

Towards better embedding sustainability into companies' systems: an analysis of voluntary corporate initiatives

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ABSTRACT

Corporate leaders and employees have been increasingly recognising their role in contributing to sustainability. In this context, different voluntary tools, approaches, and initiatives have been developed by and for corporations to engage with sustainability. However, there has been a lack of clarity in explaining how the initiatives address the different elements of the company system (operations and processes, management and strategy, organisational systems, procurement and marketing, and assessment and communication), how they contribute to sustainability's dimensions (economic, environmental, social, and time), how they are linked, or combined to help leaders better embed sustainability into their company's system. The paper provides an analysis of sixteen of the most widely used initiatives (e.g. life cycle assessment, eco-design, cleaner production, corporate social responsibility, and sustainability reporting). Each initiative was analysed on how it contributes or addresses the four dimensions of sustainability, and the company system. It was found that each initiative has advantages with respect to scope and focus for the sustainability dimensions and the company system's elements, but it has certain disadvantages when it comes to dealing with the complexity and broadness of sustainability. The paper discusses how relying on one initiative can result in a limited and narrow contribution to sustainability and curtail coverage of the company's system. The results indicate that the least addressed elements of the company system have been organisational systems and procurement and marketing. A new framework, the Corporate Integration of Voluntary Initiatives for Sustainability (CIVIS), is proposed with two purposes: (1) to help company leaders better understand how to improve their company's contribution to sustainability, and (2) to foster a holistic approach through the combination of company initiatives that would help to embed sustainability into a company's system with the least effort and maximum results.

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1. Introduction

During the last fifteen years corporations, especially large ones, have become a key focus of attention in the sustainability debate (Cannon, 1994; Elkington, 2002, 2005; Hart, 1997), since they are perceived to be responsible for many negative impacts on the environment and on societies (Dunphy et al., 2003). In response to this, corporate leaders and employees have begun to recognise the relations and inter-dependences of the economic, environmental and social dimensions (C.E.C., 2001; Elkington, 2002), for satisfying the needs of today's societies without compromising the needs of tomorrow's societies (WCED, 1987).

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Although many sustainability categorisations can be found, Lozano (2008) presents one based on different perspectives, which includes the following types: (1) The conventional economists' perspective; (2) The non-environmental degradation perspective; (3) The integrational perspective, i.e. encompassing the economic, environmental, and social dimensions; (4) The inter-generational perspective, i.e. the time dimension; and (5) The holistic perspective. In some cases the boundaries between or among these perspectives may be blurred.

This paper is based on the holistic perspective, which proposes two dynamic and simultaneous equilibria, the Two Tiered Sustainability Equilibria (TTSE): The First Tier Sustainability Equilibrium (FTSE) is a depiction of the interactions of three dimensions, the economic, environmental, and social in the present. Bartelmus (1999) proposes the following indicators: value added, capital formation, depreciation, capital stock, net worth (assets and liabilities), and savings for the economic dimension; environmental

cost, and defensive expenditures for the environmental dimension; and value of social and human capital, time budgets, social indicators for the social dimension. These can be complemented with indicators such as: market presence, customers, earnings, value creation, and shareholders, acquisitions, and patents and intellectual property in the economic dimension; emissions and effluents (including greenhouse gases), energy, noise, wastes and recycling, water and wastewater treatment, land use and restoration, biodiversity, and certifications in the environmental dimension; wages, work hours, benefits, development, training and education, human rights; health and safety, political funding, volunteering and philanthropy, communities, and products in the social dimension (see for example the G.R.I. G3 (2006)), as well as those inter-connections, such as eco-efficiency and earnings, and communities and the environment (see Lozano and Huisingh, 2011). The TTSE incorporates the fourth dimension, time, where the FTSE interacts dynamically with the economic, environmental, and social dimensions in the future (i.e. the short-, long- and longer-term perspectives), for example the economic dimensions of today inter-relate with the economic dimensions of the future, but also with the environmental and social dimensions of the present and the future (Lozano, 2008).

Interest in sustainability from the corporate sector is evidenced by over 7,700 companies in 130 countries (UNGC, 2010) that have signed the UN Global Compact (UNGC, 2008), with discussions under headings such as Corporate Responsibility, Corporate Social Responsibility (CSR), Corporate Citizenship, Business Ethics, Stakeholder Relations Management, Corporate Environmental Management, Business and Society (Hopkins, 2002; Langer and Schön, 2003), and Corporate Sustainability (Dyllick and Hockerts, 2002; Weymes, 2004). However, embedding sustainability principles, such as the Global Compact, into a company's systems represents significant challenges, not least because of the sustainability complexity and its multi-dimensional issues (Langer and Schön, 2003). Hart (1997) proposed a three stage approach to incorporating sustainability, starting with pollution prevention, followed by product stewardship, and ending with clean technology. However, this approach is biased towards technocentric solutions, and it does not consider the other issues aforementioned.

Another indication of corporate interest in sustainability has been the number of voluntary initiatives (such as tools, approaches, and standards), developed by and for corporations, which have been gaining momentum for fostering sustainability by companies (Dunphy et al., 2003; Ny, 2009; Ny et al., 2006). This has been, in great part, because corporations do not have to abide by laws that are not adapted to business practices (Svedberg Nilsson, 2003), and because governments can avoid the time-consuming and difficult process needed to negotiate internationally binding agreements (UNCTAD, 1999). Such initiatives have the potential to make companies become more competitive (Doppelt, 2003; Hallstedt, 2008; Langer and Schön, 2003). However, voluntary initiatives can be abandoned at any time, and often at a cost to the company.

From the 1970s until the late 1990s, such corporate initiatives evolved from purely 'end-of-pipe' solutions (which are usually costly and inefficient (Porter and van der Linde, 1995; Sarkis and Cordeiro, 2001)) towards whole-system approaches, by changing products, processes and systems, so that waste is minimised, and resources used more efficiently and effectively, in almost closed-loops (McIntosh et al., 1998). In spite of this evolution, the initiatives have been limited in capturing the full spectrum of sustainability and its implications of and for corporations (Oskarsson and von Malmborg, 2005), or helping sustainability to be fully transferred to the reality of business processes (Baumgartner and Zielowski, 2007). In most cases they have been poorly linked to each other, leading to company leaders and decision-makers being

increasingly confused about how they could fit together or how they should be used (Ny, 2009; Ny et al., 2006). Attempts to provide guidelines on the best use and potential synergies have been offered by Robèrt (2000) and by experts in different tools (see Robèrt et al., 1997; Robèrt et al., 2002). However, these guidelines have not systematically explained how the tools address the four dimensions of sustainability, or all aspects of the company system.

Models of the company system have been proposed within the strategic management literature. For example, Hill and Jones (2001) indicate that the system can be divided into primary activities (including research and development (R&D), production, marketing and sales, and service), and support activities (with company infrastructure, human resources, and material management); whilst Porter (1985) proposes the following elements (see Fig. 1) divided into:

- **Primary activities:** *Inbound logistics* (receiving, storing, inventory control, transportation scheduling); *Operations* (machining, packaging, assembly, equipment maintenance, testing and all other value-creating activities that transform the inputs into the final product); *Outbound logistics* (activities required to get the finished product to the customer, such as warehousing, order fulfilment, transportation, and distribution management); *Marketing and sales* (getting buyers to purchase the product, including channel selection, advertising, promotion, selling, pricing, retail management, etc.); and
- **Secondary activities:** *Service* (maintaining and enhancing the product's value, including customer support, repair services, installation, training, spare parts management, upgrading, etc.); *Procurement* (purchasing of raw materials, servicing, spare parts, buildings, machines, etc.); *Technology development* (supporting the value chain activities, such as research and development, process automation, design, and redesign); *Human Resource management* (recruiting, development and education, retention, and recompensing employees and managers); and *Firm infrastructure* (general management, planning management, legal, finance, accounting, public affairs, quality management).

The primary and secondary division activities can help explain to companies where production, marketing, or sales are the main core competences. However, these models have limitations when it comes to companies that are focused on management or organisational systems consultancy, or companies in the finance sector.

A number of authors have addressed some parts of the system aforementioned in the context of sustainability, from which it is possible to group them in the following elements:

- **Operations and production**, including technologies, materials, energy sources, and product development (DeSimone and

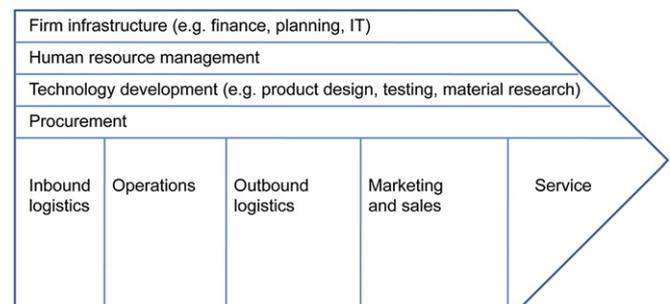


Fig. 1. Company system. Source: Porter (2006).

Popoff, 2000; Doppelt, 2003; Hart, 1997), with closed-loop manufacturing combined with resource efficiency and effectiveness (Lorenzi and Riley, 2000; Lovins et al., 2000);

- **Management and strategy**, including productivity, investment and profit (Dyllick and Hockerts, 2002; Hopkins, 2002; Reinhardt, 2000; Robèrt et al., 2002), business values and attitudes, objectives, vision and mission, strategies, products, and programmes (DeSimone and Popoff, 2000; Lorenzi and Riley, 2000; Quazi, 2001), transparency and ethics in corporate decision-making (Coelho et al., 2003; Robèrt et al., 2002), and stakeholder engagement, participation, and management (C.E.C., 2001; Doppelt, 2003; Hopkins, 2002; Langer and Schön, 2003);
- **Organisational systems**, such as people, culture, leadership styles, management skills and learning, problem-solving approaches, structures, systems (Doppelt, 2003; Lorenzi and Riley, 2000), human resources and development, change management, and innovation (Dunphy et al., 2003; Lozano, 2009);
- **Procurement and marketing**, taking into consideration the supply chain (i.e. outbound and inbound logistics and transportation), the customers, and consumers, through purchasing, advertising, promotional policies, procedures, and related activities (DeSimone and Popoff, 2000); and
- **Assessment and communication**, including reporting (Dalal-Clayton and Bass, 2002; G.R.I., 2011), risk disclosures (products, operations, construction and resource utilisation) (Cannon, 1994), and accountability (ISO, 2009).

