CrossMark

The increasing relevance of product responsibility

Benefits of product sustainability for companies and sustainable development

Zoe Rost

Zoe Rost

Abstract Companies, which are committed to corporate sustainability, nevertheless often neglect a critical and systematic examination of their products and the social and ecological impacts along their products' life cycles. However, in practice, diverse reasons exist to more intensively deal with product responsibility. Legislation, cost reductions, resource constraints, societal demands and moral concepts are analyzed as drivers of product responsibility and assessed according to their level of complexity. Simultaneously, the potential contributions of resulting measures for business success and sustainable development are derived. The analysis shows that the consideration of additional drivers may confront businesses with substantial challenges, however, can simultaneously also increase added value for the company and the corporate contribution to sustainable development.

Z. Rost (✉)
DEKRA Assurance Services GmbH,
Handwerkstraße 15,
70565 Stuttgart, Germany
e-mail: zoe.rost@dekra.com; zoe.rost@student.unisg.ch

Z. Rost
Institut für Wirtschaft und Ökologie, Universität St. Gallen,
Tigerbergstraße 2,
9000 St. Gallen, Switzerland

Zusammenfassung Unternehmen, die sich der Nachhaltigkeit verpflichtet haben, vernachlässigen oftmals eine kritische und systematische Auseinandersetzung mit ihren Produkten sowie den sozialen und ökologischen Auswirkungen entlang der Produktlebenszyklen. Jedoch existieren in der Praxis für Unternehmen diverse Gründe für eine intensivere Auseinandersetzung mit dem Thema Produktverantwortung. Gesetzgebung, Kosteneinsparungen, Ressourcenknappheit, gesellschaftliche Ansprüche und moralische Vorstellungen werden als Treiber der Produktverantwortung analysiert und gemäß ihrer Komplexität bewertet. Die Analyse zeigt, dass die Berücksichtigung der verschiedenen Treiber mit teils großen Herausforderungen für Unternehmen einhergeht, jedoch gleichzeitig auch der betriebliche Mehrwert und die Beiträge für eine nachhaltige Entwicklung zunehmen.

1 Product responsibility: an introduction

Human activities continuously push the limits of our planet's carrying capacity. Climate change, ocean acidification, ozone depletion, biodiversity loss, lack of freshwater, the depletion of non-renewable resources, chemical pollution, poverty, and the growing gap between rich and poor are only some challenges accelerated by unsustainable human production and consumption patterns (Dyllick and Muff 2015; Rockström et al. 2009). A great deal of those problems are directly caused or accelerated by products and services of the private sector. Toxic electronic wastes are shipped to developing countries with tremendous consequences for ecosystems and human health. Villages in water

scarce regions suffer from dried-up wells caused by near-by production facilities of large international soda companies. SUVs waste scarce resources while at the same time heavily contributing to air pollution. Fashion labels accept questionable labor conditions in Bangladeshi factories, just so that they can proudly promote a 2.99 EUR T-shirt for European customers.

Hence, current as well as future products and services play a crucial role in tackling sustainability challenges. More sustainable goods and services are a key lever to alleviate the pressure on our environment and contribute to a just and livable society (Schaltegger and Wagner 2011). According to Schaltegger and Wagner (2011), "*companies contribute most to the sustainable development of an economy and society if their core business deals with solutions to environmental and social problems, if they supply environmentally and socially superior products, and if their innovations influence the mass market and society substantially*" (Schaltegger and Wagner 2011, p. 1). Through their decision which products and services to offer, manufacturers and service-providers can create scaled solutions with a valuable impact on sustainable development. Therefore, scholars, governments, and consumers are showing increasing interest in corporate responsibility. Organizations start to respond to the increased public awareness and pledge to integrate sustainability into their core business activities (Bansal and Roth 2000; Purser et al. 1995). However, progress in terms of integrating product considerations in sustainability strategies is low. Companies, to a large degree, avoid critical examination of the wider ecological and social impact of their products and only fulfill legal requirements or operate more sustainable niche products for a conscious customer group with respective purchasing power (Ceres and Sustainalytics 2014). Beyond legal obligations, several more key arguments for greater product responsibility exist which have a large potential to advance company success and to boost sustainable development.

