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Strategic sustainable development[1] using the ISO 14001 Standard

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Abstract

The ISO 14001 Environmental Management System Standard has become a wide-spread administrative tool in the field of corporate responses to sustainability. As a framework for the administering of sustainable development in firms, ISO 14001 in itself does not speak of strategic planning for sustainability, nor of upstream solutions of problems at their source. Furthermore, confusion exists with respect to where ISO 14001 fits in relation to a complex array of tools for sustainable development. This research proposes the integration of a "backcasting" method that embodies a five-level approach to planning in complex systems, with the ISO 14001 planning process requirements. The result is a strategic planning framework that focuses on the minimum requirements for a sustainable society and embeds them in a process to assist firms in their sustainability initiatives.

Keywords: Strategic sustainable development; Sustainability; The Natural Step Framework; ISO 14001; Environmental Management Systems; Backcasting

1. Introduction

ISO 14001 Environmental Management Systems (EMS) have emerged as a leading management tool to address environmental degradation at the firm level, and rapid adoption is occurring worldwide as evidenced by the exponential increase in global registrations to the Standard. Reasons for adopting the Standard range from compliance and consumer pressure to the potential for cost savings and a healthier environment.

Although this trend is encouraging, and while the implementation of ISO 14001 is a good start, the subsequent concrete work within corporations often focuses on identified downstream effects from non-sustainable activities—i.e., "aspects"—rather than identifying the underlying principles behind these aspects. Consequently, the work often relies on vague guiding principles of "continual improvement" without the identification of ultimate objectives that comply with basic principles for sustainability. For this reason, it is difficult to facilitate comprehensive planning and elevate sustainability higher on the corporate agenda [1–7]. Compounding these factors, the presence of many tools has created confusion with respect to how each relate to one another and when each should be used in planning.

Given the popularity of ISO 14001, and the fact that the Standard provides a comprehensive and logical administrative vehicle, can the system be made more effective in helping firms move systematically toward complying with basic principles for a sustainable society?

Recent studies in this area have focused primarily on superimposing basic principles for sustainability at various points in the ISO 14001 implementation process, mainly during policy setting, target setting and staff training [3,4]. The goal of these efforts was to combine a process (ISO 14001) with a set of basic principles for sustainability, effectively giving the ship a compass. While this is a first step conceptually, a set of principles does not necessarily help managers take more concrete steps from a strategic planning perspective, particularly

[1] "Strategic Sustainable Development" was coined by authors of a seminal study [12] that underpins this paper.

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when society is so far from being sustainable as to make the journey appear almost incomprehensible. Bridging the gap between guiding principles and action is required.

A framework for systematic planning towards compliance with basic principles for sustainability has previously been described [5,8–10]. This framework builds on backcasting from the principles, i.e., the planning procedure takes as its starting point an imagined successful outcome—compliance with the principles—and is followed by a planning procedure that responds to the question: "What do we need to do today to reach that outcome?" [11]. The backcasting method of "planning from principles of success" is different from working with scenarios of preferred futures, because it occurs from more or less detailed descriptions of success. Using a games metaphor, scenario building resembles assembling a jig-saw puzzle, where a specific image guides one successful outcome. "Backcasting from principles of success" on the other hand resembles chess, where the principle of check-mate provides the overall guiding principle for the game, and many outcomes or visions of success are possible. Backcasting therefore has certain advantages: (i) it is often easier to agree on incontrovertible principles of success than on detailed visions, (ii) future technologies and innovations are by definition not known beforehand—they can be introduced while the "game" proceeds, and (iii) detailed scenarios are not necessarily sustainable if they are not scrutinized using basic principles for sustainability.

Since the initial efforts at integrating basic principles for sustainability within the ISO 14001 framework, a five-level approach for planning in complex systems has been presented [7] that outlines five discrete levels that should be kept separate in order to ensure comprehension and rigour. The model was later applied by a number of pioneers of well-known tools and approaches to sustainability to respond to the question: "where does it all fit, and how can the many tools and approaches be used synergistically to move a firm toward sustainability?" [12].

This paper proposes the integration of the "backcasting" method, which itself embodies the five-level approach to planning in complex systems, with the ISO 14001 planning process requirements (section 4.2), and converts academic language to business language. It approaches the firm's typical strategic planning cycle and allows room for economic and competitive aspects, thereby applying ISO 14001 from a more strategic perspective. The aim is to create a simple, comprehensive and effective tool to aid managers in moving their firms toward sustainability.

Section 2 revisits major concepts in (i) the ISO 14001 Standard, (ii) backcasting, and (iii) the five-level planning approach, as critical and substantive components of the proposal. Section 3 presents the proposed integrated planning section for ISO 14001, with an explanation and rationale for each component and an example of what each element might mean in a firm. Section 4 presents a brief reflection on the potential opportunities of this approach.

2. A review of concepts

2.1. ISO 14001 Environmental Management System (EMS) Standard

The ISO 14001 Standard consists of the EMS specification and 17 clauses, or general requirements, in five categories. Each clause was written to apply to a wide diversity of organizations, and is therefore not specific or prescriptive [13,14]. The requirements describe general outcomes of the system, but do not prescribe specific approaches an organization must implement to get there.

The following is a summary of the 17 ISO 14001 clauses:

4.1 Environmental policy
4.2 Planning
  4.2.1 Environmental aspects
  4.2.2 Legal and other requirements
  4.2.3 Objectives and targets
  4.2.4 Environmental management program(s)
4.3 Implementation and operation
  4.3.1 Structure and responsibility
  4.3.2 Training, awareness and competence
  4.3.3 Communication
  4.3.4 Environmental Management System Documentation
  4.3.5 Document control
  4.3.6 Operational control
  4.3.7 Emergency preparedness and response
4.4 Checking and corrective action
  4.4.1 Monitoring and measurement
  4.4.2 Non-conformance and corrective and preventive action
  4.4.3 Records
  4.4.4 Environmental Management System audit
4.5 Management review

Together, these clauses compose the ISO 14001 EMS Standard. This paper proposes an expansion of the planning section (4.2).

