Richard Adams*
Senior Research Fellow
University of Exeter Business School
Centre for Innovation and Service Research
Building One
Rennes Drive
Exeter
EX4 4ST
UK
Tel: +44 (0)1392 722549
Email: correspond.adams@btinternet.com

Sally Jeanrenaud
Senior Research Fellow in Sustainable Development
University of Exeter Business School
Streatham Court
Streatham Campus
University of Exeter
Exeter
EX4 4ST
UK
Tel: + 44 (0) 1392 723461
Email: S.Jeanrenaud@exeter.ac.uk

John Bessant
Professor of Innovation and Entrepreneurship
University of Exeter Business School
Senior Research Fellow in Sustainable Development
Streatham Court
Streatham Campus
University of Exeter
Exeter
EX4 4ST
UK
Tel: +44 (0) 1392 723233
Email: J.Bessant@exeter.ac.uk

*Corresponding author

ACKNOWLEDGEMENTS

The authors acknowledge the generous contribution of the Network for Business Sustainability (www.nbs.net) in supporting this work, and to Patrick Overy and David Denyer for comments on earlier versions of this paper. John Bessant would also like to acknowledge the support of the Theo and Friedl Schoeller Foundation.

ABSTRACT

In this article we systematically review the literature relating to Sustainability-Oriented Innovation (SOI), and present a model to help understand different types and phases of SOI in companies. SOI involves making intentional changes to organizational mind-sets and values, as well as the products, processes or practices that produce environmental and/or social benefits in addition to economic value. The model distinguishes between contexts of Operational Optimization, Organizational Transformation, and Systems Building, and is populated with a range of innovation practices illustrating what firms do to become more sustainable. The model is developed from a review of 127 articles from the academic and practitioner literature and focuses on the period between the two Earth Summits (1992-2012). The systematic review forms the foundation of this paper, but we supplement and populate the model with instances of SOI activity drawn from more recent practitioner literature to provide richer insights into contemporary pioneering SOI practice.

INTRODUCTION

Preoccupation with sustainability and the need for innovation to deal with it is, of course, not new. The 'Limits to growth' debate triggered in the 1970s led to a continuing stream of research and advocacy around these issues and there is an extensive literature to draw upon. (see e.g., Cole et al., 1973; Hart, 1995; Bradbury and Clair, 1999; Cowell et al., 1999; Phaal et al., 1999; Jansson et al., 2000; Senge and Carstedt, 2001; Paramanathan et al., 2004; Hansen et al., 2009; Porter and Kramer, 2006; Tukker et al., 2008). Within this debate the business community has been accused of having separated itself from the rest of society (Simanis and Hart, 2009), responsible for creating many environmental and social harms. Owners, shareholders and managers have been accused of overlooking the environmental and social consequences of their activities in favour of the superordinate economic objective of private profit maximisation. Firms attending to the environmental and social consequences of their activity were in the minority and existed largely on the fringes of this 'traditional' economic activity.

Since the turn of the century the situation has changed and greater numbers of firms regard themselves as part of, not apart from, wider society, and seek to reduce, minimise or eradicate harmful social and environmental impacts from their activity. A number of drivers lie behind this change (Aguinis and Glavas, 2012), including regulatory compliance (Dechant and Altman, 1994), competitive advantage (Porter and Van Der Linde, 1995), stakeholder pressure (Baya and Gruman, 2011), social legitimacy and reputational enhancement (Boiral, 2007, Kesidou & Demirel, 2012), and moral consciousness (Bos-Brouwers, 2010).

Whatever the configuration of drivers individual firms feel, it is clear that, collectively, firms are facing pressure to change and increasing numbers are exploring and engaging with the principles of sustainability. Although its origins can be traced back to Rachel Carson's seminal 'Silent Spring' (1962) if not before, the concept of sustainable development, focusing on environmental, social and economic factors (WCED, 1987; UN, 2005), has gained in importance. It was popularized in the work of the World Commission on Environment and Development's Brundtland report (WCED, 1987), defining it as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Business was encouraged to find the means to maintain economic growth within the context of environmental, social, and economic considerations of sustainable development, as captured in Elkington's (1997) notion of the *Triple Bottom Line.*

In this context, business managers question whether or not existing approaches to business are sustainable (Nidumolu, Prahalad, & Rangaswami, 2009). To attend to the sustainability agenda, businesses require innovative responses: either 'doing what we do, but better' (i.e. efficiency-oriented change) and/or 'doing what we do, but differently' (i.e. radical change) (Seebode *et al.*, 2012). Becoming sustainable may require incremental and/or radical technological and/or social change (Hellström, 2007) and because of the additional complexity afforded by the integration of environmental and social factors into organizational thinking, SOI can be differentiated from conventional innovation in both its purpose and direction (Bos-Brouwers, 2010).

In spite of WCED's (1987) and Elkington's (1997) efforts, many businesses remain uncertain precisely what 'sustainable business' means. A variety of conceptualisations can be observed (see e.g., Elkington, 1994; Gladwin et al., 1995; Fussler and James, 1996; Blättel-Mink, 1998; Blowfield *et al.*, 2007; Bos-Brouwers, 2010; Chang, 2011; George *et al.*, 2012). As a consequence, it is difficult for firms to know how, through innovative activity, to move

toward the goal of sustainability. Little guidance has been available about the innovative practices and processes that characterise becoming a sustainable business (Linnenluecke & Griffiths, 2010). To support those firms that are keen to respond to these challenges, but are unsure of the route to business sustainability there is an urgent need to identify and report on these firm level practices and processes and to publish examples of specific actions.

This systematic review focuses on the literature relating to the practice and management of SOI and aims to provide guidance on how firms might adapt their innovation systems to drive toward sustainable outcomes. SOI involves making intentional changes to organizational mind-sets and values, as well as the products, processes or practices that produce environmental and/or social benefits in addition to economic value. In this paper we summarise our key findings and provide guidance by identifying activities that firms could adopt and how they might adapt their innovation systems towards sustainable outcomes.

This review is structured as follows. First, we describe our systematic review methodology and present descriptive results. Next, we introduce a model of SOI inductively derived from the reviewed literature and distinguish three contexts. We argue that to move through the model requires a step-change in mind-set, values and behaviour to target systems change in which multiple stakeholders collaborate to address the biggest problems with radical solutions. We conclude with a discussion that locates this study in the context of the literature and explores the implications of our findings for future scholarship and management practice.

METHOD

The systematic review remains a relative novelty in management and organization studies (MOS), despite considerable methodological development drawing on experiences in other disciplines, especially medicine. However, MOS offers a particular context of its own, and, with the dual objective of being both rigorous and addressing the practical implications of the work, we were guided by the approach first outlined by Tranfield et al. (2003).

This review draws on findings drawn from primary studies that have undergone the peer review process as well as sources from the grey literature to synthesise a contemporary picture of firm-level SOI. We inductively derived a model of SOI from a review of the literature that encompassed definitions and prescriptive and descriptive studies of SOI. The model was iteratively refined as we worked through the literature and was subsequently populated with discrete SOI activities. We identified three contexts of SOI.

- *Operational Optimization* is an internal orientation to sustainability and refers to a ‘doing the same things but better’ approach oriented toward reducing harm through incremental improvements motivated by the need for regulatory compliance or in pursuit of efficiencies.
- *Organizational Transformation* refers to a ‘doing good by doing new things’ approach which may be internally oriented but increasingly looks beyond the boundaries of the firm to enact a fundamental shift in purpose.
- *Systems Building* embeds the firm as an agent to drive institutional change within the wider societal context: this is about ‘doing good by doing new things with others’.

Our systematic review protocol and methodology are more fully reported elsewhere (reference withheld for purposes of anonymity) but, in brief: the scope of the research, research question and inclusion/exclusion criteria were established through dialogue between the research team and a guidance committee consisting of academic and industry experts. Our search strategy (figure 1) consisted of looking for relevant studies in both the scientific

literature and grey literature sources, both of which offer particular types of insight for this review. Our search was restricted to the period bounded by the two Rio Summits, 1992-2012. The assessment and retrieval process largely followed the process outlined in Barroso et al. (2003) including scanning all citations identified from the various databases and web searches and within-team review to validate selections. Disagreements were resolved by discussion. After scanning titles and abstracts, and then full texts of articles, 100 scientific studies and 27 grey sources were considered eligible.

Figure 1 About Here

The systematic review process provides the foundation for this paper, in particular underpinning the model of SOI. However, in what follows, we draw selectively on a wider body of grey literature to populate the model with pioneering and insightful instances that are better able to capture and illustrate contemporary practice than, for reasons of publication lag (Conn et al., 2003), is the scientific literature. This is particularly apposite for the third context of the model *Systems Building*, which represents the leading edge of thinking and practice but is, as yet, poorly supported with empirical studies.

RESULTS

DESCRIPTIVE SUMMARY

On the basis of the included studies we, like others (e.g. Baumann et al., 2002; Klewitz & Hansen, 2011; Schiederig et al., 2012), find the literature to be disjointed, skewed and widely distributed across a diverse and immature body of literature: we have included 100 articles selected from 54 separate journals. 36 journals provided one article each, and 18 journals each provided two or more articles (Fig 2).

Figure 2 About Here

Two journals, *Business Strategy and the Environment* and *Journal of Cleaner Production*, accounted for over one quarter of the included studies. According to the Association of Business Schools (ABS) journal rankings for 2010 (**footnote 1 here**), the former is ranked as a number 2 publication whilst the latter has no ranking.

The next most prolific journals each provided three papers for this review (ABS ranking in parentheses):

- *European Journal of Innovation Management* (1)
- *International Journal of Innovation and Sustainable Development* (not ranked)
- *Journal of Business Ethics* (3)
- *Management Decision* (1)
- *R&D Management* (3)
- *Sustainability* (not ranked)

Furthermore, SOI has proved relatively slow in finding exposure in the mainstream journals, including the innovation journals. Within our sample, six journals are of the highest rank (4), but provide a total of only eight articles between them, five of which have been published since 2007:

- *British Journal of Management* (one article: 2002)
- *California Management Review* (one article: 2001)
- *Economic Geography* (one article: 2001)

- *Journal of Management Studies* (one article: 2012)
- *Journal of Product Innovation Management* (two articles: 2012)
- *Research Policy* (two articles: 2007, 2012)

Nevertheless, as figure 3 shows, the field is attracting greater levels of research interest. In the period 1992-2002, 26 papers were published. Between 2003 and 2012 (**footnote 2 here**) 74 papers were published.

Figure 3 About Here

Table 2 presents further descriptive statistics relating to selected studies.

In terms of sectoral coverage, of the 100 scientific papers, 33 represent sectorally-mixed studies. The mixed-industrial category consists of a range of industry types, whereas the mixed-various category includes studies that consider a diversity of sectors such as manufacturing, services and charities.

Within our sample, the service and consumer goods sectors are under-represented and manufacturing and process industries are overrepresented, which reflects a focus in the literature on environmental considerations in the manufacturing context. Until recently, the literature on SOI has focused on technical processes, with work largely done by scholars in science and engineering. As recently as 2010, Bos-Brouwers showed that many sustainable innovations are incremental and focused on improving technological processes (i.e. eco-efficiency) and lowering production costs.

Table 2 About Here

The geographical distribution of studies shows global interest in the topic, though the greater proportion of single-country studies focus on the developed economies. Just less than one-third of the studies reviewed adopted a multi-country focus, ranging from cross-country case studies (e.g. Clark et al., 2009) to surveys across Europe (e.g. Wagner, 2008).

60 per cent of included studies adopted a cross-sectional approach; the remaining studies were longitudinal (11 per cent), historical (10 per cent) or did not explicate a clear perspective (19 per cent). The dominant methodological approach is qualitative (46 per cent), 22 per cent of studies were quantitative. A large proportion of studies (22 per cent) did not make explicit their methodology — though they mostly reported on single case histories – and 8 per cent were mixed method.

Frequently, studies refer in general terms to sustainability and do not distinguish between a social or environmental focus. Occasionally, studies make these differences explicit, for example, innovation at the bottom of the pyramid, where the social dimension is emphasised. However, from our selected studies, clearly the great proportion of attention has focused on environmental considerations. The social dimension of SOI is under-represented.

A MODEL OF SUSTAINABILITY-ORIENTED INNOVATION

We mapped the innovation activities that we uncovered along three dimensions (figure 4): whether they focused on technology or people; how they reflected the firm's view of itself in relation to wider society, and; the extent to which the innovation extends across the firm. Our

framework (figure 5) builds on these dimensions and presents a new conceptualisation for assessing and planning an organizational approach to SOI.