2 Drivers of product responsibility

Research and practice have identified several main drivers of product responsibility (e.g. Dangelico and Pujari 2010). Five key drivers of product responsibility crystallize, that resemble the phases in the development of corporate sustainability elaborated by Benn et al. (2014). According to their model, after rejection and non-responsiveness, companies evolve through a stage of compliance, cost and resource efficiency, and strategic proactivity, until they become a "*sustaining corporation*" (Benn et al. 2014).

2.1 Legislation

In the European Union, member states have recognized the importance of more sustainable products. Many laws have been enacted that regulate the environmental performance of physical products as well as aspects to avoid risks for human health during the production process and during usage.

Regulations exist, for instance, concerning specific product categories. Examples include the European directive 834/2007/EG on processing methods for organic food products, the REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) regulation concerning the registration and handling of chemical products, or the European eco-design guideline 2009/125/EG on energy-related products, which aims at a reduction of energy and resource consumption throughout the entire product life cycle. Other laws concern specific stages of the product life cycle. Directive 2008/98/EC, for instance, establishes a legal framework for the treatment of waste in the EU and defines the "polluter pays principle". Also incentive schemes have been introduced that promote the design of more sustainable products, e.g. the EU energy label which provides a label indicating the product's energy efficiency from A+++ to D. Directive 2012/19/EC on waste electrical and electronic equipment (WEEE Directive) aims to provide incentives to improve the design of electrical and electronic equipment to facilitate recycling.

As law and regulations are meant to be obeyed, they can thus be seen as minimum requirements for product responsibility and compliance. Binding regulations urge companies to critically assess their entire product portfolio and to take corrective measures for all affected products. Therefore, the law is often a starting point for improving the ecological or social performance of products.

2.2 Cost reductions

Companies have recognized that by "greening" their products and processes, they can substantially save expenses along the product life cycle. Often, this "business case" is highlighted as reason why companies should assume social and ecological responsibility for their operations and products (e.g. Epstein and Roy 2003).

Particularly manufacturing companies spend a substantial amount of money on input materials, auxiliary materials, energy and water, and for the disposal of incurred wastes. Furthermore, prices for many key inputs like metals, fuels, timber and biomass are rising. Responsible social and ecological business practices bear a significant saving potential concerning these cost factors. Cost savings in terms of product responsibility are often related to increased efficiency and reduced consumption, e.g. in terms of resources, energy

and recycling (Baumgartner and Ebner 2010). Many cost saving opportunities relate to specific phases of the product life cycle, for instance production processes or end-of-life treatments, and are therefore a driver of increased product responsibility. Energy efficiency measures, for instance, enhance competitiveness by allowing companies to consume less energy while maintaining or even increasing economic output. Between 1995 and 2009, energy use in the EU manufacturing industry remained fairly constant while output increased (EC 2012).

In order to stay competitive, companies try to exploit these win-win situations of cost savings and the demonstration of responsible business practices. Thereby, companies driven by costs usually also comply with legal requirements as the adherence to laws reduces the risks of penalties for non-compliance. The understanding of responsibility behind this driver is primarily an obligation towards company and shareholders. Responsibility for products is assumed as long as it has an immediate positive impact on financial results. Thus, those companies operate in line with Milton Friedman's notion of corporate responsibility announced in 1970 where the ultimate goal of the company is profit maximization and its main duty is towards shareholders and owners of the company (Friedman 1970).

2.3 Resource constraints

The availability of specific raw materials, such as rare earth elements, oil, platinum group metals and other exotic elements, is limited. A number of industries, particularly in the high-tech sector, strongly depend on exactly these materials as inputs for their products. As resources get increasingly scarce extraction will move to more sensitive sites, e.g. the deep sea or the Arctic, causing even more environmental problems and green house gas (GHG) emissions, and extraction will be only possible at increased environmental and financial cost. Furthermore, the quality of resources might be negatively affected (Köhler 2012). Companies have recognized that resource scarcity is often both an economic and environmental dilemma (Kooroshy et al. 2010). Growing natural resource scarcity is a severe threat to supply chains if companies fail to respond to related challenges (Bell et al. 2012).

