

# SUSTAINABLE INNOVATION – ORGANISATION AND GOAL FINDING

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## **ABSTRACT**

This paper is a position paper indicating two ill-addressed areas in the sustainability literature: the 'who' and the 'what'. 'Who' explores the persona of the change agents and leaders in terms of new transformational strategies for sustainability. The 'what' addresses the importance of goal finding for sustainable innovations. The paper discusses the current body of literature touching on the 'who' and the 'what', identifies gaps, and presents proposals for further research. This paper proposes that where the questions 'why' corporations should 'go sustainable' and 'how' to design this commitment into products has received wide attention, the 'who' and 'what' of the innovation process have received far less attention. The research suggested here brings together the 'who' and the 'what' of sustainable innovation in order to identify the people with the 'right' set of behaviours as well as to develop the 'right' set of techniques to make the transformational change to sustainability.

**Keywords:** sustainable innovation, goal finding, transformational strategy, opportunity identification, idea selection, innovation strategy

## 1. INTRODUCTION

It can be said that to produce sustainability, incremental improvements will not suffice: reducing unsustainability is not the same as creating sustainability (Ehrenfeld, 2008). Following on from this, whilst radical or systemic innovation is needed, there is also a need for a change in the approach we take in the search for new solutions. This requires stepping away from the old path, or as Ehrenfeld (2008) suggests, we should not be “the drunk who lost the car keys but kept looking for them under the street lamp because that is where the light was.”

Proposing a general outline of what ought to be done is often easier than proposing how it will be accomplished. To be able to step out of the ‘beam of the street light’ when searching for sustainable innovation, an organisation needs to be aligned accordingly and the design team at the front end of the innovation process needs to be equipped with the appropriate tools, methods and behaviours. There is abundant literature demonstrating *why* corporations should go beyond compliance when it comes to sustainability (e.g. Elkington, 1997; Hawken, 1994) as well as *how* to design this commitment into products (e.g. Brezet & Hemel, 1997; Diehl & Crul, 2007; Tischner, 2000). The challenge lies with getting from *why* to *how*: *who* is making it happen and *what* are the products that will be produced (Figure 1). This paper proposes that the *who* and *what* have received far less attention than the *why* and *how*; Boks (2006) being one of the notable exceptions researching the organisational side and Wever, et al. (2008) exploring the goal finding aspects.

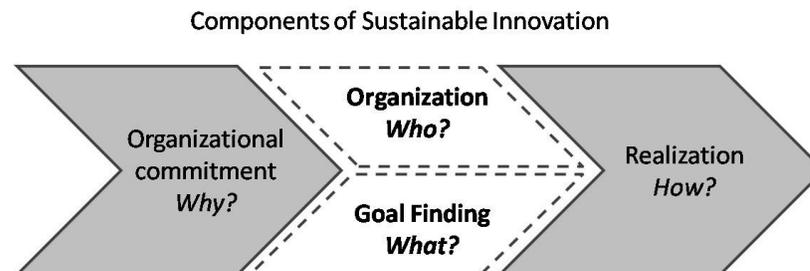


Figure 1. The ‘why’ and ‘how’ are extensively addressed by existing literature. ‘Who’ and ‘What’ remain weakly-addressed.

As for the ‘why’, many authors and institutions have argued the unsustainability of single-bottom-line business. They have often also argued that industry should be part of the solution (e.g. Brundtland, 1987, Hawken, 1994, p.17). Several have argued the business case for corporate

social responsibility, discussing such successful examples as the Pollution Prevention Pays program of 3M (Hawken, 1994, p.60; Elkington, 1997, p. 54), or the Body Shop philosophy (Ottman, 1992, p. 68).

As for the 'how', an extensive tool repertoire has been developed in order to assist product designers in optimizing products. These tools range from analytical to prescriptive and from quick-and-dirty to quite extensive (see Figure 3.2 in Tischner, 2000, for an overview). Most of these tools require an existing product, or at least a pre-established design goal. Hence, they are about optimization only. The sustainability potential that may be achieved during the determination of the design goal lies outside the scope of these tools.

