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A model of social responsibility for start-ups: developing a cross-fertilisation of responsible innovation, the lean start-up approach, and the quadruple helix approach

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ABSTRACT

In this paper, we cross-fertilise responsible innovation (RI), the Lean Start-up approach (LSA) and the Quadruple Helix approach (QH) within one model: the social responsibility for start-ups model (SRSM). SRSM aims to instil responsibility into the start-up innovation process by ensuring that the voices of stakeholders from all four helices are taken into account, whilst providing an assessment of current impacts in these areas compared with the ambition of start-ups. This helps to identify room for improvement in order to provide an iterative, lean approach for start-ups to inform the strategy of the start-up cycle, which incorporates the four helices of the QH, and the four process requirements found in RI theory (anticipation, reflexivity, inclusiveness, and responsiveness). This model works as a way to operationalize responsibility in start-ups. This paper fills a gap where there is a lack of suitable approaches for start-ups to follow and implement.

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Introduction

Innovation is the development of new ideas and approaches, often realised in the form of goods, services, processes, and technologies. Innovation has been a major factor in improving our standards of living, providing new medicines and disease treatment, and providing employment opportunities throughout society. Imagination, creativity, and visionary efforts underpin innovation and have allowed humanity to thrive while reducing many of life's burdens. In particular, innovation is a cornerstone for good business opportunities, increased competitive advantage, and boosting economies. Innovation is an important requirement for successful businesses, fields of research, and

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entire industries. There has been a lot of research around entrepreneurship opportunities in recent years (Shane and Venkataraman 2000), as well as the many socio-ethical concerns and the social price of these opportunities (Davidsson 2015).

In the desire to move fast, meet targets, and realise innovative goals, there is the possibility of overlooking risks, whether these be economic, environmental, or societal risks. There are many criticisms against organisations that place innovation ahead of safety. This has been strongly voiced in the business world, resulting in the emergence of business ethics to steer companies in a more ethical direction. Although business ethics as a subdiscipline primarily focuses on the strategic and operational level of corporate social responsibility (CSR), or on the individual level of leaders, professionals, and employees, the particular context of research and development (R&D) and innovation ethics is often not addressed (Blok, 2019).

While there has been a lot of social and ethical literature in business generally, there has been less of a focus on how start-ups should incorporate responsible and ethical practices[1], generally, and even less on high-tech STEM (Science, Technology, Engineering, and Math) start-ups, and the corporate activities and innovation of these start-ups. For example, there have also been developments in social innovation (Mulgan et al. 2007) and sustainable business model innovation (Evans et al. 2017; Shakeel et al. 2020), but this focus has largely been on mature businesses, rather than specifically focusing on start-ups. This is clearly a shortcoming given the emphasis that has lately been placed on achieving research and development (R&D) outcomes through start-ups. A shortcoming that RI can certainly assist with. Although developed in 2010 as an approach to guide responsible practices in the context of public research projects, it has since then increasingly been incorporated into the private sector as well (Blok and Lemmens 2015; Blok and Long 2016; Nazarko 2019; Stahl et al. 2017). Nevertheless, there has been very little attention given to the application of RI to the strongly innovative area of high-tech STEM start-ups.

Much of the RI literature (eg see Brand and Blok 2019; Lehoux et al. 2020; Ryan, Mejlgaard, and Degn 2021; van de Poel et al. 2020), with the exception of (Long et al. 2020), is broadly concerned with the research and innovation process in academic and business organisations in general, failing to address the intricate and idiosyncratic nature of a start-up: start-ups are typically quite different from more mature businesses, particularly in their dynamic nature, small composition, and fluid intra-organisational roles; thus, they may need to take into account different strategies, guidelines, and objectives for responsible behaviour. There is, therefore, a research gap on how start-ups can initiate these objectives, particularly start-ups with a desire to implement responsible practices.

This paper aims to address this gap by examining how RI can be used in the context of start-ups. It will demonstrate that there are a lot of challenges in implementing responsible action for start-ups, which RI may be able to help with. However, RI creates its unique issues when applied to start-ups because it often focuses too heavily on social and research impacts, and civil society stakeholders, rather than economic impacts, which may be unviable for start-ups early into their life cycle. Therefore, we will show that there is a need to cross-fertilise RI with a more distinctly business-oriented approach, particularly one that focuses on the specific needs of a start-up, such as the lean start-up approach – LSA. LSA focuses more on the economic impacts and business requirements for successful start-ups, and industry stakeholders (we will make reference

also to some antecedents of LSA, focused on the concept of entrepreneurial opportunity), and could therefore complement the more socially-focused position of RI.

While the cross-fertilisation of RI and LSA provides a more thorough examination of stakeholders, processes, and responsible practices for a start-up, there may still be some tensions when it comes to implementing it in practice. There may be uncertainties about how much weight to place on research, compared to economic growth, or how much concern to give to societal impacts in contrast to policy requirements and regulations. To overcome this challenge, we propose that RI and LSA benefit from one more cross-fertilisation: the quadruple helix (QH) approach. Within the QH, enterprises (private) must collaborate with policy, research, and CSO to contribute to societal challenges. QH is a characteristic of collaborations in which enterprises operate and contribute to the four helices: societal, research, business, and policy.

Altogether, we will cross-fertilise these three approaches (RI, LSA, and QH), within one model: the social responsibility for start-ups model (SRSM).[2] SRSM aims to instil responsibility into the start-up innovation process by ensuring that the voices of stakeholders from all four helices are taken into account, whilst providing an assessment of current impacts in these areas within start-ups. This provides an iterative, lean approach for start-ups to inform the strategy of the start-up cycle, which incorporates the four helices of the QH, and the four process requirements found in RI theory (anticipation, reflexivity, inclusiveness, and responsiveness). This model will provide preliminary insights for start-ups to incorporate, and works as an ideal way to operationalize responsibility. This paper provides an important contribution to the field and fills a gap where there is a clear lack of a suitable responsibility paradigm for start-ups to follow and implement. The paper is the first of its kind to bring together RI, LSA, and the QH under one roof and to align this model to the needs and idiosyncrasies of a start-up.

This paper aims to answer the research question: How can the literature on social – responsibility in start-ups be enriched by insights from current approaches within the field (such as RI, LSA, & the QH)?

The paper will begin by providing typical characteristics of start-ups (Section 2) and what we mean by responsibility and RI (Section 3). Section 4 will outline LSA and will demonstrate how it can support RI, while Section 5 will show the benefit of both approaches cross-fertilising with the QH, which gives equal importance to business, societal, social, and political factors. Section 6 will provide an exploration of how our SRSM, incorporates all three approaches (RI, LSA, and the QH) together for a more socially-responsible approach for start-ups. Finally, the conclusion will summarise our SRSM and how it can be developed in future research and applications in the field.

High-Tech STEM start-ups

A common issue faced by start-ups[3] is identifying what are socially responsible business practices and how these can be embedded into the start-up innovation and/or venture creation process, crucially in balance with entrepreneurial activities (Voinea et al. 2019). To identify such practices, one needs to begin by outlining what distinguishes a start-up from other types of businesses. A start-up involves the conception/development of an (innovative) idea and the decision to pursue it in the business arena. The five factors listed below are inevitable and essential characteristics of any business structure that is

formed for pursuing the (innovative) idea and which, crucially, stands some chances for (commercial) success:

- Start-ups are early-stage ventures that mostly lack real stakeholders (Retolaza, Ruiz, and San-Jose 2009; Voinea et al. 2019); only anticipated stakeholder characteristics can be theorized.
- The owner(s) (entrepreneur(s)) of a start-up is also its manager(s), and in the absence of real stakeholders, maximization of profit is not usually a main priority (Retolaza, Ruiz, and San-Jose 2009). Moreover, start-ups have a fluid structure when it comes to titles, roles, status, and function within the organization (Henriques and Öberg 2016; Long et al. 2020); incomplete or under-defined business models and processes add to this fluidity.
- Start-ups are highly specialized (niche) ventures of significantly smaller size than regular companies and this might affect the degree to which responsible behaviour can be undertaken, predicted, and evaluated, due to the lack of appropriate tools, resources and procedures (Henriques and Öberg 2016; Long et al. 2020; Maccarrone and Contri 2021; and Retolaza, Ruiz, and San-Jose 2009); moreover, the newness that characterizes start-ups may even justify less propensity to responsibility by falling off the margins of relevant national regulations (De Lange 2017; Russo & Tencati, 2009; Voinea et al. 2019).
- Start-ups are seldom in control of the many technical, social, economic, and political values that may contribute to shaping the product design, leading to high levels of product uncertainty that may last even past the commercialization phase (Henriques and Öberg 2016; Long et al. 2020; Retolaza, Ruiz, and San-Jose 2009). Such uncertainty negatively affects the ability to undertake and predict responsible behaviour. There is an uncertainty about the improvement of rival innovation, complementarities among innovations, and consumer demand/preferences (Dew and Sarasvathy 2007).
- Start-ups are brooding places for innovation. They survive if and only if they initiate creativity and adaptability, along with the hiring of highly-skilled employees (Henriques and Öberg 2016; Long et al. 2020; Retolaza, Ruiz, and San-Jose 2009). A start-up involves the conception/development of an (innovative) idea and the decision to pursue it in the business arena. This can take the form of a 'New Venture Idea', which is the inclusion of ideas to help create new social and corporate ventures (Davidsson 2015). The new activity must offer users something that has not been previously offered by that actor; so it must be something new, rather optimising an existing activity (Davidsson 2015).

Approaches that provide guidance on socially-responsible practices and CSR within start-ups should take these characteristics into account in their development and implementation. It is important to examine some of the existing frameworks and attitudes to CSR to identify if any of these approaches suit the needs of a start-up that wants to implement socially-responsible practices. As mentioned in the introduction, CSR and business ethics are not particularly new and there have been many approaches to responsible business practices developed over the past 50 or so years. For example, agency theory (Friedman 1970) has been used for guiding CSR practice in an

instrumental manner that perceives CSR as a means to maximizing shareholder value (Gregg 2001) rather than as an end in itself.

This perspective has been criticized by researchers such as Donaldson, Preston and Carroll (Caroll 1979; Donaldson and Preston 1995) who advocate a corporate social performance (CSP) framework that proposes three dimensions of social performance: economic, legal, and ethical; the ethical dimension includes the responsibility of businesses to act in a manner benefiting society by considering the interests of stakeholders beyond just shareholders.

The CSP framework is a precursor to Freeman's stakeholder theory (Freeman 1984) which has emerged as a dominant paradigm in CSR[4], and highlights the importance of stakeholder identification and engagement – through meaningful and effective dialogue (Maccarrone and Contri 2021) – for integrating CSR into strategy and proactively responding to stakeholder demand (Maon, Lindgreen & Swaen, 2010; Porter and Kramer 2006). Stakeholder theory has formed the basis of several models and frameworks (see Table 1).

Nevertheless, the application of approaches based on stakeholder theory, let alone on agency theory, for identifying socially responsible business practices and embedding them into the start-up innovation and/or venture creation process, is problematic due to the idiosyncratic characteristics of start-ups outlined in the five bullet points earlier (Retolaza, Ruiz, and San-Jose 2009; Voinea et al. 2019).

To overcome the limitations of traditional stakeholder theory-based approaches, Retolaza et al. (Retolaza, Ruiz, and San-Jose 2009) propose a practical and efficient method for embedding CSR into start-ups whereby CSR is not developed in response to external demand, but proactively in the initial phases of venture creation through the identification of, and engagement with, 'interest groups' ie categories of anticipated stakeholders; they also highlight the importance of the start-up entrepreneur's influence in defining these groups and how to engage with them.

In (Voinea et al. 2019), the authors resort to social capital theory as a theoretical underpinning for embedding CSR into start-ups, and point out that CSR engagement is based on a 'combination of financial and social capital', whilst it can be treated as 'an investment decision' for it primarily aims at creating trust-based, beneficial relations

Table 1. Outline of models that stem from stakeholder theory.

