

Chapter 2

The Basics of Responsible Research and Innovation

Abstract Responsible research and innovation (RRI) is a newly emerging governance framework, promoted initially by public funders of research. This chapter explains the concept by defining its individual elements (responsibility, research and innovation). Three case studies are given: one from South Africa, where indigenous community involvement provided a significant lead for a health innovation; one from Germany, where end-user involvement in the innovation process led to faster and less contentious market entry; and one from India, where an innovation significantly improved the lives of the poorest girls and women. The concepts of responsiveness, inclusiveness and providing a societal good are illustrated through the case studies, mapped against policy and academic work on RRI and derived from the earlier discussions of responsibility.

Keywords Responsible research and innovation · Responsibility · Responsiveness · Inclusiveness · Societal good

One could reasonably argue that responsible research and innovation (RRI) is a down-to-earth concept for researchers, innovators, citizens and policymakers alike. Unlike other concepts in science and innovation governance, it is expressed in familiar terms: ‘responsible’, ‘research’ and ‘innovation’. As such the contrast with more technical concepts such as midstream modulation (Fisher et al. 2006), upstream engagement (Rogers-Hayden and Pidgeon 2007) and real-time (Guston and Sarewitz 2002) or constructive technology assessment (Schot 1992) is considerable.

However, if one takes a closer look there are highly interesting and complex discussions hidden within the concept of RRI. The first part of this chapter will therefore explain the basic terms that constitute RRI. The second will ask ‘responsibility for what?’ and explore why RRI is of interest to the business community. In the third part technical definitions of RRI will be introduced to elucidate what the term means specifically to researchers and innovators. The chapter concludes with a summary and recommended further reading.

2.1 Defining Research, Innovation and Responsibility

2.1.1 *Research and Innovation*

Research is systematic investigation (observation, experiment, critical thinking), which aims to increase knowledge and reach new conclusions. It is a very broad term. For instance, if somebody stands in front of a public library every morning to see how many people enter between 9.30 and 10.00 and then derives some conclusion from this observation (e.g. the library might as well only open at 10.00, because nobody ever comes between 9.30 and 10.00), one could call this research. At the same time, the search for the Higgs boson¹ at the Large Hadron Collider in Switzerland, estimated to have cost around US\$13.25 billion (Knapp 2012), is also research. A research question or target is needed, as well as a systematic investigation and the attempt to derive new conclusions.

Innovation, on the other hand, is a more specific concept and more closely related to business and industry. It can be described as a process of using information and existing phenomena to improve human lives by creating better products, services and technologies that are readily available to markets, governments and society (Stahl et al. 2013). In the context of writing about *responsible* innovation, it has been defined as follows.

Innovation is an activity or process which may lead to previously unknown designs pertaining either to the physical world (e.g. designs of buildings and infrastructure), the conceptual world (e.g. conceptual frameworks, mathematics, logic, theory, software), the institutional world (social and legal institutions, procedures and organization) or combinations of these, which - when implemented - expand the set of relevant feasible options for action, either physical or cognitive (van den Hoven 2013).

Talking about responsible research and innovation therefore means talking about *applying the concept of responsibility* to deliberate actions performed in the process of increasing knowledge and reaching new conclusions through systematic investigations, or through the development of new products, processes, technologies or services. What does ‘responsibility’ mean then?

2.1.2 *Responsibility*

The term ‘responsibility’ goes back to the Latin *respondere* or *respondum*, which was used in Roman courts to refer to the justification or defence of certain actions and inactions (Schwartländer 1974, p. 1579). Some philosophers broaden the term

¹An elementary particle in physics.

to include responsibility for opinions and the adoption of values.² However, we will restrict our discussion here to the responsibility for action or non-action. The term then implies that a

person had a reason, or reasons, to perform some action, then formed an intention to perform that action (or not perform it) and finally acted (or refrained from acting) on that intention, and did so on the basis of that reason(s) (Miller 2011, p. 138).

To explain what this means in more detail and to distinguish a range of different senses of responsibility, let us look at criticism of the textile industry. We have chosen an example that fits into the theme of corporate responsibility (see Chap. 3) rather than RRI debates, given that no innovators are involved, in order to ensure that the better-known concept of corporate responsibility can help us understand the newer concept of RRI.

In an article on ethical consumerism, a campaigner and author³ asks what one should call fashion produced in an environmentally friendly manner and without exploitative labour conditions. Green fashion? Fair fashion? Eco-fashion? Ethically correct fashion? He continues:

‘Ethically correct fashion? I am tired of hearing this,’ a young fashion designer recently said to me. ... To work with materials free of poison? To pay staff fairly and not let them labour endlessly? To produce clothes one can dispose of without environmental problems? ‘Why are we not looking for words for those who do not accept these standards?’ ... How far have we come if we laboriously have to designate and certify what should be the most obvious thing in the world? (Grimm 2015) (our translation)

The fashion designer may be right, but the label ‘ethically correct fashion’ would probably be inappropriate, for example, for large parts of the Bangladeshi ready-made garment sector, where the following practices are widespread:

informal recruitment, and irregular payment, sudden termination, wage discrimination, excessive work, and abusing child labour. Moreover workers suffer various kinds of diseases due to the unhygienic environment and a number of workers are killed in workplace accidents, fires and panic stampedes (Ahamed 2012, p. 3).

In addition, corruption is very widespread in Bangladesh. On a corruption perceptions index by Transparency International (2015), it came 145th out of 175 countries and territories.

The ready-made garment industry contributes a vast proportion of Bangladesh’s exports (78 %) and employs 3.6 million people, 2.8 million of whom are women (Ahamed 2012, p. 2). By comparison, the most dominant industrial sector in Germany, automotive engineering, employs 756,000 people (Make it in Germany n.d.). Which levels of responsibility for practices within this industry can be distinguished?

²For instance, Raz (2001) argues that people are responsible for their own biases and ‘other distortions of their cognitive functioning’ and therefore are also responsible for failed judgements coloured by bias. He calls this epistemic responsibility.

³Grimm, author of *Shopping hilft die Welt verbessern* (2009).

First, we have natural or individual responsibility, which can be ascribed to the person who is most immediately involved with a given practice, for example somebody who recruits child labour locally, accepts bribes or dismisses staff ad hoc.