Depending on the nature of the corporation, R&D can fall within operations and production, management and strategy, or organisational systems.

In any company (whether small, medium, or large) most of the elements interact as parts of the whole system (Bartelmus, 1999; G.R.I., 2006). The proposed generic system is offered to help understand the company, and to assess the tools. The generic system does not distinguish primary and secondary activities, since this would limit its scope. Each company should decide which parts are primary or secondary, according to their core competences.

The discussion on the company system and sustainability serves as the basis for the analysis of the tools. This is aimed at helping company leaders, champions, and decision-makers to reduce confusion with regard to corporate sustainability initiatives by (1) improving the understanding and contribution of different voluntary initiatives to the company system and sustainability dimensions, and (2) fostering a holistic approach through the combination of company initiatives that would help to embed sustainability into the company with the least effort and maximum results.

2. Analysis of voluntary initiative contributions to sustainability

Sixteen¹ initiatives were selected from twenty-two corporate sustainability initiatives.² The selection criteria were; having more than 5000 hits on Google Scholar (see Table 1), and, having been developed in or before 2001 (thus providing time for the initiative to be implemented and mature). The initiatives belong to Robèrt et al.'s (2002) 'Follow up/Tools' level, which is aimed at measuring, managing, and monitoring activities.

¹ ISO 26000 is considered to have potential to become a widely adopted standard.

² The author has tried to cover a wide range of corporate sustainability initiatives; however there might be some that he is unaware of.

Table 1

Google Scholar hits of 22 corporate voluntary initiatives for sustainability (sorted according to their number of hits).

Corporate initiative	Scholar Google number of hits ^a
Industrial Ecology	231,000
Environmental and Social Accounting	139,000
Corporate Social Responsibility	80,080
Life Cycle Assessment	42,800
Cleaner Production and Zero Emissions	28,500
Corporate Citizenship	21,000
Sustainable Livelihoods	19,700
Environmental Management Systems	19,200
Green Chemistry	17,700
Triple Bottom Line	16,800
The Natural Step	16,700
Sustainability Reporting	15,900
Eco-efficiency	15,600
Design for Environment	11,400
Factor X	8720
Eco-labeling	7740
Green engineering	3080
ISO 26000 ^b	1750
Sustainability Balanced Scorecard	473
Ecological Rucksack	341
Material Inputs per Unit of Service	92
European Corporate Sustainability Framework	76

^a Checked on the 25 February 2011 using conditional formatting to avoid problems such as 'eco efficiency', 'ecoefficiency', and 'eco-efficiency'. All initiatives were checked so that there were mentioned in the literature before and including 2001.

^b Although there were some publications in 2001 mentioning ISO 26000, the final draft was published in 2010.

It should be noted that each initiative has been studied in detail by different authors (some even have a specific journal dedicated to them). The purpose of this paper is to provide an overview of each initiative, and to facilitate its understanding and subsequent analysis.

The initiatives were studied under the critical realism paradigm, where the experiences from sensations or images of the real world are processed through mental models, not the things directly (Jupp, 2006; Saunders et al., 2007), and the holistic perspective (Lozano, 2008). The initiatives were analysed using Grounded Theory's (GT) constant comparative analysis,³ which offers the potential to generate theory by explicitly coded and analytic procedures that help to identify, develop, and relate the concepts that make the building blocks of theory more systematic and creative (Glaser and Strauss, 1999).

The constant comparative method has four stages: Firstly, comparing incidents applicable to each category, i.e. classifying the data into meaningful categories that may be derived from the data, from the theoretical framework, or from the researchers' reading, life experiences, research, and scholarship. The categories used at the outset were taken from: (1) the TTSE's four dimensions of sustainability (economic, environmental, social, and the time); and (2) the corporate system elements (operations, management, organisation, procurement and marketing, and assessment and communication). For the first set, the initiative analysed had to be explicit when addressing or having positive benefits with respect to the aforementioned issues in each dimension. For example, for the economic dimension, the indicators were market presence, customers, or acquisitions; an example of the environmental dimension would be reductions in the use of artificial chemical compounds, and energy usage, or an improvement in efficiency. For the second set, the initiative had to address the aforementioned

³ Refer to Lozano and Huisinigh (2011) for further details on the use of GT's constant comparative analysis in the corporate sustainability context.

elements of the company system, which include technologies or materials for operations and production, culture or leadership for organisational systems, and reporting or accountability for assessment and communication. The coding was done from the definition of each initiative and from key papers that relied on or discussed it. For example, consider the statement: “CP is the continuous use of integrated preventive strategies to process products and services, utilising raw materials, e.g. energy and water, efficiently to reduce waste at source, and minimising risks to the environment and society” (DeSimone and Popoff, 2000; Robèrt et al., 2002; UNEP, 2000a, 2001). In general, CP focuses on achieving environmental improvement in processes and product development (Glavič and Lukman, 2007; Pauli, 1997). This was coded as part of Operations and production (since it refers to processes and products) within the company system; and to the Environment and the Economic dimensions (since these aim to reduce environmental impacts which, usually, result in improvements to production efficiency); see Cleaner Production (CP) section for more details.

Secondly, integrating categories and their properties. Table 2 shows the coding for the different initiatives with respect to the company system and to sustainability, where it can be seen that the initiatives have been limited in capturing the full spectrum of sustainability and its implications of and for corporations (which concurs with Oskarsson & von Malmborg, 2005).

Thirdly, helping to distinguish which elements had been addressed, and how the initiatives could complement each other to deal more holistically with the company system and the four dimensions of sustainability (see Table 3). This helped to address the point that the initiatives have been poorly linked (see Ny, 2009; Ny et al., 2006).

Finally, writing the new or modified theory (or framework), which can then be used to develop or test hypotheses (Corbin and Strauss, 1990; Glaser and Strauss, 1999; Strauss and Corbin, 1998). In the case of this paper, it helped to develop the Corporate Integration of Voluntary Initiatives for Sustainability (CIVIS) framework, see Table 4 for an example.

It should be noted that each tool and initiative might have overlaps with others, and each could be a study area in itself. The sixteen initiatives are presented in alphabetical order.

2.1. Cleaner Production (CP)

CP is the continuous use of integrated preventive strategies to process products and services, utilising raw materials (e.g. energy and water) efficiently to reduce waste at source, and minimising

risks to the environment and society (DeSimone and Popoff, 2000; Robèrt et al., 2002; UNEP, 2000a, 2001). In general, CP focuses on achieving environmental improvement in processes and product development (Glavič and Lukman, 2007; Pauli, 1997). The definition of CP was developed by UNEP in Paris in 1989. Since then the definition has been expanded and a sustainable development orientation has been added (Glavič and Lukman, 2007). Some authors (see Baumgartner and Zielowski, 2007; DeSimone and Popoff, 2000) indicate that CP should not only be about changes in raw materials, processes, and products, but also about changing corporate culture and attitudes, applying know-how, and overcoming non-technical barriers, i.e. organisational changes.

The Journal of Cleaner Production and the International Journal of Sustainable Engineering provide a number of CP examples. An illustrative one is the application of CP's principles to a pulp and paper company in Turkey, where waste reduction option measures were appraised and implemented. This resulted in increased production efficiency, and reductions in effluent pollution (Avşara and Demirel, 2006).

A concept closely related to CP is Zero Emissions (ZE), introduced by Pauli (1997), who indicates that the ultimate goal of CP is zero waste (with respect to all biomass and minerals on Earth). ZE combines ecological and economic aims to rid production systems of emissions (Baumgartner and Zielowski, 2007; Ehrenfeld and Gertler, 1997; Kuehr, 2007), more specifically harmful emissions, utilizing technological solutions (Kuehr, 2007).

When compared against the analysis criteria it is possible to observe that CP focuses on processes and services, i.e. operations and production within the system (although some authors indicate that CP should also address organisational systems). Regarding the sustainability dimensions, CP focuses mainly on the environmental dimension (by minimising waste and risks, and achieving environmental improvements), with typical positive improvements for the economic dimension (e.g. reducing costs or increasing productivity). The time dimension seems to be considered by the call for a continuous use of CP's strategies, but it is not explicitly addressed.

2.2. Corporate Citizenship (CC)

Corporate Citizenship (CC) is a concept where corporations have social rights and responsibilities to their stakeholders beyond wealth maximisation (Carroll, 1998; Leisinger, 2003; McIntosh et al., 1998; Zadek, 2001). This includes compliance with laws and regulations, ethical behaviour, and contributions to social and economic welfare (Carroll, 1998; Rondinelli, 2003). CC is considered

Table 2
Analysis of the contributions of voluntary corporate initiatives to sustainability.

Corporate initiative	Corporate system					Sustainability			
	O&P	M&S	OS	P&M	A&C	Econ.	Env.	Social	Time
CP	✓					✓	✓		Limited
CC		✓						✓	
CSR		✓				Limited		Limited	✓
DfE	✓						✓		
Eco-efficiency	✓					✓	✓		
Ecolabelling				✓	✓		✓		Limited
EMS		✓	Variable		✓		✓		
ESA		✓			✓	✓	✓	✓	
Factor X	✓					Limited	✓		
GC	✓						✓		
IE	✓	✓				Limited	✓		
LCA	✓				✓		✓		
SLs		✓				✓	✓	✓	✓
SR		Limited			✓	✓	Variable	Variable	
TNS		✓	Limited			Limited	✓	Limited	Limited
TBL		✓		✓		✓	✓	✓	

Table 3
Corporate and Industrial Voluntary Initiatives for Sustainability (CIVIS) framework.

