approach of RI. Due to overlapping conceptual origins, research and thought from the RRI domain is drawn upon where appropriate.

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example, RI calls for inclusive deliberation (Owen *et al.*, 2013), which could parallel stakeholder engagement and dialogue activities associated with integrating external knowledge in terms of OI (Gould, 2012).

Finding common practices between RI and OI would be significant for innovators utilising OI strategies who want to start to consider and integrate socio-ethical factors. A common practice would be an activity or process that had the potential to contribute to the achievement of both OI and RI. For example, co-creation is an inbound OI activity, while also being applicable to the RI dimension of inclusivity. Where OI involves co-creation, an innovator would not have to start a new activity, but rather extend current activities to include consideration of socio-ethical factors. This would be an advantage in terms of time, costs, and complexity. For example, RI enables solutions to be better embedded into society, which in turn increases the uptake and helps guard against rebound effects. For businesses and innovators, RI offers opportunities in terms of reducing risk in the innovation process, providing more systematic ways for managing socio-ethical issues, enhancing social legitimacy and a better understanding of market and user demands (Husted and De Jesus Salazar, 2006; Sutcliffe, 2011).

Exploring the links between OI and RI furthers the conceptual development of RI in industry contexts. Identifying alignment will allow relevant aspects of OI to be integrated into a conceptualisation of RI more aligned to industry contexts. The theoretical benefit could also operate in the other direction. Industry actors are increasingly under pressure to ensure that their practices are responsible and socially acceptable. Integrating RI concepts into OI would make the approach more responsive to, and aligned with, societal demands. In this sense, OI would be upgraded for a socially and environmentally conscious world.

This research aims to (1) explore the extent to which OI overlaps with RI; (2) whether these overlaps facilitate the management of socio-ethical issues in industry OI processes; and (3) what is required to fully integrate RI dimensions into industry OI processes.

By achieving these aims, this research will provide the following contributions. First, we establish conceptual link between OI and RI, by examining key synergies and differences, via inductive reasoning and an empirical analysis. We show that activities associated with exploratory OI have potential to overlap and to be consistent with RI dimensions, meaning we could expect firms who undertake exploratory OI strategies to be more able to integrate RI dimensions into their activities. Second, the paper provides a better understanding of the management of socio-ethical factors in industry settings, within the context of start-up businesses innovating for climate-smart agriculture (CSA). Third, we provide a theoretical contribution, by exploring what changes are required to OI for RI dimensions to be fully integrated – and in doing so, we articulate a vision for an extension to the OI paradigm – an OI 2.0. This includes highlighting that whilst OI activities offer a process level opportunity to integrate RI into an innovation program, RI will have to be a strategic input in order to be fully enacted[2].

To achieve our objectives, the study draws on concepts associated with OI and RI and applies them to the context of CSA innovations developed in Europe. This represents an interesting context as agriculture faces many challenges, including the need to feed a growing world population whilst reducing its ecological footprint and dealing with climate change impacts (Mietzsch *et al.*, 2012). In order to achieve CSA, the form and impact of innovations will have to change in order to create a resilient, low carbon and productive agri-food system (Rennings, 2000). Whilst CSA offers potential solutions for agricultural challenges, ethical issues are potentially raised in terms of how these technologies impact and interact with society, the environment and farm animals (FAO, 2001; Paarlberg, 2009).

[2] It should be noted that in seeking an overlap, and going on to articulate an OI 2.0 concept, we are not making the claim that the existing theories are necessarily incomplete. Rather, we are building on previous work (cf. Blok and Lemmens, 2015; Blok *et al*., 2015) and seeking to extend OI with socio-ethical components.

We advance by first reviewing the literature on OI and RI, and then by comparing and contrasting the two approaches to innovation. A theoretical framework based on the literature review is developed and then explored empirically within the context of innovations for CSA in Europe.

2. Literature review

2.1 Open innovation

Concepts associated with OI have been noted within the management literature since the 1960s (Huizingh, 2011; Trott and Hartmann, 2009), however, the OI paradigm rose to prominence during the 2000s. The central assumption is that useful (valuable) knowledge and information is widely spread. To be successful, business should make use of external sources of information and knowledge as well as internal sources (Chesbrough *et al.*, 2006). Conversely, closed innovation is where companies generate ideas and knowledge internally (Huizingh, 2011), and proceed with innovation and production as a vertically integrated process (Chesbrough *et al.* 2006). Chesbrough *et al.* (2006: 1) define OI as: 'the use of purposive inflows and outflows of knowledge to accelerate internal innovation, and to expand the markets for external use of innovation, respectively'.

OI has been facilitated by changes to working patterns (such as the increasing prevalence of 'portfolio' working), increasing labour division due to globalisation, improved institutions for trading ideas and knowledge, as well as technological advances in communications (Huizingh, 2011). Driving factors include the need for growth in sales, revenues, and innovative outputs (Chesbrough and Crowther, 2006; Van de Vrande *et al.*, 2009), making OI a business strategy focused on competitiveness.

OI is a paradigm that connects ideas and concepts from a broad range of management sciences and approaches (Fredberg *et al.*, 2008), involving a range of activities. A simple dichotomy contrasts technological exploitation with exploration (Van de Vrande *et al.*, 2009). Exploitation (or outbound OI) includes venturing, for example, the use of spin-off companies and the outward licensing of intellectual property; whilst exploration is more focused on customer involvement in research and development (R&D), external networking, the outsourcing of R&D, the inward licensing of intellectual property, or more novel approaches such as crowdsourcing (Chesbrough and Brunswicker, 2013). This dichotomy is analogous to inbound (also outside-in) versus outbound (inside-out) categorisation (Enkel *et al.*, 2009; Huizingh, 2011). Much like exploration, inbound activities are those that involve bringing knowledge into the firm from outside. And as with exploitation, outbound activities are focused on utilising internally generated knowledge outside of the firm, for instance through the licensing of technology, in order to find new markets or new applications. OI can also be pecuniary versus non-pecuniary (Dahlander and Gann, 2010). In addition to these dichotomies, several authors note the phenomenon of coupled processes (Enkel *et al.*, 2009), involving innovation through co-creation and the use of alliances, which would involve both the inflow, but also the outflow of R&D efforts and intellectual property. Initial research on OI focused on large firms, often within high-tech industries (Chesbrough and Crowther, 2006). This raised questions as to whether OI was a phenomenon restricted to these contexts. However, OI research is increasingly focusing on smaller actors, such as small and medium-sized enterprises (SMEs) (Van de Vrande *et al.*, 2009). Evidence suggests that a lack of financial resources can restrict the success of smaller firms, implying that they are often more reliant on their networks and openness for their success. The key factors that are seen to indicate whether an industry is prone to engage in OI, are characterised by globalisation, technology intensity, new and innovative business models and knowledge leveraging (Gassmann, 2006).

