

## **SUSTAINABILITY-ORIENTED INNOVATION: A SYSTEMATIC REVIEW**

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### **Abstract**

This article is intended as a contribution to the ongoing conceptual development of Sustainability-Oriented Innovation (SOI) and provides initial guidance on becoming and being sustainable. We organize and integrate the diverse body of empirical literature relating to SOI and, in doing so, develop a synthesized conceptual framework onto which SOI practices and processes can be mapped. SOI involves making intentional changes to an organization's philosophy and values, as well as to its products, processes or practices to serve the specific purpose of creating and realising social and environmental value in addition to economic returns. A critical reading of previous literature relating to environmental management and sustainability reveals how little attention has been paid to SOI and what exists is only partial. In a review of 100 scholarly articles and 27 grey sources drawn from the period of the three Earth Summits (1992, 2002 and 2012), we address four specific deficiencies that have given rise to these limitations: the meaning of SOI, how it has been conceptualised, its treatment as a dichotomous phenomenon and a general failure to reflect more contemporary practices. We adopt a framework synthesis approach involving first constructing an initial architecture of the landscape grounded in previous studies which is subsequently iteratively tested, shaped, refined and reinforced into a model of SOI with data drawn from included studies: so advancing theoretical development in the field of SOI.

Keywords – Sustainability-oriented innovation; Systematic review; Framework synthesis

### **Introduction**

Growing concern about resources over-consumption, environmental degradation and social inequity have resulted in calls for a transition toward a more sustainable society and economy. The first mass-readership environmental book detailing the scale of damage

wrought on nature by humanity was Fairfield Osborne's (1948) classic *Our Plundered Planet*. Other more, or less, apocalyptic studies followed (e.g. Carson, 1962, Cole et al., 1973, Meadows et al., 1972), their fears and ideas echoed in institutional environmental initiatives such as The International Union for the Conservation of Nature and Natural Resources (IUCN, founded 1956), The United Nations Environment Programme (UNEP, 1972) and the launch of the World Conservation Strategy in 1980, the product of a collaboration between IUCN, UNEP and the World Wildlife Fund (WWF, 1980). The latter document showed, for the first time, that economic development and conservation are not incompatible. It was in the subsequent work of the World Commission on Environment and Development's Brundtland report (WCED, 1987), that the idea of sustainable development – “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” - became more mainstream. Elkington (1997) popularized the notion of sustainable development in terms of the *Triple Bottom Line* (TBL) in which businesses are exhorted to adopt a responsible approach and give equivalence to environmental, social and economic dimensions in decision-making.

Markets and economic agents have been identified as either part of the problem, thus requiring changes to the dominant economic paradigm (Mittelstaedt and Kilbourne, 2008) or part of the solution, positioned to effect positive change in the direction of sustainability (Mittelstaedt and Kilbourne, 2008, UN, 1999, Desrochers and Hoffbauer, 2009, Simanis and Hart, 2009). Either way, business has been encouraged to find means of achieving sustainable economic growth, and so the role of innovation in helping businesses transition to sustainability has received considerable interest from academics, managers and policy makers (EYGM, 2012, OECD, 2010a, UNDP, 2010, Hall, 2002). Sustainability-Oriented Innovation (SOI) involves making intentional changes to an organization's philosophy and values, as well as to its products, processes or practices to serve the specific purpose of creating and realising social and environmental value in addition to economic returns. A critical reading of previous literature relating to environmental management, sustainability and innovation reveals how little attention has been paid to SOI (Doherty et al., 2014) and what exists is often deficient in four respects.

Firstly, within the existing literature it remains uncertain precisely what sustainability means or how it can be achieved. A variety of conceptualisations exist (Elkington, 1994; Gladwin et al., 1995; Fussler and James, 1996; Blättel-Mink, 1998; Blowfield et al., 2007; Bos-Brouwers, 2010; George et al., 2012) and a confusing array of labels applied to (aspects of) the phenomenon, including, but not exhaustively: corporate social responsibility, green-, eco- or ecological innovation, social environmental management and, responsible innovation (Owen et al., 2013; Carroll and Shabana, 2010; Seebode et al., 2012). Second, previous work tends to treat sustainability dichotomously (sustainable/not sustainable), rather than embedding SOI as a dynamic, unfolding process that is achieved over time. Third, with some notable exceptions (e.g. Klewitz and Hansen, 2013), previous work often overlooks the social dimension (Schiederig et al., 2012) of SOI. Fourth, many reviews of environmental management and sustainability exclude contemporary grey evidence and are thus prone to time lag and incompleteness of search.

The purpose of this article is to present the evidence on SOI through identifying, analysing and synthesising firm level SOI practices and processes and provide guidance on becoming and being sustainable. In so doing, we attempt to address the deficiencies highlighted above. To achieve this, we employ a novel review approach involving three stages:

- (1) *Stage 1: Developing an initial ‘architecture’ for reviewing SOI:* drawing on theories of environmental management and of innovation in fields cognate to sustainability, we sketch the basic building blocks of an *initial* conceptual framework of SOI, its underlying assumptions and key dimensions.
- (2) *Stage 2: Systematic review of SOI.* We systematically review (Tranfield et al., 2003) the literature on SOI published between 1992 and 2012. We choose these dates as they mark an era when business began seriously to engage in the sustainable development debate, highlighted by their role in the 3 Earth Summits 1992, 2002, and 2012. **(Footnote 1)**
- (3) *Stage 3: Framework synthesis.* We adopt a framework synthesis methodology for our systematic review in which the initial framework from stage 1 is iteratively developed as it is tested, shaped, reinforced and refined by findings from included studies (Barnett-Page and Thomas, 2009, Dixon-Woods, 2011, Thomas et al., 2013).

We propose a model of SOI that commences, as a response to regulatory stimuli, with incremental change at the firm level and culminates with radical change at a large-scale systems level. We argue that to move through the framework requires a step-change in philosophy, values and behaviour and that this is reflected in the firm’s innovation activity. The article concludes with a discussion of the implications of findings for scholarship, policy and practice, and identifies opportunities for further research.

### **Stage1: Developing an initial ‘architecture’ for reviewing SOI**

The importance of innovation in refreshing products and services, renewing the organisation, even ensuring its survival is seldom disputed. Innovation is also mobilised to pursue environmental and social objectives. One key sustainability question is: “What are the innovation activities firms engage in to become sustainable?” The question implies organizational change over time, a dynamic process with different models of activity playing a dominant role in each (Hargrave and Van de Ven, 2006). Sustainability is not about *either/or*: rather, sustainability is about *becoming*, an idea usefully captured by the journey metaphor (Mohrman and Worley, 2010).

To address this question, we first construct an ‘initial architecture’ by drawing on and integrating two theoretical perspectives from cognate fields: the innovation activities of firms (e.g. D’Este et al., 2012), to give ‘Dimensions of SOI’ and theories of environmental management (e.g. Kolk and Mauser, 2002), to give a temporal aspect, or ‘Contexts of SOI’ (see figure 1). This architecture provides the starting point for our evidence synthesis which follows the framework synthetic approach (Barnett-Page and Thomas, 2009, Dixon-Woods, 2011, Thomas et al., 2013), and we build on these bodies of literature to take better account of the wide range of innovation activity, dynamic and contextual possibilities (e.g. Schiederig et al., 2012) to provide a more complete picture of SOI.

#### *Dimensions of SOI*

The mainstream study of innovation for environmental and social benefit is young, yet its relatively rapid growth has already prompted a number of reviews. Research to date reveals important dimensions of SOIs but has excessively focused on a limited range of innovation types (products and technologies) predominantly in the realm of environmental challenges.

Table 1 summarises previous reviews in fields cognate to sustainability, and is organized according to the innovation area of focus with which each study is predominantly concerned: product innovation; product and process innovation, and; product, process and organizational innovation. This organization reveals the field's rather narrow, product-centric origins and subsequent evolution to include more diverse innovations implemented and impacting in different contexts.

We draw on these studies to provide dimensions of SOIs in our conceptual framework. Three dimensions emerge: technical/people; stand-alone/integrated, and; insular/systemic. These dimensions are discussed below and illustrated in see figure 1.