Corporate initiative	Corporate System					Sustainability			
	O&P	M&S	OS	P&M	A&C	Econ.	Env.	Social	Time
SLs		■				■	■	■	■
TBL		■		■		■	■	■	■
TNS		■	■			■	■	■	■
EMS		■	■		■	■	■	■	■
ESA		■				■	■	■	■
LCA	■					■	■	■	■
CP	■					■	■	■	■
DfE	■					■	■	■	■
Eco-efficiency	■					■	■	■	■
IE	■					■	■	■	■
Factor X	■					■	■	■	■
GC	■					■	■	■	■
Eco-labelling				■	■	■	■	■	■
CSR		■			■	■	■	■	■
SR		■			■	■	■	■	■
CC		■				■	■	■	■

Colour coding
 ■ Full contribution
 ■ Limited contribution
 ■ Variable contribution

to be a core business strategy tool (Birch and Littlewood, 2004), which has started to become mainstream in business thinking (Leisinger, 2003).

CC is used as a synonym for concepts such as Business Ethics, Corporate Environmental Management, Business and Society, Business and Governance (Hopkins, 2002; Matten and Moon, 2004; Swift and Zadek, 2002), and sometimes for CSR (Frankental, 2001; Langer and Schön, 2003; Matten and Moon, 2004).

The UN Global Compact report on HIV/AIDs provides an illustrative example from DaimlerChrysler, which through its DaimlerChrysler South Africa Medical Fund (DCMed) has provided, since 1999, employees enrolled in the Aid for AIDS programme with anti-retroviral medicine. DCMed is financed 50/50 by DCSA and its workforce (UNGC, 2003).

CC contributes mainly to the management and strategy element of the corporate system, by focusing on social rights and responsibilities beyond wealth maximisation. This is based on improving issues within the social dimension of sustainability.

2.3. Corporate Social Responsibility (CSR)

CSR may be considered to be one of the first initiatives to contribute to sustainability (Lozano, 2009). While CSR practices can be traced almost as far back as the French Revolution (Frankental,

2001), the origins of the ‘modern’ form of CSR are subject to discussion. Academically, it can be argued that it began in the wake of the Great Depression, in the late 1920s (Carroll, 1998; Dodd, 1932; Lantos, 2001), especially with Dodd’s (1932) article. Since then, many CSR definitions have appeared, from which the key points addressed include: stakeholder engagement and participation (C.E.C., 2001; Holme and Watts, 2000); product impact; health and safety; dealing with corruption (Holme and Watts, 2000); human rights and freedom of association (C.E.C, 2001; Holme and Watts, 2000; UNGC, 2008; Welford, 2005; Zadek, 1999); communication, reporting, disclosure, and transparency (Holme and Watts, 2000); and environmental protection and management of resources (C.E.C, 2001; Elkington, 2002; Holme and Watts, 2000).

In general, there are three main CSR positions: (1) corporate philanthropy (see Porter and Kramer, 2003; Smith, 2003); (2) a more broadly based approach to stakeholder responsibilities from a social perspective (see Avi-Yonah, 2005; Dodd, 1932; Hopkins, 2002; Reinhardt, 2000); and (3) integration of environmental concerns (for more details refer to C.E.C., 2001; Carroll, 1999; WBCSD, 2002).

Two major positions critiquing CSR can be found: (1) those in which the authors follow Friedman’s (1970) ‘the business of business is business’ position, indicating that CSR is merely a public relations exercise, increasing costs, impairing performance, and

Table 4

Combination of three initiatives that satisfy the constraints of the Corporate and Industrial Voluntary Initiatives for Sustainability (CIVIS) framework.

Corporate initiative	Corporate System					Sustainability			
	O&P	M&S	OS	P&M	A&C	Econ.	Env.	Social	Time
TBL		■		■		■	■	■	
TNS		■	■			■	■	■	■
LCA	■				■		■		

Colour coding

■	Full contribution
■	Limited contribution
■	Variable contribution

distracting attention by taking into account stakeholders (Frankental, 2001; Henderson, 2005; The Economist, 2005); and (2) those for whom CSR is not fulfilling its promised potential, such as being difficult to demonstrate its positive correlation to the 'bottom line' (Avi-Yonah, 2005; Langer and Schön, 2003), being difficult to evaluate performance against the issues required by CSR (Avi-Yonah, 2005), being considered a panacea for world problems (van Marrewijk and Hardjono, 2003), not being well defined (Frankental, 2001; Frederick, 1994; Welford, 2005), being confusing due to the large number of definitions and interpretations (Lozano, 2009), not explicitly mentioning the environment in the CSR term (Fukukawa and Moon, 2004; Willard, 2002), and being difficult to ground and put into operation by the different stakeholders (Lozano, 2009).

Although CSR has the potential for making a large contribution to sustainability, it is limited by three major issues: having been defined and interpreted many times, so that the definitions are sometimes confusing, and at others contradictory; being, in many cases equated to philanthropy; and being perceived as referring only to the social dimension (e.g. stakeholder engagement, health and safety, and corruption).

With respect to the corporate system, CSR efforts usually take place under the aegis of management and strategy (such as stakeholder engagement, and the bottom line), with some links to assessment and communication.

2.4. Design for the Environment (DfE)

DfE, also called eco-design, refers to the inclusion of environmental factors and considerations (such as material elimination or substitution, process optimisation, energy reduction, and product reuse (DeMendonça and Baxter, 2001)) in the design of the product or service (Holliday et al., 2002), so that it becomes easier to recover, reuse, or recycle (Anastas and Breen, 1997; Ashley, 1993; DeMendonça and Baxter, 2001; Hart, 1997). This has mainly emanated as a response to increased consumer' environmental awareness, and tougher competition in the market respecting the environmental impacts of products (Hallstedt, 2008).

The design stage is a critical time for addressing environmental and economic impacts of a product (Anastas and Breen, 1997; Ashley, 1993). The inclusion of environmental dimensions in product design and services contributes to product innovation

(Glavič and Lukman, 2007), and it can serve as a guide for investment and technical optimization prioritization (Hallstedt, 2008).

DfE encompasses eco-efficiency, health and safety, recycling, source reduction and waste minimization (Glavič and Lukman, 2007). Thus, DfE has the potential to offer cost-effective take-back of products for recycling (Ashley, 1993). In 2009 the European Commission established eco-design requirements for all energy using products by defining conditions and criteria for product characteristics (EC, 2009).

An example of DfE is IBM's Environmentally Conscious Products programme that has resulted in modifications to product development processes, where environmental attributes are routinely considered in decisions about new products (Ashley, 1993).

DfE efforts are mainly directed at reducing the environmental impacts of products, based on changes in process optimisation, i.e. operations and production.

2.5. Eco-efficiency

The term eco-efficiency is a contraction of ecological and economic efficiency (Willard, 2002). It is fundamentally a ratio of some economic value added relative to some measure of environmental impact (Ehrenfeld, 2005). Eco-efficiency's aim is to link environmental and business excellence, i.e. making profits by using fewer natural resources, with less waste and emissions within the earth's carrying capacity (DeSimone and Popoff, 2000; Ekins, 2005; Hamann, 2003). It is one of the concepts most widely accepted as the business link to sustainability (Dyllick and Hockerts, 2002; Korhonen, 2003). Eco-efficiency is quite similar to CP. The former started as an initiative of the World Business Council for Sustainable Development (see WBCSD, 2002, 2003), while the latter is of the UNEP (see UNEP, 2000a, 2000b, 2001).

According to Holliday et al. (2002) eco-efficiency is guided by four principles⁴: (1) Dematerialization, by substituting knowledge flows for material flows, or through customization; (2) Production loop closure, by working continuously toward closed-loop production systems and zero-waste factories wherein every output is returned to natural systems as a nutrient or becomes an

⁴ DeSimone and Popoff (2000) consider that eco-efficiency has seven guiding principles, however these are included in Holliday et al.'s (2002).

input in the manufacture of another product; (3) Service extension, by offering products that have extended durability or products that can be leased; and (4) Functional extension, by designing and manufacturing products with newer and enhanced functionalities and services.

Eco-efficiency has been criticised as having: (1) Relativity or rebound effect (Korhonen, 2003), i.e. improvements in efficiency that lead to an increase in products or services, making the absolute impacts larger than previously (Dyllick and Hockerts, 2002; Jansen, 2003; NGLS and UNRISD, 2002); (2) A lack of focus on the social dimension, or a confusion with health and safety issues (Dyllick and Hockerts, 2002; Ehrenfeld, 2005; Holliday et al., 2002); (3) Difficulty in measuring or proving the appropriate business case to quantify opportunities (Korhonen, 2003; Willard, 2002); and (4) Eco-efficiency being affected by standard economic theory assuming limitless resources and availability (Ehrenfeld, 2005). In order to tackle the first two problems Eco-effectiveness, or eco-efficacy, has been developed, which addresses the absolute positive environmental impact a firm could reasonably achieve (Dyllick and Hockerts, 2002).

An example of Eco-efficiency is Scotchtint (a film manufactured by 3 M that can be attached to a window to increase energy efficiency), which provides Eco-efficiency by reflecting sunlight, resulting in energy savings of 55%–76% (when using air conditioning in buildings) (DeSimone and Popoff, 2000).

As with CP, Eco-efficiency focuses on improving operations and processes, mainly concentrating on the environmental dimension, which tends to have positive repercussions for the economic dimension. Whilst the discussions on CP tend to consider the time dimension, Eco-efficiency appears not to, at least explicitly.

Two concepts that are aimed at addressing the social aspects, based on Eco-efficiency and Eco-effectiveness, are Socio-efficiency (minimising negative or maximising positive social impacts) and Socio-effectiveness (concerned with the absolute positive social impact a firm could reasonably achieve) (Dyllick and Hockerts, 2002; Hockerts, 1999). However, their implementation and academic discussion has been limited.