Second, we have those in a superior institutional role to the individually responsible person; those who are ‘responsible for the actions of other persons in virtue of being the person in authority over them’ (Miller 2011, p. 139). In smaller companies this will be the chief executive officer, but in larger companies it may be the local or regional managing director. Both are likely to support existing business practices, if they are widespread.

Third, some responsibility for given practices is commonly given to local governments. For instance, when a fire killed 110 people in a Bangladeshi garment factory just outside Dhaka in 2012, a trade union representative in Pakistan noted that it ‘is the responsibility of the local governments to make sure that the labour laws are properly implemented in these factories’ (Shams and Birkenstock 2012).

Fourth and fifth, the last two levels of responsibility that can be identified in the case of the Bangladeshi garment industry look at those who benefit directly from these harmful practices, in particular powerful international retailers and their consumers. For instance, after the Rana Plaza⁴ tragedy, a workers’ rights pressure group noted: ‘Anybody sourcing in Bangladesh should be aware this could be happening in their supply chain’ (Butler 2013). The trade union representative in Pakistan who commented after the 2012 fire said:

Countries like Bangladesh and Pakistan face tough competition from other markets that provide cheap labour to international companies. They compromise on safety measures to reduce their services cost. It works well for international retailers as they are there to make a profit (Shams and Birkenstock 2012).

Those who profit from practices that foreseeably create harm must carry some responsibility for those practices (Schroeder 2011). This is best argued with reference to the most severe harm of human death. Although philosophers have been debating the intricacies of moral theories for millennia, there is broad agreement that avoidable deaths constitute a harm (Nagel 1979; Feldman 1991) and that foreseeable harm must be avoided by those who have the power to do so, such as international buyers. In virtue theory, ‘[b]eing able to live to the end of a human life of normal length; not dying prematurely’ (Nussbaum 2000, p. 78) is given prime importance, as the first human capability that exerts a moral claim on others. In utilitarian theory, it is taken for granted that ‘[s]uffering and death ... are bad’ and that we must ‘prevent something bad from happening’ (Singer 2009, p. 15). In rights-based theory it is assumed that the ‘state of Nature has a law ... to govern it;

⁴On 24 April 2013, an eight-storey commercial building collapsed in Savar, near Dhaka, the capital of Bangladesh. The building hosted mostly garment factories; the accident killed 1129 people and left many more with serious disabilities (Butler 2013).

... no one ought to harm another in his life' (Locke 1690). Hence, bad things happening in one's supply chain, as the Bangladeshi trade unionist put it, need action by the responsible manager or firm.

It is not only retailers that benefit, but also the end users, in this case the consumers of cheap garments. However, discussions of this type of collective responsibility are more controversial. For instance, it is unclear whether consumers have an obligation to obtain the knowledge required to buy ethically. In this context, some also argue that ethical consumers can never substitute for strong workers' rights locally (Esbenshade 2004). Figure 2.1 summarizes the various levels of responsibility for action or non-action in the Bangladeshi garment industry.

How would these responsibility levels look to researchers and innovators? Let us assume a team of innovators is working in a private laboratory developing skin-care products based on properties found in marine invertebrates. As the research team needs to remove marine invertebrates from their natural habitat to extract

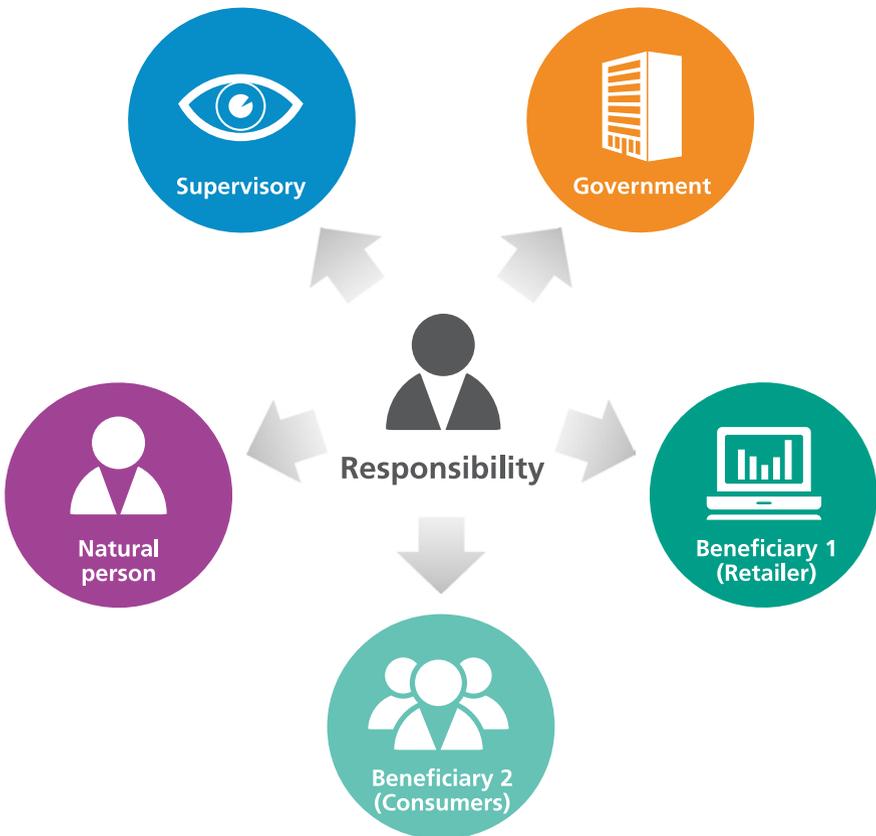


Fig. 2.1 Levels of responsibility

promising biomolecules, the innovation process involves risks for the environment, especially since some of the invertebrates are on the CITES⁵ list of endangered species. To match the Bangladeshi example, we now assume that the harmful practice can be identified, in this case that an endangered species has been further depleted, and additionally that the research team is not native to the area where the species was harvested, but works with local collaborators.

Natural or individual responsibility for the resulting environmental harm then lies with the harvesters, who are the local collaborators. Supervisory responsibility lies with the research team that funds and directs the harvesting process. Governmental responsibility is easily identified in this example, as 180 governments have agreed to become parties to CITES (n.d.). It is then their responsibility to adopt domestic legislation to ensure that the convention is implemented. A failure to adopt adequate compliance mechanisms may have led to the overharvesting in this example, for which the local government carries some responsibility. As for the responsibility level of beneficiaries, we again have two groups of beneficiaries in this example: those who will eventually commercialize any skincare products and benefit financially and those who consume the products that were produced while depleting biodiversity.