Area of focus	Findings (Studies)	SOI dimension (example)
Product innovation or NPD	<ul style="list-style-type: none"> <li>• Environmental NPD an emergent phenomenon, principally regarded as a set of tools, techniques and hardware</li> <li>• SMEs' environmental innovation predominantly technological, internally-focussed and incremental</li> <li>• Firms lack, but require, a strategic orientation to NPD &amp; environmental challenges</li> <li>• NPD taking place in isolation from its context</li> <li>• Environmental NPD seldom linked to other processes inside the company, nor to processes outside the company</li> <li>• Need for functional departments (R&amp;D, marketing, operations etc) to act together in an integrated way with external stakeholders for successful environmentally-related NPD (Winn and Roome (1993); Baumann et al. (2002); Johansson (2002); del Brío and Junquera (2003))</li> </ul>	<ul style="list-style-type: none"> <li>• Technical (tools, techniques and hardware)</li> <li>• Insular (internal-focus)</li> <li>• Integrated (linking across functions)</li> <li>• Stand-alone (isolated NPD)</li> </ul>
Product and process innovation	<ul style="list-style-type: none"> <li>• Innovations focus mostly on technological development but are facilitated by non-technological changes</li> <li>• Practices are evolving from 'end-of-pipe' solutions to integrated environmental strategies</li> <li>• External stakeholders within firm's value chain becoming involved</li> <li>• More challenging sustainability goals require multiple targets to be addressed, by wide range of mechanisms in different contexts</li> <li>• Eco-innovation can be strategically and competitively advantageous, not simply a cost to the business (OECD (2009); Pereira and Vence (2012))</li> </ul>	<ul style="list-style-type: none"> <li>• People (non-technological change)</li> <li>• Stand-alone (end-of-pipe technologies)</li> <li>• Systemic (external stakeholders)</li> <li>• Integrated (strategically and competitively advantageous)</li> </ul>

<p>Product, process and organizational innovation</p>	<ul style="list-style-type: none"> <li>• Interaction with external actors increases as sustainability behaviour becomes more strategic and market oriented</li> <li>• Firms adopt different response modes to sustainability challenge</li> <li>• The most active exponents of SOI interact extensively with external actors and effecting transformations on a systemic level</li> <li>• Many SMEs mostly engage in incremental innovation</li> <li>• Business model innovation emerges as enabler of radically changing processes, products, and organizational forms in order to more successfully integrate sustainability into core business (Schiederig et al. (2012), Klewitz and Hansen (2013))</li> </ul>	<ul style="list-style-type: none"> <li>• Systemic (external actors and wider systems)</li> <li>• Integrated (strategic and market orientation)</li> <li>• People (business model innovation)</li> </ul>
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*Table 1: Previous reviews of innovation in fields cognate to sustainability*

### **Technical---people**

The literature to date has been dominated by a technically-focused, product-oriented view of innovation, promoting incremental adjustments in practice to attend to environmental challenges. For example, Winn and Roome (1993) conclude that R&D management and the environment is represented in the literature as a set of tools and techniques rather than a strategic management issue: Baumann et al. (2002) observe increased understanding within firms of ‘tools’ - any systematic means for dealing with environmental issues – in the product development process. Contrasting with this is a more recent focus on people-centred innovation, in which sustainability is treated as a socio-technical challenge affecting a cluster of elements including, for example, technology, regulation, user practices and markets, cultural meaning, infrastructure, and supply networks (Geels, 2005). The technical responses that characterize early SOI literature have become supplemented or supplanted by fundamental transformations at different levels of socio-technical systems. Some ‘advanced players’, OECD (2009) report, innovate in domains beyond the technical, such as adopting new business models or replacing products with services which represent alternatives, or additions, to primarily technological solutions, suggesting that the focus is not just technological, but also on how innovations are used, who they involve and how they impact behaviour change (Geels, 2004).

### **Stand-alone---Integrated**

This dimension is internal to the firm and describes the extent to which SOI thinking extends across the firm: whether or not SOIs ‘stand-alone’ as increments to the dominant design (Abernathy and Utterback, 1978) associated, typically, with individual departments, functions or products, or are integrated widely through the firm. OECD (2009) provides evidence of a shift to a more strategically-oriented practice. They note how innovation for sustainable manufacturing has moved on from end-of-pipe, ‘stand-alone’ solutions to modes of practice that require sustainability to be more deeply embedded in the culture of the firm: for example, through the effective adoption of product lifecycle thinking, integrated environmental strategies and environmental management systems. That is, SOI moves from being an ‘add-on’ activity to diffusing and suffusing throughout the organization as strategic sustainability behaviour (Klewitz and Hansen, 2013, Schiederig et al., 2012, del Brío and Junquera, 2003).

### **Insular---systemic**

The insular/systemic dimension reflects the firm’s view of itself in relation to wider society. It is about whether or not innovations are internally-oriented, addressing internal issues, or are designed and targeted to impact a wider socio-economic system beyond the firm’s immediate boundaries and stakeholders. Baumann et al. (2002) observe that firms’ environmental product development processes are seldom linked to other processes outside the company. More progressive SOI firms are described as looking beyond their boundaries, engaging with and facilitating change in wider systems and engaging with diverse actors, possibly including



forming coalitions with stakeholders such as NGOs, lobby groups and governments (Schiederig et al., 2012, OECD, 2009, Pereira and Vence, 2012).

Figure 1: SOI dimensions



### Contexts of SOI

Kolk and Mauser (2002) reviewed 50 firm-level, stage/phase models and typologies of environmental management published between 1987 and 2000. In the period following, more models have been proposed, reflecting a continuing desire for better understanding and clearer insight into how organisations become sustainable.

These models have evolved from simple linear representations to more elaborate taxonomies reflecting context and activity. However, they remain limited by their relatively static view of the world: a general failure to recognise that, over time, firms may look to extend the levels and nature of their response (Kolk and Mauser, 2002). Furthermore, they tend to be limited either by their largely conceptual or anecdotal origins or, in the case of empirical studies, methodological quality. Typically, this means that models directly or indirectly suggest categorisations unique to each individual study. So, for example, models are inconsistent with respect to the point of departure, number of stages, stage duration, transitions through stages and end point. These characteristics limit generalizability and make cumulative and comparative work difficult. Nevertheless, from these models, which typically consist of between three and five categories, we are able inductively to derive three distinct contexts of activity as described below.

Mostly, models adopt an intra-firm perspective in which a firm's sustainability orientation is passive, reactive and incremental or pro-active in integrating and embedding sustainability into strategy. For example, (Hart, 1995) describes a three-category model. Initially the focus is on *Pollution Prevention*, focusing on end-of-pipe methods to continuous improvement to reduce emissions; next is *Product Stewardship* in which the use of tools (e.g. Life-Cycle Analysis) is integrated into the firm's product-development process; the final category is *Sustainable Development* in which a strong sense of social-environmental purpose provides the backdrop for the firm's corporate and competitive strategies. More recently, Baya and Gruman (2011) have described a *Sustainability Maturity Path*, a four-part journey in which sustainable practices are adopted along a trajectory mapped from *Compliance* through

*Obligation* and *Efficiency to Leadership*. However, even in *Leadership*, in which sustainability is embedded in every part of the business and economic, environmental, and social impacts are equally and intelligently weighed, activity remains internally-focused.

In more recent models, sustainability is seen as a systems level problem in which some of the challenges are simply too great for any single organization to tackle alone (Lamming et al., 1999). In this sense, SOI ultimately must address and impact on a diverse set of external issues, collaborators and stakeholders (Florida, 1996). A small number of models include this ultra-firm perspective. Berry and Rondinelli (1998) describe three categories, *Non-Compliance*, *Compliance* and *Beyond Compliance*: *Beyond Compliance* is characterised as a new industrial revolution reflecting changes in the perceptions of legislators, government regulatory officials, business leaders, and environmental interest groups of their own and of each other's roles. Tukker and Butter (2007) describe a three-category model commencing with *System Optimization* (e.g. fuel efficiency, low-emission technologies) and *Singular Innovations* (changing elements of the production/consumption chain) culminating with *Systems Level* innovations which focus on societal needs or functions and the systems that determine how these are fulfilled (e.g. spatial planning and transport infrastructure).

Based on this analysis, we propose three initial contexts of SOI activity, initially labelled *Reactive*, *Embedding*, and *Systems change*. Integrating these with the Dimensions of SOI generates our initial architecture of the field. It is *initial* in the sense that it provides an *a priori* framework onto which we map innovation activity data from studies identified for this review.

Initially, the model was conceived as presented in figure 2 but, as we accumulated SOI activities, and consistent with the framework synthetic method (Barnett-Page and Thomas, 2009, Dixon-Woods, 2011) it was iteratively developed, applying the data to the framework and the framework to the data in a process of model refinement, enrichment and validation to produce our final model (see figure 3).