2.2. A five-level approach to planning in complex systems

The world of principles, strategies, actions and tools is complex, with different ideas and frameworks often competing for intellectual dominance. From *Cleaner Production* and *Pollution Prevention* to *Industrial Ecology* and *The Natural Step Framework*, the approaches vary in scope, scale, intent and comprehensiveness. While all

represent legitimate efforts to help organizations move in more sustainable directions, confusion can exist regarding the qualities, differences and linkages between the tools and approaches, and consequently, how to best apply them [12].

Over the past two years, a number of pioneers of popular approaches and tools for sustainable development have come together to make sense of the complexity by utilizing the published five-level approach to planning to sort the various principles, strategies and tools [12]. The objective of the study was to answer the question "where does it all fit?" and elaborate a general model for the relationships among principles, objectives, strategies, actions and tools. Since the levels of the planning approach are critical to the proposed strategic planning enhancement for ISO 14001, they are covered in more detail in the following paragraphs [7]:

1. Constitutional level—principles for the *constitution* of the system (e.g., ecological and social principles).
2. Objective level—principles for a favorable *outcome* of planning within the system (e.g., *principles for sustainability*).
3. Strategic level—principles for the *process* to reach this outcome (e.g., *principles for sustainable development*).
4. Action level—*actions, i.e., concrete measures* that comply with the principles for the process to reach a favorable outcome in the system (e.g., recycling and switching to renewable energy).
5. Tool level—*tools* to monitor and audit (i) the relevance of actions with reference to actual compliance with the plan (e.g., indicators of flows and key figures to comply with principles for sustainability), and/or monitor (ii) the status of the system itself, and impacts (e.g., ecotoxicity and employment), or reduced impacts, as a consequence of strategically planned societal actions.

Constitutional level: 1—the overall system (i.e., ecosphere)—represents the overarching system of societies and surrounding ecosystems—the system within which planning takes place. In order to plan for a successful outcome in this system (i.e., sustainability) it is necessary to understand the constitutional principles underpinning its functioning (e.g., thermodynamics; the biogeochemical cycles; the ecological interdependencies of species; the societal exchange with, and dependency on, the ecosphere) [7]. With this understanding of the physical laws and biophysical realities of the system, one can move to the next level.

Objective level: 2—principles for sustainability—defines the goal or objective, i.e., the *state* of sustainability within the ecosphere. *The Natural Step*[2] has—in collaboration with universities, municipalities and corporations—developed a more specific framework of complementary, non-overlapping conditions for social and ecological sustainability—the four System Conditions [5,8–10].

The three System Conditions for *ecological* sustainability are derived from the three basic mechanisms by which natural life-sustaining systems can be destroyed, followed by inserting a "not" to create the converse of those mechanisms. The System Condition for *social* sustainability is simply stated as the requirement to not undermine the ability of humans to meet their needs (within the frame set by the three System Conditions for ecological sustainability).

In the sustainable society, nature is not subject to systematically increasing:

1. concentrations of substances extracted from the Earth's crust[3]
2. concentrations of substances produced by society[4]
3. degradation by physical means[5]

and, in that society

[2] The Natural Step is an international non-profit organization in ten countries that uses a science-based, systems framework to help organizations and communities understand and move towards sustainability using the four System Conditions for a sustainable society.

[3] The societal influence on the ecosphere due to accumulation of lithospheric material is covered by this principle. The balance of flows between the ecosphere and the lithosphere must be such that *concentrations* of substances from the lithosphere do not systematically increase in the whole ecosphere, or in parts of it. Besides the upstream influence on this balance through the amounts of mining and choices of mined minerals, the balance can be influenced by the quality of final deposits, and the societal competence to technically safeguard the flows through recycling and other measures. Due to the complexity and delay mechanisms in the ecosphere, it is often very difficult to foresee what concentration will lead to unacceptable consequences. A general rule is not to allow societal-caused deviations from the natural state that are large in comparison to natural fluctuations. In particular, such deviations should not be allowed to increase systematically. Therefore, what must at *least* be achieved is a stop to systematic increases in concentration.

[4] This principle implies that the flows of societally produced molecules and nuclides to the ecosphere must not be so large that they can neither be integrated into the natural cycles within the ecosphere nor be deposited into the lithosphere. The balance of flows must be such that concentrations of substances produced in the society do not systematically increase in the whole ecosphere or in parts of it. Besides the upstream influence on this balance through production volumes and characteristics of what is produced, such as degradability of the produced substances, the balance can be influenced by the quality of final deposits, and the societal competence to technically safeguard the flows through measures such as recycling and incineration.

[5] The societal influence on the ecosphere due to manipulation and harvesting of stocks and flows within the ecosphere is covered by the third principle. It implies that the resource basis for: (i) productivity in the ecosphere such as fertile areas, thickness and quality of soils, availability of fresh water, and (ii) biodiversity is not systematically deteriorated by over-harvesting, introductions, mismanagement or displacement.

4. people are not subject to conditions that systematically undermine their capacity to meet their needs.[6]

The System Conditions represent objectives that must be fulfilled in a sustainable society. As a first step, the System Conditions must be "translated" into objectives that are relevant to the individual organization (the System Conditions are basic principles for the whole ecosphere). For an organization that does not want to be a problem in the system, a logically and ethically relevant way of translation would be to add 'our contribution' into the phrasing of the System Conditions:

Therefore, the sustainability objectives of an organization are to:

1. eliminate its contribution to systematic increases in concentrations of substances from the Earth's crust,
2. eliminate its contribution to systematic increases in concentrations of substances produced by society,
3. eliminate its contribution to systematic physical degradation of nature,
4. eliminate its contribution to the undermining of humanity's ability to meet its needs worldwide.