Figure 4 About Here

Stand-alone/integrated

This dimension is internal to the firm and describes whether sustainability thinking 'stands-alone' associated with individual departments, functions, products or processes or is integrated widely throughout the firm in terms of vision, values and strategy. SOI moves from being a stand-alone, 'add-on' activity to a philosophy suffused throughout the organization.

Firms often innovate initially to comply with regulations and then to optimize efficiencies derived from SOI — in other words, moving from stand-alone innovation to an approach that is integrated into the processes, practices, culture and strategy of the firm. Stand-alone innovation addresses sustainability piecemeal, tackling single issues such as pollution control through end-of-pipe technologies (e.g. Frondel et al., 2004). In contrast, integrated SOI might use information systems to connect disparate functions around a set of sustainability goals. Firms that progress with the sustainability journey adopt such an approach, embedding their sustainability into core processes and strategic thinking. SOI will have limited reach unless sustainability is fully embedded in all decisions and processes of the firm.

Technological/Socio-technological

Technological innovation gives way to greater socio-technical innovation. Innovations are said to be socio-technical when they affect social and organizational factors within the firm and beyond. The technical responses that characterize earlier effort are supplemented or replaced by fundamental transformations at various levels of socio-technical systems, from business models to the more challenging systems level, involving new mind-sets, values and behaviours.

For example, end-of-pipe solutions are unlikely to have significant implications for the way work is organized within the firm. In contrast, sustainability reporting requires identifying and extracting the appropriate information and responding to it in meaningful ways. Beyond the firm's boundaries, at the wider systems level, reporting also implies changes in systems design: for example, changes in capital markets so that social and environmental metrics can be appropriately valued.

Insular/systemic

This dimension reflects how the firm sees itself within a wider system. Is it a part of society, or apart from society? More progressive SOI firms are looking beyond their boundaries to address the SOI challenge, paying attention to wider systemic considerations. Their SOI initiatives engage with and facilitate change in wider systems. These efforts may include influencing value chains or engaging with wider communities and forming coalitions with stakeholders such as NGOs, lobby groups and governments.

Firms innovate along each of these dimensions at different rates and extents that correspond to three contexts of SOI that we label *Operational Optimization*, *Organizational Transformation* and *Systems Building* (fig 5).

Figure 5 About Here

Operational optimization

Operational optimization can be defined as compliance with regulations or optimizing performance through increased efficiency. For many firms, the first steps toward SOI stem from activities to ensure compliance with environmental and social regulations. At the start of the period of this review, SOI was thought of principally in terms of firms' environmental impacts and technological solutions. Solutions were often regarded by managers as an additional cost to the firm and the dominant strategic orientation was reactive; implementing environmentally related innovations was seen as a costly but necessary response to compliance.

The argument that adopting responsible social and environmental policies is competitively disadvantageous to firms has subsequently been challenged by Porter and Van Der Linde (1995) among others (e.g. Peloza, 2009; Peloza and Shang, 2011), and SOI becomes more proactive when the reactive position becomes uneconomic — for example, when add-on solutions incur costs greater than the cost of process redesign (Alston & Roberts, 1999) or when firms recognise sustainability not as a risk but as an opportunity.

In this context of SOI, the organization reduces existing environmental and social impacts without fundamentally changing its business model – sustainability gain is a by-product of business-as-usual. In other words, an Optimizer innovates in order to "do more with less" and consequently contributes to sustainability by doing less harm per unit of production. The focus is on technological innovations in order to, say, reduce emissions, replace toxic components or, minimise the use of non-renewable materials.

As such, the focus of an Operational Optimizer is predominantly internal: inward-looking, risk-reducing and efficiency-seeking. Innovative solutions seek to diminish unsustainable practices by focusing on resource efficiencies and incremental technological improvements to products and business processes typically by addressing a single issue at a time. The "techno-fix" is the favoured approach – focusing on new technologies as ways to reduce harm while maintaining business as usual.

Operational Optimization innovations tend not to be radical. They do what existing technologies already do, but in a more ecologically efficient manner attending to, for example materials and energy use and pollution capture/control (Dangelico & Pujari, 2010). Characteristic of the 'reduce harm done' perspective is a focus on technological, product and process aspects of 'green' or 'eco-innovation'. Such innovations include changes to product content, product portfolios and processes to tackle such issues as waste management, eco-efficiency, energy saving, reducing emissions, recycling, eco-design or any other action implemented by firms to reduce their environmental footprint (Chen et al, 2012; De Marchi, 2012).

Additionally, SOI can be supported by a variety of design and development tools, e.g. to aid dematerialization (Maxwell and Van De Vorst, 2003). Such tools enable users to evaluate sustainable materials and sustainable design alternatives and relate them to financial incentives, environmental regulations or the demands of clients (Bossink, 2002). Design tools can address issues of reducing pollution, make more effective use of energy, incorporate waste and recyclability considerations into product and process design, and promote dematerialisation and so forth.

Operational Optimization is enabled by conventional innovation and knowledge-management capabilities but which are newly oriented toward sustainability. For example, firms that adopt sustainability-oriented design tools may integrate them into existing processes to ensure environmental and social considerations become routine: by establishing sustainability milestones, roadmaps and checkpoints or by integrating sustainability as an explicit goal in the design process.

But, from a sustainability perspective, is operational optimization sufficient? In spite of the substantial sustainability gains that have been delivered through it, there is one notable limitation. Operational Optimization is a context of *diminishing unsustainability*: resources continue to be used, but less quickly than previously; pollution and waste are still produced, but not in the same volumes as previously. In effect, the flight path remains the same: "Doing more with less" ultimately results in the same end-point, resource expiration and environmental degradation. Indeed, scale effects may nullify any gains from SOIs (Machiba, 2010).

So, a shift in mind-sets is needed: a shift away from diminishing unsustainability to becoming increasingly sustainable - and this is about Organizational Transformation and Systems Building - the second and third contexts in our model. Organizational Transformation addresses some of the limitations of Operational Optimization. It is a more complex context, it is one in which sustainability thinking becomes more pervasive throughout the firm – it is no longer an add-on: it becomes 'business-as-usual', it becomes the culture of the firm.

Initial steps taken by Operational Optimizers may be a stepping-stone toward increasing firm-level sustainability, for example by contributing to generating a culture of SOI throughout the firm empowering individuals to come forward with solutions to other problems (Peloza, 2009). Thus enabled, firms may move from this largely ad hoc approach to a more formalized integrated strategy of SOI that instils sustainability more widely.

Organizational transformation

The shift between *Operational Optimization* and *Organizational Transformation* is not a simple one. During this phase, firms leave behind *diminishing unsustainability* and begin to embrace the notion of *increasing sustainability*: firms' orientations shift from focussing on reducing harmful impacts toward delivering social and environmental as well as economic benefits for themselves and wider society. In the context of *Organizational Transformation*, firms' innovation activities become increasingly integrated and increasingly socio-technical.

In the *Organizational Transformation* context, firms explore ways of shifting the organizational mind-set from 'doing less harm' to 'creating shared value' and 'delivering wider benefits for society.' Firms operating in this context also increasingly focus, either incrementally or systemically, on the social dimension of sustainability, which emphasizes the need to address unmet human and societal needs. This is a shaping logic that goes beyond an internal, operational focus on greening to a more external, strategic focus on sustainable development (Hart, 1997).

Many companies have embraced the practices of environmental management in the sense of *Operational Optimization*, but fewer have seriously engaged the wider implications of sustainability thinking (Shrivastava & Hart, 1995). Moving beyond *Operational Optimization* requires a more radical approach that renders innovation more complex and ambiguous. Once

firms are in the *Organizational Transformation* context, its complexities include the following:

- Balancing the three dimensions of the TBL and, in particular, paying greater attention to the social and environmental dimensions
- Embedding appropriate tools and processes to enable implementation of SOI across the firm
- Involving and engaging with a wider range of external stakeholders particularly with suppliers and customers who may lack experience, knowledge and confidence in SOI
- Developing new mechanisms to access specialist knowledge and expertise
- Acquiring appropriate search skills to respond to new knowledge requirements
- Redefining who key stakeholders are and ensuring that their interests are understood and incorporated into decision-making aligned with sustainability
- Investigating life cycles of products, the origins and sustainability of raw materials, the physical and social consequences of production and consumption, and the fate of products at the end of their useful life
- Integrating sustainability thinking more deeply into organizational behaviours and processes through leadership and culture
- Adopting new definitions and metrics of business success, such as Integrating sustainability reporting as well as financial reporting into yearly accounts
- Unlearning existing competences as the current models of innovation and R&D may not be sufficient to deliver a sustainable business

Innovation in the context of *Organizational Transformation* involves small-scale explorations and experimentation not only in products and services but also in social and organizational aspects, which may lead to new business models. Such innovation is more challenging but offers significantly higher potential to achieve more ambitious sustainability-oriented goals than the gradual incremental SOI that is characteristic of *Operational Optimization*.

In this context, an awkward juxtaposition can occur between good business economics of cost savings through environmental investments and strategic re-orientation of the firm around sustainability concerns, in which the firm takes on new responsibilities regarding environmental and social development. Our review shows firms in this category experiment within an existing institutional framework at, for example, the level of the product or the strategic business unit. This transition has been discussed in terms of the Schumpeterian notion of creative destruction, the continuous reconfiguring of organizations in response to change (e.g. Stafford & Hartman, 2001). Firms find this to be a challenging space to occupy, and many innovators can meet with resistance from within the firm, established firms, the marketplace and other stakeholders.

Navigating the transition can be particularly difficult for incumbent firms possibly constrained by legacy systems and core rigidities (Leonard-Barton, 1992). Entrenched behaviours and practices within existing systems act as barriers. Firms may find help to negotiate this space through novel collaborations (e.g. with environmental NGOs) and by extending the firm's non-technological competences (e.g. the ability to lobby or to find alternative routes to market).

To stimulate more radical innovations, firms are drawing inspiration from a range of new sources, including biomimicry (Box 1), backcasting and adopting new search techniques such as looking for weak signals or using peripheral vision. These techniques are not uniquely

applicable to SOI, but are powerful approaches that innovators have deliberately adopted to pursue SOI.

Box 1 About Here

Backcasting, a term popularized by the Natural Step framework (Nattrass & Altomare 1999), is about envisaging a desired end state and working backwards from that to discover and design the necessary intermediate steps to reach that point: future outcomes are defined beforehand, and their feasibility worked-out based on the implementation of short-term actions (Partidario and Vergragt, 2002). It is about creating visions rather than building from existing technologies or starting with experimentation (Loorbach, 2007) and has played an important role in defining the pathway to reach the World Business Council for Sustainable Development's (WBCSD, 2010) vision for 2050.

Looking for weak signals is about extending organizational search activities into unfamiliar fields and using the firm's peripheral vision to go beyond conventional market intelligence activities (Day and Shoemaker, 2005). Weak signals, can be precursors to significant trends and change mechanisms, and emanate from a diversity of sources, including community action groups, social entrepreneurs and activists (Mulgan *et al.*, 2007). Hart and Sharma (2004) propose a similar concept, 'radical transactiveness', a dynamic capability which seeks to systematically identify, explore, and integrate the views of stakeholders on the 'fringe' or in the 'smart mob' specifically to manage disruptive change and stimulate competitive imagination. Firms need to be alert to, pick up and use such weak signals (Holmes and Smart, 2009; Joshi, 2010; Aschehoug et al., 2012) by investing in the absorptive capacity of the firm (Cohen and Levinthal, 1990), reaching out and bridging new communities of stakeholders (Hollander, 2003) and through entrepreneurial bricolage (Halme *et al.*, 2012).

A number of studies stressed the critical role that sustainable supply chain management (SSCM) plays. SSCM is characterised by its broader systems view: so, sustainability principles inform the firm's relations along the whole value chain — from the original sourcing of raw materials, through the various companies involved from extraction to end-of-life. To achieve effective SSCM, long-term collaborations with external partners are critical. Specific activities can include sourcing sustainable materials from alternative suppliers or working with existing suppliers to provide sustainable materials; developing sustainability standards for the supply chain and then operationalizing them through a supplier code of conduct; providing environmental design specification to suppliers; co-operating with suppliers to work toward environmental objectives; performing environmental audits for suppliers' internal management; requiring suppliers' ISO 14000 / ISO 26000 certification; co-operating with customers on environmental objectives (Pujari et al., 2003; Zhu, Sarkis, & Lai, 2011).