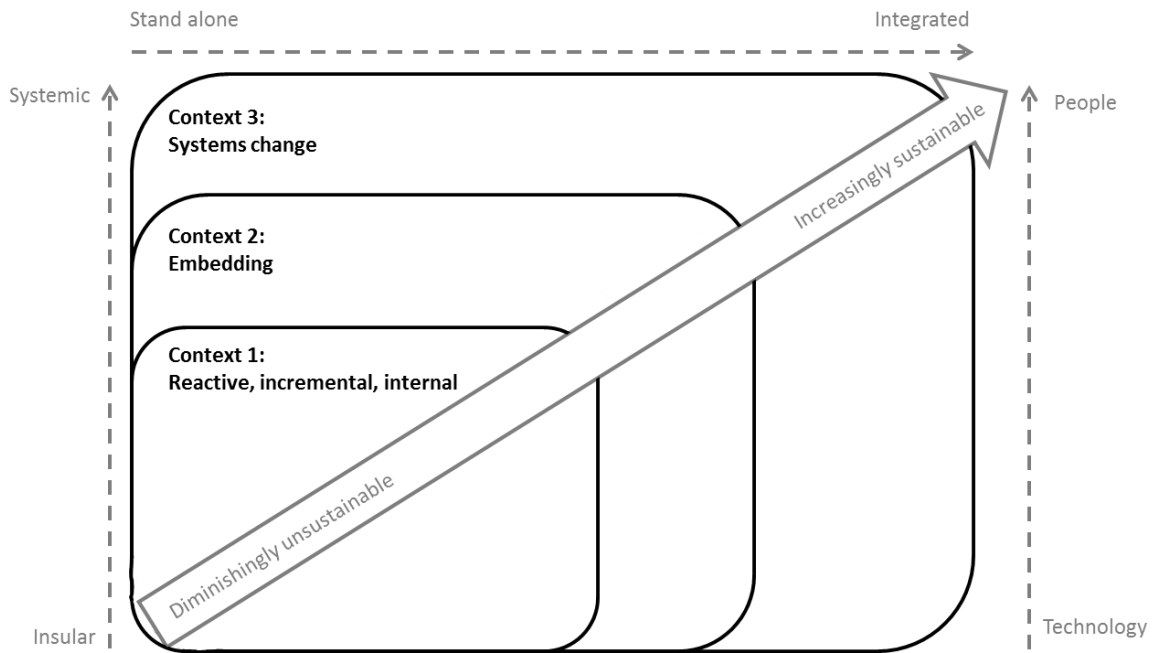


Figure 2: Initial model of SOI

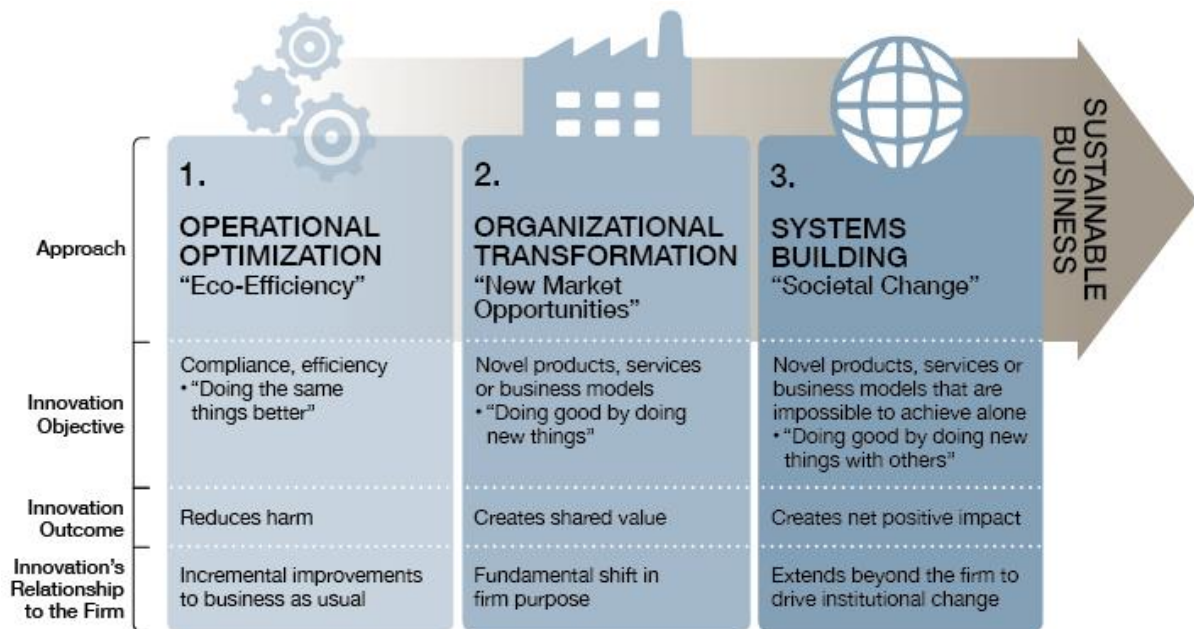


Figure 3: Final model of SOI

## **Stage 2: Systematic review of SOI**

Denyer and Tranfield (2009) describe five steps in producing a systematic review: Question formulation; Locating studies; Study selection/evaluation; Analysis/synthesis, and; Reporting /using results. Focusing on the first four, our review approach was as follows:

### *Question formulation*

Research scope, question and inclusion/exclusion criteria and protocol were established in dialogue between the research team and a guidance committee consisting of academic and industry experts. Following discussion, the research question was settled as “What are the innovation activities firms engage in to become sustainable?”

### *Locating studies*

Our search strategy (figure 4) consisted of looking for relevant studies in the scientific and grey literature. An initial literature scoping helped identify keywords and search strings relating to innovation and sustainability which, with guidance committee support, was developed and refined over a number of iterations. A range of electronic databases including EBSCO Business Source Complete, IBSS, ISI Web of Knowledge and JSTOR was searched.

A supplementary, multi-layered strategy was adopted to search the grey literature including hand-searching, seeking expert recommendations, snowballing, cross-referencing, technical and specialist online databases selected on the basis of reputation, currency and authority as well as search functionality (e.g. United Nations; WWF; European Commission; World Business Council for Sustainable Development; Global Reporting Initiative) as well as five blogs, again, using authority and reputation as the yardstick for inclusion.

### *Study selection and evaluation*

Evaluation is not simply a mechanism for excluding evidence on the basis of its quality, but is about appraising and reporting what is included to allow conclusions to be drawn about the reliability of findings (Denyer and Tranfield, 2009).

We bound our study in the period 1992-2012, book-ended by the Rio Earth Summits. During this period, the foundations of sustainable business practice began to be laid, reflected in the establishment and/or growth of many influential platforms and initiatives, including: the World Business Council for Sustainable Development (1991); The Global Reporting Initiative (1997); business and consumer certification systems e.g. the Forest Stewardship Council (1993); the United Nations Global Compact (2000); international environmental and social standards for business, e.g. the ISO 14000 (1990s) and 26000 series (2010); and, various sustainable business think tanks, strategy and consultancy groups e.g. Volans (2008) and blog sites e.g. the Guardian Sustainable Business Blog (2010).

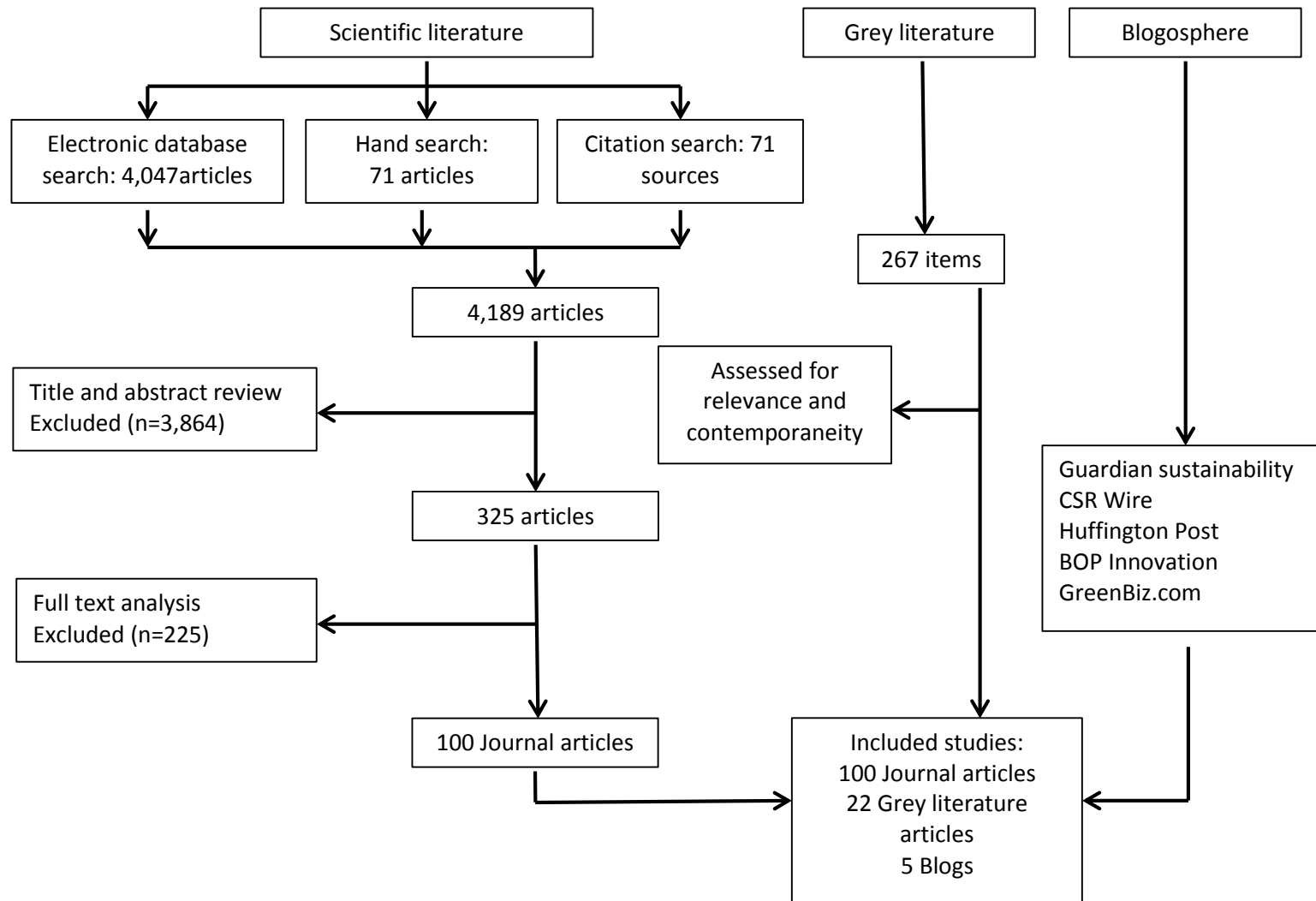
For the two types of source material (academic and grey) a dual and pragmatic approach to selection and evaluation was adopted. No studies were excluded on the basis of quality; rather, relevance – that the innovation described directly addresses at least one of the three components of the *Triple Bottom Line* (Elkington, 1997), people, planet profit, but not profit alone - was the important inclusion criterion. This approach is consistent with the notion of fit-for-purpose evidence (Boaz and Ashby, 2003, Gough, 2007, Briner et al., 2009) in which quality appraisal can be subordinate to the objective of a review: the important consideration is the contribution of the evidence to synthesis and understanding (Pawson, 2006, Pawson et al., 2004, van Aken and Romme, 2009).