Products have often been developed with little attention to possible resource and material constraints. The paradigm of planned obsolescence has governed the design of industrial products (Cooper 2004). Shorter product life cycles, the aggressive advertising of ever-new trends, and the promotion of a throwaway society have all further accelerated the problem. Now, in the light of imminent non-availabilities, resource constraints begin to find their way into business considerations. Producing companies have recognized these shortages as strategic challenge for the long-term success

of their business activity and start to respond with manifold activities concerning their product design, inputs and production processes (Wagner 2002).

Compared to legislation as driver of product sustainability, resource scarcity involves a higher degree of complexity, as companies are free to decide upon their corrective business activities. Across a diverse product range, often a multitude of resources are relevant, and adopting an extrapolated long-term focus is not simple. Additional uncertainty is involved concerning the degree of scarcity, the time of ultimate depletion, and the availability of substitutes. Resource constraints are closely related to cost reductions as driver of product responsibility. However, companies that acknowledge imminent challenges related to resource constraints typically go one step further than those motivated by costs. They adopt a long-term perspective without expecting immediate financial benefits and pursue a deeper integration of those considerations into their product portfolio and processes.

2.4 Societal demands

The drivers introduced above are in line with a classical understanding of the company with a sole responsibility towards shareholders and the achievement of financial objectives. However, the stakeholder concept of Freeman (1984) argues that a company has responsibilities and commitments towards many different internal and external interest groups, not only towards shareholders, but also towards employees, customers, suppliers, and the society. The public and non-governmental organizations (NGO) as representatives of largely unheard stakeholder groups seem particularly relevant in the case of product responsibility.

Abundant studies demonstrate an increasing public awareness of product sustainability, which in turn urges companies to integrate social and ecological aspects into their product decisions (PwC 2010; Crane 2001). Recently, for instance, customer demand for organic and natural household products has strongly grown due to a greater focus on health and well-being, a rising incidence of allergies, and higher awareness of chemical safety issues (PwC 2010). In contrast, companies that neglect sensitive sustainability topics have lost their reputation and societal acceptance. Thus, companies have recognized the need to seriously deal with public concerns and NGO criticism in order to maintain their "license to operate" and societal legitimacy.

However, aligning product responsibility measures with societal expectations is highly challenging. As Crane (2001) argues, using for instance customer demands as a guiding principle for sustainability management at product and portfolio level is a difficult task as "customers" are not a uniform group of people with uniform values and purchasing decision behavior. In contrast, there are a multitude of customer

segments with different values and different expectations towards products. Some customers might prioritize fairness towards suppliers, while others will not tolerate the use of certain chemical substances in the supply chain. Crane (2001) exemplifies this consideration by animal testing, which might lead to a product boycott by certain customer groups, however might have little impact on the purchasing decision of other customers, who consider animal testing legal and required for assuring human health. Companies may experience similar challenges with NGO and public demands. Also here reflection is required on which NGO concerns to consider in production processes. NGO argue for a specific case, a key topic, and typically represent those stakeholders, who cannot effectively lobby for themselves, e.g. small-scale farmers, dependent workers in developing countries, or nature. Amnesty International campaigns for human rights and fair treatment of employees along the supply chain, while Greenpeace criticizes the use of environmentally harmful substances. Due to different moral concepts, a product itself may therefore hardly satisfy all ethical requirements. Although progressive companies are willing to integrate societal expectations into their product portfolio, they thus face significant challenges on how to optimize their products in a balanced way.

2.5 Ethics and morality

Previously introduced responsibility understandings often suffer from being overly reactive to external pressures and are often ultimately based on the financial goals of a company. Companies are however central actors of the world community and therefore are expected to assume moral responsibility (Wieland 1999; Wieland 1996). Thus, also the corporate goal to behave in an ethical way can be a driver of product responsibility.