Reference	Outline of the Position
(Porter and Kramer 2006)	Porter and Kramer for developing a 'shared value' approach to CSR, where businesses identify social and environmental issues that intersect with their business objectives and develop initiatives that address these issues whilst enhancing their competitive advantage
(Waddock and Bodwell 2007)	The approach proposed by Waddock and Bodwell that emphasizes that businesses should adopt a 'mainstream' view of social and environmental responsibility, that goes beyond mere compliance with regulations, and integrates responsibility into all aspects of business operations
(Oertwig 2017)	This framework is based on the tenet that sustainability can be a driver for innovation and competitive advantage, and that it should be integrated into all aspects of an organisation
(Baumgartner 2014)	This framework integrates CSR into business management practices though three key elements – values, strategies, and instruments – where values align with a company's mission/vision and shape strategies, whilst instruments measure progress towards strategic targets
(McWilliams and Siegel 2001)	This model proposed in for determining CSR investment depending on firm size and other factors such the level of diversification, research and development, advertising, government sales, consumer income, and labor market conditions

with suppliers, creditors, customers, and local communities for increased profitability potential. They recognize the role of the start-up entrepreneur as 'a key driver in engaging in CSR' and recognize the importance of entrepreneurial orientation in determining CSR engagement in start-ups.

A high-level of entrepreneurial orientation, with a strong focus on innovativeness, risk-taking and proactiveness can help start-ups is developing CSR strategies that go beyond mere compliance and can contribute to truly sustainable development (Hockerts and Wüstenhagen 2010). For example, startups willing to take risks may experiment with new CSR initiatives or pursue more ambitious sustainability goals; similarly, startups that are proactive and innovative may be more likely to seek out new opportunities for CSR engagement and develop new business models that align with sustainability principles as well as the peculiarities of start-ups in nascent stages.

There have been many other efforts to place a greater degree of care on social aspects in the innovation process, but these often still have an overemphasis on economic aspects and approaches to business and entrepreneurship (for example, social entrepreneurship (Praszkier and Nowak 2011) and the circular economy (Corvellec, Stowell, and Johansson 2022; Kirchherr, Reike, and Hekkert 2017)).

While this paper could use or adapt any of these approaches, or a number of other recent approaches that entrepreneurs and firms are adopting to contribute to their social responsibility, this paper instead focuses on the position of responsible innovation (RI) as it has a much clear focus on the responsibility component in business and research than these other approaches. The approaches discussed in this section often fail to sufficiently address the centrality of research and innovation processes in start-ups, in particular high-tech ones, thus overlooking the criticality of embedding CSR in such processes. In contrast, this work takes a different standpoint and advocates that embedding CSR in high-tech STEM start-ups crucially entails the development of a model that can infuse mainstream responsibility in the research and innovation processes of these start-ups. The following section will outline an approach that may be able to assist start-ups during this (we do not claim that RI is the best approach, or that other approaches are not also suitable or could be used, it is simply because RI places a stronger emphasis on responsibility and it may offer a better balance with more economically-focused positions).

RI as an approach to guide start-ups

According to (Klein and, Knight 2005), the term responsibility primarily refers to causal responsibility, legal responsibility, and moral responsibility. Causal responsibility for a particular situation means bringing that situation about either directly or indirectly. Legal responsibility means fulfilling the requirements for legal accountability. Moral responsibility covers the fulfilment of the criteria for deserving blame or praise for a morally significant act or omission. Causal responsibility is typically an essential criterion for both legal and moral responsibility.

Another commonly used definition or type of responsibility is that of role responsibility (Hart, 1968). This includes the duties (often culturally determined) which are attached to particular professional, societal, or biological roles. Failure to fulfil such duties can expose the role-holder to censure which may – depending on what the roles and

duties are – be of a moral or legal kind (Cane 2016). Role responsibility is thus very close to the notion of responsibility as understood in RI (Gianni 2016). It is an inherently relative notion that can only be assessed in context and according to one more belief system: for instance, to decide whether a teenager has behaved irresponsibly in buying an automatic machine gun we can appeal to the ideal of responsibility as developed within the Christian doctrine, within legal prescriptions, within familial institutions, within a certain culture and historical context, within the ethical theory and many more.

Conceptually, there is also some variation: being normative relative to the same situation one could employ a 'backwards-looking' notion of responsibility and check whether the machine-gun owner is at fault in some way, or a 'forward-looking' notion to check whether the owner has fulfilled her duty of capturing future scenarios and counter-arguments within her decision-making process (van de Poel 2011; van de Poel and Sand 2018).

The position of RI should incorporate both backwards-looking and forward-looking processes to achieve a rounded and effective definition of responsibility to avoid social and environmental hazards and injustice (Blok 2022). RI should not be limited to a passive form of responsibility, one which only relies on avoiding harms and injustices, but it should be more proactive, addressing the positive contributions that research and innovation may (or must) actively bring about to society (Blok 2022). Acting responsibly and behaving responsibly are used interchangeably with the notion of responsibility in RI and infer that agents should implement backwards-looking and forward-looking, as well as passive and proactive, forms of responsibility, as discussed here.

This notion of responsibility is important for start-ups because an underpinning of innovation is not just an intellectual endeavour of finding new solutions to problems, rather, it is also a social endeavour in which society and science change together and influence each other (Evers and Ewert 2015). New technologies do not just answer technical questions – they change the world we live in. RI is thus a way of 'taking care of the future through collective stewardship of science and innovation in the present' (Owen et al. 2013). Innovation is, as the phrase goes, 'society in the making' (Callon 1987). The moral obligation of scientists to innovate responsibly has been linked with, eg the democratic control over public funds, and the prospect of 'technology traps' (see overview in Popa, Blok, and Wesselink 2020a).

With this backdrop, various models of RI have been developed in the past decade to help bring this idea of science closer to reality (Asveld 2017; Koops et al. 2015; van den Hoven et al. 2014). Since 2011, RI has also shaped the European scientific and technological research framework programmes (Wiarda et al. 2021). Such European policy was addressed primarily at research organisations and universities, and it has focused on the following keys: ethics, gender equality, public engagement, open access, science education and governance (Randles, Tancoigne, and Joly 2022; Rip and Rip 2018; Zwart, Landeweerd, and Van Rooij 2014). The research field of responsible innovation (RI) coincided with the European Commission's responsible research and innovation (RRI) framework (Shanley 2021). For ease of reference, we will refer to both under the heading of RI, as this is where most of the scientific research has been and contributed to over the past decade.

A model that has been particularly successful in capturing the essence of RI is the one proposed by Owen et al. 2013. This model revolves around four principles or 'process requirements' (Table 2).[5]

Table 2. RI's four processual requirements (Owen et al. 2013).

Process Requirement	Description
Anticipation	Asking questions about the future, taking into consideration not just what is known and fairly certain but also what is not known, what is likely, what is plausible and what is possible. This forward-looking thinking is not only aimed at preventing negative consequences but also improving the embedding of technology in social innovation imagining 'new venture ideas' (Davidsson 2015)
Reflexivity	Thinking and being critical about the innovation process and being aware that perspectives, cultures, paradigms, frames of reference and other parameters might play a role in framing that issue such that no universal viewpoint is valid at all times.
Inclusion	Engaging various stakeholders to participate from the start in science and innovation such that societal values are absorbed in the process of bringing new technologies to the market. This aspect involves setting up deliberative structures that empower stakeholders to defend their values in a dialogue with the experts involved in innovation.
Responsiveness	Responsiveness refers to the practice of responding and modifying ways of thinking and behaviours. It asks scientists, companies, and industries to change their research and innovation practices if their stakeholders or the public deem their practices ethically unacceptable or contrary to the needs of society. It is responding to changing perspectives, knowledge, and values within society.

It must be made clear that these four processual requirements were initially developed in the context of research, and not necessarily industry. Since 2015, dedicated research on the particular context of RI in industry emerged, highlighting the different contexts in which private sector innovations take place (Blok and Lemmens 2015). It lead to dedicated European projects on RI in the industry like Prisma (van de Poel et al. 2020) and special issues on the challenges of RI in the industry (Martinuzzi et al. 2018), in which the motivations of companies to engage in RI (Garst et al. 2017), company strategies to engage in RI (van de Poel et al. 2017) and particular RI challenges in specific sectors like ICT (Stahl et al. 2019) are discussed.

The implementation of RI may help the core business of innovation-oriented firms (Blok et al. 2020). It was clear in Blok et al. 2020 that the upstream engagement of stakeholders, from the early stages of the innovation process, can help anticipate risks downstream, hence improving the end product and its acceptability; this may also bring about collateral benefits such as improving a firm's image and reputation (Blok et al. 2020).

RI practices may also improve the marketability of a company by being 'responsible', identifying problems or issues before they occur, avoiding controversy over irresponsible activities, and giving back to one's community and society. For example, Long and Blok (2018) conducted 11 semi-structured interviews with entrepreneurs developing climate-smart agricultural innovations. They found evidence for the 'compatibility between exploratory open innovation activities and dimensions of responsible innovation'. It was shown that many socio-ethical issues can be addressed through open innovation that implements a sensitivity to ethical considerations within innovation (Long and Blok 2018).

Research has highlighted how RI can provide a competitive advantage to firms (Blok et al. 2020), and how it can be aligned with Corporate Social Responsibility (Blok 2018; Long and Blok 2018) and the open innovation strategy of companies (Long et al. 2018). Research has also indicated how RI RRI can be implemented in R&D decision-making processes (Blok et al. 2017), and integrated into company strategy (van de Poel et al. 2017) to mature over the years (Stahl et al. 2017). However, there has been a relative

gap in the literature up until now focusing on RI RRI in the context of start-ups. These findings have been corroborated also by reviewing a strand of European projects[6] meant to explore the contribution of RI to firms, including SMEs.

Lubberink et al. (2017) have combined the model by Owen et al. 2013 with social innovation and sustainable innovation literature in order to reframe the four processual requirements for academic RI in terms that are better suitable to be applied in industrial contexts. The Lubberink et al. 2017 paper demonstrates how the four processual requirements can be implemented in a business context and also influences the adoption of these four processual requirements in our paper. Lubberink et al. 2017 operationalise the four processual requirements of RI, which can be seen in Table 3.

The work conducted by Lubberink et al. 2017 enables the conceptualisation and realisation of RI in business contexts and further details how the four processual requirements can be implemented in such a context. It also aligns with the strategies to implement RI in industrial contexts by van de Poel and colleagues (2017) and in particular sectors by Stahl and colleagues (2017). However, as Lubberink et al. 2017 also stated in their paper, although RI in the business context is an emerging field, the specific application to start-ups is virtually nonexistent (Long and Blok 2022).

The context of start-ups is different from larger corporations, as they often operate in highly dynamic and complex contexts in which they are small actors with no market power yet, have a lack of resources and are highly dependent on private investors and venture capital (Long et al. 2020). While their advantage is their smallness and flexibility, which enables them to engage in RI practices like experimentation with various designs to increase responsiveness (van de Poel, 2020), their disadvantage is that they have less time and resources available to engage in RI (Long et al. 2020). Nonetheless, the innovation practices of both start-ups and larger corporations function in open innovation (Long and Blok, 2017) and multi-stakeholder networks (Ceicyte et al. 2021; Lubberink et al. 2019).

One factor that may contribute to the lack of RI uptake in start-ups, is the difference between how it is implemented in academia and how it is used by companies in practice. While existing RI research and practice mainly focuses on public Research & Innovation (R&I) at universities, privately funded industrial R&I provides a completely different context with its challenges (see Blok and Lemmens 2015 for an outline of these). The

Table 3. Processual requirements conceptualised in Lubberink et al. (2017).

Processual requirement	Key activities
Anticipation	1. Determining desired impacts and outcomes of innovation 2. Preventing or mitigating negative impacts 3. Development of roadmaps for impact
Reflexivity	1. Actions and responsibilities 2. Values and motivations 3. Knowledge and perceived realities
Inclusion	1. Involvement of stakeholders at different stages (who and when) 2. Provision of resources and capital (how) 3. Raised commitment and contribution (how)
Responsiveness	1. Making sure that one can respond to changes in the environment 2. Actual response to changing environments 3. Addressing grand challenges 4. Mutual responsiveness

self-evidence of public engagement in RI (Stilgoe, Owen, and Macnaghten 2013) turned out to provide particular challenges in the industrial context (Blok, Hoffmans, and Wubben 2015) because of fundamental tensions between the social logic and the economic logic employed by companies (Brand and Blok 2019). This particular context of industrial RI received increasing attention in the literature, resulting in dedicated special issues in recent years (Blok, Scholten, and Long 2018; Martinuzzi et al. 2018; Scholten and Blok 2015).