2.6. Ecolabelling

Ecolabelling is based on a market approach to the protection of the environment (Hale, 1996; OECD, 1997). It aims to inform consumers of the environmental impacts throughout the production, consumption, and waste phases of products and services, and, to a great extent, influence consumers' behaviour towards more environmentally friendly consumption patterns (Hale, 1996; Nadai, 1999; Rex and Baumann, 2007). It also aims to encourage producers, governments, and other agents to increase the environmental standards of products and services (Galarraga Gallastegui, 2002; Hale, 1996).

The Ecolabelling process consist of two phases: (1) The negotiation phase takes place between the firms and the regulator in order to set up the Ecolabelling criteria; and (2) A market phase, where products that meet the criteria can be appropriately labelled (Nadai, 1999).

Ecolabelling has increasingly become popular among corporations and policy-makers. During the last two decades, several national Ecolabelling programmes have appeared (Nadai, 1999; OECD, 1997; Rex and Baumann, 2007), with 20 schemes in the OECD (Nadai, 1999). Some examples include the German Blue Angel, the Nordic Swan, the Swedish Environmental Choice, the EU Eco-Label Award Scheme, the Canadian Environmental Choice Program, the Green Seal operated in the USA, the Japanese Eco-Mark, and the French NF Environnement (OECD, 1997). According to the OECD (1997), Ecolabelling programmes have been more

successful in countries or regions with higher levels of environmentally aware consumers.

In spite of the Ecolabelling schemes' promises, they have some drawbacks, such as: their moderate success with individual consumers (OECD, 1997), the low overall market share of ecolabelled products (Rex and Baumann, 2007), and their lack of a guarantee that effective product ecolabels have been developed (Nadai, 1999).

By informing consumers of environmental impacts, Ecolabelling activities can be considered mainly as part of the assessment and communication element in the corporate system, with a strong link to procurement and marketing.

The bases of Ecolabelling rely on informing different stakeholders of the environmental impact of, mainly, products, thus linking the social and environmental dimensions.

2.7. Environmental Management Systems (EMS)

EMS are administrative tools aimed at assessing the environmental impact of the operations of organisations, mainly corporations, and in improving their environmental performance (Brorson and Larsson, 1999; Robèrt, 2000). Five main elements can be found common to all EMS: (1) Identifying company impacts on the environment; (2) Understanding current and future legal obligations; (3) Developing plans for improvement; (4) Assigning responsibility for implementation of plans; and (5) Periodic monitoring of performance (DeSimone and Popoff, 2000).

Two of the most recognised EMS are the International Organization for Standardization (ISO) 14000 series, and the EU EcoManagement and Audit Scheme (EMAS) (Brorson and Larsson, 1999; Robèrt, 2000). The two schemes are fairly similar, with both following the five main elements aforementioned. The main differences are that: ISO is internationally recognised while EMAS is solely European; and, EMAS sets stricter requirements in some areas (Brorson and Larsson, 1999). The EMAS III has improved registration procedures, applicability for small and medium sized enterprises, and registration of several sites (which can be worldwide) under one corporation (EC, 2011).

EMS have generated great interest, prompting large numbers of businesses to adopt them in their facilities. However, ISO certification can be costly, between US\$5,000 - 20,000 for the first audit and an annual cost of between US\$4,000 - 5,000 (NGLS & UNRISD, 2002), and implementation can incur a long adaptation process (DeMendonça and Baxter, 2001). Additionally, for EMS to be useful for SD, new metrics need to be incorporated (Robèrt, 2000).

Within the corporate system, EMS are mainly part of the management and strategy element, but they may have important links to operations and production, assessment and communication, and on organisational systems (by means of having the potential to change or systematise them).

EMS, as the name indicates, are designed to address the environmental dimension of organisational operations, although some outcomes might result in cost reductions due to better use of resources. EMS also call for periodic monitoring, which could be considered as addressing the time dimension.

2.8. Environmental and Social Accounting (ESA)

ESA's⁵ objective is to attach monetary values to the direct and indirect environmental and social impacts of a company's activities using a diversity of valuation methods (Burritt et al., 2008; de Beer and Friend, 2006; Warhurst, 2002). This can help to demonstrate

⁵ Kolk (2008) considers ESA to be a precursor of Sustainability Reporting.

the potential for environmentally beneficial investments to yield significant financial pay-offs, through the avoidance of environmental and social liabilities (de Beer and Friend, 2006). Some of the issues that are monetarised include: air and climate, waste, wastewater, soil and groundwater, noise and vibration, biodiversity and landscape, and radiation (de Beer and Friend, 2006), as well as costs of plant closure (Lehman, 1999). Parker (2011) indicates that 54% of academic papers on ESA focus on environmental issues, 26% on social issues, and the rest on both areas. Although, ESA can help to assist companies in managing, measuring and improving the environmental aspects of their operations (de Beer and Friend, 2006), its bases limit reform, and focus on the corporation as the accounting entity, thus perpetuating the *status quo* (Lehman, 1999).

ESA aims at valuing the environmental and social impacts that a company might have (i.e. linking them to the economic dimension). It deals mainly with assessing and communication (mainly internally) productivity, investment, and profits to help guide decision-making (partly Management and Strategy).

2.9. Factor X

Factor X refers to the Eco-efficiency initiatives Factor 4, Factor 5, and Factor 10, developed by the Wuppertal Institute (Robèrt, 2000; UNU, 2007; von Weizsäcker et al., 1998), and extended to Factor 20 (Quist et al., 2001). They are based on reductions in turnover of resources on a global scale (Robèrt, 2000), i.e. increasing by a factor of 'x' the amount of wealth that is extracted from one unit of a natural resource (DeSimone and Popoff, 2000; Holliday et al., 2002; von Weizsäcker et al., 1998). According to Reijnders (1997) Factor X is qualitatively similar to eco-efficiency, but its focus is more quantitative.

Reijnders (1997) offers a comprehensive review of Factor X, where he argues that, in practice, it is being used for products, services, industries, or the economy as a whole. He indicates that there have been mixed reactions to Factor X; while in the USA its use has been restricted to environmental NGOs, in Europe (mainly in Austria, Germany, and the Netherlands) it has had a positive impact on environmental policies. Nonetheless, there has been no substantial technological or economical enforcement for its implementation in such countries.

Factor 4 principles were applied by a team in the Rocky Mountain Institute in the design for a car with 57% lighter structure and 34% lighter chassis components, allowing a 38% lighter propulsion system. Including reductions in the mass of the electrical system, trim and fluids, the overall vehicle was 52% lighter (von Weizsäcker et al., 2009).

Factor X is mainly used for operations and production, and it could have some repercussions for management and strategy. It focuses on improving the environmental dimension.

2.10. Green Chemistry (GC)

GC follows similar principles to DfE, but its focus is on the use of chemical techniques to reduce or eliminate the use, or generation, of feed-stocks, products, by-products, solvents, reagents, or other hazardous chemicals that are, or might be, dangerous to human health or the environment (Anastas and Breen, 1997).

GC is aimed at preventing waste before it is ever formed by considering the environmental impact, or potential impact, of a product or process (Anastas and Breen, 1997). GC relies on 12 rules based on five principles (waste minimisation, renewable resources, eco-efficiency, degradation, and health and safety) that are aimed at designing or modifying chemical reactions to be more environmentally friendly (Glavič and Lukman, 2007).

An initiative that can be included within GC is Responsible Care, a chemical industry's global voluntary code of conduct under which companies, through their national associations, work together to continuously improve their health, safety and environmental performance (ICCA, 2011; Prakash, 2000).

It is possible to find a large number of examples of GC, one of which is BASF's Savant™, where BASF has initiated a take-back program for used nylon carpet, so that recovered. Recovered nylon 6 can be depolymerised and used in Savant™. Rather than down-cycling it into a material of less value, the used nylon is "up-cycled" into a product of high quality (Heine, 2007).

As with DfE, GC is mainly directed at reducing the environmental impacts of products, which in the company system aforementioned are included in operations and production.

2.11. Industrial Ecology (IE)

Industrial Ecology (IE) refers to the restructuring of industry in the form of an ecosystem with materials (including raw materials and wastes) flowing through inter-connections of production processes (EC, 2009; Ehrenfeld, 2004; Iseemann, 2003; Lowenthal and Kastenber, 1998). The object of IE is to treat materials and energy, considered as by-products or waste, as raw materials by other companies (DeSimone and Popoff, 2000; EC, 2009; Heeres et al., 2004; Lowe and Evans, 1995). This is done on: the firm level, with design for environment, pollution prevention, eco-efficiency, and green accounting; across firms, with industrial symbiosis, life cycle analysis, and industrial sector initiatives (Gibbs and Deutz, 2007); and the regional/global level, including budgets, materials and energy flow studies, de-materialisation, and decarbonisation (EC, 2011; Jacobsen, 2006; Warhurst, 2002).

The key concept in IE is that processes and industries are seen as interacting systems rather than comprising isolated components in a system of linear flows (EC, 2011). The interactions are quite similar to the Japanese *keiretsu* concept (EC, 2009). IE can help to optimise industrial systems by taking a whole-systems perspective (EC, 2009; Parker, 2011), with a closed-loop model resembling that of ecosystems (Lehman, 1999).

IE has, as inherent benefits, the reduction of pollution, a decrease in natural resource usage, and, it is claimed, the creation of new jobs (Lehman, 1999). However, it requires exchange of information about the different industries and their inputs and outputs (EC, 2009), and integration across different fields, and the overcoming of barriers, such as cultural (EC, 2009), technical, economic, information, organisational, and regulatory/legal (EC, 2009; Warhurst, 2002).