2.2 Responsible innovation

Research and innovation processes and outcomes must integrate socio-ethical issues so that they contribute to societal grand challenges, and to manage the questions, dilemmas and unintended consequences, both positive and negative, that can arise (Owen *et al.*, 2013). Indeed, unforeseen and negative consequences can

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be seen to be probable, not just possible, in many cases (Hacking, 1983). The negative impacts of innovation have led to calls to improve the way the innovation process is managed and governed (Groves, 2006). Market forces alone may not provide societally optimum innovation outcomes. Retrospective regulation is often employed when innovation outcomes are problematic (Owen *et al.*, 2013). But retrospective regulation is limited in its ability. As science and innovation have become more globalised, more complex and more dynamic – especially in high-tech disciplines – such control measures are insufficient (Owen *et al.*, 2013).

RI has emerged due to these issues. RI attributes a lack of early, ethical reflection and inclusive deliberation as a problem in current innovation processes (Owen *et al.*, 2013). RI goes beyond risk management (Stilgoe *et al.*, 2013), to ensure the innovation process specifically addresses a societal challenge and that it is consistent with societal demands. RI has been defined as 'a collective commitment of care for the future through responsive stewardship of science and innovation in the present' (Owen *et al.*, 2013: 36), as well as 'a new approach towards innovation, in which social and ethical aspects are explicitly taken into account... and economic, socio-cultural and environmental aspects are balanced' (Blok and Lemmens, 2015: 20). The most widely used definition is from Von Schomberg (2011: 9), who notes:

> Responsible research and innovation is 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).

The extent to which RI (and responsible research and innovation) can be considered a new paradigm in research and innovation governance is contested. Indeed, Stilgoe *et al.* (2013, 1570) present RI as a 'location for making sense of the move from the governance of risk to the governance of innovation itself', rather than a distinct and novel governance paradigm. That said, RI seeks to influence current governance and innovation paradigms, such as a move away from the technocratic-instrumental paradigm, characterised by the use of a restricted communities expertise, towards a democratic-inclusive paradigm, associated with democratic participation and an opening up of processes to society (Gianni *et al.*, 2016). Whilst the concept and practice is still developing, much research has focused on the development of frameworks that aim to help incorporate an array of political and ethical considerations into the innovation process, whilst also allowing tensions and dilemmas to be identified and incorporated.

A dominant framework sees RI articulated heuristically through four dimensions (Owen *et al.*, 2013; Stilgoe *et al.*, 2013). These include firstly, anticipation, aimed at prompting innovators to ask 'what if...' questions, being open to myriad possibilities and thinking systematically about possible impacts and futures within a context that recognises the unpredictable and uncertain processes that govern innovation. Second is the dimension of reflexivity, which concerns the moral boundaries and roles of innovators, seeking self-critique of assumptions and commitments as well as reflection on how issues are being framed.

Inclusion is the third dimension, which requires a wider set of societal actors to engage in dialogue and engagement processes, whilst the fourth dimension is responsiveness, which seeks to ensure that innovation processes have the capacity and leadership to respond to the questions and concerns raised through the first three dimensions. This framework offers a basis through which to explore the impacts of co-creation on the consideration of ethical implications of smart farming technological innovations.

Whilst frameworks add value via their ability to highlight key components of RI, how RI is applied and practised is less understood. Research to date has focused on science and policy contexts, meaning little is understood of what RI means for industry contexts (Scholten and Blok, 2015). However, this topic is receiving increasing attention. For instance, a recent literature review identifies applicable practices and processes across social, sustainable and responsible approaches to innovation, highlighting that a range of activities are available to enhance RI dimensions (Lubberink *et al.*, 2017). Research within the context of ICT and

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health sectors has identified RI activities such as stakeholder engagement, long-term scenario planning and the use of open access for research results (Chatfield *et al.*, 2017).

The role of stakeholder engagement is highlighted across several studies (Blok *et al.*, 2015; Chatfield *et al.*, 2017; Lubberink *et al.*, 2017; Sonck *et al.*, 2017), and linked to the RI concept of mutual responsiveness. For innovation to tackle societal challenges and to be able to anticipate innovation outcomes, engagement with a wide set of societal actors is needed (Blok and Lemmens, 2015). Stakeholder engagement is required as an input into the RI process, with the additional requirement that the stakeholder relationship or engagement process is mutually responsive; such partnerships are important for both innovation performance and responsibility (Blok and Lemmens, 2015).

Research focused on the Dutch Food Industry found that even where companies had a disposition towards RI, that their activities fell short of mutual responsiveness as articulated by RI (Blok *et al.*, 2015). Critical issues included commercial firms fearing knowledge leakage and subsequent loss of competitive advantage (Blok and Lemmens, 2015). Transparency in these engagement processes suffered due to uncertainties in the innovation process. Difficulties were also identified in terms of the different missions, visions and values of the stakeholders engaged, meaning that a single message is difficult to distil.

As this research is seeking to explore OI and RI empirically, research linking RI to practical management actions would be valuable (Table 1).

Table 1. Mechanisms and tools for supporting responsible innovation in the private sector (adapted from Lubberink *et al.*, 2017; Burget *et al.*, 2017).

Dimension	Tools
Anticipation	Scenario thinking
	Value mapping
	Ideation for business modelling
	Translating vision into mission (target setting)
	Game theory/perspective
	Crowdsourcing
Inclusion	Crowdsourcing (via software)
	Living lab structures
	Collaborative business modelling
	Partnerships
	Consultancy of experts
	Focus groups
	Integrating views and opinions
Reflexiveness	Formal evaluations
	Third party critical appraisal
	Informal (self-) assessment culture
	'Knowledge-concept-process' mechanisms
	Empowered and open communication
Responsiveness	Customising or mainstreaming
	Preventing organisational inertia
	Adjust/withdraw innovation
	Monitor external environment post introducing of innovation

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3. Theoretical framework: comparing and contrasting open innovation and responsible innovation

OI is a strategy that is widely used and so likely to be the context within which RI takes place in industry (Bessant, 2013). OI may provide a route or initial step for the integration of ethical and societal concerns, and ultimately RI dimensions, into the innovation process, and provide theoretical indications as to how RI could be applied. However, the potential of RI dimensions to overlap with commercially orientated OI is under-researched (Owen *et al.*, 2013). In this section, we compare and contrast OI and RI and create a framework that can then be explored and tested empirically. We explore possible synergies by establishing frameworks of OI and RI and exploring overlap.