Another related issue is that since RI has not been widely disseminated in industries, many companies (particularly start-ups) have not heard of it or are not aware of its theoretical and practical development[7] (Novitzky et al. 2020). One of the causes of this lack of familiarity seems to be that most of the output stemming from RI literature and projects is directed toward academic or semi-academic (grey literature) publications that are not more widely disseminated throughout society (Novitzky et al. 2020). Additional causes may be because of a lack of clarity about RI (because of confusing terminology)[8] benefits may be unclear, and it may be difficult to measure and provide certification (these possible causes are also discussed in the sections following as issues). Even when the conclusions of the research are reached through collaborative interactions with the business environment, the results are not channelled back into this environment but rather remain embedded in academic publications.

Furthermore, RI is often seen as focusing too much on research and societal impacts of businesses, rather than taking into account many of their business and economic components. While RI provides a normative framework to underpin responsible behaviour in start-ups, it may focus too stringently on the societal and research aspects of a business, which may be inappropriate for a start-up. It may also put too much pressure on a start-up to allocate an imbalanced amount of resources towards societal concerns, which could lead to them overlooking their business obligations.[9] In addition to the perceived upfront costs of implementing RI for start-ups, where it is unclear the measurable benefit or tangible impact of doing so, these issues all make it challenging for the implementation of RI in start-ups.

To overcome these issues, and to retrieve the benefits of RI in start-ups, we propose that the RI framework can benefit from cross-fertilisation with LSA. While LSA is an approach that is much more familiar to start-ups, it does not have a very strong ethical direction or focus. The level of responsibility and social impact in the LSA approach is sparse, demonstrating that it could benefit from the guidance and framing of a strong, socially and research-focused, approach such as RI. The following section will demonstrate how these two approaches can benefit from one another and for the implementation of socially responsible practices within start-ups.

Supporting RI with LSA

The 'lean start-up concept', or Lean start-up Approach (LSA, as it will be called here), has been widely used in the literature on the start-up phenomenon in recent years. The main ideas about LSA have been highlighted not only by the authors who proposed it in 2011 (Ries 2011a) and contributed to its diffusion (see Blank 2013) but by a very wide range of scholars. The approach is highly relevant as it is based on the idea of bringing innovations closer to the market in a resource-efficient manner (Blank 2013). Such an idea is attuned

to the approaches to the institutionalization of RI that are focused on the promotion of multi-stakeholder engagement stages.

LSA is a technique for the development of start-ups that aims to make the process of their formation and early development more agile through systematic interaction with possible customers. LSA takes various ideas from other management approaches and theories, starting with the idea of leanness (Luise 2019), dialogue with customers, 'Open Innovation', and co-creation (Frederiksen and Brem 2017). Furthermore, as Mansoori and Lackeus (2020) clearly state in a comparison of several entrepreneurial methods, LSA is an entrepreneurial method that is 'practitioner-grounded' and, probably for this reason, it gives emphasis on 'large toolkits for managing different aspects of the venture creation process' (Mansoori and Lackeus 2020). In general, the idea is that the development of a start-up is a process of discovery (of customer needs) and construction (of the business model) rather than the execution of prearranged operations (a business plan) (Blank 2013). This idea implies a strong focus on the context in which the entrepreneurial action takes place, the collection and exchange of information and points of view with a variety of actors inside and, even more, outside the enterprise. As a process, the practice of LSA implies it is iterative change, updating not only action plans but also, above all, the objectives of the activities that are carried out (pivoting) (Blank 2013; Bortolini et al. 2018).

The operational core of the LSA consists of the exploitation of the hypotheses around which the business model is built which entails their validation. This validation takes place through various forms of consultation with customers (and the various actors potentially interested/involved in the use of the product/innovation) using the so-called Minimum Viable Product (MVP), ie a simplified prototype of the product precisely elaborated for being tested with customers. This testing process, which has elements of experimentation, enables the acquisition of information (eg the orientations of consumers and other recipients of an innovative product) that would otherwise be unattainable. One of the central aspects of LSA is that this testing process is based on the use of appropriate 'metrics' and indicators that primarily aim at facilitating the understanding of the acquired information. The proposers of the approach and other scholars thereby speak in this regard of a 'Build-measure-learn loop' (Ries 2011b; quoted in Frederiksen and Brem 2017, 178; Gbadegeshin and Heinonen 2016). MVP is defined as 'the smallest set of activities needed to disprove a hypothesis' (Eisenmann, Ries, and Dillard 2012; quoted in Ghezzi and Cavallo 2020) or as 'that version of the product that enables a full turn of the Build-Measure-Learn loop with a minimum amount of effort and the least amount of development time' (Ries 2011b, 77; quoted in Frederiksen and Brem 2017).

The literature suggests that the merit of LSA is eminently economic. The idea is that, through the practices that are suggested, the whole process of creating a start-up can become more effective (leading to fewer failures) and therefore more efficient (by saving time, reducing expenses in hypothesis testing and so on; Blank 2013; Bortolini et al. 2018). The LSA is not aimed at anything other than achieving entrepreneurial success or, conversely, minimising the damage of failure.

In addition, the construction of the business model that underpins a start-up is the result, if LSA is practised, of a process of construction through successive approximations. The challenge is that a given scientific discovery or innovative technological

solution must be transformed into an economic opportunity, but that the latter is not a necessary consequence of the former. The LSA suggests a series of procedures of a participatory nature to make this transition to the entrepreneurial entity.

RI, on the other hand, focuses on an element that is not included in the LSA, namely the issue of responsibility and ethical foundations for implementing innovation. However, we could say that, from a practical/operational point of view, the LSA concerns product validation through articulated and complex forms of confrontation and communication with an important category of stakeholders, the customers. This could be integrated with the four dimensions of an organisation practising responsible innovation (eg the four processual requirements discussed earlier: anticipation, inclusiveness, responsiveness and reflexivity). Despite this, there is still only one category of stakeholder that LSA focuses on (the customer), which would be deficient, according to RI, because it overlooks other important stakeholders.

In general, the link between RI and LSA can be further strengthened as the four processual requirements of RI are often implicit within much of LSA practice. We can further strengthen this relationship by taking the four dimensions of RI and including them in LSA. For example, the practice of LSA can be considered as a way to produce *anticipatory* behaviour (ie to anticipate customer behaviour or product problems). LSA already aims to *include* an important stakeholder – the customer – and is intended to promote a learning process on the part of the business group (an aspect of responsiveness). Furthermore, customer involvement can imply an iterative *reflexive* process (Mansoori 2017) in which various actors, both external and internal to the company, participate. Concerning these same actors, one must be able to show consequentiality (ie that the indications that have come from the dialogue carried out have been taken into account).

In essence, it can be argued that the practice of LSA, although different from RI, could be seen as a specific way of realising many of the goals in responsible innovation. Again: if it is true that there is an overlap, albeit partial, between RI and LSA, then it can be argued that the practice of RI, at least in principle, is not in conflict with the pursuit of the goals of cost-effectiveness by companies and start-ups. More specifically, it can be argued that if an organisation seeks to practice reflexivity, inclusiveness, anticipation and responsiveness, this orientation is not necessarily at odds with the pursuit of cost-effectiveness and that, under certain conditions, the cost-effectiveness of a start-up can benefit from RI-related practices. At first appearance, there is no fundamental reason against the alignment of RI and LSA.

Both RI and LSA revolve around an interpretative activity that entrepreneurs undertake through dialogue with their internal group and external stakeholders. This interpretation is the product of a learning process triggered by the interaction with stakeholders (both for an existing company and a start-up). It is in the interest of start-ups to be able to operate in a context in which the drive to align the processes and outcomes of scientific research with the values, needs and expectations of society is gaining saliency. The practice of RI, therefore, far from appearing as an additional bureaucratic burden placed on the full deployment of entrepreneurial energy, presents itself to technology start-ups as an alternative way of operation that is appropriate to the current challenges they are facing. In this framework, it is useful to acknowledge that LSA is in line with antecedent approaches, as Bortolini et al. (2018) state, including one known as ‘effectuation’

according to which 'start-ups should experiment rather than plan, doing their best with the limited or "bootstrapped" resources they have to leverage contingencies, their decisions being driven by the notion of affordable loss rather than expected return' (Bortolini et al. 2018). LSA can be seen 'as a practical-oriented and up-to-date implementation of strategies (…)' that is based also on the effectuation approach to entrepreneurship. Such recognition is also important if further works of Sarasvathy with colleagues are considered (see the most important Dew and Sarasvathy 2007), especially when they demonstrate the relevance, for promoting innovative entrepreneurial actions, of the involvement of stakeholders, including practical suggestions such as the so-called 'crazy quilt principle' (ie the idea that an entrepreneurial initiative is also based on the actual involvement of diverse stakeholders). Therefore, these two approaches (effectuation and LSA) resonate so strongly that choosing one or the other could even appear unnecessary (Ghezzi 2019 holds that LSA could be seen as an operationalization of the effectuation approach). Nevertheless, differences do exist: for example, probably because of its being practitioner-grounded, in LSA feedback from the external environment, according to Mansoori and Lackeus (2020), is more a deliberate process of information gathering than the 'result of serendipity and happenstance', as it is in Effectuation. Similarly, even if continuous learning is crucial for both methods, it is an inherent strategy in LSA (as well as in other methods) while it is more a 'by-product of following other recommendations' in effectuation (Mansoori and Lackeus 2020). Anyhow, the focus on experimentation and the progressive interpretation of the context in which the enterprise is being formed basically coincide. The emphasis put by LSA on MPV is mainly technical and economical, but a better understanding of the social context and the involvement of stakeholders to define a sounder venture (the 'crazy quilt principle'), which is typical of effectuation, has also a lot to do with the definition of a business model and not exclusively with responsibility concerns. Both approaches could be adopted either for economic purposes or for more ethically oriented ones (as well as for both purposes). The issue will be dealt with in the following section (focused on QH stakeholders' involvement).

It is also to be stressed that the literature connected to the Effectuation approach is focused on how economic opportunities are defined (either following a causation logic or an effectual one). Davidsson (2015) highlighted the importance of the so-called 'individual opportunity nexus', saying that 'At micro-level explanations of entrepreneurial action and outcomes should look beyond the individuals involved. Equally important is attention to qualities of the 'opportunities' they pursue, and the fit between individual and 'opportunity''(675). Important, here, is the debate over the very nature of opportunities (see above, the concept of 'new venture idea' proposed by Davidsson 2015 to find a solution to the debate on opportunities; Ghezzi 2019, anyhow, holds that LSA users tend to take up a creational stance towards opportunities). The issue is relevant since the process through which a start-up arrives at a definition of the opportunity(ies) on which it bases its activities, ie how it occurs, has a foundational and crucial value. Furthermore, it could be said that taking up the so-called 'effectual logic' suggested by Dew and Sarasvathy (2007) could integrate the RRI approach not just in a 'defensive way' (anticipating risks) but also to define (or refine), through the interaction with stakeholders, the very opportunities. Therefore, an integration of LSA and Effectuation, as Bortolini et al. (2018) and Ghezzi (2019) suggest, is justified. Mansoori and Lackeus (2020), also stress

that integrating Practitioners and Scholarly-grounded entrepreneurial methods could help add theoretical rigor (eg on the fundamental issue of managing uncertainty) to practical suggestions, especially through the development of the entrepreneur's own understanding of specific practical advice.[10] The opposite is also true, since 'scholarly-grounded methods need to be stronger on the level of tactics' (Mansoori and Lackeus 2020). Integrating different approaches is therefore a useful exercise, especially considering the inherently interdisciplinary characters of our exercise.