To understand the concept of responsibility fully, one further distinction is important, namely the difference between legal, contractual and moral responsibility (Werner 2013, p. 41). Within the law, ‘legal responsibility’ is often considered the informal term for ‘legal liability’, which means that a person can be expected to do or refrain from doing something, as prescribed by the law. If somebody does not act as the law requires, he or she can be brought to a civil or a criminal court. For instance, unfair dismissal would be decided in a civil court (or, in the UK, for instance, by an employment tribunal⁶). The benchmark against which employee and employer actions would be judged is the labour laws of a given country.

It is also possible that a dispute may arise between employer and employee about the interpretation of a contract. For instance, employees on management contracts might believe they deserve a bonus for ‘exceptional performance’, as laid down in the contract, but there may be a disagreement on whether performance was exceptional or not. (Most employers therefore try to provide some kind of metric for the assessment of performance.) Such a case would normally be adjudicated between the contracting parties, with the help of human resources advisors or other mediators. One then speaks of contractual responsibilities.⁷

⁵CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement with 180 parties. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival (<http://www.cites.org>).

⁶Employment tribunals are set up by the UK government specifically in order to resolve disputes between employers and employees over employment rights.

⁷Contract law is a framework for regulating voluntary exchange transactions, such as employment contracts. One may wonder why legal and contractual responsibilities should be separated. However, the distinction is not only routinely made (Werner 2013:41), but helpful in untangling the complexity of obligations companies face (see next section).

Fig. 2.2 Types of responsibility



Finally, moral responsibilities in the work context are the most difficult to define. For instance, while there are clear guidelines on what is ethically *unacceptable* in the work context (e.g. sexual harassment), there are no guidelines on the level of care or empathy one should manifest.⁸ Bereavement leave, for instance, is unregulated and is within the decision-making capacity of the employer. Figure 2.2 illustrates the three types of responsibility in a Venn diagram to show that they can overlap. For instance, the bereaved employee might be able to produce a certificate from a sympathetic doctor testifying that she cannot work due to stress. The same case then moves into the labour law arena, in accordance with health and safety laws.

2.2 Responsibility for What? And Why Should This Be of Interest to Industry?

‘Responsibility’ is a term that invites the question: for what? In this sense it is a term like ‘obligation’ or ‘accountability’. Obligation for what? Accountability for what? And that question can only be answered in context or very broadly. For instance, parents are generally responsible for the safety and wellbeing of their children; CEOs are generally responsible for the profitability and legality of their companies. These are broad answers, which are unlikely to guide practical action. More contextual and therefore specific answers to the question ‘responsibility for what?’ would be that Employee X is responsible for the compilation of daily production statistics and their comparison with budgeted figures, and that Nurse Y is responsible for the blood sugar measurements on Ward Z.

⁸For an excellent argument on moving care and empathy into the centre of ethical thinking, see Slote (2007).

Table 2.1 Specificity of Responsibilities

Responsibility	Specificity	
Contractual	High	Contracts between two or more parties are usually very specific, and it is in the interests of all parties to understand their respective roles and obligations (i.e. their responsibilities), as exploitation of the lack of knowledge of a party can lead to the annulment of a contract. ^a For instance, an employment contract should specify not only remuneration and other benefits for the employee, but also the employer's expectations in terms of performance and responsibilities
Legal	Medium	Given that laws apply to much larger groups than contracts, their specificity is usually lower. In addition, awareness of a law is not immediate, as in a contract, which each party needs to sign. This may also be the case because companies can operate across national borders within different legal frameworks. While a research team that works with marine specimens can be expected to have heard of CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora), the Zembrin® case study below shows that a lot of initiative might be required to be aware of new legislation
Moral	Low	Moral responsibilities are most difficult to specify concretely. What are a company's precise moral responsibilities for distant suppliers such as those in the Bangladeshi example? To supervise their activities as one would supervise the activities of one's own employees? To ensure that local laws are applied? And if so, how?

^aFor instance, a party who has been persuaded to agree to a contract without fully understanding his or her role and responsibilities might be able to claim unconscionable dealing, meaning that the better-informed and more powerful party took unfair advantage of the weaker party

Here it is helpful to recall the distinction between types of responsibility, namely contractual, legal and moral. Table 2.1 explains why, generally speaking, contractual responsibilities are most specific, followed by legal responsibilities, followed by moral responsibilities.

To conclude this section:

Responsibility for what? Responsible researchers and innovators should discharge their contractual, legal *and* moral responsibilities.

2.2.1 The Importance of Inclusiveness and Responsiveness

One can expect researchers and innovators to know their contractual responsibilities. However, they are not always aware of their legal and moral responsibilities. For instance, the Convention on Biological Diversity (CBD) (UNEP 1992) includes the legal responsibility on industry (and others) to share benefits with the holders of traditional knowledge should such knowledge be used in the innovation process. This legal responsibility was made more concrete with the Nagoya

Protocol (CBD 2010). The protocol, in turn, required incorporation into domestic (or equivalent) law. In Europe this occurred in 2014 with Regulation (EU) No 511 (European Parliament 2014). Hence, even though benefit sharing with traditional knowledge holders has been required since 1992, more concrete European law was only issued 22 years later.

At the same time, international civil society organizations⁹ and the media (Hindu 2012) became increasingly interested in ‘biopiracy’, or the misappropriation of traditional knowledge in contravention of the CBD. Innovators who used traditional knowledge without sharing benefits were named and shamed in the international media. For instance, the British *Guardian* titled an article about the alleged biopiracy of traditional knowledge in the Kalahari: ‘In Africa the Hoodia cactus keeps men alive. Now its secret is “stolen” to make us thin’ (Barnett 2001). The article noted:

[I]t appears that while the drug companies were busy seducing the media, their shareholders and financiers about the wonders of their new drug, they had forgotten to tell the bushmen, whose knowledge they had used and patented. Phytopharm’s excuse appears to be that it believed the tribes which used the Hoodia cactus were extinct.

Being aware of one’s legal responsibilities *and* discharging them is thus clearly necessary to avoid serious reputational damage. The case study that follows recounts a case of compliance with the CBD that required considerable initiative and responsiveness from the industry partner.