To establish generalizability and reliability of findings (Gough, 2007, Denyer and Tranfield, 2009), and using journal ranking as proxy indicator of quality and Reay et al.'s (2009) hierarchy to assess strength of evidence, studies were evaluated after selection.

For various reasons, some researchers have been reluctant to include grey literature in systematic reviews: the process can be resource intensive (Benzies et al., 2006) and concerns over quality can distract from scholarly ambitions (Müller-Seitz, 2012, Goduscheit and Jørgensen, 2013). However, including the grey literature can bring benefits (Hopewell et al., 2007) including addressing the problems of time lag to provide more contemporary, relevant and contextually important findings as well as providing evidence for “the wisdom of practice,” which may not be reflected in the scientific literature (Benzies et al., 2006, Winn and Roome, 1993). Thus, our rationale for including the grey literature is twofold. First, it is grounded in having the utility for practice of our findings in mind. Second, from the observation that of the scholarly studies included, the average lag from study to publication was four years thus raising the real possibility that many contemporary practices were not included in the scholarly literature.

The selection process largely followed that 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.

Figure 4: Search strategy



### *Analysis and synthesis*

We adopted a framework synthetic approach. Framework synthesis is similar to framework analysis (Pope et al., 2007), a matrix-based technique for data analysis in primary qualitative research involving the *a priori* construction of thematic categories into which data can be coded (Ritchie and Spencer, 2002). Framework synthesis is an adaptation of this and has been used to conduct syntheses with similar *a priori* specification of a coding framework (Barnett-Page and Thomas, 2009, Carroll et al., 2011). The approach is particularly suited to addressing questions related to the attributes of activities (Gough et al., 2012, Oliver et al., 2008).

Our initial framework is drawn from an extensive reading of the environmental management and innovating for social and environmental benefit literatures, lending it legitimacy (Dixon-Woods, 2011). The studies informing the development of the initial framework were excluded from the subsequent systematic review, thus limiting potential for method variance (Chang et al., 2010).

Data were extracted to a specially designed spreadsheet pro-forma. Included studies were coded according to bibliographic characteristics, study design, quality, strength of evidence and innovation activities. Grey literature coding focused on innovation activities.

Using the Dimensions and Contexts of SOI as a guide, SOI activities were mapped onto the framework and simultaneously categorised according to established categories in the innovation management literature (e.g. Adams et al., 2006, Tidd and Bessant, 2009), namely:

- Strategy: organizational and management processes aligned to deliver sustainability;
- Innovation process: the organization of the innovation process to deliver sustainability, from searching for new ideas to converting them into products and services and capturing value from them;
- Learning: recognizing the value of new knowledge, assimilating and applying it to support sustainability;
- Linkages: internal and external linkages crafted as opportunities for learning and influencing around sustainability;
- Innovative organization: work organization arrangements that create the conditions within which SOI can take place (e.g. enabling structures, communications, training and development, leadership and, reward and recognition)

Disagreements were resolved by discussion.

### *Descriptive summary*

We, like others (e.g. Baumann et al., 2002, Klewitz and Hansen, 2013, Schiederig et al., 2012), find the scholarly literature to be widely distributed, of variable quality, immature, and skewed.

*Widely distributed:* Of the academic literature, 100 articles selected from 55 separate journals are included (**footnote 2**). Thirty-six journals provide one article each, and 18 journals provide two or more. Two journals, *Business Strategy and the Environment* and *Journal of Cleaner Production*, accounted for over one quarter of the included scholarly studies.

*Variable quality:* Academic studies were evaluated using the Association of Business Schools (ABS) journal rankings (**footnote 3**) for 2010 as a proxy for quality and assessed against Reay et al.'s (2009) evidence hierarchy, and found to be of variable quality. Only seven studies came from journals rated 4 in the ABS rankings, 16 from journals rated 3, 27 from journals rated 2 and, 8 from journals rated 1. The remaining 42 articles derive from journals not included in the ABS rankings. Reay et al.'s (2009) evidence hierarchy consists of six levels, where 1 is the strongest level of evidence and 6 the weakest. Our sample of studies consists exclusively of evidence of levels 3 (Comparative, multisite case studies or large-sample quantitative studies: 32 studies), 4 (Small-sample, single-site qualitative or quantitative studies: 45 studies) and 5 (Descriptive studies and/or self-report stories: 23 studies).

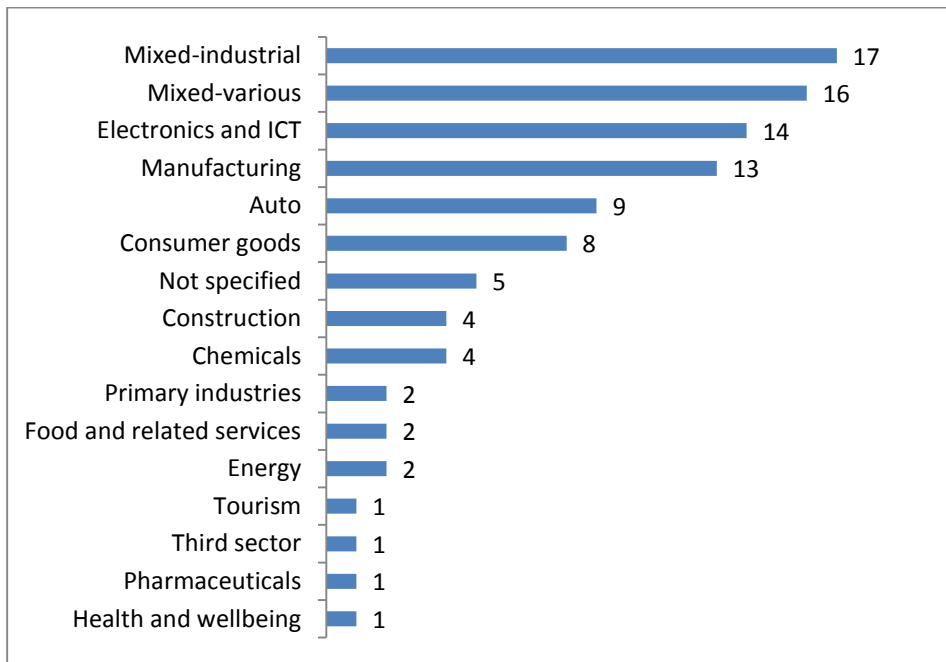
*Immature:* Sixty-eight (of 100) studies are small sample or single case, largely focused on empirical discovery and description. Top quality journals provided only seven studies. These observations suggest an immature field lacking a coherent and cumulative body of literature and theoretical development (Burgess et al., 2006, Mäkinen and Seppänen, 2007).

*Skewed:* Within our sample, the service and consumer goods sectors are under-represented and manufacturing and process industries over-represented (figure 5). This reflects a focus on environmental considerations in the manufacturing context and on technical processes, with work largely done by scholars in science and engineering.

In terms of the grey literature, we uncovered a rich stream of evidence including, conference papers, reports, teaching- and consultancy-based case studies, histories, individual stories of SOI and prescriptions relating to innovative activity that seemingly were not represented in the scientific literature — at least not in a timely fashion. We identified a short list of 267 grey items, subsequently reduced to 27 (five books/chapters, one case study, three conference papers, 11 reports/practitioner press, one thesis and five sustainability blog posts).

*Figure 5: Selected studies by industry*





### Stage 3: Framework synthesis: Final model of SOI

#### *(1) Innovation activities of operational optimization*

Operational Optimization reflects an internally-oriented perspective on sustainability, referring to a ‘doing the same things but better’ approach directed toward reducing harm through reactive, incremental improvements driven by compliance or proactively pursuing efficiencies. These are activities characteristically technical, stand-alone and insular.

#### **Strategy**

The argument that adopting sustainable social and environmental policies is competitively disadvantageous to firms has been challenged by Porter and Van der Linde (1995) amongst others (e.g. Pelozo, 2009, Pelozo and Shang, 2011). Strategically, the focus of innovation activity in operational optimization lies within the firm’s boundaries: the targets for change are internal. Principal drivers include responding to regulatory requirements (compliance) and the pursuit of efficiency gains through new practice adoption. SOI becomes more proactive when reactive innovation becomes uneconomic; e.g. when add-on solutions incur costs greater than the cost of process redesign (Alston and Roberts, 1999). The sustainability outcome is a reduction in harm per unit of production which is achieved through utilising existing innovation processes and without compromise to existing business models.

## **Process**

The innovation process focuses on incremental improvements, oriented to a single issue and related to “technical-fixes” as the way to reduce impacts while maintaining business as usual. Examples include: reducing the intensity of resource use, better waste management or pollution capture/control, recycling (Dangelico and Pujari, 2010, Alston and Roberts, 1999, Bossink, 2002, Chen et al., 2012); (re-)designing product content and packaging (Shrivastava and Hart, 1995, Clark et al., 2009, Alston and Roberts, 1999); product miniaturization (Chen and Subramian, 2010), and; using decision tools and aids to integrate environmental thinking into NPD such as through dematerialization or eco-design (Simon et al., 2000, Maxwell and van de Vorst, 2003, De Marchi, 2012). The application of tools, of which there are many and which range in purpose, complexity and ease of use, enables users to evaluate sustainable materials and sustainable design alternatives and relate them to financial incentives, environmental regulations or the demands of clients (Bossink, 2002).