For RI, we take the four dimensions of RI as articulated by Owen *et al.* (2013), as this is a widely used framework, whose dimensions often reoccur in other definitions (Burget *et al.*, 2017). Activities associated with the different dimensions are noted in Table 1. For OI, we draw on the framework of Van de Vrande *et al.* (2009), as this focuses on small and medium-sized firms (as is the case with our sample). We also draw on wider references and evidence, ensuring detail regarding the nature of the different OI activities (Figure 1), and the extent to which such activities overlap with RI dimensions. We explore synergies and contrasts in turn below and develop a set of propositions based on our reasoning using evidence existing in the literature.

3.1 Synergies between open innovation and responsible innovation

In this section, we take each RI dimension in turn and consider the extent to which OI activities and aims overlap. We restrict the analysis to the direct effects of the activities and aims.

Anticipation focuses on determining desired impacts and outcomes of the innovation process, preventing and mitigating potential negative impacts, as well as identifying paths or routes towards the desired goal or future state (Stilgoe *et al.*, 2013). OI exploration, such as customer involvement, brings information and knowledge into the innovating firm, provides contact with stakeholders, and so provides the possibility for an enhanced ability to anticipate. For example, a firm that opens the innovation process via crowdsourcing or collaborative business modelling is better able to identify common values and futures as well as possible impacts (Franke *et al.*, 2013; Füller *et al.*, 2012; Rohrbeck *et al.*, 2013).

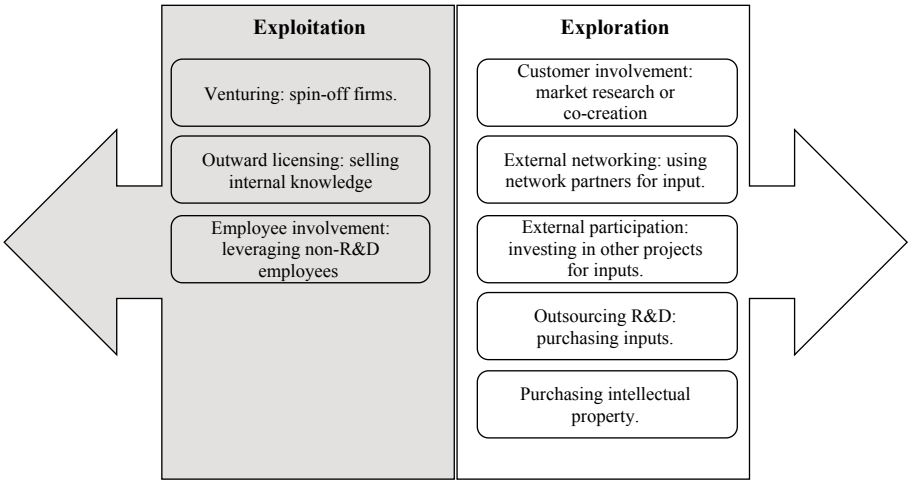

Figure 1. OI typology matrix (adapted from Van de Vrande *et al.*, 2009).

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Inclusivity requires a wider range of stakeholders and societal actors to participate in discourse and engagement processes in innovation. OI exploitation activities, such as venturing and outward licensing are commercially orientated, and as such we propose that it is unlikely that these activities could be adjusted to include socio-ethical considerations. The involvement of non-R&D workers could potentially enhance the inclusivity dimension of RI. OI exploration activities all involve attracting collaborators to expand and utilise the innovating organisation's network and links to stakeholders, which would increase inclusivity. However, in OI non-economic actors are not usually involved, so for RI to be integrated or introduced within this context, a broadening of the stakeholder base would be required. Indeed, stakeholder inclusion is one of the more common RI dimensions found in practice (Lubberink *et al.*, 2017).

The reflexivity dimension of RI focuses on questioning the moral boundaries and role of the innovators. In this sense, it seeks self-analysis and reflection on how issues are being framed and acknowledge that the particular framing taken by an innovator may not be held universally (Stilgoe *et al.*, 2013). Reflexivity often involves the use of internal discussions (Dossa and Kaeufer, 2014) and engaging with external stakeholders in order to question practices or policies. There is evidence that reflexivity can be strengthened by including stakeholders to challenge the firm's approach, which could involve information flowing in and out of the firm. The level of reflexivity achieved, however, depends on the innovator. Lubberink *et al*. (2017) have shown that there may be little potential for encouraging second-order reflexivity via OI.

The fourth dimension is responsiveness, which involves the ability and leadership to be able to respond to issues raised through the three previous dimensions; for example, responsiveness could include altering the production process where engagement with stakeholders has highlighted a harmful side effect of current manufacturing inputs, or indeed, spinning-off companies in response to new market demands (in the case of outbound OI). Synergies between OI and responsiveness are highlighted by research that found that OI processes tend to be more adaptive and flexible (Berker, 2010). The inbound nature of exploration provides information, enhancing knowledge, which in turn could facilitate responsiveness, as to be responsive, you first need to be able to understand social needs.

3.2 Contrasting open innovation and responsible innovation

Above, it has been shown that OI does have common activities and features with RI. In this subsection, we highlight differences in terms of the degree of transparency present in the innovation process, the breadth of stakeholder inclusion, and in the outcomes sought.

Many OI activities are of an outbound nature, meaning information is flowing away from the innovator. The direction of the flow means that it cannot aid RI anticipatory efforts. As such, we propose that no overlap or link is possible.

Transparency is a core principle of RI (Von Schomberg, 2011), and whilst OI involves a degree of transparency, this may not be to the degree necessary to satisfy RI requirements. This echo's previously noted difficulties in applying RI to industry contexts, and the need for information asymmetries for competitive advantage (Blok and Lemmens, 2015).

The types of stakeholders included in the two approaches are likely to differ with implications for inclusivity. RI seeks broad inclusion, including direct stakeholders such as customers or end-users but also stakeholders from wider society (Asante *et al.*, 2014; Lenssen *et al.*, 2006). Whereas OI will only involve inclusion of those with direct commercial relationships (crowdsourcing being an exception). In OI contexts partners also share values (as a precondition for a successful relationship), whereas, in RI, differing values may actually be sought (Dossa and Kaeufer, 2014) since RI seeks societal involvement and deliberation with wider stakeholders. In this sense, RI is open to and seeks a wide range of input of ideas and opinions. OI, in contrast, is likely to be more focused on inflows or outflows of information with suppliers, designers, or experts in associated industries, or customers and users for example.

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The differing focuses on economic stakeholders (OI) versus including non-economic stakeholders as well (RI), further highlight that OI and RI have different aims and so involve different types of information. For example, RI seeks innovation processes and outcomes that are (ethically) acceptable, sustainable and societally desirable (Von Schomberg, 2011). OI, in contrast, is focused on improving innovation outcomes in terms of economic value or competitive advantage for the innovating firm (Chesbrough *et al.*, 2006). OI has no explicit requirement for the questioning of values or ethics.