2.2.1.1 Case Study: Zembrin®—Taking the Initiative on Legal Compliance

In 1986, while in Australia, South African doctor and botanist Nigel Gericke came across a reference to the *Sceletium* plant in a book entitled *Narcotic Plants* by William Emboden. He was intrigued to read about this plant, native to his home country, and that it may have an influence on the central nervous system. In 1992, dried plant material was given to him by an ethnobotanist, and he tried various doses on a circle of professional friends, including doctors, psychiatrists and psychologists. In 1995, Dr Gericke engaged South Africa’s leading addictionologist, Dr Greg McCarthy, to accompany him on a visit to two communities in Namaqualand¹⁰ where the plant was still in use. The psychiatrist undertook formal structured interviews using the DSM III criteria for addiction to find out whether the plant’s use was addictive. Based on the interviews, it was provisionally concluded that the plant was likely to be safe and non-addictive. A year later, in 1996, an active component isolated from the plant was identified and found to be a

⁹See, for instance, Argumedo and Pimbert (2006).

¹⁰An arid region extending through Namibia and South Africa.

potent 5-HT uptake inhibitor, and a patent based on this activity¹¹ was filed shortly afterwards. It took almost a decade before a plant extract could be produced that was precisely standardized in terms of both the content and relative composition of the key active compounds. At this point, in 2006, a venture capitalist, Hall Investments, invested in further research, forming HG&H Pharmaceuticals.

In the early 1990s, when researching medical innovation based on botanicals in general, Dr Gericke had read about benefit sharing with traditional knowledge holders by the USA start-up Shaman Pharmaceuticals more than a decade before the South African Biodiversity Act was promulgated in 2004. As the founding director of the Traditional Medicines Programme (TRAMED) of the Department of Pharmacology at the University of Cape Town, he included recognition of indigenous intellectual property rights as one of the objectives of TRAMED. He took the initiative and decided that, to avoid raising unrealistic expectations,¹² he would only make contact with traditional knowledge holders to discuss a benefit-sharing agreement when:

- they could grow the correct chemotype of the plant on a commercial scale;
- the pre-clinical and clinical safety looked good; and
- there would be sufficient capital to support ongoing research and development and commercialization.¹³

This point came in 2007, and since Dr Gericke had been researching the requirement for benefit sharing independently, he was able to make contact with a prominent human rights attorney, who in turn identified an established organization that was able to represent the interests of the primary traditional knowledge holders. It took just under half a year from the formal opening of the benefit-sharing negotiations in October 2007 to the conclusion of a benefit-sharing agreement in February 2008. Parties to the agreement were the San peoples of South Africa, through the South African San Council (SASC), and HG&H Pharmaceuticals, the newly founded company developing an antidepressant and antianxiety botanical extract from *Sceletium tortuosum*. The following benefits were agreed:¹⁴

- Should commercialization be successful, 5 % of all sales of the extract would be paid into a trust fund for the San peoples.
- An additional 1 % of all profits would be paid into the trust fund for the use of a San logo. The company helped register a trademark for the logo selected by the SASC.

¹¹5-HT, also known as serotonin, is a hormone and neurotransmitter, an imbalance of which is likely to play a role in depression. When its reuptake is inhibited, more serotonin is available within the body.

¹²This is an important point in dealing with benefit sharing (see Wynberg et al. 2009).

¹³Personal communication from Nigel Gericke to Doris Schroeder, 2 April 2015.

¹⁴Importantly, the San representatives decided that the income from this benefit-sharing agreement was to be shared fifty-fifty with the two communities in Namaqualand that had provided the information on the addiction potential of *Sceletium*.

- During the first three years after the conclusion of the agreement, at least 250,000 South African rand (approximately €19,000) was to be paid per annum up front, before the first sales of Zembrin® were made.

Meanwhile, traditional knowledge holders contributed to the innovation process not just by providing the initial research lead on the plant and its nonaddictive character, but also by identifying a nonintoxicating variety of the plant, which was then cultivated in the commercialization process. In September 2012, a product containing Zembrin®, the brand name of the standardized and characterized commercial extract of *Scelletium tortuosum* developed by HG&H Pharmaceuticals, was launched in the South African market. In March 2013, the first products containing Zembrin® were launched in the US market. In March 2015, HG&H were granted their third US patent on *Scelletium*, and by this time some 26 branded dietary supplement products containing Zembrin® were on the US market. In addition, Zembrin® had been formally approved for sale by Health Canada as a nonprescription health product.

Responsible research and innovation involve proactively seeking information about legal conduct as well as *doing the right thing*, whether there is a compliance mechanism or not. This requires innovators to be responsive to stakeholders from other areas; in the above case from the law, from civil society organizations and from indigenous peoples' organizations. It also requires an approach to innovation that recognizes the ideal of inclusiveness. The innovation process in the above example was started on the basis of traditional knowledge.

In addition, the innovator included the traditional knowledge holders in the innovation process as well as in the distribution of proceeds derived from the innovation. As a result of this approach, and in comparison with the *Hoodia* case cited above, faster and less contentious market entry was possible, as adverse media publicity was avoided and available knowledge used effectively.

What if an innovator faces no legal obligations? Can an inclusive and responsive approach also be successful without legal responsibilities? A second case will illustrate that faster and less contentious market entry does not have to be prompted by legal requirements.

2.2.1.2 Case Study: Ambiact—Using Stakeholder Engagement for Faster, More Efficient Market Entry

One of the grand challenges of affluent nations are ageing societies (PACITA n.d.). A German start-up company (Oldntec n.d.) was successful in developing an innovative smart metre for social alarm systems, which allows elderly people to stay in their own homes for longer without compromising safety.¹⁵ Instead of relying on the active summoning of help in the case of accidents, the metre monitors whether a standard appliance (e.g. kettle, toaster) is unused for an untypically long time,

¹⁵All information for this case study was taken from Responsible-Industry (n.d.).

usually 24 h. The product, which can be placed between any appliance and the power socket, is connected to a social alarm operator via a care phone and will generate an emergency call if the chosen appliance is not used. Users feel an increased quality of life since the monitoring does not invade their privacy (as cameras, for example, would), nor does it require the daily handling of care phones, which elderly people with incipient memory problems are likely to find onerous.