Firms wanting to achieve the greatest sustainability impact may choose to target upstream green supply chain initiatives, where the greatest damage occurs in the extractive and primary processing industries (Huber, 2008). At InterfaceFLOR, for example, more than two-thirds of the overall environmental impact of a carpet tile is related to raw materials. Virgin nylon yarn alone makes up about half a carpet's greenhouse gas emissions: reducing the amount used is fundamental to the strategy of creating a more sustainable product (Arratia, 2010).

To integrate sustainability into organizational thinking, practice, products and processes a range of tools is available to mangers: most commonly used are Environmental Management

Systems (EMS) and Life Cycle Analysis (LCA), of which there are multiple variants. EMS provide a systematic way of addressing environmental impacts by developing, implementing, coordinating, monitoring and evaluating business processes and procedures and have become the pre-eminent procedural tool for internal management (Melnyk et al., 2003; Könnölä & Unruh, 2007). LCA compares all social and environmental damages related to a product or service and helps firms make informed assessments of environmental impact by considering all links in the life cycle chain, including beyond the boundaries of the firm (Simon et al., 2000; Kaval, 2011; Buttol et al., 2012).

Whilst use of these tools may result in environmental benefits, they are limited in two respects. Because LCA can be resource-intensive, many firms choose not apply it across their full product ranges, preferring to apply LCA only to new products or product modifications and allowing older products to become discontinued. Furthermore, the approaches focus on improving existing systems and so have been criticised for constraining more radical innovation opportunities (e.g. Könnölä & Unruh, 2007).

Another area of innovative activity is around the idea of changing behaviours, for example by transforming how products are delivered and consumed. This is exemplified by the concept of servitisation. The idea behind this is that human needs are fulfilled by services, not products; customers buy what the product does not necessarily the physical artefact (Vergragt and Van Der Wel, 1998). Also known as Product Service Systems (Tukker, 2004), servitisation illustrates what Clark *et al.* (2009) refer to as the essence of sustainable innovation: not necessarily leading to new technologies, but to rethinking how to meet everyone's needs and to sustain growth without costly social and environmental impacts.

By focusing on functionality, product developers ask whether a tangible product is actually needed or whether it can be replaced with a service, and so environmental and social benefits accrue from a servitisation, including fewer products being manufactured, leading to associated reductions in resource denudation and accumulation of waste. Servitization also makes services available and affordable to customers for whom owning the product is beyond their reach or for those communities consciously deciding on a collaborative model of consumption (Felson and Spaeth, 1978; Botsman and Rogers, 2010). Servitization represents a conceptual challenge in terms of product/service design, sometimes requiring that consumers be re-educated, particularly in developed economies, where consumers have become accustomed to ownership.

In terms of reporting, some firms are signing up to initiatives (**footnote 3 here)** whose objectives include making sustainability reporting standard practice for all organizations. Other organizations also are developing integrated TBL reporting guidelines (Kaval, 2011). Importantly, signing up is a public and visible commitment to sustainability. It is not the case that *Operational Optimisers* won't or don't report on their sustainability activity and achievements, but what distinguishes this group is their transparency, the extent to which sustainability reporting is integrated into the standard financial reporting of the company – the two are indivisible - and how they use sustainability metrics as a basis for further SOI in the firm. Critically, it is also about the extent to which they are prepared to be judged against these.

Some of this reporting does not require radical change to current business processes. However, much sustainability information is non-financial and needs to be converted into financial metrics, which are the main standard for evaluating organizational activity. Whether

this conversion is feasible remains to be seen. In spite of the progress made, existing metrics do not cover the whole landscape of sustainability, omitting such areas as ecological degradation and social impact. Firms are experimenting with new modes of sustainability performance measurement, such as measures that can directly relate corporate environmental performance to the marketplace, revenues, customer satisfaction and upstream environmental impacts (Lent and Wells, 1992).

In 2007, for example, Nike created its Considered Apparel Index to score the environmental attributes of its apparel. In 2010, it was upgraded to a web interface to enable earlier designer and supplier involvement and firm access to performance data (Baya and Gruman, 2011). Dow Chemical (**footnote 4 here)** developed the Eco-Compass to assess innovations environmentally by plotting product functionality, material intensity, energy intensity, toxicity and resource conservation against two economic indicators: economic value created and security of the business position.

Some sustainability reporting has been criticized as self-congratulatory 'greenwashing' (Bos-Brouwers, 2010), but limited evidence suggests that firms that commit to transparent and integrated sustainability reporting have better sustainability performance (Sardinha, Reijnders, & Antunes, 2011). Embedding sustainability metrics with financial reporting integrates sustainability as a core concern for organizations' chief financial officers (CFOs), though a globally accepted standard for peer-to-peer and industry benchmarking remains elusive.

The German sportswear company Puma is a leader in transparency and disclosure of its external costs to society. It measures, evaluates and publishes data on its carbon emissions, freshwater usage, pollution and waste. The unique aspect of this exercise is that Puma has measured and monetized these impacts, calculating them along its entire supply chain. It effectively created the world's first environmental profit-and-loss statement. Although Puma disclosed an estimated €145 million (US$182 million) in such externalities for 2010, the revelation was far from the public relations disaster that some had predicted. The firm now uses what it learned to engage its raw materials and manufacturing supply chain (which is where almost 95 per cent of these externalities arise) to improve its environmental performance (Sukhdev, 2012).

Many objectives of *Organizational Transformation* can be difficult for businesses to achieve in isolation. The context is characterised by a redefinition of relationships that increasingly are conceived in terms of environmental and social impacts. This implies a shift toward networks of relations in which sustainability value is created collaboratively rather than individually (Del Río, Carrillo-Hermosilla, & Könnölä, 2010) and firms shift from existing in isolation and in competition to integrated collaborations, with the potential to bring systems-shaping innovations (Gulbrandsen, 2005; Taylor, 2005; Carrillo-Hermosilla et al., 2010). This raises important questions about whether or not it is in the capacity of individual firms to be sustainable on their own or whether or not sustainability can only be achieved within a wider sustainable system.

It is this question that demarcates the frontier of current thinking and practice, and introduces the third context of our model - *Systems Building* - which is characterised by the redesign of institutions and infrastructures, and a reconceptualization of the purpose of business.

Systems building

Systems perspectives are not new to sustainable development, or corporate sustainability literature. The importance of understanding the inter-linkages between ecological, social and economic systems to scope the dangers of systemic risks to business; or to promote better governance, management or operational approaches; or to explain the multi-faceted dimension of innovation processes is well documented (Freeman 1995; Roome 1998, 2011; Elzen et al 2003; Reynolds 2008).

A system can be defined as a set of interacting or interdependent elements forming an integrated whole that produces a set of characteristic behaviours (Meadows 2009); or from a more constructivist perspective as "a cognitive construct for making sense of complexity" (Barton & Haslett, 2007; 143). Systems thinking may be considered as "the ethical, scientific pursuit of knowledge using the socio-ecological (open) systems frame" (Barton & Haslett, 2007; 143), which seeks to understand 'problems' as the product of a system, rather than of one specific element or event. Almost anything can be conceived as a system, from micro to macro scales, and it is therefore important to identify workable boundaries in system-building SOI perspectives. The *Systems Building* context recognizes that companies are *part of* wider open systems involving the interactions between ecologies, policies, legislation, incentives, markets, cultural values and behaviour, all of which influence individual corporate practices, and which influence what any one corporation can do to realize sustainability.

While some systems-level innovations have been successfully planned (e.g., the containerization of shipping freight), many do not happen by design, nor are they mainly catalyzed from within business itself. The development of the World Wide Web, for example, has transformed the physical infrastructure of communications and cultural behavior, and has had profound implications for the ways businesses operate. However, the notion of 'deliberate' or 'orchestrated system innovation' for sustainability, which implies the purposeful search for system innovations to address major sustainability challenges as well as generate corporate value, is still in its infancy (Draper, 2013).

Systems innovation has been defined as the "*interconnected set of innovations, where each influences each other, with innovation in the parts of the system and in the ways they interconnect"* and involves many actors and institutions (Mulgan & Leadbeater, 2013; 4). In terms of sustainability, it can be seen as "*as a set of actions that shift a system – a city, a sector, an economy – onto a more sustainable path*" (Draper, 2013; 11). From this perspective it is recognized that large scale transformations are needed in key systems such as energy, water, food, housing, transportation, waste management if society is to solve the pressing sustainability challenges. And it is claimed that changes are needed to make systems more resilient and more equitable if they are to continue over the long term (Draper, 2013).

Several key issues emerge as corporations start moving into a Systems Building space, including:

- *Repurposing the role of business in society,* and defining new end goals
- *Developing an economy in sync with nature,* with greater appreciation of the value of biophysical systems and planetary boundaries
- *Addressing meta-level societal challenges,* e.g. energy, food, water, materials, waste systems, which are beyond the scope of any one company or sector
- *Collaborating beyond firm boundaries,* including with many non-traditional business partners and using different skills and behaviours

- *Generating and sharing new forms of value*
- *Appreciating the multi-faceted and co-evolutionary nature of systems building*, and how to take systems innovations to scale

Systems Building implies a different purpose from only 'private' gain or profit. A systems building perspective sees a company as part of a larger, inter-connected, co-dependent whole, rather than a detached, independent, competitive unit. It recognizes that the short term good of an individual firm is dependent upon the long term good of the whole; and that it is impossible to build a sustainable organization in an unsustainable system: in other words "What is not good for the hive is not good for the bee" (**footnote 5 here)**. Such perspectives underpin the logic of collaborating with others, creating shared value, and investing in systems solutions. Because the concept of *Systems Building* reflects an unconventional economic paradigm, relatively few organizations currently occupy this space. The move from *Organizational Transformation* to *Systems Building* requires another radical shift in mind-set – this time from doing new things and serving new markets, to thinking beyond the firm and reframing the purpose of business in society. Rather than seeking to make a business case for 'corporate sustainability ', systems builders recognize the need for corporations to contribute to the overarching goal of sustainable development.

For example, The 'Benefit Corporation' or 'B Corp', which emerged in the US in 2010, is a striking example of how the role of business in society is being reframed to tackle systemic challenges. The B Corp has created a new legal form to allow it to go beyond benefiting shareholders to benefiting wider society and the environment. B Corps legislation "helps return business to its proper role in society to create shared and durable prosperity" (B Corps, 2013). Certified B Corps are required to make decisions that have a positive material impact on society and the environment. The B Corps website (2013) claims:

"*Government and the nonprofit sector are necessary but insufficient to address society's greatest challenges. Business, the most powerful man-made force on the planet, must create value for society, not just shareholders. Systemic challenges require systemic solutions and the B Corp movement offers a concrete, market-based and scalable solution. It encourages companies to compete not just to be the best in the world, but to be* ***the best for the world*****"**.

A growing community of ≥850 Certified B Corps from 28 countries and 60 industries working toward redefining success corporate purpose now exists (B Corps, 2013), including ice cream producer Ben & Jerry's, e-commerce platform Etsy and cleaning product manufacturers Method and Seventh Generation. Similar developments include ideas expressed by Conscious Capitalism and Corporation 2020, models of enterprise that explicitly take social and ecological considerations into account in their business strategies and purposes (Waddock and Mcintosh, 2011).
Systems Builders also take the dynamics of biophysical systems and planetary boundaries into greater consideration and seek to develop a new economy in sync with nature. They perceive economic activities as being 'part of' nature, not 'apart from' it. Some companies have developed an understanding which goes beyond the 'three pillar' model of sustainable development (a figure which suggests that economic, social and ecological systems are unconnected), to recognize that all economic and social activities are actually nested within and depend upon natural systems (Giddings et al., 2002; Seebode 2011).

Science indicates that the planet's natural regulatory system has maintained stable temperatures, fresh water availability and biochemical flows within a fairly narrow range, and

has created ‘a safe operating space’ for humanity allowing human life to flourish over the last 10,000 years. However, this has come under increasing pressure since the Industrial Revolution as a result of human activities (Rockstrom et al., 2010). It is claimed that crossing certain biophysical thresholds, or ‘planetary boundaries’ could be disastrous for humanity, and that three of nine interlinked planetary boundaries, including climate change, loss of biodiversity, and the nitrogen cycle have already been overstepped (Rockstrom et al., 2010). Some management scholars are calling for corporate sustainability thinkers to reconsider the ecological and systemic foundations for sustainability and to integrate their work more closely with the natural sciences (Whiteman et al., 2012), such as through biomimicry (Benyus 1997).

A well-known example of collaborative and interdependent working, which involves mimicking natural systems, is the phenomenon of Industrial Symbiosis. The Kalundborg project (Birkin *et al.*, 2009) is an often cited example of this: eight firms concurrently co-operate to convert their environmental problems into business opportunities whereby one company’s waste material or waste energy becomes another’s resource facilitated by explicit inter-organizational co-ordination (Reid and Meidzinski, 2008). Sony’s initiative with Forum for the Future is another example (Box 2).