The classical example of IE is the seaside industrial town of Kalundborg, Denmark, where eleven physical linkages comprise much of the tangible aspects of IE (EC, 2009), with estimated savings between US\$ 12 and 15 million per year (Warhurst, 2002). The Kalundborg case was not designed as IE, but it evolved gradually over a number of decades (Warhurst, 2002). Lowe and Evans (Lehman, 1999) indicate that any petrochemical complex tends to exhibit aspects of IE, such as the Houston Ship Channel.

It is claimed that IE is still at an early stage (de Beer and Friend, 2006; EC, 2011), which is still promising towards more sustainable societies (de Beer and Friend, 2006; Warhurst, 2002), for example by offering a bridge between CP and the attainment of an industrial system within the constraints of carrying capacities (Lehman, 1999).

IE focuses on improving operations and processes, mainly on the environmental dimension, which has positive repercussions on the economic dimension, by reducing wastes throughout the system.

2.12. Life Cycle Assessment (LCA)

LCA refers to the evaluation of all processes in the life cycle of a product or service, from down stream (i.e. extraction), to upstream (i.e. disposal), including use (DeSimone and Popoff, 2000; Holliday et al., 2002; Robèrt, 2000). It focuses, primarily, on quantifiable information that can help in the decision making process (Hale, 1996).

According to Robèrt (2000), LCA, usually, refers to the evaluation of all aspects of a product, but not stating how it is done or for what purpose. LCA is considered to be one of the most rigorous tools; however, LCAs often lack a sustainability perspective and entail trade-offs between specificity and depth, and comprehension and applicability (Holmberg and Robert, 2000). LCA is time-consuming, expensive, and data intensive (Hale, 1996). It is necessary to determine how the inputs and outputs should be weighted to reflect their environmental risks; and can become cumbersome due to the data requirements and boundary setting for the analysis (Ashley, 1993).

An example of LCA is presented by Cederberg and Mattsson (2000), who compare milk production in conventional and organic farming, showing that although the latter can reduce pesticide use and mineral surplus, it requires substantially more farmland than conventional production.

LCA is principally concerned with assessing the environmental impact of products and services. Thus, it deals with operations and production, and has some aspects that touch upon assessment and communication.

2.13. Sustainable Livelihoods (SL)

SL is a term that links livelihoods with SD (UN, 1992). SL focuses on creating new businesses and markets that benefit the poor and the company. As opposed to philanthropy, SL aims to align the company with the laws, norms, expectations and aspirations of the society in which it operates. It has a conscious focus on the poor as aspiring customers and business partners (WBCSD, 2004a). SL aims to benefit society by focusing on, in addition to employment, natural resource management, redistribution of livelihood resources, prices and payments, and health, while abolishing restrictions and hassle, and providing safety nets for poor people during bad times (Chambers, 1995). SL is based on providing the skills and assets necessary for people to live reasonably secure lives, to cope with and recover from stress and shocks, and to provide opportunities for the next generation (Chambers, 1995; WBCSD, 2004a).

Usually, SL reflects the combination of a focus on core competencies that facilitate innovation, partnerships across sectors (e.g. governments and NGOs), and the localisation of value creation (WBCSD, 2004a).

An example of SL is the South African Sugar Association's (SASA) joint venture with provincial departments of agriculture, aimed at building an effective and well coordinated extension service for small-scale farmers through mentorship in business skills, workshops on cane growing, grassroots leadership, and business and functional training sessions (WBCSD, 2004b).

SL efforts fall mainly into the management and strategy initiative, more specifically regarding community engagement.

SL aims to cover the four sustainability dimensions by providing economic resilience, natural resource management, improving social wellbeing, whilst considering this, and future generations.

2.14. Sustainability Reporting (SR)

SR is a voluntary activity with two general purposes: (1) to assess the current state of an organisation; and (2) to communicate

to stakeholders the efforts and progress in the economic, environmental and social dimensions (Dalal-Clayton and Bass, 2002).

Dalal-Clayton and Bass (2002), and Cole (2003) offer comprehensive SR tools and guideline lists, with their advantages and disadvantages. The most widely used include: the ISO14000 series and EMAS, covered in the EMS section; the Social Accountability 8000 standard (SAI, 2007); and, the GRI Sustainability Guidelines (Kuehr, 2007). The GRI being one of the best options available (Hussey et al., 2001).

During the last several years the number of companies reporting has been increasing (Andersson et al., 2005; G.R.I., 2010), in 2010 there were around 1,800 (G.R.I., 2010). This has been facilitated by the use of web-based reporting (Fukukawa and Moon, 2004).

SR, as the name indicates, is focused on the assessment and communication element of a company system. SR should serve to integrate and to communicate the different initiatives and activities of the company that contribute to sustainability. However, SR has some inherent disadvantages, such as, once started the process is practically impossible to stop; stakeholders tend to demand more from the corporation; and it is difficult to keep the balance between the details and the core information (Lozano, 2006). Additionally, sustainability is largely addressed through compartmentalisation of sustainability issues (Lozano and Huisingh, 2011).

Different guidelines address different sustainability dimensions, e.g. EMS focuses on the environmental dimension, SA 8000 mainly on the social dimension, whilst the GRI covers the economic, environmental, and social dimensions. Ideally, SR should encompass these three dimensions and, importantly, the time dimension (as discussed by Lozano and Huisingh, 2011).

2.15. The Natural Step (TNS)

The Natural Step (TNS) is an international educational organisation dedicated to accelerating society's movement towards SD (Robèrt et al., 2002; Willard, 2002), with a framework to aid in this transition (Robèrt, 2000). The framework aims to redirect people's attention from detailed environmental problems far 'down stream' in cause-effect chains (e.g. addressing every new chemical with a new risk assessment), instead of focusing upstream on the unifying causes behind many problems (such as the general increase in the systematic concentration of man-made chemicals in nature) (Doppelt, 2003). TNS is built on back-casting, i.e. envisioning a desirable future and working to move to that point (Robèrt et al., 2002). It works on four sustainability principles (SPs):

1. Concentrations of substances extracted from the Earth's crust;
2. Concentrations of substances produced by society;
3. Degradation by physical means; and
4. Conditions that systematically undermine people's capacity to meet their needs.

Ny et al. (2006) updated the original TNS framework by proposing four steps: (A) sharing and discussing the suggested framework with all participants of the planning exercise; (B) assessing current material and energy flows and practices in relation to the basic sustainability principles (SPs), rather than relying solely on today's perception of impacts); (C) creating options and visions that support society's compliance with the basic SPs; and (D) prioritizing early solutions and investments from C that not only take care of the short-term challenges, but also prepare for coming actions to make society comply, eventually, with the SPs.

The updated TNS indicates that the economic dimension be considered. This is part of step D, where it is specified that 'low-hanging fruits' should be scheduled early to obtain economic

power to deal with bigger challenges, and that substitution/change might be better than de-materialisation (i.e. higher resource productivity and less waste within the new production lines and products) (Ny et al., 2006).

IKEA has incorporated the principles of TNS to improve its contribution to Sustainability, which has resulted in structural changes (with long-term cost reductions in many cases), such as: (a) the use of the E1 standard for all IKEA products in all sales markets; (b) the use of ultraviolet (UV) hardened and water-based lacquers to avoid solvents; and (c) the process of optimizing transportation to reduce exhaust emissions (Ashley, 1993).

TNS is mainly a management and strategy initiative, redirecting people's attention, with some links to the organisational systems element of the corporate system, such as changing behaviours using the funnel metaphor.

TNS addresses explicitly the environmental dimension, and aims to link it to societies' abilities to meet their needs (the social dimension). Step D aims to integrate the economic dimension through de-materialisation and materials substitution/change; however, it could be more explicit with respect to other issues in the economic dimension, such as market presence, customers, acquisitions, and shareholders. The time dimension is addressed through back-casting.

2.16. The Triple Bottom Line (TBL)

The TBL focuses on incorporating environmental and social performance indicators, while complementing and balancing the economic indicators, into company management, measurement and reporting processes (Atkinson, 2000; Elkington, 2002; Frankental, 2001; Wilenius, 2005). TBL aims to question a company's values, strategies and practices, and how these can be used to achieve SD (Milne et al., 2003).

For some companies TBL has become the concept representing their actions and contribution to SD (Milne et al., 2003; Verdeyen et al., 2004). However, reporting on TBL, specially in the case of incomplete practices, does not equate to moving towards sustainability (Milne et al., 2003).

An illustrative example is Johnson Controls Inc. (JCI, 2011), which uses the TBL as a framework to define sustainability within the company.

TBL's scope and focus are relatively narrow, i.e. it remains as an abstract concept that is difficult to understand, ground, and put into practice.

TBL focuses on management and strategy, and assessment and communication. TBL is also one of the few initiatives that integrate, in a comprehensive and simple way, economic, environmental, and social dimensions. However, as a concept *per se* it does not explicitly address the time dimension.

2.17. Contributions of voluntary corporate initiatives to sustainability

Even though there have been proposals to explore the initiatives' potential synergies (see Robèrt, 2000; Robèrt et al., 1997; Robèrt et al., 2002), the repertoire of initiatives presented have been limited in their contribution to: the economic, environmental, and social dimensions of sustainability (see Oskarsson & von Malmborg, 2005); the time dimension (Lozano, 2008); company processes (see Oskarsson & von Malmborg, 2005; von Weizsäcker et al., 2009); how they are linked to each other (see Ny, 2009; Ny et al., 2006); or how could they be combined to address the entire company system.

Sixteen commonly used voluntary corporate sustainability initiatives have been analysed against the indicators in two sets of criteria (based on critical realism and the holistic perspective, and

using GT's constant comparative analysis): (1) the TTSE's four dimensions of sustainability (economic, environmental, social, and the time); and (2) the corporate system elements (operations, management, organisation, procurement and marketing, and assessment and communication).