From the initial idea to a legally approved product took only three years, from 2011 to 2014. The owners of the start-up company believe that ‘the cooperation of all stakeholders during the development process was a key factor in the successful development of the ambiact’ and that:

1. early engagement of all stakeholders saves costs during development since necessary changes in the product – in terms of acceptability – can be made early in the development process and occasionally in later stages,
2. the possibility for timely feedback on problems or suggestions by stakeholders increases their willingness to participate in the development free of charge and with enthusiasm, and
3. science education is not only helpful for subsequent easier adoption of the new product in the care process, but is also a simple and effective marketing tool for the new product (Responsible-Industry n.d.).

Stakeholder engagement included interviews with end-users as well as social alarm operators at the start of the innovation process to determine the priorities of each group. Further interviews were undertaken before field trials to determine the daily habits of end-users. Field trials helped refine the prototype, and discussions with research participants revealed some interesting requirements. For instance, to the great surprise of the innovators, colour turned out to be the most serious problem with the device for the end-users. The initial black made the device too noticeable to visitors, drawing attention to the possible frailty of the householder, while the white, proposed later, tended to show the dirt. A light grey device proved acceptable to all. The company owners concluded:

Overall, the ambiact was developed from an initial idea to the final product in only three years with comparatively little cost by using the ‘work force’ of volunteer end-users (Responsible-Industry n.d.).

To conclude this section: of the three types of responsibilities we distinguished (contractual, legal and moral), we have taken for granted that researchers and innovators know their contractual responsibilities. They enter the contract and hence have to be aware of it. We have also seen how initiative, responsiveness and inclusiveness can help fulfil legal responsibilities while potentially leading to faster and less contentious market entry. Plus we have shown that such faster and less contentious market entry can be achieved through inclusiveness in the innovation process, independent of legal requirements. This leaves moral responsibilities to discuss.

2.2.2 *The Importance of Societal Good*

In moral philosophy, one usually distinguishes ‘do no harm’ from ‘do good’ responsibilities. Philosophers might call this the difference between negative and positive duties (Berlin 1969) or the difference between perfect and imperfect duties (Kant 1998). A typical ‘do no harm’ duty would be ‘do not kill’, while a typical ‘do good’ duty would be ‘help those in need’. Not to kill somebody, ignoring special cases like self-defence, usually requires no effort and not much thought. One just needs to refrain from doing it. To help those in need, by contrast, requires a lot of thought and often considerable effort. Whom do we help? Only those in our sphere of familiarity (family and friends?) or distant strangers? If the latter, why? For both, *what* can we do to help and where do our responsibilities end; i.e. when have we done enough?

Such debates are usually far removed from the industrial sphere and especially from research and innovation. Science governance frameworks preceding RRI focused almost exclusively on ‘do no harm’. For instance, the background and foundation of technology assessment was formed by ‘negative experiences with the development and use of new technologies’, especially ‘unintended consequences and catastrophic accidents’ (Dusseldorp 2013) (our translation). It is therefore unsurprising that technology assessment’s main focus is new and emerging technologies such as nanotechnology, synthetic biology and, still, genetic modification. Likewise, corporate responsibility usually focuses on ‘do no harm’, while ‘do good’ is separated out as ‘corporate philanthropy’. Figure 2.3 illustrates this graphically.

If responsible research and innovation is based on contractual, legal *and* moral responsibility, as the term ‘responsible’ requires, the ‘do good’ element of moral responsibility cannot be ignored. What does this mean for innovators?

2.2.2.1 **Case Study: The Indian Sanitary Pad Revolutionary—Doing Good Through Innovation**

It is easy to find straightforward, but also striking, examples of innovators who have made a huge difference to people’s lives and done enormous good. For instance, in 2014, an Indian man from a poor family made headlines around the world as he ‘revolutionised menstrual health for rural women in developing countries by inventing a simple machine they can use to make cheap sanitary pads’ (Venema 2014). Years earlier, as a newlywed, he had been appalled by his wife’s use of dirty cloths during menstruation and set out to invent cheap alternatives that poor women, like his wife and widowed mother, could afford. (In 2011, only 12 % of Indian women could afford disposable sanitary pads, while, at the same time, around ‘70 % of all reproductive diseases in India are caused by poor menstrual hygiene—it can also affect maternal mortality’ (Venema 2014)).



Fig. 2.3 Moral responsibility in context

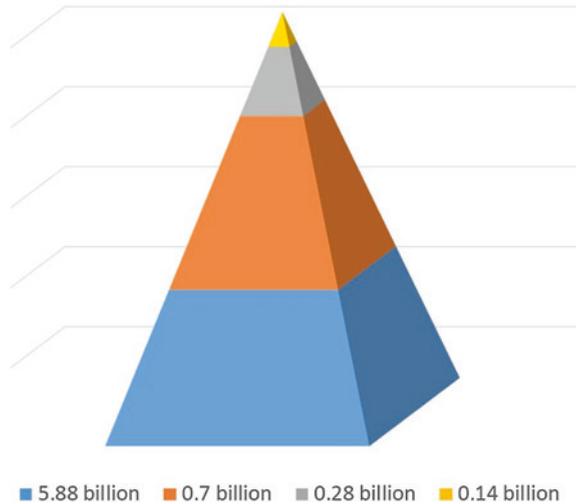
It took Arunachalam Muruganantham almost five years to create a cheap method of producing sanitary pads, but in the end the social entrepreneur invented a low-cost machine that could be operated with little training and used with locally available materials. Regarded as having breached the taboos surrounding menstruation in India, he was believed to be possessed by evil spirits, and thus was deserted by his wife and mother and required to leave his village (Venema 2014). Subsequently, his wife and mother returned and he was given an innovation prize by the Indian president.

He was once asked whether receiving the award from the Indian president was the happiest moment of his life. He said no – his proudest moment came after he installed a machine in a remote village in Uttarakhand, in the foothills of the Himalayas, where for many generations nobody had earned enough to allow children to go to school. A year later, he received a call from a woman in the village to say that her daughter had started school. ‘Where Nehru failed,’ he says, ‘one machine succeeded’ (Venema 2014).¹⁶

This may also be the reason why *Time* magazine put him on its list of the most influential 100 people in 2014 (Gupta 2014). Meanwhile, the innovation has also reached half a million African girls and women through Afripads (AFRIpads n.d.).

¹⁶In rural India, girls are likely to drop out of school with the onset of menstruation.