OI and RI have different objectives: RI is primarily concerned with improving the embedding of scientific and technological advances in society, while OI is primarily focused on business value and success. Further, the requirement of mutual responsiveness and the aim of 'democratising' the innovation process included within RI is likely to be absent in cases of OI. Indeed, OI does not presuppose that different stakeholders are also in dialogue with each other, as is desired in RI. In this sense, a key difference between RI and OI is how information flows are arranged.

3.3 Outcome of comparison and conceptualisation of connection

An overview of the outcomes of comparing and contrasting RI and OI processes is presented in Table 2. This matrix shows where OI concepts overlap and where they contrast.

In broader terms, the theoretical connection between RI and OI concerns how both seek an innovation process intimately connected to stakeholders (Chesbrough *et al.*, 2006; Huizingh, 2011). There are differences in the aims of including outside stakeholders in the process – for competitive advantage for OI and for societal inclusion for RI – however, both approaches see the process as two-way. OI has inbound (outside-in) and outbound (inside-out) dimensions (Enkel *et al.*, 2009; Huizingh, 2011), meaning information and ideas are leaving and coming into the innovating firm. RIs conceptual connection to this characteristic is via mutual responsiveness and broader ideas that the innovation process should be 'with' and 'for' society (Von Schomberg, 2013). Societal actors are asked to provide inputs into the innovation process in terms of societal desirability, while innovators are asked to ensure that societal actors and other key stakeholders are included and that the innovation process is open and transparent.

These characteristics form the basis of the conceptual connection. However, it is the more practical level activities that will be key in terms of determining the extent to which the approaches can be linked in practice. Without the practical overlap, the potential benefits of each approach to the other are unobtainable.

Table 2. Matrix comparing responsible innovation dimensions to open innovation types to highlight potential overlap.

Type of OI activity	Anticipation	Inclusivity	Reflexivity	Responsiveness
Exploitation: venturing	No link	No link	No link	Possible link
Exploitation: outward licensing	No link	No link	No link	Possible link
Exploitation: non-R&D involvement	No link	Possible link	No link	Possible link
Exploration: customer involvement	Possible link	Possible link	Possible link	Possible link
Exploration: external network	Possible link	Possible link	Possible link	Possible link
Exploration: external participation	Possible link	Possible link	Possible link	Possible link
Exploration: outsourcing R&D	Possible link	Possible link	Possible link	Possible link
Exploration: inward licensing	Possible link	No link	Possible link	Possible link

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4. Methods

The aim of this research is to explore the extent to which OI represents an avenue for the introduction of RI dimensions into industry innovation processes. We explore this possibility by identifying areas of potential overlap between the two practices. The research focuses on start-up firms in Europe developing innovations in the area of CSA, which address the grand challenges of food security and climate change adaptation and mitigation (FAO, 2010). CSA innovations are likely to embody a range of ethical and societal issues as they lead to the further industrialisation of farming for example.

In the previous section, we established a theoretical foundation for the collection and analysis of empirical data. The acknowledgement and use of previous theories mean that we take an analytic inductive approach, combining an inductive research style whilst acknowledging and building on existing theory (Gilgun, 2015). That said, we remain open to new interpretations and are sensitive to the empirical context, actions of actors and interpretations of the participants under investigation (O'Reilly *et al.*, 2012). This enables us to develop theoretical propositions, which serve as a platform from which to develop new insights and contributions.

To ensure that any new insights are valid, we needed data saturation. Our research sample consisted of innovators within the CSA context, and as such could be considered homogenous in terms of their perspectives. For theory generation, it is generally accepted that 10-15 interviews is the smallest acceptable size (Creswell, 2012). With any qualitative approach, however, the richness of the data obtained is also important (Mays and Pope, 2000). Data collection was constrained by a small number of available cases. That said, data saturation was evident towards the end of the data collection process, as little new information was being obtained. Whilst the number of data sources is at the lower end of acceptable numbers, the quality of the data collected met the requirement of theory generation. We consider the validity and quality of the results further in the discussion section.

4.1 Case selection and data collection

To fulfil the research aims, examples of both RI and OI were required. Small innovative firms have a high probability of conducting some forms of OI (Van de Vrande *et al.*, 2009). We expected incidents of RI to be rare and therefore, focused on the context of CSA as climate change represents a grand challenge which requires innovation-based solutions. In this respect, these innovations can be considered *de facto* RIs. To be consistent with CSA, innovations had to be contributing to more productive or efficient food production whilst simultaneously reducing greenhouse gases or adapting to climate impacts (FAO, 2010). The degree and nature of the OI activities were established during interviews and analysis of the interview transcripts. All respondents exhibited some OI activities, leaving the analysis to identify potential overlap between the RI and OI activities.

Semi-structured interviews (n=11) were used to collect the data. Participants were selected using a non-probabilistic purposive sampling strategy, as the number of suitable examples was limited. Participants were primarily identified through internet searches and co-nomination and then approached for an interview. Table 3 provides an overview of the firms participating in this research. The table includes the nature of the innovation and start-up company and details why they fulfilled the CSA criteria. We highlight *prima facie* socio-ethical issues related to the technologies in the table. Issues such as human well-being, or justice and fairness impacts are highlighted for each innovation (Gillund *et al.*, 2015).

The semi-structured interviews provided a relatively open data collection method. Participants were asked to what extent and how they considered and managed socio-ethical issues in the innovation process, the type of activities they undertook and the benefits and the drawbacks of their approach. To avoid socially desirable answering and the leading of participants, questioning initially sought a narrative of the start-up process, followed by more specific questions aiming to understand the nature of the RI and OI activities and the extent they overlap.

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Table 3. List of research participants interviewed including the nature of their climate-smart agriculture (CSA) innovations.

#	Innovation description, size of company and year founded	Interview data	Characteristics of key partners	CSA impacts – contribution towards grand challenges	Potential social or ethical issues	Open innovation activities
R1	Vertical soilless growing system. System enables plants to be grown vertically and without soil, using pumped water and nutrients. Product innovation. 1-10 employee. Founded 2014.	Co-founder interviewed. Meeting length: 45 min. Notes taken.	Networking support from government agency. Investors were being sought.	Productivity/income: able to grow more within same space, under more control. Adaptation: greater control, via direct irrigation to roots, providing greater resilience to heat waves or drought. Mitigation: more efficient application of inputs (water and nutrients), reduces embodied energy and materials.	• 'Freedom' Soilless systems raise questions over demands of society for 'natural' or 'traditional' agricultural and food systems.	• Engaging with customers
R2	Waste to fertiliser technology. Innovation made previously unsafe waste usable as fertiliser in agricultural contexts. 1-10 employees. Founded 2010.	R&D director interviewed. Length: 35 min. Audio recording.	Range of technical partners in the form of universities and other research firms. Investors and commercialisation partners were being sought.	Productivity/income: improves soil, boosting output. Especially applicable to poor soils, bringing previously unproductive land into use. Adaptation: allows soils to absorb more water, enhancing drought resistance. Can increase soil stability, enhance resilience, and reducing soil losses due to more extreme weather. Mitigation: None.	• 'Freedom' Fertiliser raises the potential for changes in the location of agriculture, raising issues of land-use change. The composition of waste for fertiliser also subject to question (i.e. where waste is animal based).	• Learning from others • Broader engagement

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Table 3. Continued.