## **Learning**

SOI is rendered uniquely complex by the requirement to integrate diverse knowledge relating to economic, social and environmental considerations: this makes SOI an information and learning challenge, making new knowledge and knowledge management essential. Firms with effective knowledge management processes can exploit these to support SOI (Ayuso et al., 2011), and focus on: exploiting existing knowledge management capabilities to identify and access relevant knowledge; unlearning existing knowledge that contradicts sustainability principles (Bossink, 2007, Magnusson et al., 2003); filling competence gaps through training, targeted recruitment or importing expertise (Geffen and Rothenberg, 2000, Petruzzelli et al., 2011), and; integrating diverse elements of sustainability by issuing guidelines and monitoring compliance (Zwetsloot, 2001).

## **Linkages**

The necessary linkages in the context of operational optimization are those that connect line workers and managers with the necessary knowledge to effect the changes appropriate to comply with legislation and regulation. Typically, such knowledge does not exist within the firm, especially in regard to sustainability tools, and external knowledge experts may be required to help navigate and implement these (Conway and Steward, 1998, Lee, 2009).

## **Innovative organization**

Operational Optimization is achievable through mobilising existing innovation capabilities. Any already-developed innovation capability can be an important antecedent of SOI capability (Ayuso et al., 2011). Innovation activities directed in this way can be a stepping-stone toward increasing firm-level sustainability, e.g. by contributing to the beginnings of an empowering SOI culture throughout the firm (Peloza, 2009). This can be enhanced if internal communications are reframed to focus on sustainability, such as by incorporating the sustainability message (Reed, 2002), establishing clear goals at the product level (Petala et al., 2010) and securing the involvement (Florida et al., 2001) and motivation of line workers (Sandström and Tingström, 2008).

Shrivastava and Hart (1995) noted that 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. Moving beyond Operational Optimization requires a more radical approach that renders innovation more complex and ambiguous.

## *(2) Innovation activities of organizational transformation*

Innovation activity for Organizational Transformation represents a fundamental shift in mindset and purpose from ‘doing less harm’ to creating shared value and delivering wider benefits for society: ‘doing good by doing new things’. The context is characterised by a redefinition of internal and external relationships that increasingly are conceived in terms of environmental and social impacts. Returning to the three dimensions of the SOI framework, activities are characteristically more people-oriented, more deeply integrate sustainability within the organisation and are less insular. It remains largely internally-oriented suffusing and diffusing sustainability throughout the organization but extends to immediate stakeholders too.

### **Strategy**

In this context innovation and sustainability are deliberately orchestrated within the firm, implying a growing SOI culture in which sustainability is no longer regarded as an add-on, but rather is/becomes embedded as a cultural and strategic norm. The strategic shift towards “doing good” offers opportunities for innovation in business concepts and practices, constituting a shaping logic that goes beyond an internal, operational focus on ‘greening’ to a more external and strategic focus on sustainable development (Hart, 1997).

A clearly articulated sustainability strategy can act as a trigger for innovation (Ayuso et al., 2011, Huang and Wu, 2010). For example, Bendigo Bank’s strategy is to improve the prospects of its customers and communities first, on the basis that doing the right thing by customers and communities results in strong community support for the Bank, and therefore sustainable growth in shareholder value (Stubbs and Cocklin, 2008).

Our review also reveals that the social dimension of sustainability emerges more strongly in the Organizational Transformation context. This is predominantly realised by organizations serving new markets with novel, sustainable products and also making products and services available to communities disadvantaged or isolated for reasons of geography, infrastructure or income (Carrillo-Hermosilla et al., 2010, Prahalad, 2012, Ray and Ray, 2011, Viswanathan and Sridharan, 2012). This observation is drawn from studies focused on sustainable innovation in developing economies, often related to bottom-of-the-pyramid innovation (e.g. Hart and Christensen, 2002, Prahalad, 2010).

## **Process**

Where Operational Optimisers may successfully leverage existing innovation processes, this may not be a useful approach for Organizational Transformers where more radical innovation may be required (Sandström and Tingström, 2008). Here the innovation process is often driven by the personal values and aspirations of concerned business leaders themselves (Dyllick and Hockerts, 2002); this can have a profound impact on organizational values and culture, as documented by Anderson and White (2009) in the case of Interface.

The innovation process can be enhanced for SOI through the adoption of new platforms and new knowledge sources. To stimulate more radical innovations, firms are drawing inspiration from a range of new sources, including: biomimicry (Benyus, 1997), a design science approach meaning “to imitate life”. For example InterfaceFLOR looked to nature for design inspiration for their ‘Entropy’ range which resulted in significantly reduced waste going to landfill, and increased company revenues (Anderson and White, 2009). Backcasting (Natrass and Altomare, 1999), involves envisaging a desired end state and working backwards from that to discover and design the necessary intermediate steps to reach that point. Other techniques include systematically looking to identify, explore, and integrate the views of stakeholders from the ‘fringes’ (Hart and Sharma, 2004) specifically including community action groups, social entrepreneurs and activists (Mulgan et al., 2007). 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 absorptive capacity (Cohen and Levinthal, 1990), reaching out and bridging to new communities of stakeholders (Hollander, 2003).

Innovation practice in bottom-of-the-pyramid markets has seen the emergence of new innovation platforms such as reverse innovation, jugaad innovation and resource constrained innovation. Reverse innovation describes a trickle-up effect, where innovations are first used in developing countries and then applied in developed countries (Immelt et al., 2009, Govindarajan, 2012). Frugal or resource-constrained innovation occurs where resource inputs are minimized with the purpose of reducing the end product’s cost without loss of quality (Zeschky et al., 2011). Similar to this is jugaad innovation, from a Hindi word that translates roughly as “an innovation fix,” referring to harnessing ingenuity to locate opportunities and improvise simple solutions (Radjou et al., 2012).

## **Learning**

Organizational Transformers recognise the importance of leadership and of the external knowledge that resides in value chains: interactions with both suppliers and customers can contribute to successful SOI (Conway and Steward, 1998). SOI driven by regulation may not result in added value, but engaging with key stakeholders of the firm can positively impact a firm’s SOI (Ayuso et al., 2011). In the case of the automotive industry, for instance, Geffen and Rothenberg (2000) demonstrated the importance of developing partnering arrangements to allow suppliers and assembly plant to work together effectively to exploit and implement complementary skills and competencies to improve the environmental performance of assembly plants. Bringing customers' input to the process, such as through sales force

proximity, market research, extensive charting and in-depth analysis of customer needs (Milliman et al., 2012), provides another mechanism for identifying where the value added from environmental innovation can be found (Foster and Green, 2002).

### **Linkages**

The emphasis in the literature is on how firms develop and exploit external linkages in pursuit of sustainability objectives. These linkages include developing new networks into their wider value chains and stakeholder networks and, in particular, into supply chains to develop long-term collaborative approaches with external partners. Whereas technological innovations reduce or eliminate impacts at a product level, in the long-term, a collaborative approach is necessary to make the whole supply chain sustainable (Stubbs and Cocklin, 2008).

Compared to other innovations developed by the same firm, SOI activity is characterized by higher levels of both inter- and intra-organizational collaboration (Petruzzelli et al., 2011). New relationships up and down value chains promoting collaborations for adapting processes to respond to sustainability are evident (Baya and Gruman, 2011). In contrast to Operational Optimization, the focus shifts from local activity to activity amongst the firm's immediate stakeholders, including: exploring new opportunities at inter-sectoral interfaces (Mirata and Emtairah, 2005, Lettice and Parekh, 2010) and developing sustainable supply chains (Stubbs and Cocklin, 2008).

Considerable attention has been paid to Sustainable Supply Chain Management (SSCM), and we found evidence of organizations extending sustainability principles into their supply chains (e.g. Carrillo-Hermosilla et al., 2010, Zhu et al., 2010, Birkin et al., 2009, Huber, 2008). To achieve effective SSCM, long-term collaborations with external partners appear 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; performing environmental audits for suppliers' internal management; requiring suppliers' ISO 14000 / ISO 26000 certification; and, co-operating with customers on environmental objectives (Pujari et al., 2003, Zhu et al., 2011). Firms wanting to achieve the greatest sustainability impact may choose to target upstream supply chain initiatives, where the greatest damage occurs in the extractive and primary processing industries (Huber, 2008). At InterfaceFLOR (**Footnote 4**), 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 InterfaceFLOR's strategy of creating a more sustainable product (Arratia, 2010).

### **Innovative organization**

Innovative activity around internal and external communications helps embed sustainability. The literature particularly emphasizes the importance of top management support and line manager commitment for sustainability: explicit, clearly defined sustainability policies intertwined with overall firm strategy; communication of values and goals of sustainability that

reach beyond operational and eco-efficiencies (Huang and Wu, 2010, Pujari et al., 2003, Lee, 2009, Reed, 2002). The call for action, communications between departments, clarity of long-term goals and strategies and the importance of the sustainability agenda in the context of the business purpose, distinguishes this context from the reactive mode of Operational Optimization (Reed, 2002, Moors et al., 2005, Polonsky and Ottman, 1998).