Box 2 About Here

Systems Builders recognize that societal or meta-level challenges are too big and too interconnected for any one company, or indeed any one actor, to manage or solve independently. The interconnected and interdependent nature of problems requires many sources of influence and expertise to solve. As Santiago Gowland, from Nike put it: *“We need to move past the current incremental mindset into a genuine shift of entire systems. Otherwise we will walk slowly towards an environmental cliff”* (Cited in Draper, 2013; 48). Some CEOs have claimed that they cannot progress further without radical changes in market structures and systems, driven by a common understanding of global priorities (UN Global Compact & Accenture, 2013).

Finding solutions to meta-level problems is not the sole remit of any individual company. Solutions require intimate, interdependent collaborations between perhaps previously unrelated organizations, including companies, governments, regulators, investors, employees, consumers, NGOs, lobbyists and other actors. It also requires the ability to build, manage or participate in complex coalitions over time (WBCSD, 2010). *Systems Building* companies play a role in shaping this wider system with innovation that goes beyond the sporadic and incremental to generate new, transformative approaches to sustainability. There is some evidence of organizations collaborating across institutions and sectors to do this (UN Global Compact & Accenture, 2013). Nike, for example (Box 3), speak of “getting the whole system in the room” in order to diagnose problems, understand system complexity, build trust, identify possible levers for change, and develop common thought processes. *Systems Builders* are thus increasingly engaging in constructive dialogues with multiple stakeholders rather than simply acting on their own.

Box 3 About Here

Systems building collaborations require different mind-sets, values and behaviours to those involved in more technologically driven innovation processes. *Systems Builders* exhibit particular characteristics, including: seeing a bigger picture; understanding the role of

networking; being receptive to conflicting stakeholder perspectives, new possibilities and outcomes; being collaboration-oriented; capable of building trust, share knowledge, and work in participatory, fluid, open, emergent systems; and be willing to take action and invest in novel experimental, pioneering practices with others. *Systems Building* involves developing a new language that recognizes the plurality of values and perspectives, and generates new stories, myths and collective identities (Dyer et al 2011; Roome 2011; Bent & Le Grand 2012).

Another approach to transforming systems is to identify 'leverage points' where a small shift in one thing can produce big changes in connected parts. Meadows (1999), for example, describes 12 leverage points for intervening in a system to create big systems shifts. These range from the most subtle but effective levers with long term effects, such as transforming paradigms, mind-sets, values and priorities, to the least effective and most material levers such as regulating negative feedback loops, or changing material stocks and flows, such as infrastructures. While the latter are still important they are considered to have less transforming power than the non-material levers.

Importantly, *Systems Building* also helps generate, capture and share new sources of value, by aligning systems, stakeholders and markets. For example, in the LAUNCH initiative (Box 3), Nike recognizes that by collaborating with others, and identifying pre-competitive spaces, it can benefit from wider systems- level innovation, reduce individual operational costs as well as reputational risks (Draper, 2013). By investing in innovative solutions which benefit the whole system, Nike is fostering its own competitive advantage and long term success. However, if the value created within these new organizational ecosystems is not equitably distributed – including social and environmental domains as stakeholders – they are unlikely to endure (Leadbeater, 2013), and so often require a formal articulation of how value will be shared.

Collaborative practice raises interesting questions about: who owns and controls which systems; the future of systems co-ownership; and, how new models of corporate and systems governance might evolve (Roome, 1998; 2011). Co-management and collaborative governance models are quite well documented for some natural resource systems, such as protected areas, forests or marine resources (e.g. Borrini Feyerabend, 1996; Borrini Feyerabend et al., 2004), and new collaborative models and standards are currently being developed for water stewardship (WWF, 2013). However, the long term response of firms to system risks and system stewardship remains to be seen.

Overall, *Systems Building* and organizational change is recognized as a multi-faceted and co-evolutionary process. A number of parallel innovations, within social, economic and environmental domains need to happen simultaneously to effect such transformational change (Lewin et al., 1999; Geels 2004; Pachecho et al., 2011). It cuts across many different business and policy domains and it goes far beyond innovative technologies to involve the influence of public policy and regulations, economic drivers, cultural values, political dynamics and social movements.

DISCUSSION

An ISO survey has revealed that at the end of 2010 more than 250,000 firms in 155 countries had achieved ISO 14001 certification[1], but ISO 14001 focuses on environmental

[1] See http://www.iso.org/iso/home/news_index/news_archive/news.htm?refid=Ref1491

sustainability and many firms remain still to make the move. This raises a question for firms yet to embark on the sustainability journey: what is an appropriate point of entry?

Although our conceptual framework (figure 5) is presented in a linear fashion this should not necessarily imply a linear progression. Of the reviewed studies, the great majority focus on the innovation activities of O*perational Optimisers*. There are several possible explanations for this. First, at the start of our period of study (1992) many firms innovated as a reaction to regulatory requirements. Second, new technologies and management innovations offered the opportunity to integrate sustainability thinking into existing operations and deliver efficiency savings and competitive advantages. Third, it is easier for firms to integrate sustainability thinking into existing systems rather than reinvent the way they worked.

Some firms, such as Desso (Howard *et al.*, 2012), have attempted to leap the chasm to *Systems Building* through a range of activities including the setting of audacious goals, investment in new technologies working with their suppliers, collaborating with new partners including policy making bodies, and integrating cradle-to-cradle principles throughout their operations. Similarly, start-ups may look to enter the model at any stage: for example, many social enterprises are founded specifically to support sustainable development and will launch as *Organizational Transformers* or *Systems Builders*. Others engage with SOI on a more piecemeal basis, in an ambidextrous fashion in which sustainability emerges at different rates within the firm.

But above all, what really defines whether or not an organization is in a particular context is not so much the activities it engages in or the tools it uses, but the extent to which sustainability principles underpin why the firm exists and what it does. The shift between contexts, then, reflects shifts in mind-set as much as it does a different way of innovating, a flip from 'reducing harm done' to 'doing no harm'. In other words, to aim for sustainability through zero negative impact if not making a net positive contribution (McDonough and Braungart, 2002; Klewitz and Hansen, 2011). As SOI progresses, it increasingly requires more integrated thinking, connecting a wider range of considerations than those that characterize traditional innovation. More progressive firms are looking to ensure that sustainability practices are embedded in all decisions and processes throughout the business and into wider society.

However, from a sustainability perspective (climate change, resource depletion, emissions, biodiversity loss, social equity and fairness etc.) it is apparent that optimisation cannot and will not deliver the changes necessary to reach the targets set by the World Business Council for Sustainable Development (WBCSD, 2010) and others. Firms ambitious to be sustainable must move beyond optimisation toward *Organizational Transformation* and *Systems Building,* contexts that challenge the dominant paradigm of diminishing unsustainability and directly address the need for fundamental institutional re-configuration in support of long-term social equity and environmental resilience (Brown, 2011).

Our findings suggest that SOI and traditional innovation have some commonalities – particularly in the context of *Operational Optimization* - firms with existing innovation capability are well positioned to make progress in this arena. Their already developed innovation capability is an important antecedent of their capability for *Operational Optimization*. Similarly, firms with experience of quality management systems such as Six

Sigma or ISO 9000 should relatively easily be able to integrate LCA or EMS. However, as firms move from left to right in the framework, new capabilities are required as SOI increasingly challenges the taken-for-granteds, processes and, role and functional competences of the profit-maximizing business (D'Amato and Roome, 2009). In particular, SOI requires the active involvement of a broader and more diverse network of actors than firms are customarily used to working with and in pursuit of an agenda of systems change, and so specific new capabilities are needed here (Van Kleef and Roome, 2007). Table 2 summarises innovation activities across the three contexts.

Table 2 About Here

Surprisingly, given the field's relative immaturity, a number of reviews of the literature have already been undertaken (table 3). The current study builds on these in several ways. Early reviews focus on the implications of eco-innovation, particularly in terms of R&D practice and how its prescriptions might be integrated into new product development (Winn and Roome, 1993; Johansson, 2000; Baumann et al. 2002). Later reviews reveal how the literature has burgeoned to reflect a better understanding of the multidimensionality of the phenomenon, the range of factors that drive it (Pereira & Vence, 2012) and the complexity of its management (Klewitz & Hansen, 2011; OECD, 2009). By 2009, the OECD noted that eco-innovations in manufacturing still tend to focus on technological advances but that more advanced firms had started to adopt new business models and alternative modes of provision. Klewitz and Hansen's (2011) review draws some attention to this multi-dimensionality, but limit their study to SMEs. They conclude that firms have a range of strategy options, that innovation takes a variety of forms, including degree of novelty and area of focus (process, product business model etc.); and, depending on their orientation, firms' SOI may be more or less strongly influenced by regulators or market conditions.

Reflecting continued evolution of the field, it is not until Schiederig et al's (2012) review and efforts toward conceptual clarification, that the social dimension of sustainability is acknowledged in reviews. This neglect of the social dimension by the academic literature is currently being addressed mostly by studies that consider social aspects in less-developed and developing economies, particularly in studies related to 'Bottom of the Pyramid' innovation (e.g. Prahalad and Hart, 2002; Prasad and Ganvir, 2005; Anderson and Billou, 2007; Anderson and Markides, 2007; Prahalad, 2010). Despite the fact that a number of international corporate sustainability platforms, notably The Global Reporting Initiative (GRI), and UN Global Compact have integrated social criteria into their frameworks, the social aspects of SOI appears to remain largely neglected in studies in developed economies.

Table 3 About Here (previous research)

In summary, the literature reflects an evolving body of work. The diversity of perspectives on SOI evident in previous reviews is also reflected in our findings: testament to the phenomenon's dynamism and the field's relative fragmentation and immaturity.

We offer a sense of a dynamic phenomenon. That is, SOI is not an event but something that happens over time calling into play the inter-twining of social, environmental and economic considerations, rendering SOI a complex activity. This has significant implications for a firm's capabilities; its networks of stakeholder relationships; its knowledge management (particularly its ability to acquire, assimilate and exploit new knowledge); its wider systemic

relations; its visionary leadership and culture for SOI; and, the integration of sustainability into products, services, practices and strategy.

The end-point has yet fully to be defined but it is clear that increasingly there is pressure for firms to move beyond 'doing less harm' to a reframed purpose for business firmly embedded in communities not separate from them. We also draw attention to the socio-technical potentiality of SOI: a narrow internal focus giving way to a broader systemic view as sustainability principles become deeply ingrained into organizational DNA. We developed a framework that integrates the range of diverse perspectives which present SOI, variously, as a series of small incremental steps in 'the right direction' all the way to something more radical, a disruptive transformation. Next, we distinguish between three different contexts of SOI which allows for a more nuanced understanding of the sustainability journey. Finally, we argue that the move through the framework requires a step-change in both mind-set and behaviour. It is about whole systems change in which companies, large and small, government agencies and international regulators, NGOs and other stakeholders collaborate to address the biggest problems with radical solutions.

LIMITATIONS AND FUTURE RESEARCH

Our objective has been to rigorously and objectively review the literature on SOI. Nevertheless, there are a number of limitations to this review which future research on SOI should seek to address.

The body of evidence

SOI literature is widely divergent and fragmented which presents challenges for synthesis and sensemaking. Only the smallest part of our sample came from top quality journals and, generally, SOI research is relatively immature, lacks a coherent body of literature, is limited in terms of quality and the substantive issue is dynamic and fast moving which means that scholarship can significantly lag practice. Under such circumstances, there is a case to be made for broadening the evidence search beyond the peer-reviewed literature into the grey literature cataloguing more contemporary practices. In our review, we tentatively explored the grey literature, even to the extent of analysing blogs, but lack of resources and methodological challenges prevented us from incorporating much evidence from this source.

Conceptualising and theorising SOI

The concept of sustainability exhibits plasticity: although Elkington's (1997) triple bottom line and WCED's (1987) notion of sustainable development are widely accepted, they are selectively applied in studies. Although our focus was on innovation activities, we also note a lack of theoretical development in the field: a focus on a widely dispersed, loosely connected domain describing how it is done rather than explicating precisely what it means. The fact that only 6 of the 100 academic papers were drawn from leading journals might suggest that SOI is still in search of theoretical legitimisation: the lack of strong theoretical foundations implies that it is hard to develop testable hypotheses, which reinforces the tendency for phenomenon driven, rather than theory-driven, work (Keupp and Gassmann, 2009). It is hoped that the framework and activities presented in this paper provide a basis for future theory-building.