The analysis of each initiative against the criteria is summarised in Table 2, which shows that most initiatives focus on operations and processes (O&S) and management and strategy (M&S) (seven out of sixteen), followed by assessment and communication (A&C) with five initiatives. Two initiatives touch upon procurement and marketing (P&M), and two with the organisational systems (OS), albeit in a limited way. Five initiatives deal with two parts of the corporate system (ecolabelling, EMS, ESA, LCA, and TBL), while the rest tend to focus only on one of element of the system. The analysis shows that the organisational systems are addressed in a limited basis by the initiatives.

With respect to sustainability's dimensions, the analysis shows that most of the initiatives tend to contribute to the environmental dimension (thirteen out of sixteen). Roughly, the same number of initiatives addresses the economic and social dimensions (between five and seven considering that some initiatives have limited or variable contributions). Only three of the initiatives (ESA, SL, and TBL) contribute to the economic, environmental, and social dimensions fully. Only SL explicitly addresses the time dimension (CP and TNS touch upon it, but their contribution is limited). Depending on the guidelines, e.g. the GRI, SR may also address the time dimension. It should be noted that although some of the initiatives might be focused on one dimension, their outcomes might be positive with respect to another dimension, e.g. EMS focuses on making positive impacts to the environmental dimensions, which may result in cost reductions.

As the analysis shows, none of the initiatives, on its own, covers the full corporate system or the TTSE. A combination of initiatives could cover a large part of the corporate system and sustainability's dimensions.

For the sixteen initiatives discussed there could be 65,535 combinations, the apposite combination depending on company strategy, organisational culture, and contextual factors. One option would be to use all of the initiatives presented; however, this requires countless resources, effort, and coordination, as well as potential duplication of tasks. Another option is to choose only one initiative, but as previously discussed, this does not address the company system and the four dimensions of sustainability.

To try to solve this conundrum, this paper uses the principles of mathematical combinatory group theory to propose the Corporate Integration of Voluntary Initiatives for Sustainability (CIVIS⁶) framework. The CIVIS framework is developed under the premise that a combination of initiatives is needed, constrained by (1) the least possible number of initiatives, and (2) achieving full coverage of the company system and the four dimensions of sustainability. In other words, let CSy be the company system, FDS the four dimensions of sustainability, and CI the combination of initiatives; therefore, the CIVIS framework establishes that CI is a set of initiatives that is constrained by the conditions CSy and FDS.

Table 3 (sorted to try to group the initiatives) can provide guidance for obtaining the combinations that satisfy the CIVIS constraints, which are (note that eco-efficiency can be used instead of CP):

- With three initiatives:
 - LCA, TBL, TNS (see Table 4); and
 - CP, Ecolabelling, TNS;

⁶ The framework's acronym, CIVIS, is derived from the Latin, *civis*, meaning citizen.

- With four initiatives:
 - EMS, Factor X, SL, TBL;
 - CP, CSR, TBL, TNS;
 - CP, SR, TBL, TNS;
 - CP, EMS, SL, TBL;
 - CP, CSR, Ecolabelling, TNS;
 - ESA, LCA, Ecolabelling, TNS; and
 - ESA, TBL, TNS, and CP

As it can be seen from Table 3, most of the initiatives address the environmental dimension, the challenge lies in complementing the different parts of the company system, as well as addressing the economic, social, and time dimensions, whilst at the same time integrating the results from the initiatives in order to avoid repetition.

Two caveats are in order: firstly, the combination of initiatives is dependent on the company's strategy, organisational culture, and contextual factors; and secondly, at present, the initiatives are limited when addressing the organisational systems and the time dimension. This should be further explored to better integrate such elements into some of the tools, or by developing new tools to encompass these elements.

An illustrative example of how to address all the system's elements and the four sustainability dimensions could be a manufacturing company that sells to other businesses. The company could choose a combination of Cleaner Production (to address the operations and processes and the environmental dimension), TBL (for the management and strategy, and procurement and marketing), and Sustainability Reporting, thus providing coverage of four elements of the company system. The last two initiatives address the economic, environmental, and social dimensions. However, the chosen initiatives must be linked and fully integrated with each other, otherwise there is the risk of task duplication that could lead to resource waste, and even to eventual failure of the scheme.

3. Conclusions

Corporate leaders and employees have been increasingly recognising their role in contributing to sustainability. In this context, a number of voluntary tools, approaches, and initiatives have been developed by and for corporations to engage with sustainability. However, there has been a lack of clarity in explaining how the initiatives address the different elements of the company system (operations and processes, management and strategy, organisational systems, procurement and marketing, and assessment and communication), how they are linked, or how they contribute to sustainability's four dimensions (economic, environmental, social, and time).

This paper provides a brief explanation and an analysis of sixteen of the most widely used initiatives. The analysis shows that each initiative, on its own, has advantages with respect to scope and focus for the sustainability dimensions and the system elements, but also disadvantages when it comes to dealing with the complexity and broadness of sustainability, especially in addressing the four dimensions of sustainability or the entire company system. Relying only, or even mainly, in one initiative can result in a limited and narrow contribution to sustainability, with limited coverage of the company's system. It should be noted that attempting to make all the discussed initiatives mandatory through governmental regulation would be almost impossible, as evidenced by ecolabelling.

The challenge for leaders and sustainability champions is to understand the structure of their companies, their core competences, and the context of their operations, so that they can choose

the combination of initiatives that would address their entire company system, as well as the four sustainability dimensions. Even for the same company, a different set of initiatives might need to be considered in different locations, especially where they have different economic, environmental, social, and legal contexts.

Another challenge for leaders is to ensure that the chosen initiative combination creates synergies among them, so that the sustainability dimensions and the company system are fully addressed.

To help overcome these challenges, and orchestrate sustainability in companies, this article proposes the CIVIS framework, which has two purposes: (1) helping company leaders and champions to better understand the initiatives; and (2) fostering a holistic approach through the combination of company initiatives that would help to embed sustainability into the company system with the least effort and maximum results (*Operations and production, Management and strategy, Organisational systems, Procurement and marketing, and Assessment and communication*), whilst addressing the four dimensions of sustainability (as explained by the TTSE).

The least addressed elements of the company system have been organisational systems and procurement and marketing. Perhaps, technocentric fixes are deficient, especially when they are relied upon as the sole 'fix', and, rather, the answer lies in engaging holistically with 'people' in changing companies (and organisations) in order to help current generations and future ones to become more sustainable. This paper may also help corporate sustainability educators in their quest to move towards educational paradigms that are more holistic and sustainability oriented, especially for engineering and management education.

Two issues requiring further investigation are: how to better address the organisational systems (including people, culture, human development, change management, and innovation); and how to incorporate intra- and inter-generational equity, i.e. the time dimension.

Further research is also needed in exploring company cases that have used a combination of the initiatives, and the results that these have yielded in regards to embedding sustainability.

The author has plans to expand the work presented in this paper into an edited book. He would like to invite readers to contact him to participate in writing or co-writing chapters for such publication.

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Acronyms

A&C	Assessment and communication
CP	Cleaner Production
CC	Corporate Citizenship
CSR	Corporate Social Responsibility
CSy	Company System
DCMed	DaimlerChrysler South Africa Medical Fund
DfE	Design for the Environment
EMS	Environmental Management Systems
EMAS	EcoManagement and Audit Scheme
ESA	Environmental and Social Accounting
FDS	Four dimensions of sustainability
FTSE	First Tier Sustainability Equilibrium

GC	Green Chemistry
IE	Industrial Ecology
ISO	International Organisation for Standardization
LCA	Life Cycle Assessment
M&S	Management and strategy
O&P	Operations and processes
OS	Organisational systems
P&M	Procurement and marketing
PI	Combination of corporate sustainability initiatives
TTSE	Two Tiered Sustainability Equilibria
SL	Sustainable Livelihoods
SP	Sustainability Principles
SR	Sustainability Reporting
STSE	Second Tier Sustainability Equilibrium
TBL	The Triple Bottom Line
TNS	The Natural Step
UV	Ultraviolet