It is not irrelevant if the definition of opportunities (which is not linear) happens through the involvement of a wide array of stakeholders or a more limited set (as, notwithstanding their similarities, the two approaches LSA/Effectuation tend to prescribe). Anyhow, it could be stressed that – especially STEM – start-ups when developing their new venture ideas and finding ways to put them into practice, have to create contacts with a wide array of actors: not just funders of various kinds (eg angels, venture capitalists), consultants (eg lawyers, accountants, incubators), but also various possible partners, customers and the scientific community (in its diverse components). We could say here, in general terms, that the issue of how to involve external actors and stakeholders, affects the overall development of start-ups, which is crucial for both approaches, is substantive and cannot be dealt with only technically. As highlighted by Marschalek et al. (2022) and Timmermans et al. (2020) involving stakeholders can be effectively done through the social lab approach. Such an approach is a way to address emerging social phenomena – therefore also a social endeavour such as the promotion of innovation through start-up – by connecting at the same time stakeholders' actual involvement and the interpretation they consequently give of these experiences, given the overall context in which they interact. This perspective is appropriate also when the context of the entrepreneurial process includes the promotion of RRI.

In light of this, the possible stages of the development of start-ups can be defined depending not only on the pathway that is being walked by a new business but also on the specific context in which it is. For example, funds can be lent in different amounts depending on the attention raised among potential investors available for the receivers in a certain geographical and institutional context (financial systems functioning and performances change a lot across nations and even regions); local policies and regulations dictate diverse conditions for receiving public funds for new ventures, or for being a recipient of consultancy services for start-ups (eg access to incubation services, consultancy, etc.). The availability of connections with local research systems, as well as the orientation of scientists to cooperate with (or be involved in) private business probably affects the ways in which the technological core of a high-tech start-up develops.

The literature on the LSA, including that on the 'nexus', and RI proposes some elements that deserve further attention and that focus on the issue of interpretation and the nature of the entrepreneurial actor. In this regard, the following considerations can be made. The RI approach implies a step that cannot be taken for granted ie making explicit the issue of responsibility in the system of choices that underlies the entrepreneurial process in general and, therefore, also the construction of a start-up and its business model. This may be attributed to the uncertainty and dense time that typically dominate this process, not leaving enough room for responsibility-oriented choices (Blank 2013; Bortolini et al. 2018). Therefore, there is a need for entrepreneurs to raise shared expectations about the future of their economic endeavours and the degree to

which this future is oriented towards responsible forms of innovation (Beckert 2016; Declich 2014).

The process of creating a start-up has a pronounced discursive and, therefore, communicative nature, which implies the collection of information on the business model hypothesis, as well as the creation of a suitable representation of this information. In addition, it can be stressed that the evolution of the business model through the pivoting process must find consensus within the entrepreneurial team that develops it (eg Mansoori 2017 focuses attention on the possible divergences among the start-up's team members concerning the results of the application of the LSA), so communication dynamics are very relevant. In this connection, the importance of storytelling in the start-up industry, connected to the management of expectations and uncertainty (Beckert 2016; Declich 2014), has been stressed (Luise 2019; Wiener 2021).

The group dimension of the enterprise, in this framework, becomes a non-secondary issue that must be placed at the centre of the reflection on the process of building start-ups. The suggestions coming from the LSA and RI literature on this aspect could be interpreted in the light of the recent studies that highlight the centrality of the entrepreneurial group and its dynamics in the life of enterprises and the process of start-up creation (Quaranta and Mastropietro 2003; Stamm and Gutzeit 2021 Stamm, Cruz, and Cailluet 2019;).[11] These dynamics are probably informed by how 'new venture ideas' are defined, developed, and discussed within the group and with relevant stakeholders, the ways in which they reiterate the trial-and-error approach through the MVP or how the practice effectual logic.

Furthermore, the potential alignment of LSA (including its antecedents) and RI and, in particular, the fact that the latter does not contradict the goal of the economic viability of a company, is not the only reason to consider RI as an appropriate approach to promoting successful start-ups. The RI approach could be crucial for start-ups that strive to meet the challenges of innovation based on advanced scientific and technological research (such as STEM). Research is increasingly the result of a complex interaction between different actors, many of them from the private and non-academic sectors, others from the public sector and civil society. This has been interpreted in a variety of ways, such as the QH approach, but also the Mode 1 – Mode 2 model (Nowotny, Scott, and Gibbons 2001), Post-academic Science (Ziman 2000) and Post-Normal Science (Funtowicz and Ravetz 1993).

Although different from each other, all these formulations describe a paradigm shift from the consolidated social model of science – often associated with the image of the 'Ivory Tower' – to a new social model, which can be referred to as an 'open social model' of science. Gibbons (1999) highlighted that the new social model is no longer based 'on the understanding that universities will provide research and teaching in return for public funding and a relatively high degree of institutional autonomy' and on the recognition of the authority and exclusiveness of science in validating scientific knowledge as well as on a set of internal mechanisms that make this possible (see Merton 1979/1942). By and large, we can say that these general trends, which characterize science-society relations, have deep effects on the potential development and performances of STEM start-ups. The issue, in a certain sense, concerns the complex dynamics through which two important poles of innovation (scientific and economic, which obey different value systems) interact. The debate and reflection on these issues

are at the basis of the scientific policies including, at the European level, that on RRI. It is also for this reason that we think that the cross-fertilisation of RI and LSA (and its antecedents) could be strengthened by gaining insights from such an approach to science and research, namely, the QH approach.

Cross-fertilising RI and LSA with the QH Approach

One deficiency still underpinning the cross-fertilisation of RI and LSA is that one often pulls more in the direction of research and societal concerns (RI), while the other pushes a start-up more towards economic and business concerns (LSA). This difference in orientation crucially manifests in the ranges of stakeholders and processes with which RI and LSA seek interactions: RI typically requires a wide range of interactions with a multitude of stakeholders, as opposed to LSA where stakeholder interactions are mostly confined to prospective customers. RI thus inherently broadens and proliferates the interactions that LSA traditionally entails. Moreover, the aforementioned difference in orientation also naturally manifests in the discourse used in stakeholder interactions: in LSA these interactions typically revolve around ways of ultimately making (more) profit, whereas in RI the focus is typically on a broader range of themes oriented towards social responsibility.

While RI and LSA may overcome many of the challenges of implementing a socially responsible approach for start-ups, a few challenges remain: how do we know how much of LSA or RI to take into account in a given situation or as the goals of a start-up? Which stakeholders should be given greater priority in decision-making? How should a start-up balance research and social concerns with those of its business, all the while trying to incorporate policy and political challenges for the start-up? We propose that the cross-fertilisation of the RI, LSA, with the QH approach, will answer many of these questions (Carayannis and Campbell 2009; 2012; Fitzpatrick and Malmborg 2018; Monteiro and Carayannis 2017).[12]

According to the QH approach, innovation occurs as the result of an interaction between four sectors (or 'helices') defined as types of stakeholders: the *industry helix* contains businesses and for-profit organizations, the *policy helix* contains policymakers as well as regulatory and executive bodies at different policy levels, the *academic helix* contains universities, research organizations and other knowledge institutes, and the (civil-)society helix contains citizens as well as media, non-governmental organizations and various other cause group and arts. But since we are dealing with the (responsibility) evaluation of actual innovation processes and not with the interaction between stakeholder representatives, it will be more expedient to utilize a more recent interpretation of quadruple helix innovation in *processual* terms (Popa, Blok, and Wesselink 2020b).

In a processual interpretation, the focus lies not on stakeholder types, their titles and identities, but on the processes through which stakeholders regardless of their identity – in our case the members of the start-up and their external partners – create different types of values during the innovation process. In this processual interpretation, then, a helix stands for the behaviour that is directed at a certain value and that is rewarded in prototypical ways when that value is achieved. For example, the helix 'Industry' will stand for, not a group of stakeholders with certain titles or identities, but the prototypical behaviour directed at the creation of 'business value' defined as 'direct or indirect monetary worth' (Popa, Blok, and Wesselink 2020b). Examples of such behaviour are 'starting

a business' or 'managing a business' and when business value is achieved, the behaviour is rewarded with prototypical outputs such as 'return on investment' or 'market share' (Popa, Blok, and Wesselink 2020b). In the processual quadruple helix model, helixes are thus distinguished by these three determinants: the value aimed at by goal-directed behaviour, the prototypical forms of this behaviour and the prototypical outputs (see Table 4).

Of course, this ideal model should be distinguished from the complexity and 'messiness' of a start-up's activity. In real life, it is not always possible to make this analytical distinction between values created on each helix. Indeed, real-life innovation activity will ideally appear as being simultaneously directed towards all four types of value: if the start-up creates an innovative product, then the act can result in added market value (eg if the product is marketable), research value (eg if in making the product knowledge was produced that can be used for future progress), societal value (eg if the new product solves a social problem) and added political value (eg if the product answers a political ideal of free democratic societies). In any given innovation act, the *values are thus entangled.*

Equally important is the fact that the values thus entangled are in a state of competition with one another (Popa, Blok, and Wesselink 2020b). Since the decision-making process that constitutes innovation cannot maximally satisfy all four values, balance is needed between the four helices and this balance will inevitably serve some values at the expense of others. Since every start-up has limited resources, the question of responsibility is in essence a question of optimum value creation. The central question for the organization looking to act responsibly, and consequently the central question for the evaluator looking to assess the responsibility of the organization is: Is the activity/product optimally serving the four helixes such that no value overpowers others and no value is sacrificed for the sake of others? Technological progress might contribute to a gain in value generally speaking, but this gain might not translate into an equal gain for all individual stakeholders and values (Dew and Sarasvathy 2007). In some cases, the disparity between two or more values can be particularly obvious leading to friction or conflict (Garst et al. 2019; Ligtvoet et al. 2016).

Table 4. Innovation as value-creation along four helices.

Helix	Values	Definition	Prototypical Behavior	Prototypical outputs
Industry	Business Value	Direct or indirect monetary worth	Starting a business, investing in a business, mergers and acquisitions, managing a business.	Return on investment, market share etc.
Policy	Political Value	Contributing to a fair and just system.	Campaigning (arguing) for or against a policy, a programme or an individual.	Votes (for a party or policy)
Research	Research and education Value	Producing new knowledge contributing to the development of a disciplinary field or science in general	Researching, publishing and presenting scientific work.	Publications, patents, books, academic and honorary titles, citations
Civil society	Societal Value	The contribution of an act to the protection and implementation of civil, political and social rights.	Protests, petitions, lobbying, starting and managing an NGO.	Rights and artefacts that answer societal needs.

In extreme cases, artefacts excel on some values while others are not just poorly served, but are disadvantaged. The case of health risks is a standard example in this case. The start-up might create a product with amazing market value but with a decrease in the quality of life of its end-users (eg individual health risks) and other stakeholders (eg environmental risks). The gain in business value might be said in this case to overpower the loss in social value, in which case we can speak of irresponsibility. The same idea applies, *mutatis mutandis*, to other cases where the decrease in value on one side is sought to be compensated by the increase in value on the other side.

This kind of exchange is sometimes referred to as 'domination' (Miller and Walzer 1995; Walzer 1983). In the case of health risks, the market value – or more precisely the anticipated creation of market value – dominates the innovation process in a way that is detrimental to the other three helices. Responsibility thus becomes a form of balance between the four helices. In Figure 1, we represent this process visually.

As the start-up innovates, there is a value gain on the Y-axis. The increase in coloured surface designates this gain in value. But the gain needs to be distributed, meaning that each helix will be served more or less depending on the degree to which the activities/product in question result in value on that helix. An interesting observation is that, as time passes, as represented by the X-axis, there is more at stake since there will be more value to balance between the four helices (see Figure 1).

The QH approach does not overemphasise any of the four areas of value but rather balances all four helices within one overall framework to evaluate the socially responsible nature of start-ups. While the QH approach offers insights for LSA and RI, it is not meant as a sufficient approach in itself because it works more as a systematic understanding of processual relationships in business, rather than as a prescriptive framework for responsible business practices. Thus, our model brings all three approaches together in our social responsibility for start-ups model (SRSM).