This paper is a position paper based on the proposed research projects of the authors. The aim of this paper is to review and discuss the current body of literature on generic product innovation, conduct a similar review on sustainable product innovation and then identify the gaps and present proposals for further research. The area of focus can be seen in the 'who' and 'what' boxes in Figure 1. The 'who' will explore the persona of the change agents and leaders in terms of new transformational strategies (Ehrenfeld, 2008). Next to this is the crucial 'what' box that explores the front end activity in sustainable innovation. The paper brings together the 'who' and the 'what' in the journey towards the 'possibility of allowing all life to flourish on earth forever' (Ehrenfeld, 2008).

## **2. SUSTAINABLE INNOVATION**

The most widely used definition of sustainability is the one defined by the Brundtland commission in their report *Our Common Future* (Brundtland, 1987): *"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."* This definition is not directly applicable to product design and innovation. A common way of translating this into more tangible criteria is through the 'triple bottom line' and the 3P approach of People, Planet, Profit - both coined by Elkington in the 1990's (for extensive discussion, see for instance Elkington 1997). He states that sustainability is concerned with three dimensions; People, Planet and Profit. Here the term 'Planet' represents the environmental component, the term 'People' represents the social component and the term 'Profit' represents the economical component. Design for Sustainability is about designing products in such a way that they balance these three aspects. Several other authors have further discussed the definition

of the term 'sustainability'. For instance, Ehrenfeld (2008) states that: "...sustainability is the possibility that human and other life will flourish on the planet forever."

Sustainable product design integrates environmental, social, and economical considerations of the product's life cycle into the goods and services (Charter & Tischner, 2001). Sustainable innovation differs from regular innovation by the aim to decrease the negative impacts the product (good and/or service) has on the environmental, social, and economical aspects (ibid). A definition for innovation often varies from one discipline to another and for example engineering and marketing have their own peculiar views as to what is perceived as innovation. According to Garcia & Calantone (2002) the OECD definition from 1991 succinctly captures the essence of innovation from a generic perspective: "innovation is an iterative process initiated by the perception of a new market and/or new service opportunity for a technology-based invention which leads to development, production, and marketing tasks striving for the commercial success of the invention".

There are several innovation typologies used to construct innovations and innovativeness (Garcia & Calantone, 2002). For example, Kleinschmidt and Cooper (1991) propose a triadic categorization consisting of low innovativeness, moderate innovativeness, and high innovativeness. Brezet (1998) and Rathenau Institute (1996) have presented a categorization with specifically sustainable innovation in mind. It comprises of four levels: product improvement, product redesign, function innovation, and system innovation. The first two involve product optimization, process improvement, and replacement of components where function innovation changes the product functionally, or includes new products, and system innovation requires technology innovation, or changes to social and structural environment.

Although there is not just one innovation process, but rather a set of different parallel, competing and conflicting processes occurring at the same time (Buijs, 2007), the innovation process is often presented as a sequence of three different phases: the front-end phase, product development phase, and commercialization phase (Buckler 1997; Koen et al. 2001). During each phase of the innovation process, specific activities are executed to improve the quality of the idea and to let the idea grow (Buijs, 2007). The phases differ in nature and purpose (Koen et al. 2001). Where the front end of the process is often chaotic and unpredictable, the product development phase is more structured, goal oriented and predictable (ibid). Therefore, the different phases of

the innovation process need to be addressed differently – with a different set of techniques, tools and human talent.

### **3. THE ‘WHO’ IN MORE DETAIL**

The nature of industrially produced products has changed dramatically in a relatively short period. The increasing global competition, the ever-rising customer requirements and expectations, the high global pressure on sustainability and the rapid changes in technology “state-of-the art” make the process of designing and developing new industrial products more and more differentiated and complex. “Standard” engineering projects with a typical phased character in time and organisation structure are being replaced by innovation projects with a strong need for multidisciplinary teams bringing all the necessary knowledge together from the first idea generation phase. (D’hulster et al., 2009) This complex business reality is the framework and playground of the ‘who’ in this study. People are the engine of everything that is happening in there.