We identify the context of *Systems Building* the dominant characteristic of which is a firm's preparedness to challenge the dominant paradigm through reframing the purpose of business. The assumption underpinning all of the studies we reviewed was that all this takes place in the context of continued economic growth. However, questions remain over the feasibility of

continued growth and whether or not re-configuration, re-framing and the consideration of alternative strategies to address the challenges of sustainability lead inescapably to considering degrowth (Brown, 2011). This need not be as antithetical to the precepts of neoclassical economic theory as first it might appear, pitting maximizing short-term profitability against longer term sustainability. First, there are those that argue that economic growth can be uncoupled from environmental degradation (Stubbs and Cocklin, 2008) and, second, the emergence of the idea of 'Net Positive Contribution' provides an enabling discourse that moves action beyond doing less harm: so, for Kingfisher, it is not just about preventing deforestation, but working toward net reforestation (Kingfisher, 2013), to put back more than is taken. Sustainability is treated as an equivalent end to economic value.

Relationships between activities

It is difficulty to draw conclusions on the basis of our review whether or not the activities we have identified exist in a hierarchy or if different configurations better suit different contexts or, indeed, what works and in what circumstances. There is not a one-size-fits-all model. Clearly, firms have a choice of options depending on local circumstances. In firms where sustainability is a contested philosophy, the 'low hanging fruit' may offer an appropriate point of entry – a series of quick wins to demonstrate the business case. In process and primary industries, for example, there may be stand-out issues such as emissions, resource degradation or social exploitation which, if addressed, could enhance those organizations' legitimacy. More large scale studies are required to tell us about the relative importance of and relationships between factors.

Excluded themes

To manage the process of the review within the resources available, we established a strict set of inclusion/exclusion criteria in our protocol. Necessarily, then, a number of important themes fell beyond the scope of this work. For example, our review makes clear that innovation for sustainability, because of its complexity and the integration of TBL considerations, raises a different set of challenges from 'traditional' innovation. To what extent, then, are a distinct set of competencies and capabilities required for SOI for sustainability as opposed to traditional innovation (e.g. Van Kleef and Roome, 2007)?

CONCLUSION

The literature on SOI remains immature and widely dispersed, but it is growing and beginning to find its way into top management journals, practitioner literature and blogs. By means of the proposed conceptual model, we have sought to make sense of this literature, and we argue that SOI is not a unitary concept but can be understood as a process guided by a set of principles. We synthesise previously published studies into a conceptual model of innovation practices related to becoming and being a sustainable business. Onto this synthetic model, we map SOI activities to assess the state of current knowledge and identify gaps and directions for future research. Both the model and identified practices provide an important heuristic for managers and policy makers to guide toward sustainability. We hope that this review and the theoretical framework developed will advance the SOI literature by helping scholars select themes and contexts that are appropriate for their research questions and designs.

FOOTNOTES

Footnote 1: Journals are ranked on a scale of 1 (lowest quality) to 4 (highest quality).
Footnote 2: Literature searching stopped in June 2012
Footnote 3: Multiple schemes have sought to establish common frameworks for reporting sustainability progress. These include the Global Reporting Initiative (www.globalreporting.org), the International Integrated Reporting Committee (http://www.theiirc.org/), the Carbon Disclosure Project (https://www.cdproject.net) and the Dow Jones Sustainability Index (www.sustainability-index.com).
Footnote 4: See http://www.dow.com/sustainability/goals/chemistry.htm
Footnote 5: Marcus Aurelius. BrainyQuote.com, Xplore Inc, 2013. http://www.brainyquote.com/quotes/quotes/m/marcusaure148739.html, accessed December 13, 2013

FIGURES

FIGURE 1: SEARCH STRATEGY

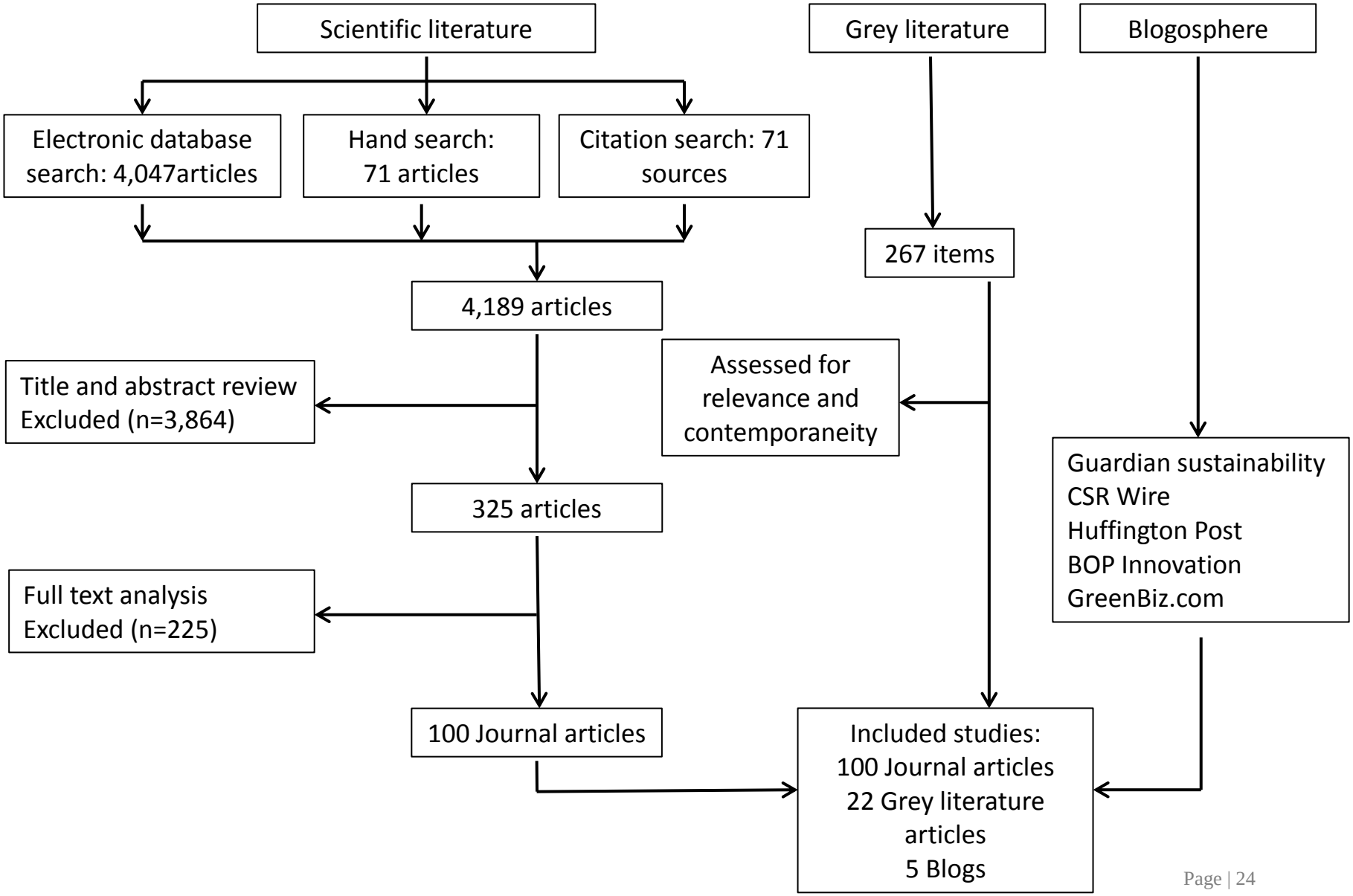

FIGURE 2: JOURNALS PROVIDING 2 OR MORE PAPERS (NUMBER OF PAPERS)

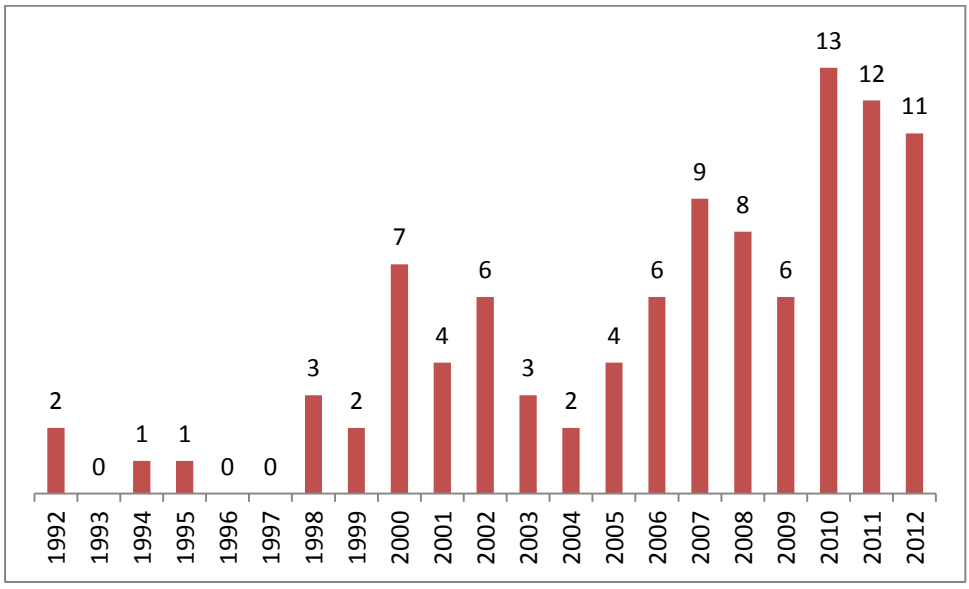

FIGURE 3: PUBLICATIONS PER YEAR, 1992 TO 2012

FIGURE 4: ANALYTIC DIMENSIONS

FIGURE 5: CONCEPTUAL MODEL OF SOI

TABLES

TABLE 1: DESCRIPTIVE STATISTICS

Country		**Sector**	
Multiple	31	Mixed-industrial	17
Netherlands	12	Mixed-various	16
UK	8	Electronics and ICT	14
USA	8	Manufacturing	13
Germany	7	Auto	9
Not specified	7	Consumer goods	8
Taiwan	5	Not specified	5
India	4	Chemicals	4
Sweden	4	Construction	4
China	2	Energy	2
Italy	2	Food and related services	2
Japan	2	Primary industries	2
Spain	2	Health and wellbeing	1
Canada	1	Pharmaceuticals	1
Ireland	1	Third sector	1
Korea	1	Tourism	1
Norway	1		
Russia	1	**Sustainability dimension**	
South Korea	1	Environmental	78
		Triple bottom line	12
		Social	10

TABLE 2: THE ACTIVITIES OF SOI

	Operational Optimization	Organizational Transformation	Systems Building
Product innovation	Efficiencies....Dematerialisation….Renewables....Recyclables….New platforms….Servitisation		
Innovation process	Existing innovation processes…Use tools like LCA to understand and reduce product impacts… Experiment with new innovation platforms (EMS, biomimicry, frugal/reverse innovation, industrial symbiosis)…Cradle-to-cradle and Closed-loop		
Institutional innovation	Work with regulators for product/process innovation……SOI at core of organizational vision…....Broaden networks to include NGOs, IAs, lobby groups etc.		
What will change	Emissions…Processes...Product…Product lifecycle…Supply chain...Servitisation... Business models…….Wider systems		
Involving whom	Production line…....R&D…….Cross-functional…….TMT……Immediate stakeholders…Customers….Wider socio-technical- Institutional- Community- Environmental- Ecosystems		
Extent of ambition	Easy wins……...……Experimentation……Radical solutions		

Opportunity identification	Regulations……..Efficiencies…..…Competitive advantage……..Lifecycle analysis…..…Knowledge networks……..Biomimicry…..…Bricoleurs……..BoP
Targets and guidelines	Set efficiency targets and policies (reduce waste/energy use by 20%)……..Set audacious goals: zero waste, net positive energy……..Change systems behaviour
Collaborations	Instil SOI internally……Extend into organizational ecosystem…..…Forge systemic partnerships