Moving further into Level 2, various dematerializations[7] and substitutions/changes[8] (transmaterializations) for minerals, persistent compounds and renewable resources are performed in order to eliminate the organization's contribution to violations of the System Conditions [12]. Dematerializations and substitutions can be further subdivided into two mechanisms[9] that vary depending under which System Condition they fall. The combination of dematerializations and substitutions will be unique depending on the organization.

Strategic level: 3—principles for the process (i.e., sustainable development)—moves further into the five levels and focuses on the process to reach the goal. In order to move toward the level of dematerialization and substitution required to eliminate violations of the System Conditions, society's actions should be focused through a set of principles to guide the process. These principles[10] include [12]:

1. Backcasting—using an envisioned successful and sustainable future as a starting point for planning and then working toward that vision from the current state.
2. Creating flexible platforms for future investments that minimize or eliminate sunk costs and/or stranded assets.
3. Ensuring a good return on investment and short-term success.

Action level: 4—requires the selection of concrete actions, based on Level 3 principles required to guide the process that will move society into alignment with the System Conditions over time.

Tools level: 5—requires the selection of tools to help guide and monitor the implementation process. Two levels must be covered in this section: (i) tools to monitor the implementation process relative to the plan, and (ii) tools to monitor actual impacts on socio-ecological systems of concern. For example, an organization may choose to implement ISO 14001 as a tool to move the organization toward sustainability. This paper specifically focuses on combining this tool with the first four levels of the five-level approach to create an integrated approach to planning.

Summary. The creation of a five-level approach to sustainability planning attempts to elaborate on and distinguish between the different levels of principles, strategies, actions and tools, so that organizations are able to better conceptualize both the process and the challenge in moving toward a more sustainable business model. The approach also ensures that essential elements of a robust strategy are not omitted, and that the design of action programs involves an informed choice about the trade-offs involved in working toward a successful outcome given the current political and social reality. It is a critical ingredient of the strategic planning section for ISO 14001.

2.3. *Backcasting from non-overlapping sustainability principles*

Holmberg and Robèrt [5,9,10] have been strong proponents of a systems-based approach to sustainability based on backcasting from the four System Conditions. From this work emerged the challenge of developing practically applicable methods. While the five-level approach described above is helpful in framing the different levels of planning, it still lacks a process through which an organization can begin planning from sustainability principles and move back to its current reality, rather than—as ISO 14001 is traditionally applied—focusing solely on relative improvements in performance without an ultimate sustainability benchmark.

[6] Human needs refer to not only the basic needs to sustain life, but all needs to maintain health—including emotional and social needs [15]. These needs should not be confused with the cultural means by which we satisfy them.

[7] Dematerialization means the reduction of material flows.

[8] Substitution here is taken in its larger context, meaning the exchange of type or quality of flows and/or activities, including mind-sets.

[9] Each sub-mechanism is presented in Table 1, corresponding with their introduction in Section 3 of the paper to save space.

[10] Principles of a socio-political nature are also presented in the paper [12]—e.g., democratic principles such as transparency and dialogue—but are not included here because they are not directly relevant.

A further iteration of the backcasting method—based on the work of Robèrt, Holmberg and *The Natural Step*—includes the following "A–B–C–D" steps [5,7]:

1. Awareness (A)—developing a common understanding and awareness of the System Conditions for a sustainable society.
2. Baseline (B)—developing a baseline of critical flows and management routines to understand where the organization is contributing to violations of the System Conditions.
3. Clear vision (C)—developing visions with reference to the System Conditions, and solutions to the list of critical flows and management routines from "B". "What will the organization look like in a sustainable society?". Solutions and measures that are theoretically feasible are listed.
4. Down to action (D)—prioritizing measures from the "C" list and managing the journey toward the clear vision. At this point, priority is given to such measures that combine the following characteristics: (i) they should serve as platforms for further improvements in line with the System Conditions (avoiding blind alleys), and (ii) give an adequate return on investment.

Over the past two years, *The Natural Step* has further built on this work by adding components to each level of the "A–B–C–D" backcasting method from the planning field [16]. This backcasting method also informs the proposed planning section for ISO 14001 because it puts into practice (i.e., it is a process) the five-level approach to planning in complex systems.

3. Planning for sustainability using ISO 14001

This section proposes an enhanced strategic planning framework for use in ISO 14001. The framework is unique because it takes the backcasting method that embodies the five-level approach to planning and integrates it with the ISO 14001 planning process. Backcasting from basic sustainability principles is in itself a strategic principle, as outlined above. This effort takes the backcasting process one step further to become a concrete working format familiar to corporations. In addition, the enhanced planning section incorporates elements of vision and strategy from traditional management literature [17,18].

In using backcasting and the five-level approach, some minor changes have been made. Specifically, the enhanced planning section focuses on "B", "C" and "D" of the backcasting framework (baseline, vision and action planning). Awareness (A) has been omitted because the focus here is on planning, and how an organization educates itself is beyond the scope of this paper. This step should, however, take place before commencing with implementation of ISO 14001 so that all stakeholders begin with a common understanding of sustainability and its requirements.

Furthermore, while the five-level approach remains intact, some of its levels have been renamed to more closely reflect business language, and some levels have been separated from others. This was done to ensure clarity and focus on more explicit outcomes without distorting the approach's intent.

The planning section was developed with a generic and scaleable focus in mind—a tool that organizations, corporations, individual business units, specific production lines, or specific product design teams could use and adapt to their individual circumstances. It focuses on asking the right questions during a rigorous process, and framing the discussion on high-level strategy so that an organization can develop a comprehensive suite of strategies and actions to help it achieve its goals.

The following sections correspond with the planning section (4.2) of ISO 14001. A summary outlining each category, its contents, and the objective of each step in the planning process is included as Table 1.