Anthropocentrism and biocentrism are two fundamental perspectives that can be applied to the responsibility of organizations for their products. In an anthropocentric worldview, a moral hierarchy is socially constructed which puts humans above nature and attributes them a superior status. Anthropocentric ethics see humankind as the single and most relevant value and nature primarily serves to satisfy human needs. According to this logic, nature should be protected for the sake of human populations (Borland and Lindgreen 2013; Purser et al. 1995). If reasoning from a pure anthropocentric view, companies should strive to assume greater responsibility for their products in order to increase well-being for all humans. This approach extends responsibility of companies towards farmers, who suffer poverty and malnutrition, workers, who are involved in the value chains of the products, customers, who get ill due to toxic ingredients, and to the entire current and future human population that is affected by the externalities of products and

production processes. According to Borland and Lindgreen (2013) the anthropocentric lens has a dominant social focus and is therefore difficult to extend to environmental issues (Borland and Lindgreen 2013).

Biocentrism sees humans not as superior entities, but as equal parts of nature. Biocentrism seeks to preserve natural systems due to their inherent value beyond their usefulness to humans. Whether or not specific landscapes, ecosystems, or species are to be protected no longer depends on human judgments. A biocentric view attributes value to nature as a whole and to ecosystems irrespective of their value for humans (Purser et al. 1995). Companies that adopt a biocentric ethical approach would have the ethical responsibility to sustain the health and integrity of ecosystems (Purser et al. 1995). York (2009) argues that particularly biocentrism is seldom adopted in business environments. However, Borland and Lindgreen (2013) promote the biocentric ethical perspective also in the business context, as it places equal importance on nature, animals, plants, humans, and eco-systems. A biocentric perspective therefore broadens the responsibility of companies not only to raw materials they consume in their processes and inputs they need for their business success, but attributes a holistic responsibility towards nature to companies despite their capitalist self-interest (Purser et al. 1995). In contrast to resource constraints as a driver of product sustainability, where the market logic attends to nature only when it is scarce, a biocentric perspective attributes inherent value to nature, irrespective its use for business purposes.

By taking either viewpoint as starting point, the understanding of responsibility thus expands to include society and nature beyond financial objectives and stakeholder pressure. The minimum paradigm for companies accepting a moral responsibility embraces all previously introduced drivers as it would be morally wrong to break laws or neglect public concerns. In their product decisions, those companies comply with regulations, acknowledge resource constraints, and consider stakeholder demands, while nevertheless trying to be economically successful in a competitive market environment. By going one step further, their approach to product responsibility strives to move away from doing "minimum harm" i.e. reducing all negative environmental impacts through the production, usage and end-of-life phase of their products, towards doing "maximum good" making a positive contribution to society and the restoration of nature (Wettstein 2010). First corporate frontrunners already actively seek to make positive contributions to society and environment by following handprinting or net positive principles (see e.g. ILFI 2015).

Table 1 Potential impacts of different product responsibility drivers on business success and sustainable development

Driver	Product responsibility approach	Benefits for the company	Impact on sustainable development
Legislation	Companies improve their products and production processes as requested by law (minimum standards)	Avoidance of legal disputes, financial and reputational penalties; maintenance of minimum societal legitimacy	Mainly incremental footprint reductions in own operations and production processes
Cost reductions	Companies improve their products and processes due to immediate financial benefits	Limited financial gains through exclusive focus on win-win situations; improved productivity; shareholder satisfaction	Ecological footprint reductions with the risk of neglecting material sustainability issues
Resource constraints	Companies improve their products and value chain processes according to present and imminent resource constraints	Long-term resource and supply chain security; addressing mass market through affordable products; public appreciation of activities	Avoidance of resource depletion and environmental burdens in upstream and downstream processes
Societal demands	Companies improve their products and product life cycle phases according to stakeholder interests and demands	Positive differential advantage; customer loyalty; license to operate; positive reputation; employee engagement and employer branding	Positive impact on material sustainability issues; ecological and social progress along the entire product life cycle
Ethics and morality	Companies improve their products and product life cycle phases in order to positively contribute to a sustainable development	Success and sustainability through novel business opportunities; high innovative potential and internal capacity building; "company of choice" for customers, talents, business partners, investors	Pro-active contribution to the solution of ecological and societal challenges; positive changes along product life cycles and beyond; transformation towards a more sustainable society