Previous studies show us that social, psychological and sometimes intangible processes can ‘make or break’ the implementation of sustainable product innovation. Unwillingness to cooperate, gaps between proponents and executors, and other organisational complexities play an important role. Such issues are not easy to organize. Successful co-operation and communication cannot be dictated; they are likely to depend on personal rather than departmental qualities and are more likely to be subject to (personal) emotion. (Boks 2005) Successful sustainable product innovation seems to rely more on the competences of key people in the company and a shared-goal driven vision and co-operation than on the right methods and tools.

Stevens (2007) has mentioned that process management and “soft side” activities are dominating the technicalities in many companies. It’s about all kind of contextual aspects in which ecodesign activities are taking place, like the internal and external value chains and communication issues (Stevens, 2007). In a study carried at Delft University of Technology (DUT) (Pascual, Boks & Stevens, 2003), an extensive literature analysis was carried out, encompassing over 850 papers published at electronics ecodesign community conferences. The study shows that over 60% of contributions at leading ecodesign conferences address technical issues. The managerial dimension does not receive much attention, roughly a 10% of the contributions. The study concludes that alignment of ecodesign with business operations is still rating low. It is

suggested that potential of ecodesign may achieve its maximum expression when its cross-functional characteristic is fully explored. (Pascual & Stevels, 2004) Where the 'what' is specified in a certain strategic phase (the front end of the innovation process), the 'who' is situated all over the Product Development Process. The importance of sociological, psychological, emotional and intangible factors plays different roles in different stages of the PDP. (Boks, 2005)

The combination of science and research (looking for the truth), engineering (applying knowledge) and innovation (inventive creation), in the current complex reality mentioned above is asking for a systematic and multidisciplinary approach to sustainable product innovation (Boks, McAlloone 2009) in combination with people with the right skills. People involved in a sustainable product innovation process should have a good overview and be able to understand detailed consequences. They should be "T-shaped". The combination of depth and width is symbolized by the "T" (Hansen & von Oetinger, 2001).

In terms of an individual's skill-set, the vertical stroke comprises domain-specific skills and knowledge, while the horizontal stroke represents the generalist domain-independent skills. (D'hulster et al., 2009). T-shaped people in this context have a deep knowledge over a good part of technologies, entrepreneurial and/or design related issues and good understanding of interrelationship and consequences in the other fields. They should be both creative and analytical (Gerson, Taylor, Ramond, 2007). Tim Brown (2005) describes them as people who are very inquisitive about the world. They have a principal skill that describes the vertical leg of the T, but they are so empathetic that they can branch out into other skills and do them as well. They are able to explore insights from many different perspectives and recognize patterns of behavior that point to a universal human need. The T-shaped people will, however not simply appear as if by magic in the organisation – a change (or series of changes) will have to take place to facilitate their activity. The change management literature appears to support this view.