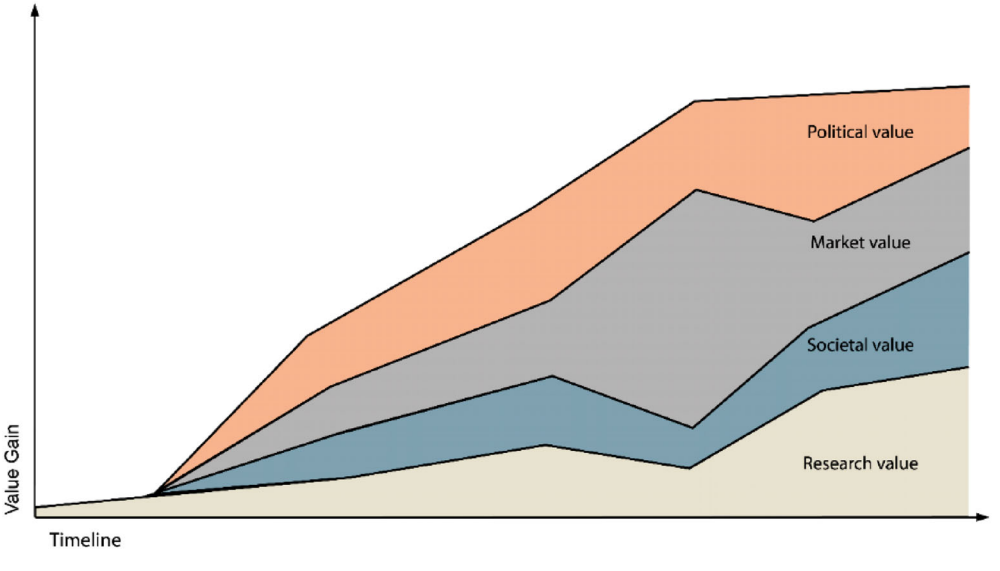

Figure 1. Value gain (Y-axis) distributed unequally in time (X-axis) along four helices (Popa, Blok, and Wesselink 2020b).

The social responsibility for start-ups model (SRSM)

The SRSM views innovation as a phenomenon involving a multiplicity of actors with impacts that go beyond those affecting the parties directly involved in entrepreneurial activity, ie firms and customers. It is based on three main components, RI, LSA, and the QH approach. The model addresses the shortcomings in the one-sidedness of the social orientation in RI and in the economic orientation of LSA. Integrating the QH approach within the SRSM allows for a complementary way to benefit both LSA and RI and for balancing the four main stakeholder groups and processes to guide a start-up toward socially responsible behaviour. The QH approach is a systematic way of viewing the co-dependencies and relationships between different stakeholders and processes within business dynamics, and in our case, start-ups. However, it is more a way of detailing systematic dynamics and relationships *between* stakeholders and processes, rather than necessarily providing prescriptive recommendations or guidance for start-ups (hence, the need for RI and LSA).

To implement SRSM practically, a start-up can begin by adopting a general framework as described earlier in the four processual RI requirements, as outlined in Owen et al. 2013. These processual requirements can be mapped within the four helices of the QH approach, and implemented in a lean, iterative way, as described in LSA (see Table 5).

Table 5 outlines the intersections of QH and RI and how socially responsible processes can be implemented into a start-up. However, focusing on these aspects without the context of the social responsibility of the products/services that the start-up is developing will be problematic for a start-up, as they are in such an early business life-cycle that they need to really concentrate on the product/service that they are delivering to the market. Table 5 highlights the intentions of a start-up to become socially responsible but it does not yet operationalise where, and how, these intentions would become implemented into the products/services of the start-up. Take the examples of gender inclusivity, donating to charitable organisations, or ensuring adequate open access and transparency of the company as responsible action. Table 5 would provide guidance on these topics, the overall social responsibility goals of the start-up itself, and how to better include stakeholders in the process. However, there is no guidance about how their product should be developed and used in a socially responsible way. From an economic/commercial point of view, we should also consider that start-ups, unlike established firms, don't have a business-as-usual activity to be kept going on. While Table 5 may be helpful (alone) for a mature company, the lack of product/service focus would make this socially responsible approach quite challenging for a start-up to implement.

This is one of the reasons why other approaches to responsibility – albeit useful – are less relevant for start-ups: start-ups must think about responsibility while grappling with the challenge of setting up successful businesses. This implies that those who undertake such ventures, be they a group or an individual, have to manage processes such as the establishment of a new organization, strengthening the group of workers, creating connections with external stakeholders for the implementation of the main operations, refining the core product or service, and defining the related business model.

The product/service development is not something that can be put aside for a start-up.

Table 5. Implementing SRSM with the four RI process requirements and four helices.

	Iterative Processes in SRSM			
RRI Requirements	Market Value	Political Value	Research Value	Societal Value
Anticipation	Identify the work to be done to anticipate something relevant for the achievement of industry values. Involve industry experts to identify possible issues to initiate positive social change, act responsibly, avoid harm, and ensure the economic success of the start-up.	Identify the work to be done to anticipate something relevant for the achievement of political values. Involve policymakers in identifying possible issues to initiate positive social change, act responsibly, avoid harm, and ensure the economic success of the start-up.	Identify the work to be done to anticipate something relevant for the achievement of research values. Involve researchers in identifying possible issues to initiate positive social change, act responsibly, avoid harm, and ensure the economic success of the start-up.	Identify the work to be done to anticipate something relevant for the achievement of civil society values. Involve civil society to identify possible issues to initiate positive social change, act responsibly, avoid harm, and ensure the economic success of the start-up.
Reflexivity	Think and be critical about the innovation process of the start-up and its impact on business success.	Think and be critical that the start-up is abiding by policy and is in line with the standards of the countries it operates.	Think and be critical of research and constantly ensure that the start-up is aware of changing perspectives and findings in research.	Think and be critical about the impact of the start-up and its products on cultures, groups, and society as a whole.
Inclusion	Engage industry stakeholders and employees in the science and innovation of the start-up. Give power to employees to incorporate their values within the start-up.	Engage with policymakers in the science and innovation of the start-up. Absorb these standards and rules within the dynamics and processes of the start-up.	Engage researchers (internal and external) in the latest science and innovation relevant to the start-up. Give power to these views and ensure they are incorporated within the processes and knowledge of the start-up.	Engage civil society stakeholders and include these values and concerns into the entire life-cycle of the start-up. Give power to civil society and ensure they are included in the processes and developments of the start-up.
Responsiveness	Respond and modify innovation and business practices in response to the changing dynamics of the industry and the needs of the start-up.	Respond and modify innovation and business practices in response to the changing policies, regulations, and social norms of the society in which the start-up is operating.	Respond and modify innovation and business practices in response to changes in research and available information relevant to the start-up and its product(s).	Respond and modify innovation and business practices in response to the changing dynamics in society, the needs of the public, and what is acceptable or needed in society.

This is the reason why LSA is so important: it is an approach that is relevant for start-ups, a focus that the other approaches do not have. All the focus on defining an opportunity, on implementing experimentations and on establishing of important (foundational) relations with stakeholders for a nascent firm is crucial (included because of the lack of experience and, somehow, of resources for doing it). These are aspects that are not covered by RRI and QH, and that have a more general scope (only lately focused on firms, with little or no attention on start-ups). We could have chosen Effectuation but LSA is practitioner-grounded and provides some more useful (because

practical) hints for start uppers. We recognized that Effectuation, anyhow, is very important, especially for what concerns the definition and refinement of opportunity.

Therefore, Table 5 demonstrates a first step toward tangibly realising SRSM. It illustrates how RI and the QH intersect together within the SRSM model. The LSA guides the overall process of the design, build, and deployment of the business's products/services. This LSA integrates the contents of Table 5 in every major step in the product's life cycle and drives forward the start-up's main business goals while implementing a socially responsible approach to business. The integration of Table 5 in the LSA approach is demonstrated in Figure 2 below.

This Figure is based on the LSA 'Build-measure-learn loop', discussed earlier in the paper (Ries 2011b; quoted in Frederiksen and Brem 2017, 178; Gbadegeshin and Heinonen 2016). It aims to bring in the intersection of RI-QH iterative processes described in Table 5 above throughout each stage of the life cycle of products, services, and actions, within a start-up. While the LSA was initially intended as a product-oriented approach to test product/market fit, when it is combined with the SRSM model, it adopts the social responsibility dimensions of the QH-RI approaches into each step of the product's life cycle. While there are certain limitations with LSA, as it is primarily focused on the product/service provided by start-ups, this focus on the social responsibility of the start-up's products is vital for the overall social responsibility of the start-up.

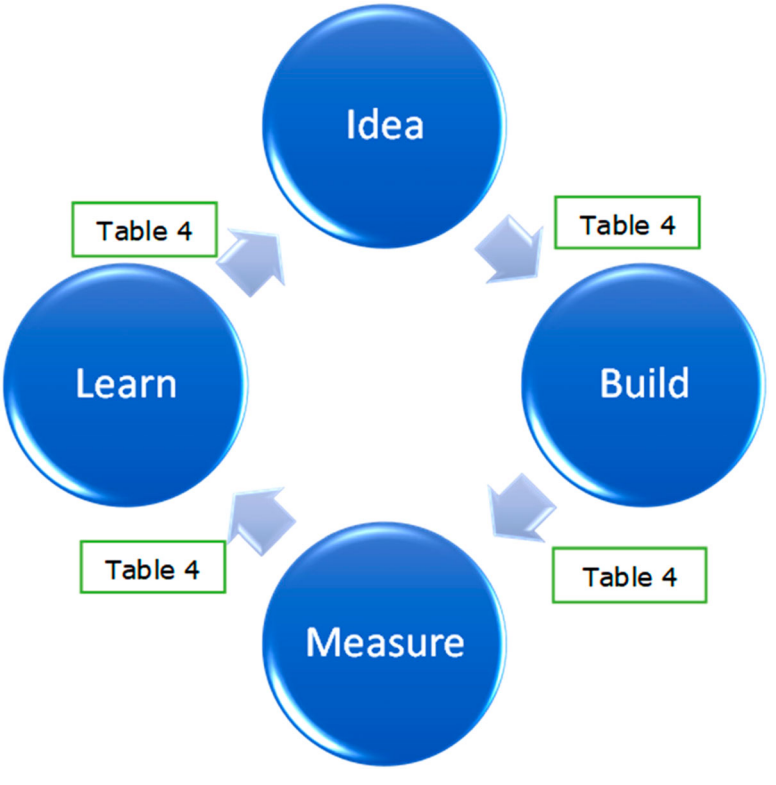

Figure 2. The four RI processes and four QH in an iterative LSA.

Each of the four iterations outlined in Figure 2 would apply the content of Table 5. For example, in the idea generation stage, the start-up could implement an anticipatory approach to potential issues when coming up with new ideas for products. Another aspect in this step could be to include market, political, research, and societal stakeholders, to discuss potential issues with their product at a very early stage of development. They may also use this step to generate ideas about how they can actually create new products or services that meet specific societal challenges outlined by the stakeholders. This can result in early reflections upon the ideas for products of the company, while also, responding to these concerns in the further steps in the iteration loop.

Similarly, the start-up could apply these actions to the further steps in the iterative 'build-measure-learn' loop. In the build step, the same types of actions could be taken as in the idea generation stage, but now the start-up would have a built prototype or usable example to discuss with the stakeholders. In the measuring stage, further feedback can be retrieved from stakeholders about their product, which includes the measurement of preferences and values about their product. Subsequently, the start-up learns from these insights and formulations in the next iteration of its product, which has gone through several iterations of social responsibility testing. As was discussed earlier in the paper, LSA (and Effectuation as well) tells us that Anticipation, Reflexivity, Inclusion and Responsiveness should be implemented in the framework of an experimentation effort (of MVP or similar aspects of start-ups' operations) and that this will impact on the core business and on the business model construction. It tells us that building up a new firm is an iterative and open process and not a blueprint-like exercise.