3 Effects of drivers on company success and sustainable development

In the previous section, a multitude of different external and internal drivers of corporate product responsibility have been introduced. Even if motivated by a pure economic logic, companies should have a self-interest to continuously improve their product portfolio in order to comply with laws, realize cost saving potential, be independent from price developments for scarce resources, and avoid the risk of customer boycotts. In reality, companies are not driven by one single motivation, but to a certain degree, all drivers in combination influence business practices. Except legal drivers that relatively clearly frame required activities and must be adhered as minimum standard, all other drivers leave sufficient scope to companies how comprehensively, strictly, and by which strategies they respond to the respective challenges. Thus, complexity and challenges for companies increase with the inclusion of additional drivers into their business activities. While legislation was identified as potential starting point for product responsibility, a company may evolve by considering resource constraints and including wider stakeholder concerns. The final development step is the acceptance of broader responsibility towards society and nature. Those companies, which are driven by a sense of moral obligation, thereby face the highest challenge, as an ethical approach to product responsibility bears the highest level of complexity: they need to holistically integrate various stakeholder concerns into their core business, but additionally seek ways to positively contribute to society and environment. This requires the adoption of an entirely new way of thinking and doing business.

The analysis shows that drivers correlate with different degrees of complexity and challenges for companies. However, coping with those diverse challenges can pay off. With increasing complexity, simultaneously benefits for both the company and sustainable development goals also increase. Each driver may lead to potential positive impacts on business success and sustainable development. The benefits that arise from each driver—both for the company and for sustainable development—are summarized in Table 1 and will be introduced in more detail below.

Product improvements resulting from legislative pressure are not voluntary and are thus not subject to a moral assessment and an expression of the company's sense of responsibility. Companies are therefore not in an ethical dilemma and need not to take decisions if they should improve their products according to legal norms. Complying with regulatory standards thus may be seen as the simplest way to assume responsibility (Shatkin and North 2010). Accordingly, the mere compliance with laws does not offer greater benefits to companies and is not considered as ethical behavior (Bieker and Waxenberger 2002). The resulting improvements typically follow the logic of "footprint reductions" where negative impacts of own production processes are incrementally reduced.

Product life cycle improvements based on cost reductions are driven by a classical market logic and therefore bear the risk of "greenwashing". Purser et al. (1995) argue that "greening business" is used as a cover for doing business as usual, where the ultimate goal is still growth and profit maximization. Thus, also benefits for companies are limited to financial gains with little appreciation by the public. Immediate win-win situations often only apply to the ecological dimension of sustainability, and the exclusive

focus on low-hanging fruits and possibilities to realize cost reductions tends to neglect material sustainability issues.

Also resource-driven product improvements along the life cycle are voluntary, although they lie in the economic self-interest of the company (York 2009). Sharma and Iyer (2012) argue that resource-constrained product development on the one hand aims at producing affordable products for the mass market, on the other hand has an inherently positive environmental performance due to lower input requirements. Due to this positive effect, based on voluntary corporate action, the public might value those resource driven activities as responsible corporate behaviour. The activities typically target resource scarcities and environmental problems related to resource extractions and product disposal. Thus, companies contribute to sustainable development by reducing environmental burdens not only in own production processes, but also in upstream and downstream processes.

Improving the product life cycle according to societal demands can result in a positive product augmentation and a positive differential advantage (Crane 2001). For the company, the consideration of societal demands often entails an increased willingness to pay by customers and a higher acceptance of the product in the market place. The public visibility as responsible producer also attracts talents and motivates the existing workforce. As societal demands usually concern serious social and ecological issues, companies thereby respond to material sustainability issues along the entire product life cycle, which in turn creates a significant contribution to sustainable development.