The prevailing neoliberal economic paradigm privileges profit maximisation as the critical value dimension in firms' business models. Amongst Organizational Transformers, an emergent paradigm is evident: a business that ascribes value to social and environmental as well as economic considerations (Bertens and Statema, 2011, Esslinger, 2011, Stubbs and Cocklin, 2008, Dyllick and Hockerts, 2002). The precise nature of the sustainable business model remains unclear and, for Birkin et al. (2009) at least, no business claims to be fully realizing one. Nevertheless, a number of emergent types, such as social entrepreneurship (OECD, 2010b), and characteristics, such as treating nature as a stakeholder (Laine, 2010, Stubbs and Cocklin, 2008), have been identified.

Less radical business model innovation can mean changing the nature of the deliverable. This can be done in several ways, for example by designing "green" from the outset of the product development process (Sandström and Tingström, 2008) to focusing less on creating products and more on delivering services: this is a process of servitization where a tangible product is replaced with a service, and reflects one response to re-thinking how to meet needs while sustaining growth without costly social and environmental impacts (Tukker, 2004, Hansen et al., 2009).

For sustainability to be strategically embedded, reward systems and incentives need to reflect its centrality: linking individual and group reward systems to sustainability goals reflects corporate commitment and can help in shifting sustainability from a programmatic phenomenon to a corporate mindset (Lent and Wells, 1992, Blake, 2006, Baya and Gruman, 2011). Sustainability cultures can be built from the top-down — e.g. by embedding sustainability goals and objectives in strategic and operational plans — and from the bottom up — e.g. by being alert and responsive to and rewarding employees' SOI ideas and initiatives (Florida et al., 2001, Haanes et al., 2011).

Embedding sustainability metrics with financial reporting integrates sustainability as a core concern through the organization and can lead to better sustainability performance (Shrivastava and Hart, 1995, Sardinha et al., 2011). A globally accepted standard for peer-to-peer and industry benchmarking remains elusive, and so organizations adopt new reporting mechanisms either of their own design (Kaval, 2011), or by signing up to one or more of the initiatives striving to make sustainability reporting standard practice (**footnote 5**). Alongside new performance metrics (Lent and Wells, 1992), new structures and new lines of communication are instituted, supported with CEO backing and cross-functional management committees (Haanes et al., 2012).

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).

### *(3) The innovation activities of systems building*

Systems Building requires another radical shift in philosophy to thinking beyond the firm and reframing the purpose of business in society: 'doing good by doing new things with others'. A key feature is that sustainability cannot logically be thought of as an attribute of a single firm but can only properly be applied at the global level (Lamming et al., 1999), this puts linkages at the heart of SOI activity, as is reflected in the limited evidence we found.

The context is characterised by a shift toward networks of relations in which sustainability value is created collaboratively rather than individually (del Río et al., 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): "interconnected set[s] of innovations, where each influences the other, with innovation both in the parts of the system and in the ways in which they interconnect" involving many actors and institutions (Mulgan and Leadbeater, 2013; 4). In terms of sustainability, it can be seen as the "set of actions that shift a system – a city, a sector, an economy – onto a more sustainable path" (Draper, 2013; 11).

Because the concept of Systems Building reflects an unconventional economic paradigm, relatively few organizations or industries appear currently to occupy this space: at least, this is the impression given from the limited number of empirical scholarly papers we were able to identify (Loorbach et al., 2010, Seebode et al., 2012). Consistent with our objective of informing practice, we found it helpful to turn to the grey literature to provide instances of activities.

### **Strategy**

Being a Systems Builder means leaving behind the prevailing economic paradigm to reframe the purpose of the firm in society: a part of society, not apart from it. This moves beyond efficiency to effectiveness (McDonough and Braungart, 2002a). The perspective underpins a logic of wide collaborations and investing in systems solutions to derive new, shared value propositions from the entire socio-technical and ecosystem network to make a positive impact.

Because the ultimate objectives of sustainability lie beyond the individual capacity of firms to achieve, the role of Systems Builders becomes one of initiating, mobilizing, inspiring and leading change: business is uniquely placed, more than government or civil society, to lead on this (Hart, 2010). There is evidence of intimate, interdependent collaborations between perhaps previously unconnected actors, such as NGO's, industry associations and economic development organizations, emerging as a response (UN Global Compact & Accenture, 2013, Wagner, 2009). Such radical shift in philosophy and behaviour can present a considerable challenge for incumbent firms. The macro-level dynamics of the context constitute a socio-technical landscape, an exogenous environment beyond the direct control of organizations (Geels, 2005), but within their sphere of influence. Changes at the landscape level usually take place slowly, in the order of decades.

### **Process**

We found few scholarly studies reporting the innovation process amongst systems builders, and this remains a gap in the literature. The sorts of wide collaborations described above, though rare, involve developing workable relationships between a wide range of private, public and civil society partners (McDonough and Braungart, 2002a, UNDP, 2010). Where the sustainability challenges are of such scale that there is no single 'owner' of the problem and there is need to implement transformations aligned with the requirements of a more environmentally sustainable development, diverse collaborations usefully collectively define the problem and search for solutions (Mirata and Emtairah, 2005).

Firms are working in new platforms with collaborators. Examples include: Nike's LAUNCH open innovation platform, involving working with industry representatives, material scientists, governments, investors and consumer groups on sustainable materials; Unilever's Sustainable Living Plan, involving working with governments and NGOs on broader system transformation to tackle food, energy and health issues; and, Sony's initiative with Forum for the Future bringing together technical experts, futurologists, designers, sustainability experts, writers and the public to explore how technologies might redefine lifestyles in 2025 (Draper, 2013, Bent, 2012). Collaborations such as these broaden a firm's search activities and knowledge base, particularly in relation to picking up weak signals, to deliver innovations and also enhance social legitimacy (Holmes and Smart, 2009).

### **Learning**

Novel collaborations are important for systems builders for the dialogues they inspire, the legitimacy they endow, the opportunities for new knowledge acquisition and the creative and responsive solutions they stimulate. Shared value, in which the causes of eco- and social-systems are advanced as equivalents to economic returns are being addressed through these novel collaborations (Porter and Kramer, 2011). But, these opportunities may fail to be realised if firms lack the internal knowledge management processes to convert these into innovation (Ayuso et al., 2011).

Exploring the limitations of existing models of innovation in the context of working across and beyond traditional boundaries to realise new value configurations Seebode et al. (2012)



reflect on the case of Philips, the Dutch multinational. They find that more radical SOI projects follow novel pathways, involve external partners and new configurations of knowledge and that learning to work with new partners raises issues around ‘finding, forming and performing’ within new innovation systems.

In Loorbach et al.’s (2010) study of inter-firm relations amongst Dutch industrial collaborators, the concept of ambidexterity (Turner et al., 2012) is a helpful guide to understand how firms successfully experimented with and learned from multiple new approaches to sustainability in a ‘shadow track’. While simultaneously maintaining existing business models the collaborators: redefined products and services; restructured practices and organization to break away from technological and paradigmatic lock-in; and, developed a management approach integrating foresight and broader stakeholder collaboration. In these activities, they saw themselves as coevolving actors within a wider societal system pursuing radical innovation leading to increased sustainability.

### **Linkages**

Systems Building locates firms in an industrial ecology characterised by mutually-affecting interactions between multiple stakeholders embedded in networks, community, collaborations and partnerships (del Río et al., 2010). Industrial ecology calls for a radical shift from firms existing in isolation and in competition to integrated collaborations, new frameworks for working together with the potential to bring game-changing systemic innovation to sustainability challenges (Berry and Rondinelli, 1998).

For example, some of the most significant sustainable supply systems for natural resources, such as the Forest Stewardship Council and the Marine Stewardship Council, developed as a result of partnerships of industry groups, social and environmental NGOs and the public (Gulbrandsen, 2005, Taylor, 2005). We also note the coming together of previously implacable protagonists such as Greenpeace and Foron, to develop and market an ozone- and climate-safe refrigerant (Stafford and Hartman, 2001), or between WWF and Lafarge that led, amongst other things, to the latter’s decision not to pursue plans to build the UK’s biggest super quarry on an unspoiled Scottish island (Seitanidi, 2007). In a Swedish multi-sectoral initiative, the Landskrona industrial symbiosis program brought together more than 20 firms and three public organizations to find novel solutions to sustainability challenges (Mirata and Emtairah, 2005).

In this way, Systems Builders are increasingly engaging in constructive dialogues with multiple stakeholders rather than simply acting on their own. They require the ability to build, manage or participate in complex coalitions over time (WBCSD, 2010). They not only focus internally but also look to lead and inspire change in the wider societal, economic, technical and environmental management systems through strong and visionary leadership and the mobilization of dynamic capabilities. Much of this, though, remains aspirational or at least empirically untested.

## **Innovative organization**

At a conceptual level, the role of business in society has been reframed in a number of ways and the scholarly and grey literature introduce novel rhetoric around this. Chang (2010), for example, suggests moving away from metaphors of war and competition, which can (inappropriately) inform leaders' decision-making, and instead use metaphors that describe businesses as part of a co-operative community based on relationships. In line with this, new business paradigms are emerging. The 'Benefit Corporation' or 'B Corp', emerging in the US in 2010, is one striking example of the role of business reframed. The B Corp has created a new legal form allowing firms 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" and certified B Corps are required to make decisions that have a positive material impact on society and the environment: "...not just to be the best in the world, but to be the best for the world" (B Corps, 2013). A growing community of  $\geq 1,100$  Certified B Corps from 37 countries and 121 industries now exists (B Corps, 2013). 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 purpose (Waddock and McIntosh, 2011).