TABLE 3: PREVIOUS REVIEWS

Study	Purpose and period covered	Findings
Winn and Roome (1993)	Considers recent literature on R&D management responses to environmental challenge and also the implications of environmental concerns for R&D management practice	• R&D management and the environment described as being at a relatively early stage of development. • R&D management and the environment regarded in the literature as a set of tools and techniques rather than a strategic management issue • Emergent literature beginning to consider organizational and technological change.
Johansson (2000)	Review of literature to identify factors associated with the integration of eco-design into product development	Factors for successful integration of eco-design clustered into the following areas: • Management: support, goal-setting, strategy; • Customer relationships: customer focus and training; • Supplier relationships: close supplier relationships; • Development process: environmental factors articulated clearly and considered early in the process, integrated into regular R&D processes, use of support tools, use in cross-functional teams; • Competence: education and training of personnel, environmental specialists; • Motivation: champions, engagement, inclusivity and environmental mind sets
Baumann *et al.* (2002)	Review of the conceptual and empirical literature on green product development. 1970-1999	• Burgeoning in the literature on environmental product development (EPD) from about 1990; • Of the whole sample less than 10% was empirically based or tested; • Literature is fragmented and tends towards the normative or prescriptive; • Green product development is often treated in the literature as a new subject. The platform of departure is not current product development theory or practice; • Some articles question the importance of green products and the need for change of existing theories or current business practices; • Most references reflect a Western perspective. There is little emphasis on the

		developing countries and their specific environmental problems; • Ecological and environmental considerations in the product design process becoming mainstream, moving from a point where it was perceived by many to be anti-industry.
Del Brío and Junquera (2003)	To review the literature on environmental innovation management in SMEs – takes a strategy-oriented perspective	SMEs are different from MNEs and require specific support from Public Administrations to promote SOI. Determining factors of SMEs environmental strategy alternatives include: Financial resources; Organizational structure; Management style; Human resources; Environmental management status; Manufacturing activity; Technological approach; Innovative capacity and External cooperation.
Peloza (2009)	Examines business case for corporate social performance (CSP) from academic and practitioner literatures, and provides recommendations for managers who want to establish an optimal level of CSP investment for their company facilitated by measuring the impacts of CSP investment on financial performance.	Demonstrates a variety of fragmented metrics and measurement processes for CSP and consequent need for clarification of the value chain, from initiative to financial impact
OECD (2009)	To review relevant concepts and practices relating to Sustainable Manufacturing and Eco-innovation for policy and practitioner audience	• Practices for sustainable manufacturing have evolved from end-of-pipe solutions to a focus on product lifecycles and integrated environmental strategies and management systems • Sustainable manufacturing calls for multi-level eco-innovations: integrated initiatives such as closed-loop production can potentially yield higher environmental improvements but require appropriately combining a wide range of innovation targets and mechanisms. • Eco-innovations in manufacturing tend to focus primarily on technological advances, though some advanced players started adopting new business models or alternative modes of provision
Klewitz and	Systematic review of 82 peer	Develops a conceptual framework of SOI in SMEs, consisting of:

Hansen (2011)	review publications regarding sustainability-oriented innovation in SMEs. 1987-2010	• Strategic orientation: reactive, compliant, proactive, innovative • Degree of innovativeness: reactors are incremental, innovators more radical; • Predominant practices: from incremental process innovations to product and business model innovations • Mechanism of influence: reactors driven by regulation, innovators more influenced by and influencing collaborations and partnerships • External actors involved: governments and regulators, through value chain partners to knowledge institutions • Predominant driver: external regulation gives way to a market driven orientation
Schiederig *et al.* (2012)	Clarification of the concept "green innovation" and overview of the existing body of literature in the field of green innovations. 1990-2010	Finds range of synonymous terms, interchangeably used, for green innovation, including "sustainable innovation", "environmental innovation" and "ecological innovation" but found only minor conceptual differences. In both conceptualisation and operationalization, the ecological dimension is privileged over the social dimension. In the field of business, administration, finance and economics focus of study has been on economic topics on meso- or macro-level of innovation science (i.e. industry, national policy level) not managerial topics (i.e. intra-firm level). Identifies Journal of Cleaner Production as most prolific in the field
Pereira and Vence (2012)	To explore the determinants of eco-innovation at the level of the firm. 2006-2011	Identifies the following determinants of eco-innovation: • Sector: greatest activity observed in most polluting sectors; • Financial: eco-innovation not incompatible with business logic, impacts efficiency savings and competitiveness; • Market expectations: consumers are an increasingly important driver; • Technological capabilities: such as R&D; • Use of tools: adoption of environmental management systems and other tools such as life-cycle assessment and eco-labelling can positively influence eco-innovation
de Medeiros et al (2013)	To consolidate extant research on environmentally sustainable product	Presents a synthesis of the critical success factors and their constituent elements that influence environmentally sustainable innovation, four factors identified: • Market, law and regulation knowledge;

	innovation and to map critical dimensions of success factors that drive the success of products developed in this new logic of production and consumption. Dates not stated	• Interfunctional collaboration; • Innovation-oriented learning; • R&D investments

BOXES

BOX 1: BIOMIMICRY

Biomimicry, innovations inspired by nature, has become a source of design inspiration for a whole new industrial paradigm that seeks to work with the laws of nature, rather than against them (Benyus 1997). Biomimicry literally means 'to imitate life.' and the approach encourages innovators to ask the question "How does nature do it?" By learning from natural forms, processes and systems, innovators can extract design principles to help solve human sustainability issues (Chang, 2010). Biomimicry works at all three levels of the model described in this paper, helping to inform new products, organizational processes and entire systems.

For example, in terms of optimizing performance through increased efficiency, InterfaceFLOR, a global manufacturer of modular carpet tiles, looked to nature for design inspiration of a carpet tile, which has significantly reduced waste going to landfill, and increased company revenues. The design was inspired by the pattern of the forest floor which appears homogenous but actually consists of many unique parts, arranged in a pattern of 'organized chaos'. Using this design principle enables Interface's 'Entropy' carpet tile to be manufactured with a variety of patterns, and using different dye batches. Waste is eliminated during the manufacturing process, as well as during carpet installation itself. This tile has been the most popular product in the company's history, and has saved the company, as well as consumers, millions of dollars in avoided waste elimination costs (Anderson and White 2009).

Biomimicry has also inspired new approaches to decision-making within organizations. Nature provides many fascinating examples of group behavior; and social insects, such as ants and bees, which are highly organized, can exhibit useful, functional and intelligent outcomes which seem well beyond the capabilities, of any individual in the group. This is a phenomenon known as 'swarm intelligence' (Bonabeau and Meyer 2001). What is interesting about social insects, is that they are self-organized and decentralized. There is no master agent directing activities, and they function without supervision. Individuals interact according to simple rules, and the coordination of the swarm arises from the thousands of exchanges of information between individuals in the colony. This allows the group to be flexible and adapt quickly to internal and external conditions. Solutions to complex problems are robust and emergent, rather than pre-planned. Swarm intelligence generates algorithms that have been applied to solve complex problems for example in airline logistics, telecom networks, and internet applications. So called 'honey bee democracy' has also inspired goal-oriented decision-making in more collaborative management cultures (Seeley 2010).

Ideas from the natural world have also inspired new ways of thinking about wider production and consumption systems. These involve a shift away from the linear, take-make-waste models of the industrial paradigm, to circular systems such as cradle-to-cradle manufacturing (McDonough and Braungart, 2002), closed loop production (Abdallah et al., 2011), and circular economy principles (The Ellen Macarthur Foundation, 2013). The Cradle-to-Cradle (C2C) model, for example, aims to mimic the planet's natural cyclical nutrient flows, its use of solar energy, and its creation of diversity and abundance. In nature, for example, there is no such thing as waste: "waste= food", and materials are continuously recycled to nourish new organizms. Several companies have been inspired by C2C innovation, including

Interface, Desso, Herman Miller, Rhoner textiles.

Some of the principles underpinning cradle-to-cradle innovation include:

- Designing with ecological and human health in mind. This involves analyzing all the ingredients in the manufacturing process, and eradicating and phasing out all carcinogenic and other harmful chemicals.
- Developing a new framing of material flows in industry, and managing biological (organic) and technical (inorganic) nutrient flows in two separate cycles.
- Designing products with disassembly and the future use of products in mind; and refining the notion of recycling, into 'downcycling' and 'upcycling' value chains.
- Moving from a product to a service economy, in which products are reconceived as services that consumers can rent for a defined period, and which helps conserve resources.
- Promoting the concept of eco-effectiveness, which strives 'to do good' for people and planet, rather than eco-efficiency which aims 'to do less harm'.
- Preparing to learn: be adaptable and flexible to permit new ways to grow.
- Promoting fair labour practices and intergenerational responsibility.

BOX 2: SONY FUTURESCAPES

In 2011 Sony initiated a project to explore how technologies might be able to foster a better more sustainable world. It wanted to address sustainability issues, but it also sought to reframe the sustainability agenda in ways that were more inclusive, interesting and real for consumers, and to go beyond engaging with the usual 'green' audience. It went into a partnership with the NGO 'Forum for the Future' with expertise in scenario generation and future concept development.

Together they developed a 'FutureScapes' project, a collaborative initiative that brings together a range of technical experts, futurologists, designers, sustainability experts, writers and the general public across Europe to explore how technologies might redefine lifestyles in 2025. The year 2025 was chosen because it was considered close enough for feasibility, yet far away enough to stimulate people's imaginations.

The first stage of the project involved using different future scenarios to facilitate thinking beyond 'business as usual' and to spark innovative ideas. This exercise was not intended to predict the future, but rather imagine the future possibilities of technologies. A series of workshops were then held across Europe to build on debate and develop real innovations, inventions and ideas for a more sustainable future. The resulting innovations involved a new philosophy or mindset, a new product, a new platform, and a new place. The results from the collaborative initiative represent the mix of transformations that are needed to add up to a system innovation for more creative and sustainable lifestyles (Draper, 2013; Bent and Le Grand 2012).

BOX 3: A SYSTEMS INNOVATION STRATEGY: NIKE AND THE LAUNCH INITIATIVE

Nike is actively engaged in system-innovation because it recognizes that business is entering an era unprecedented risk and volatility, brought about by challenges such as resource scarcity, climate change, greater transparency and consumer demands. It realizes that current business models based on abundant raw materials, cheap labour and endless consumption, cannot be sustained over the long term. Its supply chain includes contracts with about 900 factories, and its operations use more than 16,000 materials. Environmental risks and social pressures therefore have the potential to undermine profits in major ways.

Nike has developed a system innovation strategy because it recognizes that the only effective long term solution is to play a role in changing the systems in which they operate. It has a team which focuses on shaping the system around the company to ensure its success in that system. It builds networks with others within and across its sector to create a shared vision on a number of system innovation initiatives and to generate new markets. And its system level initiatives are designed to take things to scale.

It is involved in several systems-building initiatives including a project to help transform its materials system. Some 60% of the environmental footprint of a pair of Nike shoes is embedded in the materials used to make them, so materials is a big issue for the company. It developed the Nike Materials Sustainability Index, which help designers select better materials, and has made this open source so that everyone can take up the approach.

However Nike also recognise that creating sustainable materials is too great a challenge for one company to tackle on its own. To get the level of innovation in raw materials, rethinking manufacturing to create a closed loop, new chemical approaches, and access and engagement with the consumer requires 'getting the whole system in the room' to develop more pioneering practices and to change the rules of the game.

Nike has thus entered a strategic partnership with NASA, USAID and the US State Department called LAUNCH that is promoting game-changing solutions to issues such as water, energy and health. Each year it announces an innovation challenge and then supports the best ideas and businesses submitted.

LAUNCH is currently involved in transforming the materials system. The global apparel industry is worth US $1trillion a year, and employs 40 million people. By 2015 it is predicted to produce 400 billion square metres of fabric a year. The current project, which started in 2013, brings together 150 experts in the materials supply chain to explore the challenges of the system, find leverage points and start to explore ways forward.

The 'bringing the system into the room approach' employs techniques such as gaming and system mapping to enable key actors work together to diagnose the key changes required to shift the system, such as consumer engagement, land-use and raw material innovation, green chemistry and closed-loop manufacturing. It helps generates promising new solutions and alliances, which are fed into the LAUNCH acceleration process so that they can be developed and brought to scale. Such networks can more effectively take solutions to scale, because key people such as designers or manufacturers are already part of the system (adapted from Draper, 2013).

REFERENCES

Abdallah, T., Diabat, A. & Simchi-Levi, D. (2011). Sustainable supply chain design: a closed-loop formulation and sensitivity analysis. *Production Planning & Control*, **23**, pp. 120-133.

Aguinis, H. & Glavas, A. (2012). What we know and don't know about corporate social responsibility. *Journal of Management*, **38**, pp. 932-968.

Alston, K. & Roberts, J.P. (1999). Partners in new product development: SC Johnson and the alliance for environmental innovation. *Corporate Environmental Strategy*, **6,** pp. 110-128.

Anderson, R. & White, R. (2009). *Confessions of a Radical Industrialist. How Interface proved that you can build a successful business without destroying the planet*. London: Random House Books.