Product life cycle improvements according to moral assessments include the highest complexity, but also open doors to new and enriching business opportunities. The required proactive approach fosters the development of intellectual and social capital in the workforce and leads to a high innovation potential (Benn et al. 2014). Companies are perceived as innovative and responsible frontrunners. They become "employers of choice" and society appreciates their public value generation. Since the aim is to assume responsibility and positively contribute to sustainable development, most serious sustainability challenges get tackled beyond a mere footprint reduction vision. Instead, positive impacts are generated along the entire product life cycle via handprinting or net positive approaches (see ILFI 2015). Thus, contributions to sustainable development are substantial and ring in the departure towards a more sustainable society.

4 Conclusions and discussion

Although drivers of and business reasons for corporate sustainability are well assessed, the level of product sustainability and its peculiarities often get neglected. This paper shows that companies can have multiple reasons to put more emphasis on product responsibility and wants to encourage companies to implement sustainability strategies also on product and portfolio level.

Current tendencies already show that the importance of all identified drivers will further increase in the future and companies can no longer neglect product sustainability as part of their business strategies. However, there is a gap between current priorities and urgently required changes in business operations. Most companies seem to exclusively focus on legislative pressures and win-win situations, while resource scarcities and societal expectations get neglected. Morality and ethics as driver of product responsibility can seldom be observed in practice, although they bear great potential for business success and sustainable development.

The analysis reveals different levels of complexity related to main drivers of product responsibility, due to varying degrees of corporate self-responsibility, the scale and scope of required initiatives, and the inclusion of a larger number of problem areas. The inclusion of novel drivers will pose specific challenges to businesses and will urge companies to implement changes in business organization, processes and mindsets, in order to create social and environmental value in addition to economic returns (Adams et al. 2015).

The paper demonstrates that current activities are by far not sufficient to substantially contribute to sustainable development. Nor do companies realize all benefits that can be achieved by a stronger integration of product responsibility into business strategies. A stronger incorporation of societal expectations and morality into business activity is required in order to make a real contribution to sustainable development. Promising frameworks exist, e.g. on handprinting or net positive (ILFI 2015), however, in order to realize long-term benefits for both sustainable development and corporate performance, strategic alignment and an elaborated product responsibility plan are required.

The paper will hopefully foster a reflection on own drivers and on own initiatives, and foster a further advancement of corporate product responsibility. Of course it is a long way and companies will not be able to incorporate additional drivers by tomorrow. Often, companies seem to struggle even with legislation as baseline of product responsibility, as the latest VW scandal shows. Buxel et al. (2015) have found that many companies struggle to assume more product sustainability due to a lack of management's understanding of environmental traits of their own products and little knowledge on sustainability hot spots along the product life cycle. Typically, managers are still not used to think beyond corporate boundaries and to include upstream and downstream challenges in their strategies (Buxel et al. 2015). However, pioneer companies that try to face these challenges will be able to both ensure long-term business

success and to realize substantial contributions to sustainable development goals.

References

Adams R, Jeanrenaud S, Bessant J, Denyer D, Overy P (2015) Sustainability-oriented innovation: a systematic review. Int J Manag Rev. doi:10.1111/ijmr.12068

Bansal P, Roth K (2000) Why companies go green: a model of ecological responsiveness. Acad Manage J 43:717–736

Baumgartner RJ, Ebner D (2010) Corporate sustainability strategies: sustainability profiles and maturity levels. Sust Dev 18:76–89

Bell J, Mollenkopf D, Stolze H (2012) Natural resource scarcity and the closed-loop supply chain: a resource-advantage view. Int J Phys Distrib Logist Manag 43(5/6):351–379

Benn S, Dunphy D, Griffiths A (2014) Organizational change for corporate sustainability, 3rd edn. Routledge, London