#	Innovation description, size of company and year founded	Interview data	Characteristics of key partners	CSA impacts – contribution towards grand challenges	Potential social or ethical issues	Open innovation activities
R3	Next generation seed treatment and growth stimulants. Innovation focused on much reduces application rates and its non-toxic and fully biodegradable nature. 1-10 employees. Founded 2014.	Co-founder interviewed. Length 30 minutes. Audio recording.	Government investment received. No private sector investors being sought at time of interview.	Productivity/income: stimulates growth and reduces losses, boosting production. Adaptation: increases crop resilience to pests or extreme weather. Mitigation: none.	• 'Freedom' New type of breeding technology changes the way that root vegetables are bred. Changes power balance between seed producers and farmers.	• Engaging with customers • Learning from others
R4	Algae-based foods. Using algae as a nutritional additive in common foods. Also incorporate social project. 1-10 employees. Founded 2014.	Co-founder interviewed. Length: 55 minutes. Audio recording.	Support from university start-up incubator. Looking for investors.	Productivity/income: provides food inputs (of a high level of nutrient) from previously unproductive land. Adaptation: none. Mitigation: energy efficient food source (compared to soy, beef, corn, etc.). Absorbs twice as much CO_2 compared to trees.	• 'Fairness' • 'Freedom' Potential supply chain issues in use of cocoa. Long and developing country-based supply chains.	• Engaging with customers
R5	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.	Founder interviewed. Length: 40 minutes. Audio recording.	Support from university start-up incubator, as well as international development organisation. No looking for investors.	Productivity/income: integrates into current agricultural production systems, providing a power source for productivity boosting additions such as irrigation. Adaptation: none. Mitigation: renewable energy source.	• 'Fairness' • 'Human welfare' • 'Freedom' Issues related to embodied materials within technology – potential for rare earth and 'conflict' materials, which would restrict scale-up.	• Outsourced research • Engaging with customers

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Table 3. Continued.

#	Innovation description, size of company and year founded	Interview data	Characteristics of key partners	CSA impacts – contribution towards grand challenges	Potential social or ethical issues	Open innovation activities
R6	Process for making agricultural waste it 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.	Co-founder interviewed. Length: 1 hour 05 min. Audio recording.	Support from university start-up incubator, as well as climate change focused incubator. Investors being sought.	Productivity/income: Previous waste source monetised for farmers and innovator. Adaptation: removal of waste enhances soil quality on farms. Mitigation: none.	• 'Human welfare' • 'Fairness' Substitution effect of the new products potentially leads to loss of employment in developing country.	• Learning from others
R7	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.	Co-founder interviewed. Length: 43 minutes. Audio recording.	Partner with various knowledge institutions. Investors present, but supportive of socio-ethical objectives.	Productivity/income: varieties bred are more productive. Adaptation: drought resistant varieties, increase resilience. Mitigation: new varieties require fewer fertiliser or pesticide inputs, reducing embodied energy.	• 'Fairness' Questions over societal acceptance of method for developing seeds. Possible that technology changes the distribution of benefits between potato seed suppliers and farmers.	• Outsourced research • Engaging with customers • Broader engagement
R8	Meatless food products, produced using hydrated vegetable fibres, from raw organic sources. 1-10 employees. Founded 2006.	Founder interviewed. Length: 53 minutes. Notes taken.	No investors. No significant partners.	Productivity/income: vegetable-based meat substitutes provide a more efficient source of nutrition. Adaptation: none. Mitigation: substitutes meat production, reducing greenhouse gas emissions associated with livestock.	• 'Freedom' Against societal demand and expectations for meat.	• Broader engagement

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Table 3. Continued.

#	Innovation description, size of company and year founded	Interview data	Characteristics of key partners	CSA impacts – contribution towards grand challenges	Potential social or ethical issues	Open innovation activities
R9	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.	Founder interviewed. Length: 39 minutes. Audio recording.	Working closely with research institutes. Received support from start-up organisations. Seeking investors, and investment via crowd sourcing.	Productivity/income: insect based meat substitutes provide a more efficient source of nutrition. Adaptation: none. Mitigation: substitutes meat production, reducing greenhouse gas emissions associated with livestock.	• 'Freedom' Against societal demand and expectations for meat.	• Outsourced research • Broader engagement
R10	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.	Founder interviewed. Length: 1 hour, 25 minutes. Audio recording.	No key partners. Not seeking investment.	Productivity/income: previously unproductive land now used for agricultural production. Adaptation: none. Mitigation: products substitute industrial chemicals and associated processes, reducing greenhouse emissions.	• 'Freedom' Previously unproductive land now brought into use.	• Learning from others
R11	Vegetable production using fortified water. Produce organic, community orientated produce with higher nutritional values. 1-10 employees. Founded 2015.	Founder interviewed. Length: 1 hour, 3 min. Audio recording.	No key partners. Not seeking investment.	Productivity/income: fortified water enhances production. Adaptation: none. Mitigation: reduces water use, reducing embodied greenhouse gas emissions.	• 'Freedom' • 'Human welfare' New inputs into agricultural production.	• Learning from others

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4.2 Data analysis

The interviews were coded and then transcribed, allowing analysis of the transcripts. Data analysis was conducted using NVivo 10 (QSR International, Doncaster, Australia). Initial coding involved searching for references to OI activities – for example, where information or knowledge flowed into or out of the company in relation to innovation. This data was then coded thematically, seeking to create consistent groups or categories. Next, sub-themes were drawn out under the different OI categories, and assessed in terms of whether they had enhanced or facilitated RI dimensions.

The aim of the research is to explore the extent to which OI can provide an avenue for business to start to manage socio-ethical issues. To answer this question, we sought to identify where OI and RI overlapped in terms of the activities undertaken. Where similar activities are occurring, the assumption is that RI could be introduced by broadening the content or objectives of activities to include socio-ethical issues. As such, once the OI activities of the respondents were characterised, they were examined for overlap with activities associated with RI. Where there was a link, the nature of the activity and which RI dimensions it could contribute to were explored.

5. Results

5.1 Activities providing overlap between open innovation and responsible innovation

The results of the coding and categorisation process are presented below. These are organised according to the nature of the OI activity, and then whether they had the possibility of contributing to the identification and management of socio-ethical issues, representing RI.

During data analysis, the themes that emerged diverged somewhat from the theoretical framework. As such, categories more reflective of the data were developed. The data collected showed that the OI activities related to exploration, rather than exploitation.