Fig. 2.4 The bottom of the pyramid



Of course, not all innovators can revolutionize the life of the poor. At the same time, using the term ‘responsible’ in RRI means that one cannot ignore this aspect of moral responsibility. And it is not ignored in the business community. More recent efforts among industry to bring innovation closer to society talk about ‘shared value’ and link it with business success. As a senior Harvard Professor has written in the *Harvard Business Review*:

The solution [to society’s disenchantment with industry] lies in the principle of shared value, which involves creating economic value in a way that also *creates value for society by addressing its needs and challenges*. Businesses must reconnect company success with social progress. Shared value is not social responsibility, philanthropy, or even sustainability, but a new way to achieve economic success (Porter and Kramer 2011).

References to reputational gain are common when the business literature writes about philanthropy or even, as here, about new, more socially embedded ways of doing business. But is that enough to persuade innovators to focus more strongly on societal needs?

2.2.3 *The Fortune at the Bottom of the Pyramid*

Economists differentiate between four tiers of consumers, represented in a pyramid (Fig. 2.4).

The four tiers of the pyramid each have the same annual income, namely 25 % of US\$70 trillion in 2012 (Alexander 2012).¹⁷ In 1998, C.K. Prahalad first wrote about combining corporate success with eradicating poverty and claimed:

This is a time for MNCs [multi-national corporations] to look at globalization strategies through a new lens of inclusive capitalism. For companies with the resources and persistence to compete at the bottom of the world economic pyramid, the prospective rewards include growth, profits, and incalculable contributions to humankind (Prahalad and Hart 2002).

In the fifth edition of a book now recognized as ground-breaking, *The Fortune at the Bottom of the Pyramid*,¹⁸ Prahalad presents case studies of enterprises—in fields ranging from finance to energy to high-tech solutions—that help people escape poverty while providing a commercial profit. Most importantly, he explains that ‘the rate of diffusion among the Bottom of the Pyramid around the world has shown how willing and capable the poor are to accept and benefit from advanced technology’ (Prahalad 2014). An example Prahalad gives is the mobile phone; and indeed, a study commissioned by the World Bank and undertaken in Kenya showed that, in 2012:

- Over 60 % of the respondents among the Kenyan BoP [bottom of pyramid] own a mobile phone ...
- 1 in 4 Kenyan BoP mobile phone owners use Internet on their mobile phone ...
- a quarter of ... study respondents stated that they had earned money through the use of their mobile phone ... because they were more ‘reachable’ ...
- no difference [was found] in mobile phone activities between men and women ...
- health and education Information [was] most desired (Crandall et al. 2012).

Speaking within the framework of moral responsibilities, one could therefore say, as Prahalad does, that ‘doing good’ and ‘doing well’ (making a profit) are not mutually exclusive (Prahalad 2014). This is pertinent, of course, in responding to businesses that ask why RRI should be relevant to them. Table 2.2 summarizes the twelve principles of innovation for BoP markets.¹⁹

As this is a short book for industry, it does not focus on social and community innovations for the bottom of the pyramid, except for the example above of Indian sanitary pads. This aspect has been dealt with excellently in an article by Mario Pansera and Richard Owen (2014).

Now that we have analysed the term ‘responsibility’ in detail with all its implications, we will ask: does it relate to academic and policy discussions of RRI?

¹⁷Income distribution data through personal communication from Thomas Pogge based on 2011 data from Branko Milanovic, World Bank. In 5 % steps, the shares are as follows: 0.130, 0.199, 0.248, 0.297, 0.349, 0.413, 0.493, 0.600, 0.741, 0.920, 1.167, 1.515, 1.976, 2.587, 3.396, 4.514, 6.678, 11.520, 19.487 and 42.768 %; world population at the time 7 billion.

¹⁸It has been argued that ‘base of the pyramid’ would be a more politically correct term. However, since the majority of authors use the term ‘bottom of the pyramid’, we have chosen to do so as well, for consistency with the existing literature.

¹⁹All information in the table from Prahalad (2014:52–71).

Table 2.2 The twelve principles of innovation for BoP markets

Principles	Examples
Price performance	Mobile phones used to cost Indians US\$1000. Then Reliance introduced its Monsoon Hungama for an initial payment of \$10 and monthly payments of \$9.25. Within ten days, one million applications were received
Innovation hybrids	Watered-down versions of ToP (top of pyramid) market products are often not a solution to BoP needs. Hindustan Lever limited (HLL), a subsidiary of Unilever, undertook in-depth research to ensure that iodized salt kept its iodine content in the harsh conditions of storage and transport in India. As a result a product was developed that could help the 70 million Indian children, and others, who suffer from iodine deficiency disorder. HLL is now entering markets in Ghana, Ivory Coast and Kenya with this innovation
Scale of operations	The basis for the BoP market success is volume, not price. Hence, operations must be supported by organizations that have good geographical reach
Sustainable development	When serving a potential market of five billion people, the solutions currently enjoyed by the ToP are not sustainable. However, pursuing such solutions, rather than being a hindrance, might allow all markets to achieve more innovative and sustainable products and services
Identifying functionality	Businesses innovating for the BoP should first understand that functionalities in BoP markets might differ. For instance, India has 5.5 million amputees, with up to 30,000 added each year (through accidents, polio and war). Yet a prosthetic limb must serve in a very different environment from that to which traditional prosthetic limbs are suited. For instance, customarily squatting on the floor, never wearing shoes in temples and having minimal time for fittings must all be taken into account
Process innovation	How things may be done more innovatively while building on local infrastructure can make a big difference in service success. The Aravind Eye Care System, says founder Dr Venkataswamy, aimed to achieve the quality and consistency of the McDonald's chain for eye operations, e.g. cataract surgery. It offers 'eye camps' in local villages, organizes patient transport to Aravind hospitals, and practises a clear and innovative work process for surgeons and post-operative care and counselling
Deskilling of work	Educated labour is difficult to obtain in BoP settings. Voxiva, a Peruvian start-up, developed a device that can be given to rural health care workers, helping them to diagnose a large range of diseases by, for instance, providing photos of the various stages of smallpox. The device also allows rural health workers to contact authorities in Lima

(continued)

Table 2.2 (continued)