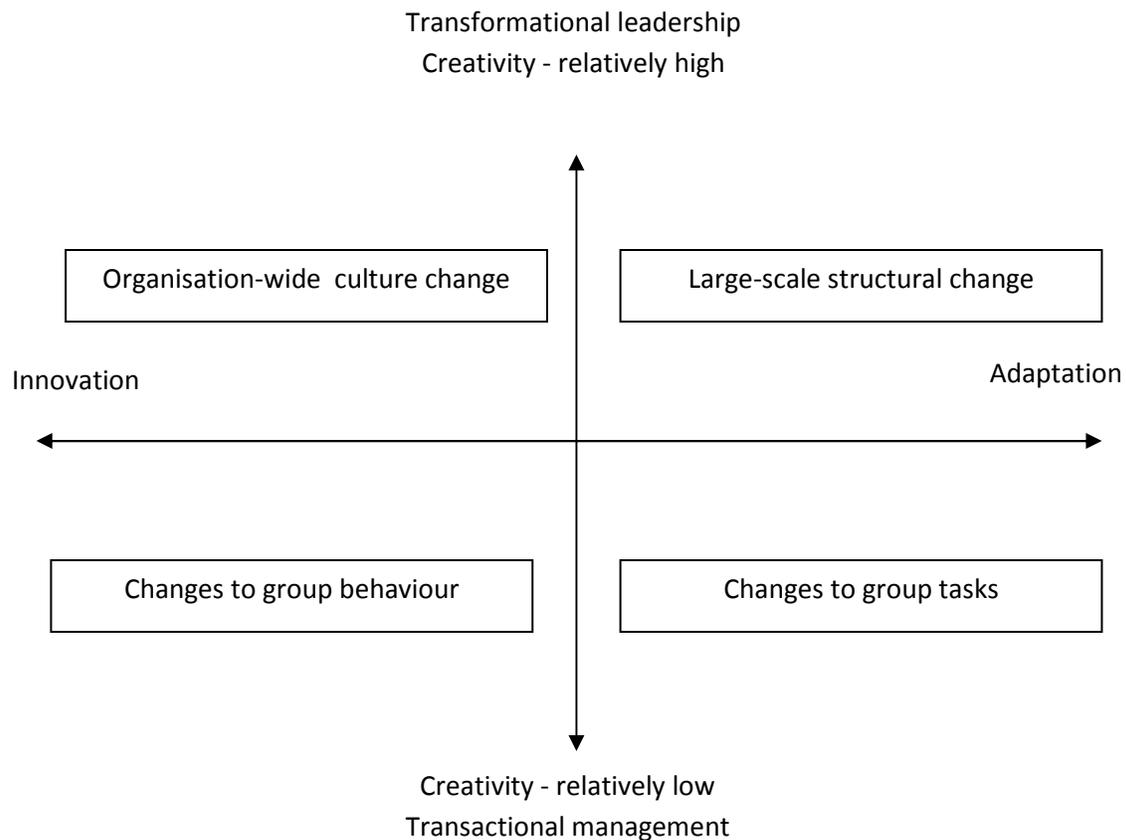


Figure 2. Leadership, management and change (Burnes, 2004)

In Figure 2 it can be proposed that a sustainable change agent or leader can have certain levels of creativity and be situated on the innovator / adaptor spectrum and there are tools and techniques for increasing their level of creativity and flexibility (Talbot, 1997). However Talbot also points out that such tools and techniques to barriers to creativity can only fully apply to the individual (Talbot, 1993). Therefore it can be proposed that if the rest of the organisation is not operating on the same level of sustainable innovation creativity then the individual will be blocked.

However the situation is further complicated if the aspect of time and complexity are introduced. It is here that real tensions and even contradictions begin to show. In Figure 3, a framework for leadership, management and change (Burnes, 2004) is presented. This is a valid model until the overarching time pressure of the sustainability challenge is applied. It is proposed that the 'luxury' of slow change and the even slower transformation will not be available. The urgency of the challenge will overcome all. In addition the concept of the sustainable innovation requiring high levels of creativity will dominate.



but by their ‘*action logic*’—how they interpret their own and others’ behaviour and how they maintain power or protect against threats. The article suggests that some leaders rely on action logics that hinder organisational performance. However certain types prove potent change agents. In particular, strategists believe that every aspect of their organisation is open to discussion and transformation. Their action logic enables them to challenge perceptions that constrain their organisations and to overcome resistance to change. They create compelling, shared visions and lead the pragmatic initiatives needed to realise those visions.

Rooke and Torbert demonstrate that strategists are rare but individuals can develop their defining strengths. This is important because as this paper proposes, many are needed. Rooke and Torbert propose that most developmental psychologists agree that what differentiates leaders is not so much their philosophy of leadership, their personality, or their style of management. Rather, it’s their internal “action logic”—how they interpret their surroundings and react when their power or safety is challenged. However they go on to suggest that leaders who make an effort to understand their own action logic can develop their ability to lead. Change agents can also develop to a higher level. In their research of thousands of leaders, they observed seven types of action logics (Table 1). The least effective for organisational leadership are the Opportunist and Diplomat; the most effective, the Strategist and Alchemist. It is these last two that this ‘who’ section will go on to focus on.