3.1. Section 4.2.1: identification of environmental aspects (System Conditions 1–3)

This five-part process ensures a clear understanding of energy and material flows in the organization and how they relate to products, processes and services. Mapping material and energy flows allows an organization to understand how it relates to the broader system of which it is a part (i.e., earth) and facilitates the identification of contributions to violations of the first three System Conditions. It is consistent with both the ISO 14001 requirement to identify environmental aspects and "B" of the backcasting method, but goes beyond simply identifying "aspects" in isolation from each other, and instead creates a framework through which the organization can understand how its aspects relate to the ecosphere.

While the resulting systems map will be unique to each organization, Fig. 1 shows an example of how *Interface Inc.* has created a generic overview systems map that could apply similarly to many corporations.

3.2. Section 4.2.2: identification of social aspects (System Condition 4)

As already mentioned, stable and diverse social systems in which people can meet their needs on a global basis are an essential component of sustainability. Therefore, it is critical that an organization identify and create a list of its social aspects—ways in which it supports or inhibits the ability of communities and stakeholders to meet their needs through diversity and self-organization. This may take the form of a stakeholder

Table 1
Strategic sustainable development in ISO 14001

	Task	Objective
4.2	Planning	
4.2.1	Identification of environmental aspects (System Conditions #1, #2, #3)	
	Identify products, processes and services the organization delivers, and the processing stages that make up each process.	A clear understanding of the component processes that take place in delivering the organization's product or service.
	Describe inputs of energy and materials (solid, liquid, gas) into the organization and their origins.	A clear understanding of all materials and energy entering the organization and their origins.
	Describe outputs of solid, liquid and gaseous waste from the organization and their final destination.	A clear understanding of all materials and energy leaving the organization and their destinations.
	Draw a systems map of the organization detailing process energy and material inputs (e.g., extractions from the earth's crust; production or use of toxic and persistent materials; and use of renewable materials) and material outputs and their final destination in the ecosphere.	A clear understanding of the origin and destination of critical flows of energy and materials in the organization and their relationship to the ecosphere.
	Prepare a list of identified environmental aspects based on energy and material inputs and outputs.	A list of all environmental aspects associated with the organization's operations.
4.2.2	Identification of social aspects (System Condition #4)	
	Identify the contribution of products, services, processes and operations in meeting stakeholder needs or inhibiting the meeting of stakeholder needs in communities both near and remote.	A clear understanding of where the organization supports and inhibits the ability of its stakeholders to meet their needs.
	Prepare a list of identified social aspects based on the organization's impact on meeting or inhibiting the meeting of stakeholder needs.	A list of all social aspects associated with the organization's operations.
4.2.3	Determination of significant environmental and social aspects	
	Conduct a System Condition #1 analysis of each process step in product or service delivery.	An understanding of where the organization contributes to violations of System Condition #1.
	Conduct a System Condition #2 analysis of each process step in product or service delivery.	An understanding of where the organization contributes to violations of System Condition #2.
	Conduct a System Condition #3 analysis of each process step in product or service delivery.	An understanding of where the organization contributes to violations of System Condition #3.
	Conduct a System Condition #4 analysis of each process step in product or service delivery.	An understanding of where the organization contributes to violations of System Condition #4.
	Prioritize significant environmental and social aspects based on the System Condition analysis.	A priority list of environmental and social aspects to serve as a starting point for planning.
4.2.4	Articulation of core values and purpose	
	Revisit organizational core values and identify and clarify the fundamental value, utility or quality the organization's products or services deliver. Ensure this is not at odds with the System Conditions.	A clear understanding of the fundamental need the organization is satisfying and the ultimate value the organization delivers beyond its immediate product or service offering. It is critical that core values not be at odds with the System Conditions.
4.2.5	Envisioning a sustainable organization	
	Create a vision for the organization in a sustainable society by developing alternative options for delivering its current products or services without contributing to violations of the System Conditions, or by offering a different product or service to meet stakeholder needs.	A vision based on becoming a sustainable and restorative organization that does not contribute to violations of the System Conditions.
4.2.6	Creation of a sustainability policy	
	Articulate a sustainability policy based in part on the System Conditions and other organization-specific information to serve as a guiding compass for the management system.	A clear policy based on the System Conditions that resonates with all relevant stakeholders.
4.2.7	Creation of ultimate objectives and interim targets	
	Set and document the ultimate objective of eliminating the organization's contribution to systematic increases in concentrations of substances from the Earth's crust, and interim targets (based on key leverage areas) to move toward that objective.	To eliminate the organization's contribution to systematic increases in concentrations of substances from the earth's crust (e.g., metals, other minerals and fossil fuels).

(*continued on next page*)

Table 1 (*continued*)