Principles	Examples
Education of consumers	As the large majority of BoP consumers have very limited education, giving the poor access to information can create win-win situations. HLL, the Unilever subsidiary mentioned above, used ultraviolet dirt and bacteria detectors to demonstrate to children in village schools that their hands were still dirty after washing in contaminated water. Simply washing one's hands with soap before eating can reduce the incidence of death from diarrhoea by 50 % (more than two million Indian children die from stomach-related illnesses, including diarrhoea, every year). This initiative also served to increase HLL's volume of soap sales
Designing for hostile infrastructure	Products and services must work in hostile conditions, if they are to be viable for BoP markets: for example, actual mains voltages in Indian villages range from 90 to 350 volts
Interfaces	First-time users of new technologies are likely to require special support. For instance, the Mexican retailer Elektra introduced fingerprint recognition at their ATMs so that they would not have to remember nine-digit codes
Distribution	Product and process innovations are important, but in BoP markets, distribution solutions are equally important to access the customer. For instance, Avon cosmetics is extremely successful with its direct sales technique in Brazil, where Avon representatives become mini-suppliers
Challenge conventional wisdom	All the examples in this table challenge conventional wisdom and encourage innovators to embrace new paradigms

2.3 Introduction of RRI Frameworks and Approaches

The European Commission is continuing to support a programme which links research and innovation to societal concerns and interests. The 'Science with and for Society' (SwafS) programme has produced one of the most influential RRI definitions in Europe:

RRI is an inclusive approach to research and innovation (R&I), to ensure that societal actors work together during the whole research and innovation process. It aims to better align both the process and outcomes of R&I, with the values, needs and expectations of European society. In general terms, RRI implies anticipating and assessing potential implications and societal expectations with regard to research and innovation (European Commission n.d.).

In addition to the above definition, the SwafS unit has developed five measurable action lines to help implementation. These are:

- engage society more broadly in its research and innovation activities;
- increase access to scientific results;

- ensure gender equality, in both the research process and research content;
- take into account the ethical dimension; and
- promote formal and informal science education (European Commission n.d.).

Another definition, which was developed within the European Commission by Rene von Schomberg, notes that RRI is a

transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view on the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society) (von Schomberg 2013).

The most widely cited academic work on RRI points to the necessity of common efforts and respect for future generations. ‘Responsible innovation is a collective commitment of care for the future through responsive stewardship of science and innovation in the present’ (Owen et al. 2013). In implementing responsive stewardship, four RRI dimensions are necessary: anticipation, reflection, deliberation and responsiveness (see Fig. 2.5).

All three definitions, as well as the five action lines, have a *process* and an *outcome* dimension.

Process—Undertaking research responsibly is a collective undertaking. ‘Scientists and innovators play an important role, but responsible innovation must be a holistic approach across the innovation ecosystem’ (Owen et al. 2013).

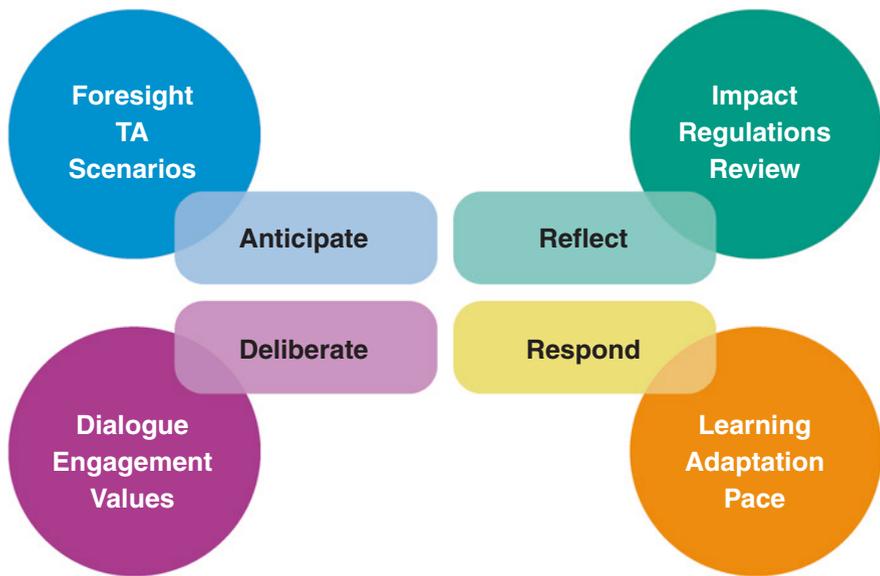


Fig. 2.5 Responsive stewardship

Table 2.3 RRI definitions and responsibilities

RRI statements	Responsiveness	Inclusiveness	Societal good
<p><i>For the European Commission</i> RRI is an inclusive approach to research and innovation (R&I), to ensure that societal actors work together during the whole R&I process. It aims to better align both the process and outcomes of R&I with the values, needs and expectations of European society. In general terms, RRI implies anticipating and assessing potential implications and societal expectations with regard to research and innovation, and working to:</p> <ul style="list-style-type: none"> • engage society more broadly in its research and innovation activities • increase access to scientific results • ensure gender equality, in both the research process and research content • take into account the ethical dimension • promote formal and informal science education 	<p>Societal actors:</p> <ul style="list-style-type: none"> • Work together during the whole R&I process • Anticipate and assess potential implications and societal expectations • Engage society more broadly 	<p>An inclusive approach Ensuring gender equality</p>	<p>Better aligning both the process and outcomes of R&I with the values, needs and expectations of European society</p>
<p><i>René von Schomberg</i> RRI is a transparent, interactive process by which societal actors and innovators become mutually responsive with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society)</p>	<p>Societal actors and innovators become mutually responsive</p>		<p>The societal desirability of the innovation process and its marketable products</p>
<p><i>Richard Owen</i> et al. Responsible innovation is a collective commitment of care for the future through responsive stewardship of science and innovation in the present. Scientists and innovators play an important role, but responsible innovation must be a holistic approach across the innovation ecosystem. The first and foremost task for responsible innovation is then to ask what futures we collectively want science and innovation to bring about</p>	<p>Responsive stewardship</p>	<p>A holistic approach across the innovation ecosystem</p>	<p>The futures we collectively want science and innovation to bring about</p>

This includes universities, research funders, civil society organizations and, importantly, the general public, and requires a co-responsibility for research and innovation.