Action Logic	Characteristics	Strengths	% of research sample
Opportunist	<i>Wins any way possible.</i> Self-oriented; manipulative; "might makes right."	Good in emergencies and in sales opportunities.	5%
Diplomat	<i>Avoids overt conflict.</i> Wants to belong; obeys group norms; rarely rocks the boat.	Good as supportive glue within an office; helps bring people together.	12%
Expert	<i>Rules by logic and expertise.</i> Seeks rational efficiency.	Good as an individual contributor.	38%
Achiever	<i>Meets strategic goals.</i> Effectively achieves goals	Well suited to managerial roles; action and goal	30%

	through teams juggles managerial duties and market demands.	oriented.	
Individualis	<i>Interweaves competing personal and company action logics. Creates unique structures to resolve gaps between strategy and performance.</i>	Effective in venture and consulting roles.	10%
Strategist	<i>Generates organisational and personal transformations. Exercises the power of mutual inquiry, vigilance, and vulnerability for both the short and long term.</i>	Effective as a transformational leader.	4%
Alchemist	<i>Generates social transformations. Integrates material, spiritual, and societal transformation.</i>	Good at leading society-wide	1%

Table 1. Seven Ways of Leading action logic table Rooke and Torbert (2005)

### **The Strategist**

Rooke and Torbert show that strategists account for just 4% of leaders. The Strategist is adept at creating shared visions across different action logics —visions that encourage both personal and organisational transformations. This is very important in the transformational change that the sustainability challenge will require. Rooke and Torbert also show that strategists deal with conflict more comfortably than those with other action logics and they're better at handling people's instinctive resistance to change. As a result, Strategists are highly effective change agents. Again the key type of change agent required in the sustainability change.

According to Rooke and Torbert strategists are fascinated with three distinct levels of social interplay: personal relationships, organisational relations, and national and international developments. This is also seen in T shaped people. Finally Rooke and Torbert found that

strategists typically have socially conscious business ideas that are carried out in a highly collaborative manner. They seek to weave together idealist visions with pragmatic, timely initiatives and principled actions. The Strategist works to create ethical principles and practices beyond the interests of their organisation.

### **The Alchemist**

The research by Rooke and Torbert proposes that what sets alchemists apart from strategists is their ability to renew or even reinvent themselves and their organisations in historically significant ways. Whereas the Strategist will move from one engagement to another, the Alchemist has an extraordinary capacity to deal simultaneously with many situations at multiple levels. The Alchemist can communicate well with all at all levels. They can deal with immediate priorities yet never lose sight of long-term goals. This ties in with the 'T' shaped people concept.

Alchemists constitute only 1% of Rooke and Torbert's sample, which indicates how rare it is to find them in business or anywhere else. Alchemists share certain characteristics. Alchemists are typically charismatic and extremely aware individuals who live by high moral standards. They focus intensely on the truth. Perhaps most important, they're able to catch unique moments in the history of their organisations, creating symbols and metaphors that speak to people's hearts and minds.

### **Leadership Teams and Leadership Cultures Within Organisations**

Interestingly the research by Rooke and Torbert did not just focus on the leadership styles of individuals. They found categories of leadership styles that can be used to describe teams and organisations as well. They proposed that the most effective teams are those with a Strategist culture, in which the group sees business challenges as opportunities for growth and learning on the part of both individuals and the organisation. However Rooke and Torbert found few companies use teams in this way. Rooke and Torbert comment: *"Most senior manager teams operate at the Achiever action logic —they prefer unambiguous targets and deadlines, and working with clear strategies, tactics, and plans, often against tight deadlines. They thrive in a climate of adversity ("When the going gets tough, the tough get going") and derive great pleasure from pulling together and delivering. Typically, the team's leaders and several other members will be Achievers, with several Experts and perhaps one or two Individualists or Strategists*

*(who typically feel ignored). Such Achiever teams are often impatient at slowing down to reflect, are apt to dismiss questions about goals and assumptions as "endless philosophizing," and typically respond with hostile humor to creative exercises, calling them "off-the-wall" diversions. These behaviors will ultimately limit an Achiever team's success".*

They go on to propose that the situation is worse in large, mature companies where senior management teams operate as Experts. Team life is bereft of shared problem-solving, decision-making, or strategy-formulating efforts. Senior teams limited by the Diplomat action logic are even less functional. They are characterized by strong status differences, un-discussable norms, and ritual "court" ceremonies that are carefully stage-managed. This is a very difficult environment to ensure real sustainable change progress.