- *Formalised outsourcing*

A clear theme that emerged from the data consistent with OI was the 'formalised outsourcing' of research and development. These involved innovators connecting with Universities, Research Institutes, or commercial research organisations. These connections were established according to formal agreements, often commissioning research using PhD students or from market research firms.

> We have two or three PhDs...it was started from our selfish point of view: so how do I make sure that I don't lose a day through resistance to the technology. One thing for us that was very interesting was, how do you now grow? If I develop the perfect seed, how do you commercialise that. (R7)

> We took our products to [a market research firm], and they went out onto the street, and were asking if the consumers were open to eating insects. (R9)

As the quotes highlight, these activities were undertaken to bring outside information and expertise into the start-up to inform the innovation process. As noted by the respondent R7, this process included efforts aimed at mitigating potential resistance to the technology in society.

The nature of these activities overlaps with activities associated with both anticipation and inclusivity dimensions of RI. The anticipation dimension of RI is focused on determining desired impacts, preventing potential negative impacts, and considering routes forward. These goals involve activities such as scenario thinking and engaging with potential customers. These link to the noted examples above, creating a potential overlap. For example, the outsourcing of research facilitates the identification of impacts as well as the

consideration of future scenarios for the innovation. Within these activities, socio-ethical impacts and factors could also be considered. We assume, therefore, that this OI activity overlaps, and as such, could easily facilitate the anticipatory dimensions of RI.

A more obvious overlap exists in terms of the inclusion dimension, which draws on the use of crowdsourcing, the consultancy of experts or recruiting market research firms to conduct focus groups for example. The activities described by the participants and coded into this theme, such as sponsoring PhD projects or testing customer's preferences, could be seen to be consistent with the inclusivity dimension of RI.

It is also likely that the results of such activities are acknowledged and included in the innovation process, creating a link to responsiveness. Indeed, an underlying logic in OI is to use information inflows to improve the process and outcome of the innovation. As such, formalised outsourcing potentially overlaps with anticipation, inclusivity, and the responsiveness of RI as well. No evidence has been found to support connections to the reflectivity dimension.

■ *Co-creation*

This theme illustrated engagement with customers and utilising customer feedback to enhance product development. This included releasing prototypes to customers, as well as engaging with consumers to better understand product impacts and performance. Including the customer base in product development could be seen to constitute 'inclusivity', where this inclusion involved consideration of factors beyond technical details – for example, if the product was 'acceptable' to customers or whether it raised wider problems or concerns.

> That sort of activity has helped in terms of inclusivity – but I would have been doing this anyway. (R1)

The quote illustrates how OI activities often meant a wider set of individuals were involved in the innovation process. These OI orientated activities also aided in anticipating potential impacts of the product. The extent to which this anticipation stretched to include social or ethical issues differed, and was dependent on context. In some cases, the anticipation was focused on product development and its commercial application. However, in others, co-creation included societal or ethical factors. For example, in relation to the quote below, an objective of the company was to provide high quality and high yielding potato seeds to Africa to improve food security. By co-creating with a farmer, they could test the effectiveness of the innovation in the desired context whilst also opening up the innovation process:

> He said he had just set up the beginning of a farm to import seed potatoes from the Netherlands and to multiply them on a high-quality basis in Uganda. And he said that it was a terrible thing, as the seed potato quality is very poor, etc. He thought our seeds would be a solution. So, he asked for some of our seeds to use as a trial. (R7)

In the above-noted case, the results of this trial were fed back into the innovation process, highlighting clear links to responsiveness dimensions of RI.

Co-creation with customers follows the same rationale as formalised outsourcing, but with a focus on engaging with customers directly (downstream), rather than through research partners (upstream). Co-creation is a more focused type of crowdsourcing, a noted activity for both anticipation and inclusivity. Co-creation potentially overlaps with these two RI dimensions as well as responsiveness, whilst no evidence is available for the reflexivity dimension of RI.

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■ *Engagement with peers and industry stakeholders*

Data indicated that taking part in conferences and innovation competitions allowed innovators to learn from their peers. Peers in this sense represents other innovators and entrepreneurs or industry stakeholders. These actors were in positions to ask questions of the innovators, and would often have informal or formal support functions. They were unlikely to be customers or suppliers. The activities within this theme included taking part in incubator or competitive business support programs.

> It [participating in start-up competition] helped me to see the broader perspective, in terms of jobs for example. Some of the other start-ups are thriving just on the social part. They are just a platform for helping people. They don't even have real business models – but they show you how to see the social and ethical aspect, and get a deeper understanding of your own potential impact. So, talking to other entrepreneurs also helped.
>
> Right now, there are 600,000 people, nomads, who trade this commodity (Gum Arabic). So then, we impact some of the labour force – so we must think of the bigger picture. What are we doing to those jobs? (R6)

Involvement in these events and connecting with a wider set of actors was noted explicitly to help in terms of anticipating and recognising potential negative impacts – such as job losses where an innovation replaces an existing commodity, (see previous quote).

These types of activities meant that more stakeholders were brought into the innovation process. This activity also aided reflexivity, as respondent R5 notes, as engaging with peers at these events helped in terms of being able to 'take a step back' and consider the wider role being played by the innovator.

> So, lucky for me I get to learn a lot from all these people there [global networking organisation] – they are all a few stages ahead of me. People just ask me – how is the company doing?, etc. it's a group of people who are interested and want to help each other out. And it's really beneficial for me – and it has helped me in the last year to get a bit more of a view of what others think of my company in the business world. (R5)

These activities concerning learning from peers' link to both anticipation and inclusivity dimensions of RI – as they open the innovation processes up to a broad range of actors and inviting them to provide input. For example, taking part in the innovation competitions often involved giving pitches to large audiences, whilst conferences also involved similar types of outreach. In both cases, this could facilitate the integration of a wider set of views regarding possible futures or negative impacts, and the inclusion of a wider set of actors into the innovation process. It is possible that learning from peers only concerns anticipation and inclusivity in the commercial sense of the word, rather than socio-ethical issues. However, the commercially oriented peer learning could be utilised to broaden the anticipation dimension towards responsibility and responsiveness.

Learning from peers was also noted to facilitate appraisal or critical evaluation of the innovation process, as well as the role or performance of the innovators themselves. This is the case with R5, who noted that attending conferences and events lead to a type of self-assessment. This means that learning from peers can be linked to the reflexivity dimension of RI. The degree of reflexivity occurring is questionable and may not stretch to the second-order reflexivity described within the reflexivity dimension of RI.

■ *Broader engagement*

This theme describes how research participants engaged with actors where there was no direct (or potential) commercial relationship, and where engagement occurred outside of networking events. These activities represented a more proactive effort to engage with wider stakeholders.