References

- Anastas, P.T., Breen, J.J., 1997. Design for the environment and green chemistry: the heart and soul of industrial ecology. *Journal of Cleaner Production* 5 (1–2), 97–102.
- Andersson, L., Shivarajan, S., Blau, G., 2005. Enacting ecological sustainability in the MNC: a test of an adapted value-belief-norm framework. *Journal of Business Ethics* 59, 259–305.
- Ashley, S., 1993. Designing for the environment. *Mechanical Engineering* 115 (3), 55.
- Atkinson, G., 2000. Measuring corporate sustainability. *Journal of Environmental Planning and Management* 43 (2), 235–252.
- Avi-Yonah, R.S., 2005. The Cyclical Transformations of the Corporate Form: a Historical Perspective of Corporate Social Responsibility. University of Michigan, Michigan, pp. 45.
- Avşara, E., Demirel, G.N., 2006. Cleaner production opportunity assessment study in SEKA Balikesir pulp and paper mill. *Journal of Cleaner Production* 16 (4), 422–431.
- Bartelms, P., 1999. Economic Growth and Patterns of Sustainability. Wuppertal Institute, pp. 15.
- Baumgartner, R.J., Zielowski, C., 2007. Analyzing zero emission strategies regarding impact on organizational culture and contribution to sustainable development. *Journal of Cleaner Production* 15, 1321–1327.
- Birch, D., Littlewood, G., 2004. Corporate citizenship. Some perspectives from Australian CEOs. *Journal of Corporate Citizenship* 16, 61–69.
- Brorson, T., Larsson, G., 1999. Environmental Management, third ed. EMS AB, Stockholm.
- Burritt, R.L., Herzig, C., Tadeo, B.D., 2008. Environmental management accounting for cleaner production: the case of a Philippine rice mill. *Journal of Cleaner Production* 17, 431–439.
- C.E.C., 2001. Promoting a European Framework for Corporate Social Responsibility. Commission of the European Communities, Brussels.
- Cannon, T., 1994. Corporate Responsibility. A Textbook on Business Ethics, Governance, Environment: Roles and Responsibilities. Pitman publishing, London.
- Carroll, A.B., 1998. The four faces of corporate citizenship. *Business and Society Review* 100 (101), 1–7.
- Carroll, A.B., 1999. Corporate social responsibility: evolution of a definitional construct. *Business Society* 38 (3), 268–295.
- Cederberg, C., Mattsson, B., 2000. Life cycle assessment of milk production – a comparison of conventional and organic farming. *Journal of Cleaner Production* 8 (1), 49–60.
- Chambers, R., 1995. Poverty and livelihoods: whose reality counts? *Environment and Urbanization* 7 (1), 173–203.
- Coelho, P.R.P., McClure, J.E., Spry, J.A., 2003. The social responsibility of corporate management: a classical critique. *Mid-American Journal of Business* 18 (1), 15–24.
- Cole, L., 2003. Assessing Sustainability on Canadian University Campuses: Development of a Campus Sustainability Assessment Framework. M. A. Environment and Management, Royal Roads University, Victoria, Canada.
- Corbin, J., Strauss, A.L., 1990. Grounded theory research: procedures, canons, and evaluative criteria. *Qualitative Sociology* 13 (1).
- Dalal-Clayton, B., Bass, S., 2002. Sustainable Development Strategies, first ed. Earthscan Publications Ltd, London.
- de Beer, P., Friend, F., 2006. Environmental accounting: a management tool for enhancing corporate environmental and economic performance. *Ecological Economics* 58, 548–560.
- DeMendonça, M., Baxter, T.E., 2001. Design for the environment (DFE): an approach to achieve the ISO 14000 international standardization. *Environmental Management and Health* 12 (1), 51–56.
- DeSimone, L.D., Popoff, F., 2000. Eco-Efficiency. The Business Link to Sustainable Development. MIT Press.
- Dodd Jr., E.M., 1932. For whom are corporate managers trustees? *Harvard Law Review* XLV (7), 1145–1163.
- Doppelt, B., 2003. Leading Change toward Sustainability. A Change-management Guide for Business, Government and Civil Society. Greenleaf Publishing, Sheffield.
- Dunphy, D., Griffiths, A., Benn, S., 2003. Organizational Change for Corporate Sustainability. Routledge, London.
- Dyllick, T., Hockerts, K., 2002. Beyond the business case for corporate sustainability. *Business Strategy and the Environment* 11, 130–141.
- EC., 2009. Directive 2009/125/EC of the European Parliaments and the Council of 21 October 2009 Establishing a Framework for the Setting of Ecodesign Requirements for Energy-related Products (Recast), vol. 2011. European Commission Energy, Brussels, Belgium.
- EC., 2011. EMAS Factsheet Retrieved 7 June, 2011 from: http://ec.europa.eu/environment/emas/pdf/factsheet/fs_EMAS2to3.pdf.
- Ehrenfeld, J., Gertler, N., 1997. Industrial ecology in practice. The evolution of Interdependence at Kalundborg. *Journal of Industrial Ecology* 1 (1), 67–79.
- Ehrenfeld, J., 2004. Industrial ecology: a new field or only a metaphor? *Journal of Cleaner Production* 12, 825–831.
- Ehrenfeld, J.R., 2005. Eco-efficiency. Philosophy, theory, and tools. *Journal of Industrial Ecology* 9 (4), 6–8.
- Ekins, P., 2005. Eco-efficiency. Motives, drives, and economic implications. *Journal of Industrial Ecology* 9 (4).
- Elkington, J., 2002. Cannibals with Forks. Capstone Publishing Limited, Oxford.
- Elkington, J., 2005. Enter the triple bottom line. In: Henriques, A., Richardson, J. (Eds.), *The Triple Bottom Line. Does It All Add up?* Earthscan, London.
- Frankental, P., 2001. Corporate social responsibility – a PR invention? *Corporate Communications: An International Journal* 6 (1), 18–23.
- Frederick, W.C., 1994. From CSR1 to CSR2. *Business and Society* 33 (2), 150–164.
- Friedman, M., 1970. The Social Responsibility of Business Is to Increase Its Profits. *The New York Times Magazine*.
- Fukukawa, K., Moon, J., 2004. A Japanese model of corporate social responsibility? *Journal of Corporate Citizenship* 16, 45–59.
- G.R.I., 2010. Reports Database Retrieved 25 May, 2010 from: <http://www.globalreporting.org/ReportsDatabase/>.
- G.R.I., 2011. Reports Database Retrieved 6 March, 2011 from: <http://www.globalreporting.org/ReportsDatabase/>.
- Galarraga Gallastegui, I., 2002. The use of eco-labels: a review of the literature. *European Environment* 12, 316–331.
- Gibbs, D., Deutz, P., 2007. Reflections on implementing industrial ecology through eco-industrial park development. *Journal of Cleaner Production* 15, 1683–1695.
- Glaser, B.G., Strauss, A.L., 1999. *The Discovery of Grounded Theory: Strategies for Qualitative Research*. Aldine de Gruyter, New York.
- Glavić, P., Lukman, R., 2007. Review of sustainability terms and their definitions. *Journal of Cleaner Production* 15, 1875–1885.
- G.R.I., 2006. Sustainability Reporting Guidelines Version 3.0 (G3), vol. 2007. Global Reporting Initiative, Amsterdam, 45.
- Hale, M., 1996. Ecolabelling and cleaner production: principles, problems, education and training in relation to the adoption of environmentally sound production processes. *Journal of Cleaner Production* 4 (2), 85–95.
- Hallstedt, S., 2008. A foundation for Sustainable Product Development. PhD dissertation, Blekinge Institute of Technology, Karlskrona, Sweden.
- Hamann, R., 2003. Mining companies' role in sustainable development: the 'why' and 'how' of corporate social responsibility from a business perspective. *Development Southern Africa* 20 (2), 234–254.
- Hart, S.L., 1997. Beyond greening: strategies for a sustainable world. Harvard Business Review (January–February).
- Heeres, R.R., Vermeulen, W.J.V., de Walle, F.B., 2004. Eco-industrial park initiatives in the USA and the Netherlands: first lessons. *Journal of Cleaner Production* 12, 985–995.
- Heine, L., 2007. Sustainable materials and green chemistry. In: Graw-Hill, Mc (Ed.), *Access Science. Encyclopedia of Science & Technology Online*. McGraw-Hill.
- Henderson, D., 2005. The role of business in the world of today. *Journal of Corporate Citizenship* 17, 30–32.
- Hill, C.W., Jones, G.R., 2001. *Strategic Management: An Integrated Approach*, fifth ed., Houghton Mifflin Company, U.S.A.
- Hockerts, K., 1999. The sustainability radar – a tool for the innovation of sustainable products and services. *Greener Management International* 25, 29–49.
- Holliday, C.O.J., Schmidheiny, S., Watts, P., 2002. Walking the Talk. The Business Case for Sustainable Development. Greenleaf Publishing, Sheffield.
- Holmberg, J., Robert, K.-H., 2000. Backcasting: a framework for strategic planning. *International Journal of Sustainable Development and World Ecology* 7 (4), 291–308.
- Holme, R., Watts, P., 2000. *Corporate Social Responsibility: Making Good Business Sense*. WBCSD.
- Hopkins, M.J.D., 2002. Sustainability in the internal operations of companies. *Corporate Environmental Strategy* 9 (2), 1–11.
- Hussey, D.M., Kirsop, P.L., Meissen, R.E., 2001. Global reporting initiative guidelines: an evaluation of sustainable development metrics for industry. *Environmental Quality Management*, 1–20.
- ICCA, 2011. Responsible Care Retrieved 3 March, 2011 from: <http://www.icca-chem.org/en/Home/Responsible-care/>.
- Ismann, R., 2003. Industrial ecology: shedding more light on its perspective of understanding nature as model. *Sustainable Development* 11, 143–158.
- ISO., 2009. Draft International Standard ISO/DIS 26000. Guidance on Social Responsibility. International Organization for Standardization, Geneva.