Finally of interest in the context of product design innovation, creative, consulting, and nonprofit organisations rapid decision making may be difficult due to their individualist preference. It is this speed of decision making and speed of change (in particular transformational change) that the alchemists are able to grasp and contend with. A key unanswered question still remains; how to speed up the development of strategists and alchemists. This could be taken further and consider developing such behaviours and attitudes at lower levels of the organisation.

#### **4. THE 'WHAT' – GOAL FINDING FOR SUSTAINABLE INNOVATION**

##### ***What is 'what'?***

To be able to provide solutions that achieve sustainability in the broad sense - to do more than "reduce unsustainability", as Ehrenfeld (2008) put it - considerations for sustainability need to be brought upstream in the innovation process. This early phase of the innovation process is often referred to as the fuzzy front end (FFE) (see e.g. Reinertsen, 1985; Koen et al., 2002). FFE is the stage of the innovation process where product strategy formulation, opportunity identification, and idea generation take place and decisions about new product development are taken (see e.g. Buijs, 2003; Khurana & Rosenthal, 1998). This is when a company realizes its need for innovation. In other words, in this phase the company addresses the question of 'what' to do.

At the FFE the company does not yet have a clear idea about the product (good or service) that needs to be developed and, therefore, first initiates opportunity identification for new products (Koen et al. 2001). During this phase the goal finding for sustainable innovation

should take place. At the FFE the basic assumptions regarding existing solutions are being questioned and opportunities for sustainable innovations can potentially be identified. However, although the role of FFE is crucial in the creation of innovations (see e.g. Khurana & Rosenthal, 1998; Smith & Reinertsen, 1991), this phase of the innovation process remains ill-addressed in the existing sustainable design literature (Wever & Boks, 2007; Ölundh & Ritzin, 2004). Methods or frameworks supporting goal finding for sustainable innovations have yet received little attention.

Activities in the FFE include, for example, opportunity scouting, needs identification, lead customer orientation, scenario planning, idea generation and competitive analysis (Buijs, 2008; Koen et al. 2002). Many tools and techniques for working at the FFE already exist, but these tools do not systematically support the handling of sustainability issues; existing ecodesign literature largely ignores the FFE part of the innovation process (Figure 4) (Wever, Boks & Bakker, 2008). As Figure 5 shows, there is a number of ecodesign tools developed to guide the designer in the design process after the specification for the product is already set, i.e. after the crucial FFE phase (Ölundh & Ritzin, 2004). Previous research has neglected to sufficiently address how companies could systematically identify opportunities for sustainable innovation, as well as, how companies should determine which product development strategies are most applicable to their existing needs (Wever & Boks, 2007), i.e. are strategically sound.

#### Phases in the Innovation Process

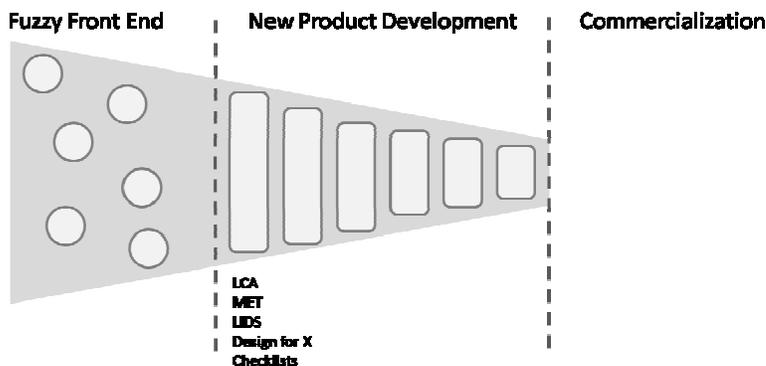


Figure 4: ecodesign tools focus on the part of the innovation process after a product idea has been determined. The Fuzzy Front End of the NPD process has received less attention. (Picture adapted from Wever et al., 2008)