Anderson, J. & Billou, N. (2007). Serving the world's poor: Innovation at the base of the economic pyramid. *Journal of Business Strategy*, **28**, pp. 14-21.

Anderson, J. & Markides, C. (2007). Strategic Innovation at the Base of the Pyramid. *MIT Sloan Management Review*, **49,** pp. 83-88.

Arratia, R. (2010). Sustainable innovation: think big, be open to new ideas and embrace successful failure. www.interfaceraise.com. Accessed 23 June, 2012.

Aschehoug, S.H., Boks, C. & Støren, S. (2012). Environmental information from stakeholders supporting product development. *Journal of Cleaner Production*, **31**, pp. 1-13.

B Corps. (2013). http://www.bcorporation.net/ (acessed 21/10/13)

Barroso, J., Gollop, C.J., Sandelowski, M., Meynell, J., Pearce, P.F. & Al., E. (2003). The challenges of searching for and retrieving qualitative studies. Western Journal of Nursing Research, **25**, pp. 153–178.

Barton, J. & Haslett, T. (2007): Analysis, Synthesis, Systems Thinking and Scientific Method: Rediscovering the Importance of Open Systems. *Systems Research and Behavioral Science* **24**, pp. 143-155.

Baumann, H., Boons, F. & Bragd, A. (2002). Mapping the green product development field: engineering, policy and business perspectives. *Journal of Cleaner Production*, **10,** pp. 409-425.

Baya, V. & Gruman, G. (2011). Sustainability: Moving from compliance to leadership. *Technology Forecast: A Quarterly Journal*, **4**, pp. 6-21.

Bent, D. & Le Grand, Z. (2012): *Breakthrough Innovation. Your Guide to Innovating for a Brighter Future*. Forum for the Future, London, UK. Available online at: http://www.forumforthefuture.org/blog/breakthrough-innovation-brighter-future (accessed 21/10/12).

Benyus, J.M. (1997). *Biomimicry: Innovation Inspired by Nature*, New York: HarperCollins.

Birkin, F., Polesie, T. & Lewis, L. (2009). A New Business Model for Sustainable Development: an Exploratory Study Using the Theory of Constraints in Nordic Organizations. *Business Strategy and the Environment*, **18**, pp. 277–290.

Blättel-Mink, B. (1998). Innovation towards sustainable economy - the integration of economy and ecology in companies. *Sustainable Development*, **6**, pp. 49-58.

Blowfield, M., Visser, W. & Livesey, F. (2007). Sustainability Innovation: Mapping the Territory. Cambridge.

Boiral, O. (2007). Corporate greening through ISO 14001. A rational myth? *Organization Science*, **18,** pp. 127-146.

Bonabeau, E. and Meyer, C. (2001): Swarm Intelligence: A Whole New Way to Think About Business. *Harvard Business Review*. **May**, pp. 106-114.
Borrini-Feyerabend, G. (1996) Collaborative Management of Protected Areas: tailoring the approach to the context. Gland, Switzerland, IUCN.
Borrini-Feyerabend, G. Pimbert, M. Favar, T. Kothari,A. Renard, Y. (2004): Sharing Power-learning by doing in the co-management of natural resources throughout the world. Gland, Switzerland, IUCN.
Bos-Brouwers, H.E.J. (2010). Corporate sustainability and innovation in SMEs: evidence of themes and activities in practice. *Business Strategy and the Environment*, **19**, pp. 417-435.
Bossink, B.A.G. (2002). A Dutch public-private strategy for innovation in sustainable construction. *Construction Management and Economics*, **20**, pp. 633-642.
Botsman, R. & Rogers, R. (2010). Beyond Zipcar: Collaborative Consumption. *Harvard Business Review*, **88,** pp. 30-30.
Bradbury, H. & Clair, J.A. (1999). Promoting sustainable organizations with Sweden‟s Natural Step. *Academy of Management Executive*, **13,** pp. 63–74.
Brown, K. (2011). Sustainable adaptation: An oxymoron? *Climate and Development*, **3**, pp. 21-31.
Buttol, P., Buonamici, R., Naldesi, L., Rinaldi, C., Zamagni, A. & Masoni, P. (2012). Integrating services and tools in an ICT platform to support eco-innovation in SMEs. *Clean Technologies & Environmental Policy*, **14,** pp. 211-221.
Carrillo-Hermosilla, J., Del Río, P. & Könnölä, T. (2010). Diversity of eco-innovations: Reflections from selected case studies. *Journal of Cleaner Production*, **18,** pp. 1073-1083.
Carson, R. (1962). Silent spring. Houghton Mifflin,
Chang, C.-H. (2011). The Influence of Corporate Environmental Ethics on Competitive Advantage: The Mediation Role of Green Innovation. *Journal of Business Ethics*, **104**, pp. 361-370.
Chang, Z.K. (2010). Biomimicry: Tool for Innovation at All Levels of Organization. Strategic Sustainability Consulting.
Chen, Y.-S., Chang, C.-H. & Wu, F.-S. (2012). Origins of green innovations: the differences between proactive and reactive green innovations. *Management Decision*, **50**, pp. 368-398.
Clark, G., Kosoris, J., Hong, L.N. & Crul, M. (2009). Design for Sustainability: Current Trends in Sustainable Product Design and Development. *Sustainability*, **1**, pp. 409-424.
Cohen, W.M. & Levinthal, D.A. (1990). Absorptive capacity: a new perspective on learning and innovation. *Administrative Science Quarterly*, **35**, pp. 128–152.
Cole, H., Freeman, C., Jahoda, M. & Pavitt, K. (1973). *Thinking about the future: A critique of the Limits to Growth*, London, Chatto and Windus.Conn, V., S,, Valentine, J.C., Cooper, H.M. & Rantz, M.J. (2003). Grey literature in meta-analyses. Nursing Research, **52**, pp. 256-261.
Cowell, S.J., Wehrmeyer, W., Argust, P.W. & Robertson, J.G.S. (1999). Sustainability and the primary extraction industries: theories and practice. *Resources Policy*, **25,** pp. 277–286.
D'Amato, A. & Roome, N. (2009). Toward an integrated model of leadership for corporate responsibility and sustainable development: a process model of corporate responsibility beyond management innovation. *Corporate Governance*, **9**, pp. 421-434.

Dangelico, R. & Pujari, D. (2010). Mainstreaming Green Product Innovation: Why and How Companies Integrate Environmental Sustainability. *Journal of Business Ethics,* **95,** pp. 471-486.

Day, G.S. & Shoemaker, P.J.H. (2005). Scanning the periphery. *Harvard Business Review,* **83,** pp. 135-148

De Marchi, V. (2012). Environmental innovation and R&D cooperation: Empirical evidence from Spanish manufacturing firms. *Research Policy,* **41**, pp. 614-623.

Dechant, K. & Altman, B. (1994). Environmental leadership: From compliance to competitive advantage. *Academy of Management Executive,* **8**, pp. 7-20.

Del Brío, J.A. & Junquera, B. (2003). A review of the literature on environmental innovation management in SMEs: implications for public policies. *Technovation,* **23**, pp. 939-948.

Del Río, P., Carrillo-Hermosilla, J. & Könnölä, T. (2010). Policy Strategies to Promote Eco-Innovation. *Journal of Industrial Ecology,* **14,** pp. 541-557.

De Medeiros, J.F., Ribeiro, J.L.D. & Cortimiglia, M.N. (2013). Success factors for environmentally sustainable product innovation: a systematic literature review. *Journal of Cleaner Production***,** (in press) http://dx.doi.org/10.1016/j.jclepro.2013.08.035.

Draper, S. (2013): *Creating the Big Shift: System Innovation for Sustainability.* Forum for the Future, London, UK. Available online at http://www.forumforthefuture.org/blog/creating-thebigshift-we-launch-our-new-report (accessed 21/10/13).

Dyer, J. Gregersen, H. & Christensen, C. (2011): *The Innovators DNA.* Harvard Business Review Press.

Elkington, J. (1994). Towards the sustainable corporation: win–win–win business strategies for sustainable development. *California Management Review,* **36**, pp. 90–100.

Elkington, J. (1997). *Cannibals with forks,* Oxford (UK): Capstone.

Elzen, B. Geels, F.W. & Green, K. (Eds) (2003). *System Innovation and the Transition to Sustainability. Theory, Evidence and Policy.* Cheltenhan UK: Edward Elgar Publishing.

Felson, M. & Spaeth, J.L. (1978). Community Structure and Collaborative Consumption. *American Behavioral Scientist,* **21,** pp. 614.

Freeman, C. (1995). The 'National System of Innovation' in historical perspective. *Cambridge*
Journal of Economics **19**, pp. 5-24.

Frondel, M., Horbach, J. & Rennings, K. (2004). End-of-pipe or cleaner production? An empirical comparison of environmental innovation decisions across OECD countries. ZEW Discussion Paper No. 04-82, ZEW. Mannheim, Germany: ZEW.

Fussler, C. & James, P. (1996). *Driving eco-innovation: A breakthrough discipline for innovation and sustainability,* London: Pitman.

Geels, T. (2003). Understanding Systems Innovations: A ciritical literature review and conceptual synthesis. In Elzen et al (2003). In Elzen, B. Geels, F.W. & Green, K. (Eds). *System Innovation and the Transition to Sustainability. Theory, Evidence and Policy.* Cheltenhan UK: Edward Elgar Publishing.

George, G., McGahan, A.M. & Prabhu, J. (2012). Innovation for Inclusive Growth: Towards a Theoretical Framework and a Research Agenda. *Journal of Management Studies*, **49,** pp. 661-683.

Giddings, B. Hopwood, B. & O'Brien, G. (2002). Environment, Economy and Society: Fitting them together into Sustainable Development. *Sustainable Development* **10,** pp. 187-196.

Gladwin, T.N., Kennelly, J.J. & Krause, T.S. (1995). Shifting paradigms for sustainable development: Implications for management theory and research. *Academy of Management Review,* **20**, pp. 874-907.
Gulbrandsen, L.H. (2005). Mark of Sustainability? Challenges for Fishery and Forestry Eco-Labeling. *Environment,* **47,** pp. 8-23.
Halme, M., Lindeman, S. & Linna, P. (2012). Innovation for Inclusive Business: Intrapreneurial Bricolage in Multinational Corporations. *Journal of Management Studies,* **49**, pp. 743-784.
Hansen, E.G., Grosse-Dunker, F. & Reichwald, R. (2009). Sustainability innovation cube - A framework to evaluate sustainability-oriented innovations. *International Journal of Innovation Management,* **13,** pp. 683-713.
Hart, S. (1995). A natural resource-based view of the firm. *Academy of Management Review,* **20,** pp. 986-1014.
Hart, S. (1997). Beyond Greening: Strategies for a Sustainable World. *Harvard Business Review,* **75,** pp. 66-76.
Hart , S. & Sharma, S. (2004). Engaging fringe stakeholders for competitive imagination. *Academy of Management Executive,* **18**, pp. 7-18.
Hellström, T. (2007). Dimensions of environmentally sustainable innovation: the structure of eco-innovation concepts. *Sustainable Development,* **15,** pp. 148-159.
Hollander, E.E. (2003). The noble art of demand shaping - how the tenacity of sustainable innovation can be explained by it being radical in a new sense. GIN2003 Innovating for Sustainability. 11th International Network Conference. October 12-15, San Francisco State University
Holmes, S. & Smart, P. (2009). Exploring open innovation practice in firm-nonprofit engagements: a corporate social responsibility perspective. *R&D Management,* **39**, pp. 394-409.
Howard, M., Jeanreneaud, S. & Correia, F. (2012). Desso and the Cradle-to-Cradle challenge: Rethinking carpet as a closed-loop supply system. University of Exeter Business School.
Huber, J. (2008). Technological environmental innovations (TEIs) in a chain-analytical and life-cycle-analytical perspective. *Journal of Cleaner Production,* **16,** pp. 1980-1986.
Jansson, P.M., Gregory, M.J., Barlow, C., Phaal, R., Farrukh, C.J.P., Probert, D.R. & So, V. (2000). Industrial Sustainability – a Review of UK and International Research and Capabilities. Cambridge: University of Cambridge.
Johansson, G. (2000). Success factors for Integration of Design in Product Development A Review of the State of The Art. Malmö: Eco Efficiency 2000: Towards Sustainable Economic Growth.
Joshi, S. (2010). Sustainable and inclusive innovation: Strategies for tomorrow's world. Confederation of Indian Industry.
Kaval, P. (2011). Measuring and valuing environmental impacts. A systematic review of existing methodologies. London; Ontario: Network for Business Sustainability.
Kesidou, E. & Demirel, P. (2012). On the drivers of eco-innovations: Empirical evidence from the UK. *Research Policy,* **41,** pp. 862-870.
Keupp, M.M. & Gassmann, O. (2009). The past and the future of international entrepreneurship: A review and suggestions for developing the field. *Journal of Management,* **35**, pp. 600-633.
Kingfisher. (2013). *Kingfisher Net Positive* [Online]. http://www.kingfisher.com/netpositive/index.asp?pageid=1 2013].
Klewitz, J. & Hansen, E.G. (2011). Sustainability-Oriented Innovation in SMEs: A Systematic Literature Review of Existing Practices and Actors Involved. *ISPIM*