The principle of an SRSM 'check' of practices – the investigation of the Minimum Viable Product (MVP) against the background of the four helices – can be adopted by start-ups. Once the start-up comes up with an idea and begins to build its MVP, it should then implement SRSM to identify how it can act responsibly when it begins developing the prototype of its product. SRSM allows the start-up to evaluate its idea and business model in the context of its impact on society, business, research, and policy. The model could also help to single out possible stakeholders through which to evaluate the MVP. Of course, the customers will evaluate it from the stance of the particular functionalities they are most interested in. Other stakeholders would assess different aspects of the same MVP (for example, in terms of the impacts on certain classes of people, such as workers).

On the other hand, using LSA (and Effectuation) according to the RRI-QH perspective tells us that exchanges with stakeholders is an exercise that does not imply just the core product but entails a wider variety of actors and relations (their values, etc.). We state that considering impacts is crucial and is bound to affect the business model and make the start-up fitter for its (business and social) environment. This is all the more important when one considers that even the practice of supporting the promotion of start-ups sometimes does not have such a broad scope (one of the reports of the pilots said that some entrepreneurs consider investors and accelerator people as their stakeholders).

Therefore, the three approaches can work together in a cohesive, systematic, and lean manner. This is a very general and broad overview of how the SRSM can be realised in practice for start-ups. However, it is only a first step and further work is needed to extrapolate procedural steps involved throughout each of the processual requirements, helices,

and iterations, of implementing responsible business practices in a start-up. Further work will help realise the function and objectives of SRSM, and also case studies to demonstrate how it can be realised in practical examples.

A second step to build upon this SRSM is already underway, with the authors of this paper developing a set of indicators for start-ups based on SRSM. Much of this work has already been conducted in a project that the co-authors of this paper are involved in (a large Horizon 2020 project) and will culminate in a subsequent follow-up paper to this one. However, it is beyond the scope of this paper to go into detail about this now.

Overall, this paper aimed to offer a first step to identifying and elaborating upon a socially responsible model for start-ups and why current positions in the field (when taken alone) are often insufficient. While we have not gone into great detail in formulating the specificities and implementation of SRSM, it is hoped that further work will be conducted to elaborate on how this model can be developed from our conceptual outline to something more tangible and usable by start-ups. However, this is currently beyond the scope of this paper, but certainly merits further research and discussion in this area, and will be elaborated upon in our follow-up paper outlining a set of indicators to guide socially responsible start-ups and investors.

Conclusion

This paper set out to answer the research question: How can we fill the gap in the literature on social – responsibility in start-ups by insights from approaches within the field (such as RI, LSA, & the QH)? RI was initially proposed as a possible framework that could help steer start-ups towards socially-responsible business practices, but it was shown that this position was not very well-developed in the literature for the specific needs of a start-up. Furthermore, its over-concentration on research and civil society may seriously hamper the specific needs of a start-up (whose reliance on dynamism, changing roles within the company, and fluidity, could inhibit it from getting off the ground in the first place).

While RI provided many valuable insights for developing responsible practices in start-ups, it needed to be balanced with a more business-focused approach, and one that is specifically aimed at start-ups themselves. We proposed that a cross-fertilisation between RI and LSA would overcome many of the issues that RI faced alone, and RI would support LSA's lack of ethical focus. However, we still noted that the different stakeholders and processes are somewhat unclear when both positions are cross-fertilised, so a third approach, the QH approach, would help provide a systematic context for RI and LSA, as it emphasises an equal balance among the stakeholders and processes involved in a start-up.

This article analysed how current approaches in theory and practice can help organisations achieve innovation and responsible behaviour in start-ups. This paper brought together the more ethically-focused world of RI, the business-orientated world of LSA, and the systematic world of the QH realised through our SRSM. SRSM combines the challenges, impacts, and requirements for responsible behaviour found in LSA and RI, ensuring that the four helices of the QH are balanced throughout. We have developed a preliminary outline of how SRSM could be developed and used in practice, demonstrating the cross-fertilisation of the four RI processes with the four helices, and adopting the iterative MVP process of LSA.

This type of approach allows start-ups to take into account all of the different stakeholders and processes involved in their business practices in a pragmatic and focused way. The use of the four process requirements of RI allows start-ups to adopt an anticipatory, reflexive, inclusive, and responsive approach towards each of the different helices involved in their organisation. These practices are implemented in a lean, iterative way, constantly developing their products, services, and organisation, in a way that meets the needs and values of their stakeholders. Altogether, SRSM is an effective approach for start-ups to implement more socially-responsible practices in a way that surpasses any of the three (RI, LSA, and the QH) approaches alone.

Limitations and further research

Our model provides the first step toward guiding start-ups towards achievable, directed, and responsible practice. Further work is required to specify how SRSM can be implemented in practice, what types of indicators and guidelines it would provide, and so forth. We provided a preliminary outline of SRSM, but this could be further developed to provide clear, tangible steps for start-ups. This model will be particularly instructive for those in start-ups or the field of RI who wish to extend their scope towards small-scale R&D through a better understanding of this context, but also for researchers in RI who wish to evaluate the responsibility of R&D practices in start-ups. This evaluation can also be carried out by investors interested in their investments' responsibility (impact) dimension.

The model is not meant to cover every single aspect that the start-up should consider, but it specifically focuses on how a company can implement responsible practices at this early stage of development in the context of the four helices. While the model is aimed mostly at high-tech STEM start-ups, it could also be used by other start-ups that want to implement ethical behaviour in their company, ensure that their employees are ethically trained, and have a positive societal impact through their products.

Further work needs to be done to demonstrate how SRSM can be implemented in practice and how it works as an approach to socially-responsible practice in start-ups. The most important next steps are to provide a clear methodology of how SRSM can be implemented, empirical exploration of the model, and perhaps, further iterations of the model based on these findings. This paper provides a first step in the process and will greatly benefit from further development of SRSM in both research and practice.

Notes

1. Responsible and ethical practices will be defined in more detail in the RI section of this paper. But, in essence, we mean what is intuitively understood by these ideals as responsibility that is forwards and backwards-looking, and is both passive and active. Ethical practices, we refer to as what is considered to be in the interests of the common good, what is right, what leads to good social outcomes.
2. The content of this article is one of the results of the (*Anonymous project name*) project. The theoretical reflection that led to the definition of the model described in this paper was carried out in the context of this European project, funded under the Horizon 2020 programme.

3. For the purpose of this paper, we will often refer to our target group as start-ups, for ease of reference. Our focus is on STEM start-ups, which are typically high-tech, because of the very nature of STEM. While we do not dispute the fact that there may be low-tech STEM start-ups, we wish to predominantly focus on high-tech ones. Also, it is typically understood that technological change is a major requirement of long-term economic growth and innovation (Rosenberg 1996). This does not state that either low-tech or non-STEM start-ups do or do not practice social responsibility, but simply for the purpose of this paper we want to concentrate on high-tech STEM start-ups. The reason for this focus is because of the (generally) higher environmental and societal impact these start-ups are anticipated will have on society. Again, this is not to claim that other kinds of start-ups (non-STEM or non-high-tech STEM) may have as large or larger impact. Finally, the paper is focused on all kinds of high-tech STEM start-ups, those already implementing socially-responsible practices and those that are not.
4. Quite naturally, one would argue, given that organizations are embedded in complex nexuses of shareholders, managers, customers, suppliers, and local populations (McWilliams and Siegel 2001; Retolaza, Ruiz, and San-Jose 2009; Voinea et al. 2019)
5. These differ from the six keys of the EU's RRI model (Ethics, Science Education, Gender Equality, Open Access, Governance and Public Engagement) because they respond to "how' to do RRI, whereas the six keys focus on the 'what', i.e. the RRI content' (ORBIT RI 2022).
6. See for instance the following EU funded projects: COMPASS, GREAT, ORBIT RRI, Responsible Industry, PRISMA, MULTI-ACT, and ROSIE.
7. See on this specific issue the following grey literature documents: D3.3 Lessons from the pilots (2019) PRISMA project; D3.3 Models of RI in industry (2017) Responsible Industry project; D5.7 Peer-reviewed paper on implementation of RI in SMEs (2018) Innovation Compass project.
8. See D3.3 Lessons from the pilots, cit.
9. See D3.3 Lessons from the pilots, cit.
10. Mansoori and Lackeus (2020) compare six entrepreneurial methods, but what they say about the advantages of integrating diverse approaches remains valid also if the focus is restricted to LSA and Effectuation. Furthermore, from their analysis emerges that these two methods are the most aligned and complete according to the dimensions they used for their comparison. In any case, it cannot be expected that one method alone covers all the aspects of the 'competing' ones while adding the new insights the competitors lack.
11. The importance of entrepreneurial groups and their dynamics also emerged in the debate regarding the evaluation of start-ups by potential investors. This has led to the 'jockey vs horse' framework' debate (Gompers et al. 2020; Blair and Shaver 2020), which questions whether investors should bet on the business ('the horse') or the management team ('the jockey') (Stromberg et al. 2009). These dynamics are particularly relevant, especially in the early stages of the start-up experience, where both the business and management team of the start-up are constantly evolving and developing (Visintin and Pittino 2014 and Blair and Shaver 2020).
12. There are numerous questions that deserve to be pursued further regarding the relation between QH and RRI and LSA. We refrain from making any claim that this paper offers an answer (or a comprehensive review) of all those questions. For example, the interaction among the four helixes could itself constitute the topic of an extensive analysis, both from the more practical and from the more theoretical approaches. What the QH brings is, as mentioned in the introduction, a framework for understanding the challenges of starting with four core groups (effectively: four core values) that do not have any principled priority over each other. This is both the common element of the QH literature and the insight that we employ in the cross-fertilization. Of course, this brings with it a plethora of questions regarding implementation in local contexts and concrete practices. However, here we do not want to open all doors at the same time. For now, the research question forces us to strip the QH approach down to its fundamentals.

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References

Asveld, L., eds. 2017. *Responsible Innovation 3: A European Agenda?* Cham: Springer.

Baumgartner, R. J. 2014. "Managing Corporate Sustainability and CSR: A Conceptual Framework Combining Values, Strategies and Instruments Contributing to Sustainable Development." *Corporate Social Responsibility and Environmental Management* 21 (5): 258–271.

Beckert, J. 2016. *Imagined Futures: Fictional Expectations and Capitalist Dynamics*. Cambridge, MA: Harvard University Press.

Blair, C. A., and K. G. Shaver. 2020. "Of Horses and Jockeys: Perceptions by Academic Entrepreneurs." *Entrepreneurship Research Journal* 10 (2). https://doi.org/10.1515/erj-2019-0011

Blank, S. 2013. "Why the Lean Start-Up Changes Everything." *Harvard Business Review* 91 (5): 63–72.

Blok, V. 2018. "Innovation as Ethos: Moving Beyond CSR and Practical Wisdom in Innovation Ethics."

Blok, V. 2019. "16. From Participation to Interruption: Toward an Ethics of Stakeholder Engagement, Participation and Partnership in Corporate Social Responsibility and Responsible Innovation. *International Handbook on Responsible Innovation: A Global Resource*, 243

Blok, V. 2022. "Innovation as Ethos: Moving Beyond CSR and Practical Wisdom in Innovation Ethics." In *Handbook of Philosophy of Management*, 897–910. Cham: Springer International Publishing.

Blok, V., and T. B. Long. 2016. "The Role of Responsible Innovation in the Technology Assessment of Smart Farming Technologies in Europe." In *Food futures: ethics, science and culture*, 2–10. Wageningen Academic Publishers.

Blok, V., L. Hoffmans, and E. F. Wubben. 2015. "Stakeholder Engagement for Responsible Innovation in the Private Sector: Critical Issues and Management Practices." *Journal on Chain and Network Science* 15 (2): 147–164. https://doi.org/10.3920/JCNS2015.x003

Blok, V., E. A. Inigo, A. Novelskaitė, R. Pučėtaitė, A. Meiji, K. Wakunuma, T. Jiya, et al. 2020. "D5.1. Recommendations for the Development of Competitive Advantage Based on RRI." https://rring.eu/wp-content/uploads/2020/08/D-5.1.-RECOMMENDATIONS-FOR-THE-DEVELOPMENT-OF-A-COMPETITIVE-ADVANTAGE-BASED-ON-RRI.pdf.