	Task	Objective
	Set and document the ultimate objective of eliminating the organization's contribution to systematic increases in concentrations of substances produced by society, and interim targets (based on key leverage areas) to move toward that objective.	To eliminate the organization's contribution to systematic increases in concentrations of substances produced by society (e.g., persistent unnatural substances).
	Set and document the ultimate objective of eliminating the organization's contribution to systematic physical degradation of nature, and interim targets (based on key leverage areas) to move toward that objective.	To eliminate the organization's contribution to systematic physical degradation of nature.
	Set and document the ultimate objective of eliminating the organization's contribution to the undermining of humanity's ability to meet its needs worldwide, and interim targets (based on key leverage areas) to move toward that objective.	To eliminate the organization's dependence on activities that undermine the ability of humans (near and remote) to meet their needs, over and above measures taken to meet the first three objectives.
4.2.8	Strategy development	
	Each organization will require emphasis on different combinations of dematerializations and substitutions in order to eliminate its contribution to violations of the System Conditions.	
	System Condition #1	
	(a) Identify dematerialization strategies (where appropriate) to eliminate contributions to violations of System Condition #1.	(i) Increase resource productivity of inputs. (ii) Create less waste outputs (e.g., closed-loop).
	(b) Identify substitution strategies (where appropriate) to eliminate contributions to violations of System Condition #1.	(i) Use abundant rather than scarce materials from the earth's crust to minimize the risk of increasing concentrations. (ii) Avoid materials from the earth's crust altogether.
	System Condition #2	
	(a) Identify dematerialization strategies (where appropriate) to eliminate contributions to violations of System Condition #2.	(i) Increase resource productivity of inputs. (ii) Create less waste outputs (e.g., closed-loop).
	(b) Identify substitution strategies (where appropriate) to eliminate contributions to violations of System Condition #2.	(i) Use human-made substances that degrade naturally into compounds that do not increase in concentration in nature. (ii) Avoid human-made substances altogether.
	System Condition #3	
	(a) Identify dematerialization strategies (where appropriate) to eliminate contributions to violations of System Condition #3.	(i) Increase resource productivity of inputs. (ii) Create less waste outputs (e.g., closed-loop).
	(b) Identify substitution strategies (where appropriate) to eliminate contributions to violations of System Condition #3.	(i) Use less land area to deliver value. (ii) Create better management routines that do not degrade the ecosphere.
	System Condition #4	
	(a) Identify dematerialization strategies (where appropriate) to eliminate contributions to violations of System Condition #4.	(i) Increase resource productivity of inputs. (ii) Create less waste outputs.
	(b) Identify substitution strategies (where appropriate) to eliminate contributions to violations of System Condition #4.	(i) Change focus from commodity to service to find new ways of meeting the same stakeholder needs with less material and energy. (ii) Do all possible within the organization's sphere of influence to ensure equitable distribution of and access to materials and energy worldwide.
4.2.9	Barrier identification	
	Identify internal and external barriers that are preventing the organization from eliminating its contribution to violations of the System Conditions.	A clear understanding of what is holding the organization back and the challenges that must be addressed to ensure success.
4.2.10	Strategy testing	
	Strategy testing and decision-making require a balanced evaluation of the spectrum of strategies identified in 4.2.8 against the four criteria identified below.	
	Identify strategies that are low-hanging fruit with high potential return on investment.	To choose strategies with the highest return on investment.
	Identify strategies that will serve as flexible platforms for future investments.	To choose strategies that will ensure the likelihood of sunk costs and stranded assets are minimized.

(*continued on next page*)

Table 1 (*continued*)

	Task	Objective
	Identify strategies that will eliminate the organization's contribution to violations of the System Conditions simultaneously.	To choose strategies that are the most direct route to eliminating contributions to violations of the System Conditions.
	Identify strategies that show the most likelihood of success from a traditional strategy analysis perspective (e.g., environment, resources, management preferences, and organizational capacity).	To choose strategies that stand the most chance of success from a traditional analysis perspective.
4.2.11	Action development	
	Develop concrete actions for strategies that fulfill the most strategy testing criteria.	To choose actions most appropriate to achieve chosen strategies given the context of the organization.
4.2.12	Indicator development	
	Create management indicators that focus on evaluating (i) how actions comply with the overall plan, and (ii) whether contributions to violations of the System Conditions are being eliminated.	A robust set of indicators that measure whether the system is actually achieving its goals and eliminating the organization's contribution to violations of the System Conditions.
4.2.13	Tool selection	
	Select tools to assist in the implementation and monitoring of strategies and actions to meet ultimate objectives.	To choose tools most appropriate in supporting implementation and monitoring of progress towards sustainability given the context of the organization.
4.2.14	Sustainability program development	
	Articulate timelines, incentives, responsibilities and accountability for achieving objectives and targets through strategies.	A clear line of responsibility for achieving the broad objective of the Sustainability Management System.
4.2.15	Identification of legal and other requirements	
	Identify legal and other requirements of the organization, and develop a process for keeping this list up to date.	A clear understanding of legal and other requirements to ensure that the organization is in compliance during the transition.

identification and consultation process to determine whether the organization is meeting the needs of its stakeholders. Identifying social aspects goes a step beyond ISO 14001's environmental focus, and is consistent with "B" of the backcasting method. Organizations such as the UK-based *Co-operative Bank* have received national and international awards of excellence using this method [19].

3.3. Section 4.2.3: determination of significant environmental and social aspects

As required by ISO 14001, significant environmental aspects must be identified to serve as a basis for setting future objectives and targets. Consistent with the requirements for a sustainable society, this exercise also includes social aspects. This step requires that an organization conduct an analysis of all identified aspects for each stage of the process in delivering its product or service using the System Conditions as a guide.

In order to guide this process, Table 2 was created based on work by Kunz et al. [6] and Robèrt [21]. Although it is impossible to compare unlike aspects objectively, and difficult to compare across System Conditions for any specific aspect, this guide helps an organization see the potential magnitude, seriousness and urgency of its aspects simultaneously across System Conditions, from which it can then begin to determine where its priorities lie. Ultimately, however, the sustainability of a given material lies in how it is managed, and how this management routine contributes or not to violations of the System Conditions [22]. Sustainability does not lie in the material itself per se. The following paragraphs focus on how each System Condition is reflected in the rating.

System Condition 1 is divided into four categories—extraction, natural occurrence, ecotoxicity, and emitted quantity. This reflects: the rate of extraction from the earth's crust; whether the material is recycled or not; the scarcity of the respective elements; overall ecotoxicity; and the quality and quantity of final deposits which determine the risk of causing increasing concentrations of the respective elements in natural systems. This serves the shaping of the ultimate sustainability target of the firm: "in the future, the firm is not contributing to systematically increasing concentrations of any kind of elements in natural systems". The current knowledge on ecotoxicity is used to prioritize required actions—plutonium having higher priority than chromium, for example.