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> So, one thing we did with [the university], we set up a hackathon – as the Dutch are quite good at going somewhere and telling others how to run their life. I thought it would be wise to turn it around. So, we thought to look for students here, and there are many foreign students here, and ask them what they thought we should do. How should we do it? Where should we introduce the product first? What would be our path to market? And they came up with some very interesting solutions. (R7)

Broader engagement links to activities associated with both anticipation and inclusivity, indicating a potential overlap with the RI dimensions. For instance, crowdsourcing corresponds well to the idea of a hackathon and the aim of including (and so responding to) the views of a large group of individuals who are not necessarily customers nor have any formal links to the innovation or start-up. Broader engagement therefore also overlaps with activities associated with inclusivity, such as integrating views and opinions of other stakeholders, as well as responsiveness as inputs of stakeholders were used to improve the innovations by the firm.

In summary, a range of activities were identified within the data as consistent with OI activities and constructs found in the literature. In turn, these were also found to have the potential to contribute to RI dimensions. Table 4 provides an overview.

5.2 Factors inhibiting the potential of open innovation to integrate responsible innovation

The data provided information on factors that inhibited the role that OI could play in providing an avenue to integrating socio-ethical factors into industry innovation processes.

- *Strategies to protect the value of innovation*

A key theme that emerged was ensuring that you could protect the innovation. This included, for instance, the use of patents, allowing the innovating firms to be more open in their innovation activities. For example:

> Before that, it was obviously quite close to our chest. But as soon as you file for a patent, it is much easier to reach out. (R7)

The granting of a patent indicates that much of the innovation process has already been completed. In turn, this limits the potential for RI to be introduced, as once a patent has been filed, it is likely that many aspects of the technology are beyond alteration, which would limit the responsiveness dimension of RI.

- *Low awareness or lack of openness in stakeholders*

A further theme highlighted that even where innovation was open, and the innovators sought input on social or ethical factors, stakeholders were either unaware or unwilling to talk about these topics:

> Interviewer: do you talk about ethical topics with these people? Participant: not really, because in general people are not aware of the social stuff. (R4)

> Normally when you speak to customers they won't tell you everything. (R5)

Table 4. Overview of categories developed through the data analysis.

Activities providing overlap between open innovation and responsible innovation
Formalised outsourcing of research and development
Co-creation
Engagement with peers and industry stakeholders
Broader engagement

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6. Discussion

The results find that OI within our sample was focused around exploration based activities and how these linked to RI; no themes associated with exploitation emerged. This may be due to our sample being focused on SMEs and start-ups, who can focus to a greater extent on exploration rather than exploitation activities (Van de Vrande *et al.*, 2009). Indeed, start-up firms and smaller businesses may not be at the stage of innovation where exploitation activities are appropriate.

Adjustments were made to the OI categories noted in the theoretical framework as the data highlighted a narrower and more specific set of activities (Van de Vrande *et al.*, 2009). Whilst new OI categories are developed, they link well to the activities established in the theoretical framework. For example, 'co-creation' develop through the results, links to 'customer involvement' found within the theoretical framework.

Based on the results, an updated matrix is developed (Table 5) highlighting which OI activities facilitated the management of socio-ethical factors, and so also provided the potential for RI dimensions to be integrated. The first column also indicates how the results link to the literature-derived categories developed (Table 2).

This analysis provides an updated set of propositions for the overlap between OI and RI dimensions, as shown in Table 4. This highlights the new themes developed but also notes links to the previous categories noted within the framework. This is also illustrated in Figure 2.

6.1 Extending the paradigm – Open Innovation 2.0

The results highlight that there is overlap between exploratory OI activities and dimensions of RI. In this sense, OI has an openness to RI dimensions. However, the potential for OI to provide a first step or route towards the management of socio-ethical factors depends on the extent to which socio-ethical factors are considered important by innovators. Overlap between the activities is a necessary but not sufficient condition.

The specific nature of OI activities and their context will be critical to their ability to provide an avenue for the management of socio-ethical factors. Many activities are used by both OI and RI (Table 5), however, how they are executed and their content will be critical as to whether they facilitate the management of socio-ethical factors. For example, crowdsourcing is associated with the RI dimensions of inclusivity and anticipation (Lubberink *et al.*, 2017) and is an activity associated with exploratory OI. However, if the focus

Table 5. Revised matrix linking results (exploratory open innovation activities) to responsible innovation dimensions ('x' indicates no evidence, whilst '✓' indicates evidence).

Activities developed from the data (linked to framework categories)	Anticipation	Inclusivity	Reflexivity	Responsiveness
Exploration: co-creation ('customer involvement' category)	✓	✓	X	✓
Exploration: broader engagement ('external networking' category)	✓	✓	X	✓
Exploration: engaging with peers and industry stakeholders ('external networking category)	✓	✓	✓	✓
Exploration: formalised outsourcing ('Outsourcing R&D' category)	✓	✓	X	✓

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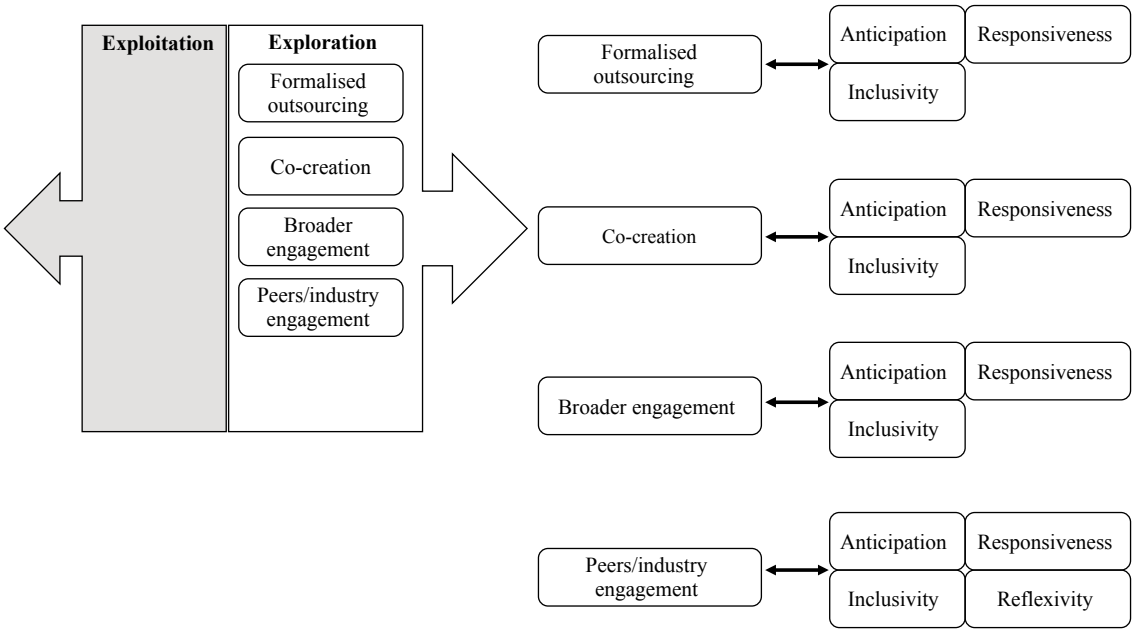

Figure 2. Illustration of links between exploratory open innovation and responsible innovation dimensions.

and topic of the crowdsourcing is only on commercial considerations, it will not have contributed to the identification and management socio-ethical factors.