Blok, V., and P. Lemmens. 2015. "The Emerging Concept of Responsible Innovation. Three Reasons why it is Questionable and Calls for a Radical Transformation of the Concept of Innovation." In *Responsible Innovation 2*, 19–35. Cham: Springer.
Blok, V., V. Scholten, and T. B. Long. 2018. "Responsible Innovation in Industry and the Importance of Customer Orientation: Introduction to the Special Issue." *International Food and Agribusiness Management Review* 21 (4): 455–462. https://doi.org/10.22434/IFAMR2018.x001
Blok, V., T. Tempels, E. Pietersma, and L. Jansen. 2017. "Exploring Ethical Decision Making in Responsible Innovation: The Case of Innovations for Healthy Food." In *Responsible Innovation 3*, 209–230. Cham: Springer.
Bortolini, R. F., M. N. Cortimiglia, A. D. M. F. Danilevicz, and A. Ghezzi. 2018. *Lean Startup: A Comprehensive Historical Review*. *Management Decision*.
Brand, T., and V. Blok. 2019. "Responsible Innovation in Business: A Critical Reflection on Deliberative Engagement as a Central Governance Mechanism." *Journal of Responsible Innovation* 6 (1): 4–24. https://doi.org/10.1080/23299460.2019.1575681
Callon, M. 1987. "Society in the Making: The Study of Technology as a Tool for Sociological Analysis." In *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*, edited by W. Bijker, T. Hughes, and T. Pinch, 83–103. Cambridge, MA: MIT Press.
Cane, P. 2016. "Role Responsibility." *The Journal of Ethics* 20 (1-3): 279–298. https://doi.org/10.1007/s10892-016-9235-8
Carayannis, E., and D. Campbell. 2009. "'Mode 3' and 'Quadruple Helix': Toward a 21st Century Fractal Innovation Ecosystem." *International Journal of Technology Management* 46 (3/4): 201–234. https://doi.org/10.1504/IJTM.2009.023374.
Carayannis, E., and D. Campbell. 2012. "Mode 3 Knowledge Production in Quadruple Helix Innovation Systems." In *Mode 3 Knowledge Production in Quadruple Helix Innovation Systems*, 1–63. Springer.
Caroll, A. 1979. "A Three-Dimensional Conceptual Model of Corporate Performance." *Academy of Management Review* 4 (4): 497–505.
Ceicyte, J., M. Petraite, V. Blok, and E. Yaghmaei. 2021. "Responsible Innovation in Industry: The Role of Firm's Multi-Stakeholder Network." In *Bio# Futures: Foreseeing and Exploring the Bioeconomy*, 581–603. Cham: Springer International Publishing.
Corvellec, H., A. F. Stowell, and N. Johansson. 2022. "Critiques of the Circular Economy." *Journal of Industrial Ecology* 26 (2): 421–432. https://doi.org/10.1111/jiec.13187
Davidsson, Per. 2015. "Entrepreneurial Opportunities and the Entrepreneurship Nexus: A Re-Conceptualization." *Journal of Business Venturing* 30 (5): 674–695. https://doi.org/10.1016/j.jbusvent.2015.01.002.
De Lange, D. E. 2017. "Start-up Sustainability: An Insurmountable Cost or a Life-Giving Investment?" *Journal of Cleaner Production* 156: 838–854. https://doi.org/10.1016/j.jclepro.2017.04.108
Declich, A. 2014. "Aspettative e narrazioni: spunti per una riflessione interdisciplinare." *Quaderni di Sociologia* 64: 111–138. https://doi.org/10.4000/qds.402
Dew, Nicholas, and Saras D. Sarasvathy. 2007. "Innovations, Stakeholders & Entrepreneurship." *Journal of Business Ethics* 74 (3): 267–283. https://doi.org/10.1007/s10551-006-9234-y.
Donaldson, T., and L. E. Preston. 1995. "The Stakeholder Theory of the Corporation: Concepts, Evidence, and Implications." *The Academy of Management Review* 20 (1): 65–91. https://doi.org/10.2307/258887
Eisenmann, T. R., E. Ries, and S. Dillard. 2012. "Hypothesis-driven Entrepreneurship: The Lean Startup." *Harvard Business School Entrepreneurial Management Case*, 812–095.
Evans, S., D. Vladimirova, M. Holgado, K. Van Fossen, M. Yang, E. A. Silva, and C. Y. Barlow. 2017. "Business Model Innovation for Sustainability: Towards a Unified Perspective for Creation of Sustainable Business Models." *Business Strategy and the Environment* 26 (5): 597–608. https://doi.org/10.1002/bse.1939
Evers, A., and B. Ewert. 2015. "Social innovation for social cohesion." *New Frontiers in Social Innovation Research*, 107–127. https://doi.org/10.1057/9781137506801_6

Fitzpatrick, G., and L. Malmborg. 2018. "Quadruple Helix Model Organisation and Tensions in Participatory Design Teams." Paper Presented at the Proceedings of the 10th Nordic Conference on Human-Computer Interaction.

Frederiksen, D. L., and A. Brem. 2017. "How do Entrepreneurs Think They Create Value? A Scientific Reflection of Eric Ries' Lean Startup Approach." *International Entrepreneurship and Management Journal* 13 (1): 169–189. https://doi.org/10.1007/s11365-016-0411-x

Freeman, R. E. 1984. *Strategic Management: A Stakeholder Approach*. Boston.: Pitman Press.

Friedman, M. 1970. "The Social Responsibility of Business is to Increase its Profits." *New York Times Magazine*, September 13, 1970.

Funtowicz, S.O., & R. J. Ravetz. 1993. "Science for the Post-Normal Age." *Futures*, September.

Garst, J., V. Blok, O. Branzei, L. Jansen, and O. S. Omta. 2019. "Toward a Value-Sensitive Absorptive Capacity Framework: Navigating Intervalue and Intravalue Conflicts to Answer the Societal Call for Health." *Business & Society* 60 (6): 1349–1386.

Garst, Jilde, Vincent Blok, Léon Jansen, and Onno S. W. F. Omta. 2017. "Responsibility Versus Profit: The Motives of Food Firms for Healthy Product Innovation." *Sustainability* 9 (12): 2286. https://doi.org/10.3390/su9122286.

Gbadegeshin, S. A., and L. Heinonen. 2016. "Application of the Lean Start-up Technique in the Commercialisation of Business Ideas and Innovations." *International Journal of Business Management and Research* 43 (1): 1270–1285.

Ghezzi, A. 2019. "Digital startups and the adoption and implementation of Lean Startup Approaches: Effectuation, Bricolage and Opportunity Creation in practice." *Technological Forecasting and Social Change* 146: 945–960.

Ghezzi, A., and A. Cavallo. 2020. "Agile Business Model Innovation in Digital Entrepreneurship: Lean Startup Approaches." *Journal of Business Research* 110: 519–537. https://doi.org/10.1016/j.jbusres.2018.06.013

Gianni, R. 2016. *Responsibility and Freedom: The Ethical Realm of RRI*. Wiley.

Gibbons, M. 1999. "Science's new Social Contract with Society." *Nature* 402: C81–C84. https://doi.org/10.1038/35011576

Gompers, P. A., W. Gornall, S. N. Kaplan, and I. A. Strebulaev. 2020. "How do Venture Capitalists Make Decisions?" *Journal of Financial Economics* 135 (1): 169–190. https://doi.org/10.1016/j.jfineco.2019.06.011

Gregg, S. 2001. "Stakeholder Theory: What it Means for Corporate Governance." *Policy* 17 (2): 33–38.

Hart, H .L. A. 1968. *Punishment and Responsibility*. Oxford: The Clarendon Press.

Henriques, N., and M. Öberg. 2016. "CSR as a Tool for Startups to Gain External Financing: A Qualitative Study in a Swedish Context."

Hockerts, Kai, and Rolf Wüstenhagen. 2010. "Greening Goliaths Versus Emerging Davids — Theorizing About the Role of Incumbents and new Entrants in Sustainable Entrepreneurship." *Journal of Business Venturing* 25 (5): 481–492. https://doi.org/10.1016/j.jbusvent.2009.07.005.

Kirchherr, J., D. Reike, and M. Hekkert. 2017. "Conceptualizing the Circular Economy: An Analysis of 114 Definitions." *Resources, Conservation and Recycling* 127: 221–232. https://doi.org/10.1016/j.resconrec.2017.09.005

Koops, B., I. Oosterlaken, R. Romijn, T. Swierstra, and J. van den Hoven, eds. 2015. *Responsible Innovation 2: Concepts, Approaches and Applications*. New York: Springer International Publishing Switzerland.

Klein, K. J., and A. P. Knight. 2005. "Innovation Implementation: Overcoming the Challenge." *Current Directions in Psychological Science* 14 (5): 243–246.

Lehoux, P., H. P. Silva, R. R. Oliveira, and L. Rivard. 2020. "The Responsible Innovation in Health Tool and the Need to Reconcile Formative and Summative Ends in RRI Tools for Business." *Journal of Responsible Innovation* 7 (3): 646–671. https://doi.org/10.1080/23299460.2020.1844974

Ligtvoet, A., E. Cuppen, O. Di Ruggero, K. Hemmes, U. Pesch, J. Quist, and D. Mehos. 2016. "New Future Perspectives Through Constructive Conflict: Exploring the Future of gas in the Netherlands." *Futures* 78: 19–33. https://doi.org/10.1016/j.futures.2016.03.008.

Long, T. B., and V. Blok. 2017. "When the Going Gets Tough, the Tough get Going: Towards a new–more Critical–Engagement with Responsible Research and Innovation in an age of Trump, Brexit, and Wider Populism." *Journal of Responsible Innovation* 4 (1): 64–70.
Long, T. B., and V. Blok. 2022. "Managing the Responsibilities of Doing Good and Avoiding Harm in Sustainability-Orientated Innovations: Example from Agri-Tech Start-Ups in the Netherlands." In *Putting Responsible Research and Innovation into Practice: A Multi-Stakeholder Approach*, 249–272. Cham: Springer International Publishing.
Long, T. B., and V. Blok. 2018. "Integrating the Management of Socio-Ethical Factors Into Industry Innovation: Towards a Concept of Open Innovation 2.0." *International Food and Agribusiness Management Review* 21 (4): 463–486. https://doi.org/10.22434/IFAMR2017.0040
Long, T. B., V. Blok, S. Dorrestijn, and P. Macnaghten. 2020. "The Design and Testing of a Tool for Developing Responsible Innovation in Start-up Enterprises." *Journal of Responsible Innovation* 7 (1): 45–75. https://doi.org/10.1080/23299460.2019.1608785.
Lubberink, R., V. Blok, J. Van Ophem, and O. Omta. 2017. "Lessons for Responsible Innovation in the Business Context: A Systematic Literature Review of Responsible, Social and Sustainable Innovation Practices." *Sustainability* 9 (5): 721. https://doi.org/10.3390/su9050721.
Lubberink, R., V. Blok, J. van Ophem, and O. Omta. 2019. "Responsible Innovation by Social Entrepreneurs: An Exploratory Study of Values Integration in Innovations." *Journal of Responsible Innovation* 6 (2): 179–210. https://doi.org/10.1080/23299460.2019.1572374
Luise, V. 2019. "Le forme dell'innovazione nell'ideologia californiana: Le retoriche, i modelli e le trasformazioni nell'economia startup. EGEA spa."
Maccarrone, P., and A. M. Contri. 2021. "Integrating Corporate Social Responsibility Into Corporate Strategy: The Role of Formal Tools, Sustainability." *MDPI* 13 (22): 1–20.
Mansoori, Y. 2017. "Enacting the Lean Startup Methodology: The Role of Vicarious and Experiential Learning Processes." *International Journal of Entrepreneurial Behavior & Research* 23 (5): 812–838.
Mansoori, Y., and M. Lackeus. 2020. "Comparing Effectuation to Discovery-Driven Planning, Prescriptive Entrepreneurship, Business Planning, Lean Startup, and Design Thinking." *Small Business Economics* 54: 791–818. https://doi.org/10.1007/s11187-019-00153-w
Maon, F., A. Lindgreen, and V. Swaen. 2010. "Organizational Stages and Cultural Phases: A critical Review and a Consolidative Model of Corporate Social Responsibility Development." *International Journal of Management Reviews*, 12 (1): 20–38.
Marschalek, I., V. Blok, M. Bernstein, R. Braun, J. Cohen, M. Hofer, and R. Kumar Thapa. 2022. "The social lab as a method for experimental engagement in participatory research." *Joursnal of Responsible Innovation* 9 (3): 419–442.
Martinuzzi, A., V. Blok, A. Brem, B. Stahl, and N. Schönherr. 2018. *Responsible Research and Innovation in Industry—Challenges, Insights and Perspectives*, 702. Vol. 10. Multidisciplinary Digital Publishing Institute.
McWilliams, A., and D. Siegel. 2001. "Corporate Social Responsibility: A Theory of the Firm Perspective." *The Academy of Management Review* 26 (1): 117–127. doi:10.2307/259398.
Merton, R. K. 1979. "The Normative Structure of Science." In *The Sociology of Science: Theoretical and Empirical Investigations*, edited by R. K. Merton, 267–278. (First publication: 1942). Chicago: The University of Chicago Press.
Miller, D., and M. Walzer. 1995. *Pluralism, Justice, and Equality*. Oxford: Oxford University Press.
Monteiro, S. P. D. O., and E. Carayannis. 2017. *The Quadruple Innovation Helix Nexus: A Smart Growth Model, Quantitative Empirical Validation and Operationalization for OECD Countries*. New York: Palgrave/Springer.
Mulgan, G., S. Tucker, R. Ali, and B. Sanders. 2007. Social Innovation: What It Is, Why It Matters, How It Can Be Accelerated.
Nazarko, Łukasz. 2019. "Responsible Research and Innovation in Industry: From Ethical Acceptability to Social Desirability." In *Corporate Social Responsibility in the Manufacturing and Services Sectors*, edited by Paulina Golinska-Dawson, and Małgorzata Spychała, 127–138. Berlin: Springer. https://doi.org/10.1007/978-3-642-33851-9_7