System Condition 2 is also divided into four categories—natural occurrence, persistence, ecotoxicity, and emitted quantity. This reflects: the presence of foreign materials in nature; how long materials foreign to nature remain in the environment; their ecotoxicity; and the quantity of material emitted which determines the risk of causing increasing concentrations of the respective

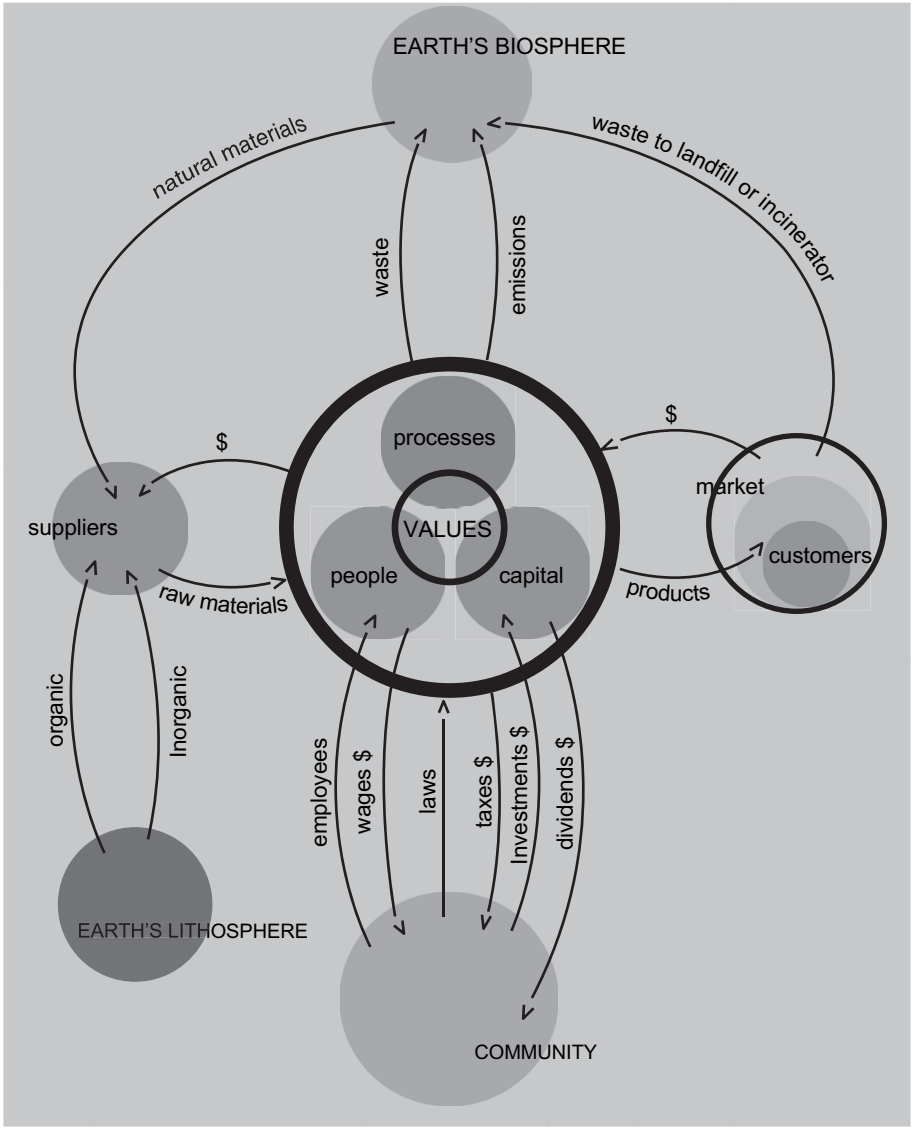

Fig. 1. *Interface Inc.* Systems Map [20].

materials in natural systems. Current knowledge on ecotoxicity provides complementary information on how to prioritize measures.

System Condition 3 is summarized as physical encroachment, and is interpreted in the rating system as whether the activity or process results in a net loss of bioproductivity or biodiversity from either wasting of renewable resources or poor management routines (this would, for example, allow for exchanges of these components given a particular development proposal).

System Condition 4 is difficult to translate in a rating system, particularly in a corporate setting where different perceptions exist of the corporation's responsibility in meeting human needs, its ability to undermine them, and specifically whose needs those are. This section has therefore been interpreted to encompass meeting the needs of a range of short and long-term stakeholders based on data acquired from consultations with these stakeholders (where possible).

The System Condition analysis and rating then informs the visioning process, but does not, unlike ISO 14001, solely determine the subsequent strategies and actions that filter into the management plan. The two are unique because the path of sustainable development often requires short-term trade-offs in light of long-term investments to achieve the overall objective of eliminating the organization's contribution to violations of the System Conditions.

3.4. Section 4.2.4: Articulation of core values and purpose

Many organizations are focused on the immediate mitigation of environmental and social impacts, and base action plans on traditional forecasting. This,

Table 2
Tool for analyzing significant aspects

System conditions for sustainability	Rating of 1 (better)	Rating of 10 (worse)
1—Extraction	100% recycled	100% extracted (mined)
1—Natural Occurrence	Abundant in nature	Scarce in nature
1—Ecotoxicity	Non-toxic	Acutely toxic
1—Emitted quantity	Safely deposited	Dispersed into ecosphere
2—Persistence	Biodegradable	Non-biodegradable
2—Natural occurrence	Abundant in nature	Scarce in nature
2—Ecotoxicity	Non-toxic	Acutely toxic
2—Emitted quantity	Safely deposited	Dispersed into ecosphere
3—Physical encroachment: bioproductivity	No loss of bioproductivity	Elimination of bioproductivity
3—Physical encroachment: biodiversity	No loss of biodiversity	Elimination of biodiversity
4—Equity	Meeting stakeholders needs	Not meeting stakeholders needs

however, often only results in a projection of current unsustainable trends, rather than focusing on the ultimate goal of sustainability and working backward to the present [9]. This may then lead to a focus on downstream action, potentially missing opportunities for important upstream interventions. In order to overcome this, it is important to first refocus on the ultimate value or utility a product or service delivers to its customers, and on the core values an organization holds in fulfilling its mission. This step is a unique addition to ISO 14001.