Bieker T, Waxenberger B (2002) Sustainability balanced scorecard and business ethics—developing a balanced scorecard for integrity management. 10th international conference of the Greening of Industry Network, Göteborg, Sweden, June 23–26, 2002

Borland H, Lindgreen A (2013) Sustainability, epistemology, ecocentric business, and marketing strategy: ideology, reality, and vision. J Bus Ethics 117:173–187

Buxel H, Esenduran G, Griffin S (2015) Strategic sustainability: creating business value with life cycle analysis. Bus Horiz 58(1):109–122

Ceres and Sustainalytics (2014) Gaining ground: corporate progress on the Ceres roadmap for sustainability. a joint report by Ceres and Sustainalytics. www.ceres.org/gainingground. Accessed: 10 June 2014

Cooper T (2004) Inadequate life? Evidence of consumer attitudes to product obsolescence. J Consum Policy 27:421–449

Crane A (2001) Unpacking the ethical product. J Bus Ethics 30(4):361–373

Dangelico RM, Pujari D (2010) Mainstreaming green product innovation: why and how companies integrate environmental sustainability. J Bus Ethics 95(3):471–486

Dyllick T, Muff K (2015) Clarifying the meaning of sustainable business introducing a typology from business-as-usual to true business sustainability. Organ Environ. doi:1086026615575176

EC (2012) Reaping the benefits of globalization, Commission Staff Working Document SWD (2012)299 final

Epstein MJ, Roy MJ (2003) Making the business case for sustainability. J Corp Citizsh 2003(9):79–96

Freeman RE (1984) Strategic management. A stakeholder approach. Pitman, Boston

Friedman M (1970) The responsibility of business is to increase its profits. In: The New York Times Magazine, 13. September

ILFI (2015) Living Product Challenge 1.0—A visionary path to a regenerative future. Seattle, USA

Köhler AR (2013) Material scarcity: a reason for responsibility in technology development and product design. Sci Eng Ethics 19(3):1165–1179

Kooroshy J, Meindersma C (2010) Scarcity of minerals. A strategic security issue! The Hague Centre for Strategic Studies, Den Haag

Purser RE, Park C, Montuori A (1995) Limits to anthropocentrism: toward an ecocentric organization paradigm? Acad Manag Rev 20:1053–1089

PwC (2010) Green products: using sustainable attributes to drive growth and value sustainable business solutions. http://www.pwc.com/us/en/corporate-sustainability-climate-change/assets/green-products-paper.pdf. Accessed: 4 April 2015

Rockström J, Steffen W, Noone K, Persson Å, Chapin FS, Lambin EF, Lenton TM, Scheffer M, Folke C, Schellnhuber HJ, Nykvist B, de Wit CA, Hughes T, van der Leeuw S, Rodhe H, Sörlin S, Snyder PK, Costanza R, Svedin U, Falkenmark M, Karlberg L, Corell RW, Fabry VJ, Hansen J, Walker B, Liverman D, Richardson K, Crutzen P, Foley JA (2009) A safe operating space for humanity. Nature 461:472–475

Schaltegger S, Wagner M (2011) Sustainable entrepreneurship and sustainability innovation: categories and interactions. Bus Strategy Environ 20(4):222–237

Sharma A, Iyer GR (2012) Resource-constrained product development: implications for green marketing and green supply chains. Ind Mark Manag 41:599–608

Shatkin JA, North W (2010) Perspectives on risks of nanomaterials and nanotechnologies: advancing the science. Risk Anal 30(11):1627–1633

Wagner LA (2002). Materials in the economy-material flows, scarcity, and the environment. US Department of the Interior Circular 1221, US Geological Survey, Washington, DC

Wettstein F (2010) For better or for worse: corporate responsibility beyond "do no harm". Bus Ethics Q 20(2):275–283

Wieland J (1996) Ökonomische Organisation, Allokation und Status (92). Mohr Siebeck, Tübingen

Wieland J (1999) Die Ethik der Governance. Metropolis-Verlag, Marburg

York J (2009) Pragmatic sustainability: translating environmental ethics into competitive advantage. J Bus Ethics 85:97–109