Conference (International Society for Professional Innovation Management), Sustainability in Innovation: Innovation Management Challenges, June 2011.
Könnölä, T. & Unruh, G.C. (2007). Really changing the course: the limitations of environmental management systems for innovation. *Business Strategy and the Environment,* **16,** pp. 525-537.
Lamming, R., Faruk, A. & Cousins, P. (1999). Environmental soundness: a pragmatic alternative to expectations of sustainable development in business strategy. *Business Strategy & the Environment,* **8,** pp. 177-188.
Leadbeater, C. (2013): The Systems Innovator. Why Successful Innovation Goes Beyond Products. In Mulgan, G. & Leadbeater, C. *Systems Innovation. Discussion Paper*. Nesta. Available online at http://www.nesta.org.uk/publications/systems-innovation-discussion-paper (accessed 21/10/13).
Leonard-Barton, D. (1992). Core capabilities and core rigidities: a paradox in managing new product development. *Strategic Management Journal,* **13 Special Issue.** pp. 111-125.
Lent, T. & Wells, R.P. (1992). Corporate environmental management study shows shift from compliance to strategy. *Environmental Quality Management,* **1**, pp. 379-394.
Lewin, A. Long. C. & Caroll, T. (1999). The Co-Evolution of New Organizational Forms. *Organizational Science* **10**, pp. 535-550.
Linnenluecke, M.K. & Griffiths, A. (2010). Corporate sustainability and organizational culture. *Journal of World Business,* **45,** pp. 357-366.
Loorbach, D. (2007). *Transition management: new mode of governance for sustainable development.* Doctoral Thesis, Erasmus University Rotterdam.
Machiba, T. (2010). Eco-innovation for enabling resource efficiency and green growth: development of an analytical framework and preliminary analysis of industry and policy practices. *International Economics and Economic Policy,* **7**, pp. 357-370.
Maxwell, D. & Van De Vorst, R. (2003). Developing sustainable products and services. *Journal of Cleaner Production,* **11,** pp. 883-895.
McDonough, W. & Braungart, M. (2002). *Cradle to cradle: Remaking the way we make things,* London: North Point Press.
Meadows, D.H. (1999). Leverage Points. Places to Intervene in a System. The Sustainability Institute. Hartland VT USA. Available online at: http://www.sustainer.org/pubs/Leverage_Points.pdf
Meadows, D.H. (2009). *Thinking in Systems. A Primer*. London: Earthscan.
Melnyk, S.A., Sroufe, R.P. & Calantone, R. (2003). Assessing the impact of environmental management systems on corporate and environmental performance. *Journal of Operations Management,* **21,** pp. 329–351.
Mulgan, G. & Leadbeater, C. (2013): *Systems Innovation. Discussion Paper*. Nesta. Available online at http://www.nesta.org.uk/publications/systems-innovation-discussion-paper (accessed 21/10/13).
Nattrass, B. & Altomare, M. (1999). The Natural Step for Business. Wealth, Ecology and the Evolutionary Business. Gabrioli Island, Canada: New Society Publishers.
Nidumolu, R., Prahalad, C.K. & Rangaswami, M.R. (2009). Why sustainability is now a key driver of innovation. Harvard Business Review, (**September**), pp. 57-64.
OECD (2009). Sustainable Manufacturing and Eco-Innovation: Framework, Practices and Measurement Synthesis Report.
Pachecho, D. York. J. & Hargrave, T. (2011). The Co-Evolution of Industries, Social Movements, and Institutions: The Case of Wind Power. Academy of Management Annual Meeting Proceedings doi: 10.5465/AMBPP.2011.65869686 (Accessed 20/11/13).

Paramanathan, S., Farrukh, C., Phaal, R. & Probert, D. (2004). Implementing industrial sustainability: the research issues in technology management. *R&D Management,* **34,** pp. 527-537.
Partidario, P.J. & Vergragt, P.J. (2002). Planning of strategic innovation aimed at environmental sustainability: actor-networks, scenario acceptance and backcasting analysis within a polymeric coating chain. *Futures,* **34**, pp. 841-861.
Peloza, J. (2009). The challenge of measuring financial impacts from investments in corporate social performance. *Journal of Management,* **35**, pp. 1518-1541.
Peloza, J. & Shang, J. (2011). How can corporate social responsibility activities create value for stakeholders? A systematic review. *Journal of the Academy of Marketing Science,* **39**, pp. pp. 117-135.
Pereira, A. & Vence, X. (2012). Key business factors for eco-innovation: an overview of recent firm-level empirical studies. *Cuadernos de Gestion,* **12**, pp. 73-103.
Phaal, R., Jansson, P.M., McNamee, L.T., Chai, K.H., Farrukh, C.J.P., Probert, D.R., Canez, L.E., Hunt, F.H. & Fraser, P.V. (1999). Management of Knowledge and Technology for Sustainable Production. Final Report for DG XII, European Commission, by Cambridge University.
Porter, M.E. & Van Der Linde, C. (1995). Green and competitive. *Harvard Business Review.*, **(September/October),** pp. 120-134.
Porter, M.E. & Kramer, M.R. (2006). Strategy & Society: The Link Between Competitive Advantage and Corporate Social Responsibility. *Harvard Business Review,* **84,** pp. 78-92.
Prahalad, C.K. (2010). *The Fortune at the Bottom of the Pyramid: Eradicating Poverty Through Profits,* Upper Saddle River, New Jersey, Pearson Education, Inc. publishing as Wharton School Publishing.
Prahalad, C.K. & Hart, S.L. (2002). The fortune at the bottom of the pyramid. *Strategy and Business***, 26.** http://www.cs.berkeley.edu/~brewer/ict4b/Fortune-BoP.pdf.
Prasad, V.C.S. & Ganvir, V. (2005). Study of the principles of innovation for the BOP consumer — the case of a rural water filter. *International Journal of Innovation & Technology Management,* **2,** pp. 349-366.
Pujari, D., Wright, G. & Peattie, K. (2003). Green and competitive: Influences on environmental new product development performance. *Journal of Business Research,* **56,** pp. 657-671.
Reid, A. & Meidzinski, M. (2008). Eco-Innovation. Brighton: Sectoral Innovation Watch, Technopolis Group. Brighton: Sectoral Innovation Watch, Technopolis Group.
Reynolds, M. (2008): Getting a Grip. Critical Systems for Corporate Responsibility. Systems Research and *Behavioural Science*. **25,** pp. 383-395.
Rockstrom, J. et al (2010): A Safe Operating Space for Humanity. *Nature* **461,** pp.472-475
Roome, N.J. (1998). *Sustainability Strategies for Industry. The Future of Corporate Practice*. Washington D.C. Island Press.
Roome, N.J. (2011). A Retrospective on Globalization and Sustainable Development: The Business Challenge of Systems Organization and Systems Integration. *Business and Professional Ethics Journal* **30,** pp. 193-227.
Sardinha, I.D., Reijnders, L. & Antunes, P. (2011). Using corporate social responsibility benchmarking framework to identify and assess corporate social responsibility trends of real estate companies owning and developing shopping centres. *Journal of Cleaner Production,* **19,** pp. 1486-1493.
Schiederig, T., Tietze, F. & Herstatt, C. (2012). Green innovation in technology and innovation management – an exploratory literature review. *R&D Management,* **42**, pp. 180-192.

Seebode, D. (2011): *Sustainable Innovation. Exploring a New Innovation Paradigm*. Philips. Available online at: http://www.philips.com/shared/assets/global/sustainability/downloads/sustainable_innovation_paper.pdf

Seebode, D., Jeanrenaud, S. & Bessant, J. (2012). Managing innovation for sustainability. *R&D Management,* **42**, pp. 195-206.

Seeley, T. (2010). Honeybee Democracy. Princeton: Princeton University Press.

Senge, P.M. & Carstedt, G. (2001). Innovating our way to the next industrial revolution. *MIT Sloan Management Review,* **2,** pp. 24–38.

Shrivastava, P. & Hart, S. (1995). Creating sustainable corporations. *Business Strategy and the Environment,* **4,** pp. 154-165.

Simanis, E. & Hart, S. (2009). Innovation From the Inside Out. *MIT Sloan Management Review,* **50**, pp. 77-86.

Simon, M., Poole, S., Sweatman, A., Evans, S., Bhamra, T. & Mcaloone, T. (2000). Environmental priorities in strategic product development. *Business Strategy and the Environment,* **9,** pp. 367-377.

Stafford, E. & Hartman, C. (2001). Greenpeace's 'Greenfreeze Campaign': Hurdling cometitive forces in the diffusion of environmental technology innovation. *In:* Green, K., Groenwegen, P. & Hofman, P. (eds.). London: Kluwer Academic Publishers.

Stubbs, W. & Cocklin, C. (2008). Conceptualizing a "Sustainability Business Model". *Organization & Environment,* **21**, pp. 103-127.

Sukhdev, P. (2012). The Corporate Climate Overhaul. *Nature,* **486**, pp. 27-28.

Taylor, P.L. (2005). In the Market But Not of It: Fair Trade Coffee and Forest Stewardship Council Certification as Market Based Social Change. *World Development,* **33,** pp. 129-147.

The Ellen Macarthur Foundation. (2013). *http://www.ellenmacarthurfoundation.org/* [Online].

Tranfield, D., Denyer, D. & Smart, P. (2003). Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. *British Journal of Management,* **14,** pp. 207-222.

Tukker, A. (2004). Eight types of product–service system: eight ways to sustainability? Experiences from SusProNet. *Business Strategy and the Environment,* **13**, pp. 246-260.

Tukker, A., Charter, M., Vezzoli, C., Sto, E. & Andersen, M. (2008). *System Innovation for Sustainability,* UK, Greenleaf Publishing.UN (2005). World Summit Outcome, Resolution A/60/1, adopted by the General Assembly on 15 September 2005.

UN Global Compact & Accenture (2013). CEO Study on Sustainability 2013. Architects for a Better World. Accenture and UN Global Compact. Available online at: http://www.accenture.com/Microsites/ungc-ceo-study/Documents/pdf/13-1739_UNGC%20report_Final_FSC3.pdf

Van Kleef, J.a.G. & Roome, N.J. (2007). Developing capabilities and competence for sustainable business management as innovation: a research agenda. *Journal of Cleaner Production,* **15**, pp. 38-51.

Vergragt, P. & Van Der Wel, M. (1998). Backcasting: an example of sustainable washing. *In:* Roome, N. J. (ed.). Washington DC: Island Press.

Waddock, S. & Mcintosh, M. (2011). Business Unusual: Corporate Responsibility in a 2.0 World. *Business & Society Review,* **116**, pp. 303-330.

Wagner, M. (2008). Empirical influence of environmental management on innovation: Evidence from Europe. *Ecological Economics,* **66,** pp. 392-402.

WBCSD (2010). Vision 2050. The new agenda for business. Conches-Geneva, Switzerland: World Business Council for Sustainable Development www.wbcsd.org.

WCED (1987). Our Common Future. *World Commission on Environment and Development.* Oxford, United Kingdom: Oxford University Press.

Whiteman, G. Walker, B. Perego, P. (2012). Planetary Boundaries: Ecological Foundations for Corporate Sustainability. *Journal of Management Studies* **50,** pp. 307-336.

Winn, S. & Roome, N. (1993). R&D management responses to the environment: current theory and implications to practice and research. *R&D Management,* **23**, pp. 147-160.

WWF (2013). *Water Stewardship. Perspectives on Business Risks and Responses to Water Challenges.* Gland: WWF International. Available online at: http://wwf.panda.org/?210092/Water-Stewardship--Perspectives-on-business-risk-and-responses--to-water-challenges

Zhu, Q., Sarkis, J. & Lai, K.-H. (2011). Green supply chain management innovation diffusion and its relationship to organizational improvement: An ecological modernization perspective. *Journal of Engineering & Technology Management,* **29,** pp. 168-185.