Other examples include, 'closed-loop production' (Abdallah et al., 2011) and 'circular economy' (The Ellen MacArthur Foundation, 2013): restorative industrial models that move away from 'take, make and waste' to active recovery (e.g. waste, heat, water, energy or other resources) reuse and return of end-of-life products, at which point they can be disassembled and recycled into new products. Also emerging is the 'net positive contributor' model (McDonough and Braungart, 2002b), that promotes adding greater value to society and the environment than is extracted.

### *Summary*

A framework was devised for examining the activities of innovating for sustainability. The organising logic for the framework was the context for innovation in which activities progressively shift from being internally-oriented, incremental and efficiency-focused to being more radical and systemic. The framework provides structure for bringing together and understanding findings on innovation activities from a diverse literature. These are complex concepts becoming reified in corporate practice as new business models and new forms of value creation. They reflect new and extensive partnerships reaching deep and wide across social, institutional, regulatory and stakeholder strata, and wider cultural change beyond the capacity of enterprises to control but the development of which they can motivate, inspire and mobilise: these findings are summarised in table 2.

*Table 2: Activities of Sustainability-Oriented Innovation*

	<b>Operational optimization: Doing more with less</b>	<b>Organizational Transformation: Doing good by doing new things</b>	<b>Systems Building: Doing good by doing new things with others</b>
<b>Strategy</b>	<ul style="list-style-type: none"> <li>• Comply with regulations or pursue efficiency gains</li> </ul>	<ul style="list-style-type: none"> <li>• Embed sustainability as a cultural and strategic norm in a shaping logic that goes beyond greening</li> </ul>	<ul style="list-style-type: none"> <li>• Logic of wide collaborations and investing in systems solutions to derive new, co-created value propositions</li> </ul>
<b>Process</b>	<ul style="list-style-type: none"> <li>• Focus on internal and incremental innovation facilitated by use of tools</li> </ul>	<ul style="list-style-type: none"> <li>• Adopt new values and platforms (e.g. reverse innovation) and new ideation practices (e.g. biomimicry)</li> </ul>	<ul style="list-style-type: none"> <li>• Adopt new collaborative process platforms with diverse stakeholders</li> </ul>
<b>Learning</b>	<ul style="list-style-type: none"> <li>• Exploit existing knowledge management capabilities to identify and access relevant knowledge</li> </ul>	<ul style="list-style-type: none"> <li>• Engage with key stakeholders of the firm – internal and external</li> </ul>	<ul style="list-style-type: none"> <li>• Develop ambidextrous skills enabling ‘shadow tracking’ and learning from experimentation with multiple new approaches</li> </ul>
<b>Linkages</b>	<ul style="list-style-type: none"> <li>• Recruit external domain experts for new knowledge</li> </ul>	<ul style="list-style-type: none"> <li>• Shift focus from intra-firm linkages to collaborations with immediate stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>• Get the whole system in the room to diagnose problems, understand system complexity, build trust &amp; identify levers for change</li> </ul>
<b>Innovative organization</b>	<ul style="list-style-type: none"> <li>• Exploit existing innovation capabilities</li> </ul>	<ul style="list-style-type: none"> <li>• Embed SOI culture through the organization</li> </ul>	<ul style="list-style-type: none"> <li>• Adopt new business paradigms (e.g. B-Corps)</li> </ul>

## Discussion

This review, organised around the idea of sustainability as a journey, presents a representation of contexts of that journey and its characteristic activities. The focus is on practices which constitute day-to-day SOI activities. The literature does not allow us to conclude whether or not the journey is linear, or that firms cannot simultaneously pursue SOI activities that characterise more than one context. In that sense, we do not claim to offer a stages model, which requires categorical exclusivity, nor is it a typology as typologies cannot account for change over time (Kolk and Mauser, 2002).

Instead, we submit the model as a *Scientific Model* (Baden-Fuller and Morgan, 2010; 168), a “generic in-between kind[s]-of-description[s] that [is] neither general theory nor full empirical description”: it submits a quasi-laboratory in which scholars can generate concepts and theories and investigate empirical domains and for managers to understand how their world works in a practical sense.

We have found the academic literature to exhibit characteristics indicative of a field at an early stage of theoretical development (Burgess et al., 2006, Mäkinen and Seppänen, 2007): it is widely distributed, largely focused on empirical discovery and description and utilises a range of conceptual labels and definitions, many of which overlap but around which there is limited consensus. In Whetten’s (1989) terms, this is the *What* phase of theory-building. Here,

the variables, constructs and concepts logically to be considered part of the explanation of the phenomenon of interest emerge. The current study offers a theoretical contribution by moving knowledge beyond this state through the organization of disparate activities into a meaningful, dynamic framework more focused on *How*.

At the outset, we proposed addressing four deficiencies in the existing research: its meaning, conceptualisation, dichotomous treatment and failure to reflect more contemporary practices. Our focus has been on the literature published between 1992 and 2012, for reasons already explicated. However, it is valuable to reflect on how the literature has developed in the months following that cut-off and the extent to which it fits with or challenges our findings.

Consequently, we searched (March 2015) for the most recent literature on SOI using EBSCOHost (“sustainab\* AND innovation”, Abstracts, 2013-2015, Academic Journals). This returned, in total, 456 references. Using criteria established in the research protocol (i.e. language, focus on the substantive question, unit of analysis, empirical study etc), and following a review of abstracts, 19 were retained for further investigation. In light of these subsequent studies, the proposed SOI framework appears robust, but we make the following observations.

The articles published since the cut-off reinforce our original analysis that a diverse and skewed literature forms the basis of this review, from which three distinct contexts of SOI activity and practice are identified. However, a more coherent research and practice agenda that inter-twines firm, societal and environmental priorities may be emerging in the most recent contributions: in particular, around the themes of implementation, the systems perspective, business models and technological insufficiency.

*Implementation:* Increasing attention in the literature is being paid to the implementation of innovative solutions for sustainability. Hallstedt et al. (2013) propose a range of prescriptions for effectively embedding a strategic sustainability perspective in the product innovation process. Ceschin (2013) reflects on corporate, cultural and regulatory barriers that hinder the uptake of eco-efficient product-service system innovations finding, specifically, that implementation is influenced by a diversity of factors not just the technology itself. Silvestre and Silva Neto (2014) explore the impediments to the implementation of technological solutions in the Brazilian mining industry and, although noting the availability of technological solutions to these challenges, conclude that technology alone is insufficient. Instead, they report a largely passive and reactive industry many of whose members lack the knowledge, motivation, education or will, and who operate in a context characterised by a lack of enforcement of environmental regulations.

On the basis of the proposed SOI model, and in the absence of empirical studies, we can speculate that start-up firms and spin-outs could select their point of entry to the framework and design their organizations accordingly: e.g. many social enterprises are founded specifically to support sustainable development and will launch as Organizational Transformers or Systems Builders. Incumbent firms, however, will likely face a stiffer task

and may find it less disruptive to build from a basis of Operational Optimization. Keskin et al. (2013) provide some empirical support for our speculation. They describe start-ups attempting to take sustainable innovation beyond the traditional environmental focus, to incorporate social aspects, as well as create awareness for sustainable behaviour through their products.

*Systems building:* Beyond operational optimization and organizational transformation lies highly radical, game-changing systemic innovation that targets transforming established societal relationships and interactions between industry, consumer behaviour and lifestyles, institutional orientations, and even the very aims of business. The financial crisis of 2008, coupled with the challenges of climate change and growing social inequalities exposed major frailties of the prevailing economic system, prompting widespread debate on the need for systemic change as well as the need to develop new corporate approaches. As such, research, policy and practice agendas are coalescing around addressing long-standing problems caused by business having become disembedded from society (Polanyi, 1944).

In the absence of managerial, policy and behavioural change within and beyond organizational boundaries, technological solutions are limited in what they can deliver. Our analysis highlights the importance of systems level innovation, but we found little empirical work to populate this context. As a result, and consistent with the notions of fit-for-purpose evidence (Gough, 2007, Briner et al., 2009) and pragmatic management research (Tranfield et al., 2003), this gap caused us to turn to the grey literature. Nike 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 (Draper, 2013).

The grey literature also highlights a number of trail-blazing Systems Building initiatives, not all of which are catalysed by the business community but in which business plays a significant role. For example, NGOs such as the World Business Council for Sustainable Development (WBCSD) and the World Wildlife Fund (WWF) are helping bridge the science-business gap through innovative initiatives recognizing that corporate sustainability must be rooted in ecological science, and that business has a key role in helping to reduce its impact and ensuring it stays within the limits of the planetary boundaries (Whiteman et al., 2013).

In the 2013-2015 literature, we observe a growing body of Systems Building empirical work. Gaziulusoy et al. (2013), for example, explore the use of the scenario method as a mechanism for firms to develop innovation pathways which require institutional, social/cultural, organizational and technological change. de Medeiros et al’s (2014) review and empirical test highlight internal, inter-functional integration and wider, stakeholder integration as critical success factors for sustainable product innovation.