Novitzky, P., M. J. Bernstein, V. Blok, R. Braun, T. T. Chan, W. Lamers, E. Griessler, et al. 2020. "Improve Alignment of Research Policy and Societal Values." *Science* 369 (6499): 39–41. https://doi.org/10.1126/science.abb3415

Nowotny, H., P. Scott, and M. Gibbons. 2001. *Re-thinking Science: Knowledge and the Public in the Age of Uncertainty*. Cambridge: Polity Press.

Oertwig, N., et al. 2017. "Integration of Sustainability Into the Corporate Strategy." In *Sustainable Manufacturing. Sustainable Production, Life Cycle Engineering and Management*, edited by R. Stark, G. Seliger, and J. Bonvoisin, 175–200. Cham.: Springer. https://doi.org/10.1007/978-3-319-48514-0_12

ORBIT RI. 2022. "The Keys of Responsible Research and Innovation." Accessed January 21, 2022 https://www.orbit-rri.org/resources/keys-of-rri/

Owen, R., J. Stilgoe, P. Macnaghten, M. Gorman, E. Fisher, and D. H. Guston. 2013. "A Framework for Responsible Innovation." In *Responsible Innovation*, edited by R. Owen, J. Bessant, and M. Heintz, 27–51. London, UK: John Wiley & Sons, Ltd.

Popa, E. O., V. Blok, and R. Wesselink. 2020a. "Discussion Structures as Tools for Public Deliberation." *Public Understanding of Science* 29 (1): 76–93. https://doi.org/10.1177/0963662519880675.

Popa, E. O., V. Blok, and R. Wesselink. 2020b. "A Processual Approach to Friction in Quadruple Helix Collaborations." *Science and Public Policy* 47: 876–889. https://doi.org/10.1093/scipol/scaa054.

Porter, M. E., and M. R. Kramer. 2006. "Strategy & Society: The Link Between Competitive Advantage and Corporate Social Responsibility." *Harvard Bus Rev* 84: 78–85.

Praszkier, R., and A. Nowak. 2011. *Social Entrepreneurship: Theory and Practice*. Cambridge University Press.

Quaranta, G., and E. Mastropietro. 2003. *Le condizioni del successo. Linee guida per la creazione d'impresa destinate alla consulenza e alla formazione*. Roma: CERFE, 2003.

Randles, S., E. Tancoigne, and P.-B. Joly. 2022. "Two Tribes or More? The Historical Emergence of Discourse Coalitions of Responsible Research and Innovation (rri) and Responsible Research and Innovation (RRI)." *Journal of Responsible Innovation* 9 (2): 248–274. https://doi.org/10.1080/23299460.2022.2061306

Retolaza, J. L., M. Ruiz, and L. San-Jose. 2009. "CSR in Business Start-ups: An Application Method for Stakeholder Engagement." *Corporate Social Responsibility and Environmental Management* 16 (6): 324–336. https://doi.org/10.1002/csr.191.

Ries, E. 2011a. *The Lean Startup: How Today's Entrepreneurs use Continuous Innovation to Create Radically Successful Businesses*. Currency.

Ries, E. 2011b. *The Lean Startup*. New Youk: Crown Business.

Rip, A., and A. Rip. 2018. "The Past and Future of RRI." *Futures of Science and Technology in Society* 10 (1): 115–133.

Rosenberg, N. 1996. "Uncertainty and Technological Change." In *Technology and Growth: Conference Series No.40*, edited by J. C. Fuhrer, and J. Sneddon Little. Boston: Federal Reserve Bank of Boston.

Russo, A., and A. Tencati. 2009. "Formal vs. Informal CSR Strategies: Evidence from Italian Micro, Small, Medium-Sized, and Large Firms." *Journal of Business Ethics* 85: 339–353.

Ryan, T. K., N. Mejlgaard, and L. Degn. 2021. "Organizational Patterns of RRI: How Organizational Properties Relate to RRI Implementation." *Journal of Responsible Innovation* 8 (2): 320–337. https://doi.org/10.1080/23299460.2021.1975376

Scholten, V. E., and V. Blok. 2015. "Foreword: Responsible Innovation in the Private Sector." *Journal on Chain and Network Science* 15 (2): 101–105. https://doi.org/10.3920/JCNS2015.x006

Shakeel, J., A. Mardani, A. G. Chofreh, F. A. Goni, and J. J. Klemeš. 2020. "Anatomy of Sustainable Business Model Innovation." *Journal of Cleaner Production* 261: 121201. https://doi.org/10.1016/j.jclepro.2020.121201

Shane, S., and S. Venkataraman. 2000. "The Promise of Entrepreneurship as a Field of Research." *Acad. Manag. Rev* 25 (1): 217–226.

Shanley, D. 2021. "Imagining the Future Through Revisiting the Past: The Value of History in Thinking About R(R)I's Possible Future(s)." *Journal of Responsible Innovation* 8 (2): 234–253. https://doi.org/10.1080/23299460.2021.1882748

Stahl, B. C., E. Borsella, A. Porcari, and E. Mantovani. 2019. "Responsible Innovation in ICT: Challenges for Industry." In *International Handbook on Responsible Innovation*, edited by René von Schomberg, 367–378. Edward Elgar Publishing.
Stahl, B. C., M. Obach, E. Yaghmaei, V. Ikonen, K. Chatfield, and A. Brem. 2017. "The Responsible Research and Innovation (RRI) Maturity Model: Linking Theory and Practice." *Sustainability* 9 (6): 1036. https://doi.org/10.3390/su9061036.
Stamm, I., A. D. Cruz, and L. Cailluet. 2019. "Entrepreneurial Groups." *Historical Social Research/ Historische Sozialforschung* 44 (170): 7–41.
Stamm, I., and M. Gutzeit. 2021. "Group Conditions for Entrepreneurial Visions: Role Confidence, Hierarchical Congruences, and the Imagining of Future in Entrepreneurial Groups." *Small Business Economics* 59 (3): 1023–1041
Stilgoe, J., R. Owen, and P. Macnaghten. 2013. "Developing a Framework for Responsible Innovation." *Research Policy* 42 (9): 1568–1580. https://doi.org/10.1016/j.respol.2013.05.008.
Stromberg, Per, Steven Kaplan, Berk Sensoy, and Per. Strömberg. 2009. "Should Investors Bet on the Jockey or the Horse? Evidence from the Evolution of Firms from Early Business Plans to Public Companies." *Journal of Finance* 64: 75–115. https://doi.org/10.2139/ssrn.657721.
Timmermans, J., V. Blok, R. Braun, R. Wesselink, and RØ Nielsen. 2020. "Social labs as an inclusive methodology to implement and study social change: The case of responsible research and innovation." *Journal of Responsible Innovation* 7 (3): 410–426.
van de Poel, I. 2011. "The Relation Between Forward-Looking and Backward-Looking Responsibility." In *Moral Responsibility: Beyond Free Will and Determinism*, edited by N. A. Vincent, I. van de Poel, and J. van den Hoven, 37–52. Dordrecht: Springer Netherlands.
Van de Poel, I., L. Asveld, S. Flipse, P. Klaassen, V. Scholten, and E. Yaghmaei. 2017. "Company Strategies for Responsible Research and Innovation (RRI): A Conceptual Model." *Sustainability* 9 (11): 2045.
van de Poel, I., L. Asveld, S. Flipse, P. Klaassen, Z. Kwee, M. Maia, E. Yaghmaei, et al. 2020. "Learning to do Responsible Innovation in Industry: Six Lessons." *Journal of Responsible Innovation* 7 (3): 697–707. https://doi.org/10.1080/23299460.2020.1791506.
van de Poel, I. 2020. "RRI Measurement and Assessment: Some Pitfalls and a Proposed way Forward." In *Assessment of Responsible Innovation*, 339–360. Routledge.
van de Poel, I., and M. Sand. 2018. "Varieties of Responsibility: Two Problems of Responsible Innovation." *Synthese* 198: 4769–4787. https://doi.org/10.1007/s11229-018-01951-7.
van den Hoven, J., T. Swierstra, B. J. Koops, and J. Romijn, eds. 2014. *Responsible Innovation 1: Innovative Solutions for Global Issues*. London: Springer Dordrecht Heidelberg.
Visintin, F., and D. Pittino. 2014. "Founding Team Composition and Early Performance of University—Based Spin-off Companies." *Technovation* 34 (1): 31–43. https://doi.org/10.1016/j.technovation.2013.09.004
Voinea, C. L., M. Logger, F. Rauf, and N. Roijakkers. 2019. "Drivers for Sustainable Business Models in Start-Ups: Multiple Case Studies." *Sustainability* 11 (24): 6884. https://doi.org/10.3390/su11246884.
Waddock, S., and C. Bodwell. 2017. *Total Responsibility Management: The Manual*. 1st ed. Routledge. https://doi.org/10.4324/9781351280402
Walzer, M. 1983. *Spheres of Justice: A Defence of Pluralism and Equality*. New York: Basic Books.
Wiarda, M., G. van de Kaa, E. Yaghmaei, and N. Doorn. 2021. "A Comprehensive Appraisal of Responsible Research and Innovation: From Roots to Leaves." *Technological Forecasting and Social Change* 172: 121053. https://doi.org/10.1016/j.techfore.2021.121053
Wiener, A. 2021. "Does Tech Need a New Narrative? In Silicon Valley, 'Disruption' is Giving way to 'Building'. What Will be Built?" Letter from Silicon Valley, the New Yorker, June 18, 2021.
Ziman, J. 2000. *Real Science. What It Is, and What it Means*. Cambridge University Press.
Zwart, H., L. Landeweerd, and A. Van Rooij. 2014. "Adapt or Perish? Assessing the Recent Shift in the European Research Funding Arena from 'ELSA' to 'RRI'." *Life Sciences, Society and Policy* 10 (1): 1–19. https://doi.org/10.1186/s40504-014-0011-x.