In this sense, OI activities can be consistent with RI dimensions and can provide an opportunity to include socio-ethical factors without greatly adapting innovation activities. However, simply enacting the overlapping activities will not produce responsible outcomes. Indeed, taking each dimension, in turn, it is possible to see what is required to integrate RI dimensions into OI processes. Exploration (inbound) processes, as demonstrated by the results, are open to RI dimensions. For instance, the integration of anticipation requires OI processes to expand their scope to include the more forward-looking and future orientated approach aimed at identifying potential negative impacts or outcomes. As an example, co-creation activities would explicitly include criteria or mechanisms that sought to include socio-ethical elements.

Inclusivity within exploitation processes would focus on expanding the types of stakeholders included, for instance, beyond partners and customers to actors such as relevant civil society group. The dimension of reflexivity would involve narrower changes, focused on ensuring that where engagement with stakeholders occurs, that this is done in a way that can support or encourage reflection and critical self-consideration. The integration of reflexivity is more concerned with ensuring that OI processes are questioned and critically assessed. This may require new roles and routines to be created within firms.

Responsiveness is focused on ensuring that where issues are highlighted that they are acted upon, or ensuring that there is flexibility and the ability to adjust designs, processes, and products in the future. OI is often characterised as flexible and adaptive (Berker, 2010) – integrating the responsiveness dimension is, therefore, more focused on ensuring that this flexibility and adaptiveness is applicable to socio-ethical factors. This point re-emphasises the need for motivation and top-management buy-in, as these are likely to be critical factors to ensuring that OI is extended in practice to include the integration of socio-ethical impacts.

The integration of RI dimensions into exploitation OI processes is less clear, partly as these aspects of OI are less aligned with and open to RI dimensions. The outbound nature of exploitation OI processes means that responsiveness and inclusivity are the two relevant RI dimensions. Integrating RI into processes such as the selling of licenses is more about ensuring that the RI process has occurred in the right way – i.e. to ensure that what you are selling or spinning off is responsible in terms of outcomes.

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So, whilst OI exploratory activities offer a process level opportunity to integrate RI into an innovation program, RI will have to be a strategic input in terms of the aims and goals of that program. Innovating organisations must be motivated to include socio-ethical factors, and willing to integrate and react to new inputs from the process (the responsiveness dimension). This could create an extended OI approach which is able to deal with and adapt to socio-ethical factors – an OI 2.0.

The potential applicability of this finding to other industries will depend upon the extent to which they engage in OI. Building on previous research, OI could then offer an opportunity to introduce or enhance the management of socio-ethical factors where the industry is characterised by globalisation, technology intensity, new and innovative business models and knowledge leveraging (Gassmann, 2006).

7. Conclusions and implications

We sought to explore the extent to which OI overlapped with and was compatible with RI. The rationale for this inquiry was that RI is limited in its current application in industry contexts, but that OI is a more common strategy. Where overlap and compatibility between OI and RI were identified, we could assume that RI could be more easily integrated into industry innovation processes.

The results highlight that some overlap does exist within the context of entrepreneurs developing innovations for CSA in Europe. We found evidence that exploratory OI activities have potential overlap with RI dimensions. Whether these OI activities can act as starting points depends on the nature and context of the actual activities and whether socio-ethical factors are taken seriously upfront by the entrepreneurs and innovators. Based on the results, we developed a provisional model of an extended OI approach – an OI 2.0 (Figure 3).

These results could have implications for innovators who utilise OI strategies and want to start to consider socio-ethical factors. The results indicate that:

1. Rather than introducing new activities to manage socio-ethical factors, innovators could use their current OI activities with the addition of socio-ethical inputs.
2. Where innovators are already considering socio-ethical issues, they can now draw on OI knowledge to see how these considerations can be integrated into RI practices.

As a qualitative study, it is appropriate to reflect on methodological issues and limitations. The framework and empirical sample were focused on small and young firms, meaning the extension of the applicability of the results and implications to different contexts is uncertain. The same provisions must also be made with regards to the agri-food empirical context. As such, to establish whether these results are applicable to wider settings this studies approach should be applied to different contexts, such as in larger firms, and within different sectors. Several points are relevant in terms of the validity and reliability of the research.

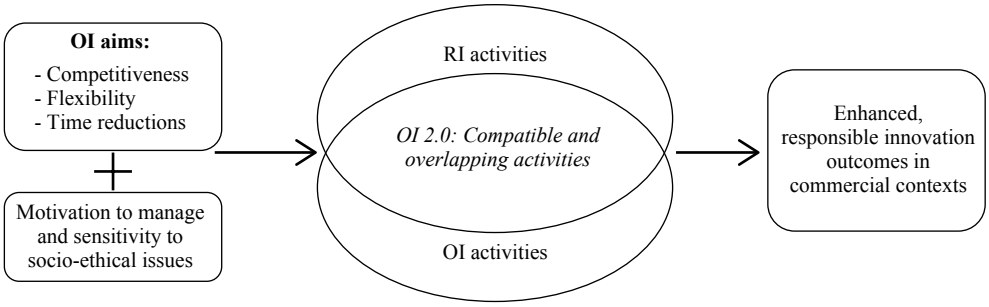

Figure 3. Model for Open Innovation 2.0.
OI = open innovation; RI = responsible innovation.

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For instance, whether the data was collected from the correct sources. The interviews focused on founders and key personnel involved in the innovating firms; it is possible that some activities consistent with RI dimensions were undertaken by partners of the innovating firm, rather than the firm that we collected data from. In this circumstance, we may have missed data and occurrences of RI overlapping with OI. Equally, the respondents held decision-making responsibilities and positions of awareness within the sampled firms, which should have provided relevant and reliable data on innovation strategies and the theme included in R&D efforts. We also took efforts to limit socially desirable answering and the leading of participants by focusing on a narrative of the start-up process, followed by more specific questions aiming to understand the nature of the RI and OI activities and if they overlapped. Finally, our sample was limited to 11 cases. Whilst we argue that data saturation was obtained, 11 is at the lower end of acceptable standards in qualitative research. As such, these results should be seen as a tentative first step in terms of theory development. Further exploration and corroboration would be required to further develop the theoretical propositions and enhance their robustness and validity.

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