*Business model:* An increasing number of scholars are framing SOI as a business model challenge (e.g. Rohrbeck et al., 2013), reflecting the complexities of developing new value propositions and opportunities for new value creation and capture that a sustainability

orientation poses. In an echo of the finding in the current review about the emergence of organizational reframing practices, Boons and Leudeke-Freund (2013) conclude that the search for business models for sustainable innovation equates to a search for a business model that challenges the neoclassical economic worldview.

This may be more aspirational than actual as many sustainability business models continue to exist within the neoliberal paradigm. Bocken et al. (2014) propose eight sustainable business model archetypes a number of which are clearly rooted in the context of optimisation. Their archetype *maximising resource productivity and energy efficiency* emphasizes doing more with fewer resources and generating less waste, emissions and pollution.

The benefits to companies of this business model, such as cost reduction sustainability and competitive advantage, are increasingly clear, (Aguado et al., 2013)(Aguado et al. (2013). The business model is articulated in terms of operational optimization, rooted in resource management – maximising the productivity of resources, energy efficiency, minimising waste etc – as, for example, Nair and Paulose (2014) describe in the case of the bio-fuel industry.

But, Bocken et al's (2014) taxonomy extends beyond this: the remaining seven archetypes include two with a technological orientation, *creating value from waste* and, *substituting non-renewables with renewables and natural processes*. The logical extension of the latter leads away from the linear 'take-make-waste' industrial paradigm, to a systems-building orientation characterised by innovative business model configurations such as the circular economy (The Ellen MacArthur Foundation, 2013).

Five archetypes are categorised as either socially- or organizationally-oriented and attend to behaviour change reflective of organizational transformation and systems building. Three archetypes have a social focus and describe business models that emphasise: 'sufficiency', solutions that actively seek to reduce consumption and production; 'functionality', services that satisfy users' needs without having to own physical products; and 'stewardship', proactively engaging with all stakeholders to ensure their long-term health and well-being.

The remaining two archetypes address the organizational domain. The first describes the repurposing of business in society, prioritizing delivery of social and environmental benefits through close integration between the firm, local communities and other stakeholder groups rather than pursuing only profit maximisation. The second, is about delivering sustainable solutions at a large scale to maximise benefits for society and the environment.

*Technological insufficiency*: The business model perspective integrates the business case with societal and environmental considerations and locates nexuses of sustainability value. The perspective also strongly indicates that sustainability is becoming less of a technical challenge than it is one of changing behaviour. To take advantage of new opportunities, societal actors and downstream entities need to be involved and invested in defining new value creation and what it is that is sustainably valuable (e.g. performance advantages and environmental impact reduction) (Iles and Martin, 2013).

Systems thinking and technological insufficiency come together at the macro level where, we note, two models have recently gained considerable academic, policy and practical traction: *Planetary Boundaries* (Rockström et al., 2009) and *Doughnut Economics* (Raworth, 2012). Rockström et al. (2009) framework of “planetary boundaries” consists of nine Earth system processes which, to the extent that they are not crossed, define a “safe operating space for humanity”. Crossing these boundaries, they argue, constitutes a risk of “irreversible and abrupt environmental change” with potentially disastrous consequences for the biosphere and, by extension, humanity. Doughnut Economics brings planetary boundaries together with 11 social boundaries, dimensions of human deprivation developed from priorities outlined at Rio+20. Integrated in this fashion, planetary and social boundaries describe a safe and just people/planet space in which humanity can thrive.

Steffen et al. (2015) note that four of the nine planetary boundaries have already been crossed with others in imminent danger. Raworth (2012), using UN data, shows that humanity is currently falling below each of the 11 social boundaries. The practical implication of occupying this space is the need for an interdisciplinary science of sustainability Leach et al. (2013) promoting innovation in the use of natural resources and far greater efficiency in transforming those resources to meet human needs at a systems level (Whiteman et al., 2013).

These perspectives assert that economic activity is embedded in and dependent on complex, living, self-organizing natural and social systems with limits; and that a healthy economy is rooted in a healthy ecology and society: as encapsulated in the nested or ‘strong’ model of sustainable development (Giddings et al., 2002). Paraphrasing Lee (2008), this means incorporating and aligning business environmentally and socially to take on responsibility to lead, through innovation, toward a sustainable world (Hart, 2010).

However, whilst it is in the Systems Building context that the grey literature sheds the greatest supplementary and contextual light, it is for reasons of its presence that the conclusions here must be treated with greater caution. Whilst we find some triangulation between the findings of the two bodies of literature (lending some validation to our framework), the paucity of empirical work highlights an immediate opportunity for further definitional and evaluative research in this context.

Indeed, the whole framework indicates important opportunities for future research. A significant opportunity exists at the transition points between the different contexts. Previous research has indicated that new knowledge (Phelps et al., 2007) and specific capabilities (Francis and Bessant, 2005) are required at different stages of firm growth and change, raising questions about the specific knowledge and capabilities required to help firms move around contexts. The capability based view originates in the work of a number of scholars, drawing on the resource-based view of the firm (Penrose, 1959, Barney, 1996). Amit and Schoemaker (1993) defined capabilities as the “capacity to deploy resources, usually in combination, using organizational processes, to affect a desired end.” By extension, then, SOI capability can be conceived as the dynamic ability to adapt, integrate and reconfigure

organizational skills, resources and functional competencies to respond to contemporary sustainability challenges (Assink, 2006, Teece, 2007). Research should focus on the further identification of specific resources and competencies of SOI that help firms move through the framework.

Furthermore, we have noted the challenge managers face in knowing how to help their organizations become and be sustainable. The proposed framework offers a useful heuristic to help navigate this landscape and provides a set of indicative activities in each context. To give further practical value to the findings of this review, future research efforts should be directed towards both empirically testing the framework and operationalizing it in the form of a maturity model.

Research in this domain would be greatly enhanced by taking a longitudinal perspective, and we have been constrained from drawing conclusions about transitions between contexts by the cross-sectional nature of the included studies.

We also make two methodological contributions. First, by adopting a novel framework-synthetic approach: to the best of our knowledge, the first in a published systematic review in management and organizational studies. Our efforts to develop SOI theory are robust given an approach grounded in the data of previous studies (Glaser and Strauss, 2009, Yin, 1994). Framework synthesis has been demonstrated useful in other domains, and it has enabled us to build a richer, more refined model of SOI through a process of iteration between the initial model and data (Ratcliff, 1994), and to provide a palette of practices from which practitioners might select. The framework, by plausibly accounting for the range of empirical observations provided by the included studies, delivers increased analytic generalizability (Locke, 2001) compared against previous, isolated studies. In this sense our synthesis, by moving to a higher level of abstraction, contributes to the development of knowledge (Tranfield et al., 2003). The use of a framework synthetic approach in this study should act as a stimulus for its continued use and for further exploratory use of other methods of synthesis in systematic reviews in the field.

The second methodological contribution is the inclusion of a wider range of the grey literature than in previous studies. By integrating the grey literature, we have been able to reflect more contemporary SOI activity than had we relied on the scholarly literature alone. In particular, we suggest that combining the two bodies of literature is particularly promising where research publications appear to lag contemporary practice and that opportunities should be taken, where appropriate, for the greater use of the grey literature in systematic reviews. Specifically, we have included the grey literature in this review to provide examples of practice to managers and others interested in making organisations more sustainable. In doing so, we push the boundaries of systematic review practice in management research into new territory. Whilst this might be contentious, the approach finds support from Nutley et al. (2013) who argue that the processes of the review should reflect not only on what we want to know and why we want to know it but also on how we envisage the knowledge product being used. With a clear practitioner purpose in mind, this review recalls the practice-oriented



purpose of systematic reviews, but not at the cost of rigour (Tranfield et al., 2003). In doing so it raises questions about under what conditions more attention might be given to grey evidence in systematic reviews.

## **Conclusion**

Roome (1992) argued that the conditions for sustainability cannot be met simply by compliance, and that managerially-led action is required. The increasing presence of business representation over the course of the three Earth Summits suggests that some managers, at least, also subscribe to this view.

The pressing need to equip managers with the tools for innovative solutions to sustainability challenges coupled with the diversity and fragmentation of the academic literature have made this review necessary. Our inductively derived framework reflects and builds on the findings of previous studies and permits a synthesis of the innovation activities of becoming and being sustainable. We argue that by understanding how organizations can become sustainable, pragmatically-oriented SOI-related research has the potential positively to influence organisational behaviour: our model provides a strong basis for such influence.

## **Footnotes**

**Footnote 1:** See, for example: <http://www.uncsd2012.org/> (accessed 25 November, 2014)

**Footnote 2:** Full list available from corresponding author

**Footnote 3:** Rated from 1 (described as “modest standard journals within their field”) to 4\* (described as “world elite journals”). Source: [http://www.associationofbusinessschools.org/sites/default/files/abs\\_lightningwintro.pdf](http://www.associationofbusinessschools.org/sites/default/files/abs_lightningwintro.pdf) accessed January 2014.

**Footnote 4:** InterfaceFLOR, designer and maker of carpet tiles, see <http://www.interface.com/> (accessed 25 November, 2014)

**Footnote 5:** Multiple schemes have sought to establish common frameworks for reporting sustainability progress. These include the Global Reporting Initiative ([www.globalreporting.org](http://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](http://www.sustainability-index.com)).

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