Outcomes—A framework for RRI goes beyond risk assessment, foresight and control of what we do *not* want research and innovation to do (Owen et al. 2013). It includes the purposes of what we do want research and innovation to do, that is, the envisaged positive outcomes. ‘The first and foremost task for responsible innovation is then to ask what futures do we collectively want science and innovation to bring about ... ?’ (Owen et al. 2013) Governance should then do a lot more than close down ethically unacceptable and unsustainable research. Instead, it should be about defining and realizing ‘areas of public value for innovation’ (Wildson et al. 2005) and ‘benefits to humanity’ (Ozolina et al. 2012). A recent report on RRI commissioned by the European Commission notes that:

The need to gear the innovation process to societal needs is reflected in many high-level policy, strategy and programming documents, such as the objective of the EU 2020 strategy to create smart growth or the Horizon 2020 programme that defines tackling societal challenges as one of the main priorities (van den Hoven et al. 2013).

To see how the definitions above map onto the responsibilities for responsiveness, inclusiveness and a drive towards societal goods, refer to Table 2.3.

2.4 Conclusion

Responsible conduct is made up of three elements. It complies with contractual obligations, with legal obligations and with moral obligations. This statement applies in research and innovation as well as in all other business areas. Traditionally, corporate responsibility was seen most pressingly as ‘do no harm’: no harm to workers, no harm to the environment and no harm to the local community through, for instance, bribery. ‘Do good’ was regarded as a bonus point, the preserve of corporate philanthropy.

As the RRI frameworks introduced in the last section show, responsible research and innovation draws no significant distinction between *do no harm* and *do good*. For instance, the SwafS definition of RRI asks innovators to align their undertakings ‘with the values, *needs* and expectations’ of society (Horizon 2020 n.d.). In particular, the term ‘needs’ has an implicit reference to doing good. Citizen needs usually go beyond not being harmed. Basic needs are generally understood as those required for survival: food, shelter, clothing and access to health care to prevent unnecessary morbidity and mortality (Sen 1992). Some of the case studies introduced in this chapter have a direct bearing on citizen needs. The Indian sanitary pads have a direct impact on health and well-being; Zembrin® and the ambiact also address the health and wellbeing market. Hence, some innovators do indeed align their actions with the needs of society.

Table 2.4 Distinction between ethical acceptability, sustainability and societal desirability

RRI element	Definition with reference to innovation	Identifiable through
Ethical acceptability	Innovation which respects fundamental values without discrimination	Codes of conduct, ethics guidelines and sustained public engagement efforts
Sustainability	Innovation ‘that meets the needs of the present without compromising the ability of future generations to meet their own needs’ (DEPweb 2001) ^a	Environmental protection and health and safety as, for instance, in ISO standards
Societal desirability	Innovation which can benefit all without discrimination	Addressing citizen needs or grand challenges of humankind

^aHere we are borrowing Brundtland’s definition of ‘sustainable development’ and applying it to ‘sustainable innovation’

According to René von Schomberg, RRI consists of three elements: ethical acceptability, sustainability and societal desirability. While one could argue that a nonpolluted environment is societally desirable and ethically acceptable, and therefore that ‘do no harm’ has precedence in all three areas, a more refined understanding would separate the three terms. Table 2.4 sets out one possible way of defining the three areas as separate.

In this interpretation of von Schomberg’s definition of RRI, one could align ‘do no harm’ roughly with ethical acceptability and sustainability and ‘do good’ with societal desirability. Importantly, though, both are present. In comparison with corporate responsibility, therefore, RRI is potentially both broader in scope, in that it demands a link to citizen needs and societal desirability, and smaller in scope, because it deals only with research and innovation rather than the entire business cycle. Figure 2.6 illustrates this in the form of a simplified diagram.²⁰

Finally, the Owen et al. definition of RRI hopes that responsible innovation will ensure the kind of future that citizens collectively want science and innovation to bring about, thereby encompassing both the ‘do no harm’ and ‘do good’ precepts of responsibility.

Can existing corporate responsibility tools cope with this new shift towards responsible research and innovation? The next chapter will first outline the basics of corporate responsibility before moving towards the answer to this question.

²⁰For more information on corporate responsibility, see Chap. 3.

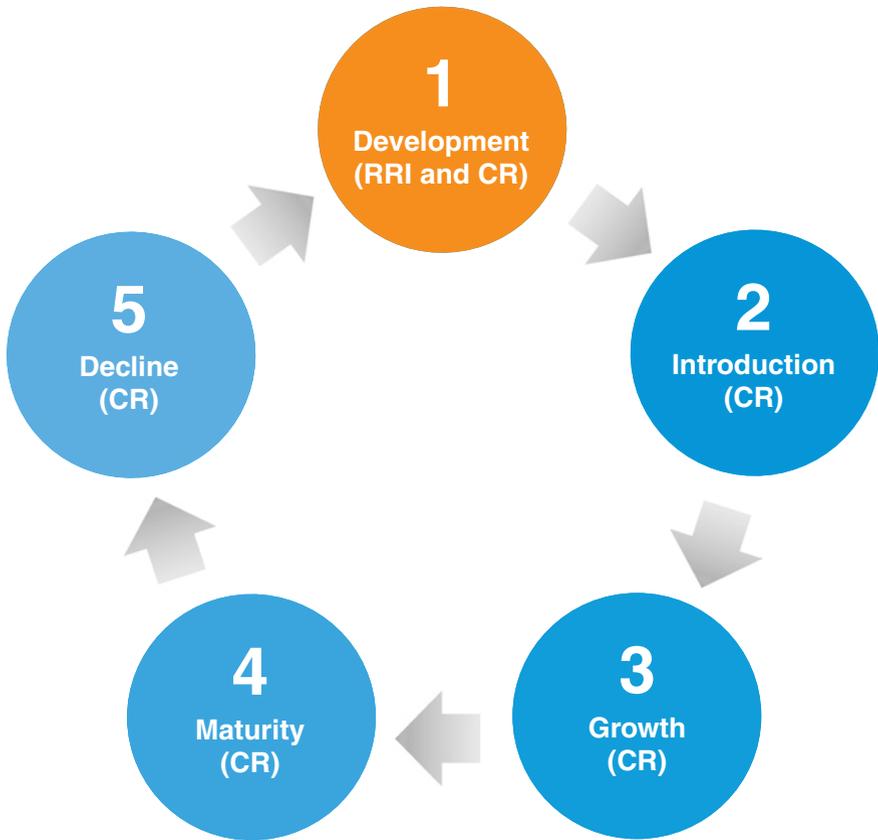


Fig. 2.6 RRI and corporate responsibility—relevant parts of the business cycle

2.5 Recommended Reading

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