For example, *Suncor Energy*, a Canadian company traditionally focused on oil and gas development, has recently adopted a renewed mission statement as an energy company rather than strictly an oil and gas company. Although still heavily involved in the Alberta Oil Sands (a major national contributor to greenhouse gas emissions), the shift is significant and may have far-reaching future impacts on corporate investment as it conceptualizes the many different options available for delivering energy, rather than being confined solely to delivering oil and gas.

This process opens up a new set of potential business opportunities by helping the organization imagine better ways of delivering value with the possibility of entirely new products and services. The challenge of sustainability then becomes a challenge of innovation and creativity. Enduring companies such as *3M* have held their core values as sacred, but the products the company delivers have changed substantially over its lifetime [17]. Collins and Porras [17] point out that this is true of many enduring global enterprises.

3.5. Section 4.2.5: envisioning a sustainable organization

A clear vision of the organization in a sustainable society is a critical component of strategic planning. Based on the value delivered to customers (identified in section 4.2.4), the organization's challenge is to imagine and develop options to deliver the same or added value to customers without contributing to violations of the System Conditions. This might imply a slight tailoring of the value offering, or a complete transformation of how the organization does business. This step is a unique addition to ISO 14001.

Interface Inc., for example, is attempting to move away from the business of selling carpets—it now promotes the option of *leasing* floor covering services to clients. The potential benefit of this approach is that it shifts the incentive structure so that instead of *Interface Inc*. being rewarded for delivering more product to customers, it is rewarded with a flat lease rate that creates an incentive to provide less, yet more durable, products. Although the market has yet to determine the ultimate success of this initiative, this business model is gaining momentum in the durable goods industry as a way for organizations to make the same or additional revenue by delivering less physical matter, and therefore being less of a burden on the environment [23]. *Interface*'s ultimate goal for the year 2020 is to "take nothing from the earth's crust and discharge nothing harmful to the ecosphere" [24].

The vision should capture a 10–30 year horizon—long enough so that the organization sets an ultimate goal of eliminating its contribution to violations of the System Conditions, and also consistent with accepted standards of corporate visioning [17]. This step is consistent with "C" of the backcasting method—creating a clear and compelling vision—and represents a critical imaginative process. Depending on the organizational context, some find it more motivating to begin with visioning instead of becoming bogged down with reams of depressing statistics about the organization's contribution to System Condition violations during the identification and determination of significant environmental aspects [16].

3.6. Section 4.2.6: creation of a sustainability policy

Rather than being the first clause (as it is with ISO 14001), the development of a sustainability policy occurs

after the organization has a complete understanding of the System Conditions and a clear vision of the way in which it will deliver its value proposition (i.e., product or service) without contributing to violations of the System Conditions. Placing policy development at this stage ensures that the policy is more than a superficial commitment to continual improvement, compliance and prevention of pollution, and instead is based on an understanding of sustainability and the state of the organization in relation to this goal.

This sets the stage for the formulation of a strong guiding policy statement that incorporates both sustainability and organizational elements, and resonates with stakeholders to motivate their participation in the journey. Organizations such as *Sanga-Saby Kurs & Konferens* (a hotel and conference center in Sweden) have adopted sustainability policies that mirror the objectives implied by the four System Conditions of *The Natural Step* Framework [25].

3.7. Section 4.2.7: creation of ultimate objectives and interim targets

Consistent with the ISO 14001 framework, the creation of objectives and targets follows from the identification and prioritization of sustainability aspects, but in this case is also based on the vision identified in 4.2.5. The ultimate objectives of the organization are to eliminate its contribution to violations of the System Conditions, with interim targets to ensure the organization is making continual progress in moving toward this alignment. Setting long-term objectives (consistent with Level 2 of the five-level approach) ensures that the organization is focused on the "landing platform" in a sustainable society rather than preoccupied with incremental reduction strategies with no definitive end. Since sustainability is the goal, ultimate objectives are critical to ensuring the process is based on outcomes that society eventually must meet.

3.8. Section 4.2.8: strategy development

Based on the ultimate objectives and interim targets set in 4.2.7, this stage involves developing internal strategies to move toward the organization's objectives and targets. It is consistent with the requirements of ISO 14001 to develop objectives and targets, but goes beyond them by requiring that specific overarching strategies be laid out before actions are specified. It is also consistent with "C" of the backcasting method and builds on the vision identified in 4.2.5.

At this point, while similar in content, the five-level approach [12] was modified slightly and contains different headings. This was done to eliminate the confusion associated with multiple levels of principles, and to translate the approach into more easily understood and familiar business language.

Level 2 is the objective level, which specifies the objectives that will be fulfilled when a sustainable society is achieved (i.e., alignment with the System Conditions). Included in Level 2 are also the two sub-mechanisms of *dematerialization* (reducing an input or output to maintain alignment with the System Conditions) and *substitution* (eliminating altogether the need for certain materials and management routines that are qualitatively problematic from a sustainability perspective) which cover the spectrum of possibilities by which an organization develops strategies to eliminate its contribution to violations of the System Conditions over the long term.

For clarity, the enhanced planning section refers to step-by-step progress in line with the sub-mechanisms, while providing flexible platforms for further improvements and simultaneous financial return. Such step-by-step dematerializations and substitutions are *strategies* to achieve the ultimate *objectives* of eliminating contributions to violations of the *principles* (i.e., System Conditions). These strategies are further broken down into two separate mechanisms outlining the two strategic options available under each dematerialization and substitution category.