- Jacobsen, N.B., 2006. Industrial symbiosis in Kalundborg, Denmark. A quantitative assessment of economic and environmental aspects. *Journal of Industrial Ecology* 10 (1–2), 239–255.
- Jansen, L., 2003. The challenge of sustainable development. *Journal of Cleaner Production* 11, 231–245.
- JCI., 2011. Sustainability Principles Retrieved 13 March, 2011 from: http://www.johnsoncontrols.com/publish/us/en/products/building_efficiency/energy_efficiency/principles.html.
- Jupp, V., 2006. *The SAGE Dictionary of Social Research Methods*. SAGE publications, London.
- Kolk, A., 2008. Sustainability, accountability and corporate governance: exploring multinationals' reporting practices. *Business Strategy and the Environment* 18, 1–15.
- Korhonen, J., 2003. Should we measure corporate social responsibility? *Corporate Social Responsibility and Environmental Management* 10, 25–39.
- Kuehr, R., 2007. Towards a sustainable society: United Nations University's Zero emissions approach. *Journal of Cleaner Production* 15, 1198–1204.
- Langer, M.E., Schön, A., 2003. Enhancing Corporate Sustainability. A Framework Based Evaluation Tools for Sustainable Development. *Forschungsschwerpunkt Nachhaltigkeit und Umweltmanagement*, Wirtschaftsuniversität Wien, Vienna.
- Lantos, G., 2001. The boundaries of strategic corporate social responsibility. *Journal of Consumer Marketing* 18 (7), 595–630.
- Lehman, G., 1999. Disclosing new worlds: a role for social and environmental accounting and auditing. *Accounting, Organizations and Society* 24, 217–241.
- Leisinger, K.M., 2003. Opportunities and risks of the United Nations global compact. *Journal of Corporate Citizenship* 11, 113–130.
- Lorenzi, N.M., Riley, R.T., 2000. Managing change: an overview. *Journal of the American Medical Informatics Association* 7 (2), 116–124.
- Lovins, A.B., Lovins, H.L., Hawken, P., 2000. *A Road Map for Natural Capitalism*. Harvard Business Review on Business and the Environment. Harvard Business Review, Boston.
- Lowe, E.A., Evans, L.K., 1995. Industrial ecology and industrial ecosystems. *Journal of Cleaner Production* 3 (1–2), 47–53.
- Lowenthal, M.D., Kastenberg, W.E., 1998. Industrial ecology and energy systems: a first step. *Resources, Conservation and Recycling* 24, 51–63.
- Lozano, R., Huisingh, D., 2011. Inter-linking issues and aspects in sustainability reporting. *Journal of Cleaner Production* 19, 99–107.
- Lozano, R., 2006. A tool for a graphical assessment of sustainability in universities (GASU). *Journal of Cleaner Production* 14 (9–11), 963–972.
- Lozano, R., 2008. Envisioning sustainability three-dimensionally. *Journal of Cleaner Production* 16 (17), 1838–1846.
- Lozano, R., 2009. Orchestrating organizational change for corporate sustainability. Strategies to overcome resistance to change and to facilitate institutionalization. PhD dissertation, Cardiff University, Cardiff.
- Matten, D., Moon, J., 2004. Corporate social responsibility education in Europe. *Journal of Business Ethics* 54, 323–337.
- McIntosh, M., Leipziger, D., Jones, K., 1998. *Corporate Citizenship. Successful Strategies for Responsible Companies*. Financial Times, Pitman Publishing.
- Milne, M., Kearins, K., Walton, S., 2003. Business Makes a 'Journey' Out of 'Sustainability': Creating Adventures in Wonderland?.
- Nadai, A., 1999. Conditions for the development of a product ecolabel. *European Environment* 9, 202–211.
- NGLS, UNRISD, 2002. *Voluntary Approaches to Corporate Responsibility. Readings and a Resource Guide*. UN Non-Governmental Liaison Service, Geneva.
- Ny, H., MacDonald, J.P., Broman, G., Yamamoto, R., Robert, K.-H., 2006. Sustainability constraints as systems boundaries. An approach to making life-cycle management strategic. *Journal of Industrial Ecology* 10 (1–2), 61–77.
- Ny, H., 2009. Strategic life-cycle modeling for sustainable product innovation. PhD dissertation, Blekinge Institute of Technology, Karlskrona, Sweden.
- OECD, 1997. *Eco-labelling: Actual Effects of Selected Programmes*. Organisation for Economic Co-operation and Development, Paris.
- Oskarsson, K., von Malmborg, F., 2005. Integrated management systems as a corporate response to sustainable development. *Corporate Social Responsibility and Environmental Management* 12, 121–128.
- Parker, L.D., 2011. Twenty-one years of social and environmental accountability research: a coming of age. *Accounting Forum* 35, 1–10.
- Pauli, G., 1997. Zero emissions: the ultimate goal of cleaner production. *Journal of Cleaner Production* 5 (1–2), 109–113.
- Porter, M.E., Kramer, M.R., 2003. *The Competitive Advantage of Corporate Philanthropy*. Harvard Business Review on Corporate Responsibility. Harvard Business School Press, Boston.
- Porter, M.E., van der Linde, C., 1995. Toward a new conception of the environment-competitiveness relationship. *The Journal of Economic Perspectives* 9 (4), 97–118.
- Porter, M.E., 1985. *Competitive Advantage*. The Free Press, New York.
- Prakash, A., 2000. Responsible care: an assessment. *Business and Society* 39 (2), 183–209.
- Quazi, H.A., 2001. Sustainable development: integrating environmental issues into strategic planning. *Industrial Management & Data Systems* 101 (2), 64–70.
- Quist, J., Knot, M., Young, C., Green, K., Vergrat, P., 2001. Strategies towards sustainable households using stakeholder workshops and scenarios. *International Journal of Sustainable Development* 4 (1), 75–89. doi:10.1504/IJSD.2001.001547.
- Reijnders, L., 1997. The factor X debate: setting targets for eco-efficiency. *Journal of Industrial Ecology* 2 (1).
- Reinhardt, F., 2000. *Bringing the Environment Down to Earth*. Harvard Business Review on Business and the Environment. Harvard Business School Press, Boston, MA.
- Rex, E., Baumann, H., 2007. Beyond ecolabels: what green marketing can learn from conventional marketing. *Journal of Cleaner Production* 15, 567–576.
- Robèrt, K.-H., Herman, D., Hawken, P., Holmberg, J., 1997. A compass for sustainable development. *International Journal of Sustainable Development & World Ecology* 4 (2), 79–92.
- Robèrt, K.-H., Schmidt-Bleek, B., Aloisi de Larderel, J., Basile, G., Jansen, J.L., Kuehr, R., Wackernagel, M., 2002. Strategic sustainable development - selection, design and synergies of applied tools. *Journal of Cleaner Production* 10, 197–214.
- Robèrt, K.-H., 2000. Tools and concepts for sustainable development, how do they relate to a general framework for sustainable development, and to each other? *Journal of Cleaner Production* 8, 243–254.
- Rondinelli, D.A., 2003. Transnational corporations: international citizens or new sovereigns? *Business Strategy Review* 14 (4), 13–21.
- Sarkis, J., Cordeiro, J.J., 2001. An empirical evaluation of environmental performance: pollution prevention versus end-of-pipe. *European Journal of Operational Research* 135 (1), 102–113. doi:10.1016/S0377-2217(00)00306-4.
- Saunders, M., Lewis, P., Thornhill, A., 2007. *Research Methods for Business Students*, fourth ed. Pearson Education Limited, Harlow, England.
- Smith, C., 2003. *The New Corporate Philanthropy*. Harvard Business Review on Corporate Responsibility. Harvard Business School Press, Boston.
- Strauss, A.L., Corbin, J., 1998. *Basics of Qualitative Research. Techniques and Procedures for Developing Grounded Theory*, second ed. SAGE Publications, Thousand Oaks, California.
- Svedberg Nilsson, K., 2003. The (Ir)responsible Organisation. A Note on the Quest for Socially Responsible Corporations Paper presented at the NFF Conference, Reykjavik.
- Swift, T., Zadek, S., 2002. Corporate Responsibility and the Competitive Advantage of Nations. The Copenhagen Centre Accountability, Copenhagen.
- The Economist, 2005. *The Good Company. A Survey of Corporate Social Responsibility*. The economist.
- UN, 1992. Agenda 21. Chapter 3: Combating Poverty. UN, Rio de Janeiro.
- UNCTAD, 1999. *The Social Responsibility of Transnational Corporations*. United Nations Conference on Trade and Development, Geneva, pp. 66.
- UNEP, 2000a. *International Declaration on Cleaner Production* Retrieved 25 January, 2007 from: <http://www.unep.org/pc/cp/declaration/pdfs/english.pdf>.
- UNEP, 2000b. *Voluntary Initiatives: Current Status, Lessons Learnt and Next Steps*. United Nations Environment Programme, Paris.
- UNEP, 2001. *Cleaner Production (CP) Activities* Retrieved 25 January, 2007 from: <http://www.unep.org/PC/cp/home.htm>.
- UNGC, 2008. *The Ten Principles* Retrieved 18 January, 2008 from: <http://www.unglobalcompact.org/AboutTheGC/TheTenPrinciples/index.html>.
- UNGC, 2010. *Overview of the UN Global Compact* Retrieved 05 May 2010 from: <http://www.unglobalcompact.org/AboutTheGC/index.html>.
- UNGC, 2003. *HIV/AIDS Everybody's Business*. UN Global Compact.
- UNU, 2007. *Factor X* Retrieved 24 January, 2007 from: http://www.ias.unu.edu/ecology/g_economy/factorx.htm.
- van Marrewijk, M., Hardjono, T.W., 2003. European corporate sustainability framework for managing complexity and corporate transformation. *Journal of Business Ethics* 44 (2/3), 121.
- Verdeyen, V., Put, J., van Buggenhout, B., 2004. A social stakeholder model. *International Journal of Social Welfare* 13, 325–331.
- von Weizsäcker, E., Lovins, A.B., Lovins, L.H., 1998. *Factor Four. Double Wealth, Halving Resource Use*. Earthscan, London.
- von Weizsäcker, E., Hargroves, K., Smith, M.H., Desha, C., Stasinopoulos, P., 2009. *Factor Five. Transforming the Global Economy through 80% Improvements in Resource Productivity*. Earthscan, London.
- Warhurst, A., 2002. *Sustainability Indicators and Sustainability Performance Management Mining, Minerals and Sustainable Development*, Vol. 43. International Institute for Environment and Development World Business Council for Sustainable Development, Geneva.
- WBCSD, 2002. *Corporate Social Responsibility. The WBCSD's Journey*. World Business Council for Sustainable Development, Geneva.
- WBCSD, 2003. *Sustainable Development Reporting. Striking the Balance*. World Business Council for Sustainable Development, Geneva.
- WBCSD, 2004a. *Doing Business with the Poor. A Field Guide*. World Business Council for Sustainable Development, Geneva.
- WBCSD, 2004b. *A Sustainable Livelihoods Approach to Industry Challenges: The South African Sugar Industry*. World Business Council for Sustainable Development, Geneva.
- WCED, 1987. *Our Common Future*, first ed. Oxford University Press, Oxford.
- Welford, R., 2005. Corporate social responsibility in Europe, North America and Asia. 2004 Survey results. *Journal of Corporate Citizenship* 17, 33–52.
- Weymes, E., 2004. Management theory. Balancing individual freedom with organisational needs. *Journal of Corporate Citizenship* 16, 85–98.
- Wilenius, M., 2005. Towards the age of corporate responsibility? Emerging challenges for the business world. *Futures* 37, 133–150.
- Willard, B., 2002. *The Sustainability Advantage*. Gabriola Island. New Society Publishers, Canada.
- Zadek, S., 1999. *Stalking sustainability*. GMI 26, 1–11.
- Zadek, S., 2001. *The Civil Corporation. The New Economy of Corporate Citizenship*. Earthscan, London.