Different organizations will require unique emphasis on combinations of dematerialization and substitution strategies depending on the type of product or service they offer. The list of dematerialization and substitution options is meant to outline the spectrum of choices an organization can make in determining the best combination of strategies to undertake in order to eliminate its contribution to violations of the System Conditions (the ultimate goal). The important question to ask is whether the organization is eliminating its contribution to violations of the System Conditions, not whether it has at least one strategy under each sub-mechanism of dematerialization and substitution.

Using this approach will ensure that the organization creates strategies most appropriate to its context, and not simply reflect a downstream identification of aspects, as with the more traditional use of ISO 14001. It also ensures a smooth transition from the visioning process to the development of strategies reflected around the System Conditions.

3.9. Section 4.2.9: barrier identification

Absent in the ISO 14001 planning process is a step for the identification of barriers that might prevent strategies from being realized. This stage of the process allows an organization to explicitly identify a broad spectrum of internal and external barriers that might prevent the organization from eliminating its contribution to

violations of the System Conditions, and to develop ways to overcome them. It is a unique departure from traditional strategy development in that it focuses on overcoming external barriers to achieving objectives rather than assuming these barriers will inevitably exist and must be accepted. For example, *Interface Inc*. in Canada realized that *Ontario Hydro's* monopoly on energy generation in the Province—the majority of which is nuclear—was preventing them from generating their own greener off-grid electricity [20]. Their strategy to overcome what others might consider inevitable led to the energy company agreeing to enter into a joint partnership to produce green energy in Ontario [20].

3.10. Section 4.2.10: strategy testing

The next logical step in the process is to determine which of the identified potential basket of strategies should be implemented in the short term based on a set of robust criteria. As a stand-alone stage, strategy testing is also a unique addition because it outlines a minimum set of criteria to consider instead of leaving the decisions to management discretion.

As mentioned previously, the criteria used at this stage are taken from Level 3 of the five-level approach, which is embodied in "D" of the backcasting method, and specifies principles to guide strategy development in the context of sustainability. Instead of calling them principles, however, they are now called strategy testing criteria because they are the principles that must guide the organization in choosing its strategies. This language more closely reflects typical business vocabulary.

In addition to these criteria from the five-level approach and backcasting method, a criterion based on traditional strategy literature has also been added to capture analysis at the strategic level [18]. Together, these criteria reflect a robust set of strategic decision-making criteria that reflect both management and end-goal (i.e., sustainability) requirements from the literature. While others may be included, these are critical minimums for proper evaluation of the trade-offs involved in any strategy decision.

3.11. Section 4.2.11: action development

Once strategies are developed and chosen, concrete actions must be developed to support the strategies—consistent with Level 4 of the five-level approach and embodied in "D" of the backcasting method. This section parallels the program development section of ISO 14001, but is split into discrete stages in order to ensure explicit consideration of each stage required to build robust sustainability programs. This section might include, for example, conducting an energy audit of the organization to determine both short-term investments that could reduce environmental impact, and long-term investments that could help the plant work toward eventual carbon-neutral designation.

3.12. Section 4.2.12: indicator development

After actions are chosen, metrics are required to measure whether actions are achieving the objectives—consistent with Level 5 of the approach and embodied in "D" of the backcasting method. Traditional metrics, however, have focused mostly on a mixture of indicators with no overarching umbrella or rationale as to their importance and place. Although a useful start, they do not ensure the organization is moving systematically toward its goals.

At this stage, what is required are rigorous indicators that measure (i) management performance in achieving the goals of the plan, and (ii) actual impacts and health of social and ecological systems and whether the organization is eliminating its contribution to violations of the System Conditions [12,26]. An organization could, for example, measure (i) whether it met its targets for plan execution (for management indicators), and (ii) the energy intensity of its products as an indication of whether the relative environmental impact was growing or shrinking.

3.13. Section 4.2.13: tool selection

Once actions are developed and indicators chosen, an organization should then consider choosing tools to support implementation and monitoring of indicators. This level is consistent with Level 5 of the approach, again embodied in "D" of the backcasting method, and is unique to the enhanced planning section. At this level, tools such as Life-Cycle Assessment (LCA) can be used to support the implementation of sustainability goals, and ISO 14001 could be used to guide the process over the long term.

3.14. Section 4.2.14: sustainability program development

Once the entire planning exercise is complete, the pieces come together in a sustainability program document. A clear program document—outlining responsibility, accountability and timelines—is essential to ensure successful completion of the program and achievement of the objectives and ultimate ends of eliminating the organization's contribution to violations of the System Conditions. This stage is consistent with the requirements of ISO 14001 in preparing a documented plan and "D" of the backcasting method.

3.15. Section 4.2.15: identification of legal and other requirements

Finally, consistent with ISO 14001, legal and other requirements should also be identified and monitored to ensure continual compliance with applicable legislation and regulations throughout the transition. Where an organization's operations are particularly vulnerable or out of compliance, actions must be built into the sustainability management plan to ensure the situation is brought back into compliance. Ensuring compliance is a basic minimum requirement in order for an organization to maintain its license to operate in a community.

4. Discussion

Corporations need a clear framework to effectively grapple with the challenge of moving toward a sustainable society. What currently exists is a broad range of approaches, tools, frameworks, principles, strategies and processes which can confuse if not understood in relation to a framework for sustainability. Furthermore, tools such as ISO 14001, while a useful start, do not in themselves assist an organization in strategic planning with true sustainability in mind.

This paper proposes a strategic planning section for ISO 14001 that integrates the "backcasting from principles" method, which itself embodies a five-level approach for planning in complex systems, to address this challenge. It is hoped that the resulting template will help organizations navigate the complex world of sustainable development with increased clarity, and speed their transition to sustainability. Future research will determine whether this in fact occurs.

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