The path towards sustainability entails many challenges. The problem of unsustainability is complex and of systemic level, requiring a multitude of changes (Elzen & Wieczorek, 2005). However, studies on innovation have shown that most innovations are of incremental nature and radical alternatives have a hard time breaking through (ibid). This is due to a variety of reasons related to production processes, regulation, user preferences, and infrastructure etc. (ibid). The question is, will a continuation of incremental changes lead to sustainability in the broad sense? In Ehrenfeld's (2008) words, "...reducing unsustainability, although critical, does not and will not create sustainability." Hence, even though the challenges of radical innovation seem insurmountable, the interest of the research proposed on the 'what' in this paper lays primarily with the function- and system level innovation, as defined by Brezet (1998) and Rathenau Institute (1996). This attitude goes along with the thoughts of Hamel (2006) "The bigger the problem, the bigger the opportunity for innovation. While big problems don't always produce big breakthroughs, little problems never do."

#### ***Goal finding – the role of the early phase of the innovation process***

The front end activities of the innovation process take place before the formal new product development phase (NPD) (Nobelius & Trygg, 2002; Koen et al., 2001). These two consecutive phases, FFE and NPD, are fundamentally different and require different methodologies, tools, and techniques (Buijs, 2007; Koen et al. 2001). Work in the FFE is not structured (where as in the NPD it is), but rather experimental and involving individuals instead of multifunctional teams. The funding for FFE is usually variable and the work at the FFE is so early that revenue expectations are uncertain. (Koen et al., 2002) Buijs (2008) describes the objective for FFE as to produce "a strategically sound design brief for future products and services for a specific company", and accordingly, the phase includes all the activities necessary to reach that objective. A *strategically sound* design brief is one that matches with the company, the international competitive environment, the relevant (sometimes new to develop) business model, the relevant technological developments, as well as the social, political and cultural developments (Buijs, 2008).

The elements of the front end include opportunity identification, opportunity analysis, idea genesis, idea selection and concept and technology development (Koen et al. 2001). In addition to these activities Khurana and Rosenthal (1998) and Buijs (2003) include also strategy formulation and communication to the activities of the FFE. The early phase of the innovation

process can therefore also be described as the strategic part of product innovation (Buijs, 2008). This perspective highlights the importance of including sustainability aspects already into the front end activities of the innovation process in order for them to be considered at a strategic level (Ölundh & Ritzin, 2004).

FFE is the breeding ground for all new goods and services. Activities in the FFE are the root of success for any company hoping to compete on the basis of innovations (Reid & Brentani, 2004). Although an innovative company must be proficient in all phases of the new product development process, the most significant benefits can be achieved through improvements in the performance of the front end activities (Khurana & Rosenthal, 1998). Also a study by Koen et al. (2001) identified the front end as the key-contributing factor for large numbers of really new products introduced annually. FFE presents one of the greatest opportunities for improving the overall innovation process (Koen et al. 2001), yet there is little research on how to incorporate sustainability considerations in to this significant phase, how to facilitate identifying opportunities for sustainable innovation, and how to select the strategically sound ideas for further development. By bringing sustainability considerations upstream in the innovation process, new options for sustainable innovations will become apparent.

The reason for the importance of the FFE is that it influences all the subsequent phases of the innovation process. In other words, significant decisions that influence the sustainability impact of the product are made early in the innovation process. Figure 5 shows how three elements, the influence on the outcome of the project, costs of change, and the information available, change over the course of innovation process. At the beginning of the process, i.e. during the FFE, the degree of freedom in design and influence on the outcome of the project are high. At that time, the costs of change are still low. Thus, of all the actions companies can take to improve their innovation process, the ones taken at the FFE provide the greatest time savings for the least expenses (Smith & Reinertsen, 1991). However, the challenge is created by the low amount of information and certainty in the FFE phase, when compared to the later phases of the innovation process. These characteristics of the innovation process affect also to the decision making related to sustainability; once the specification for the future product is set at the end of the FFE, only relatively minor changes in the sustainability impact of the products are possible – or they will be very expensive and time consuming. For this reason, it is central to consider sustainability aspects already in the FFE.

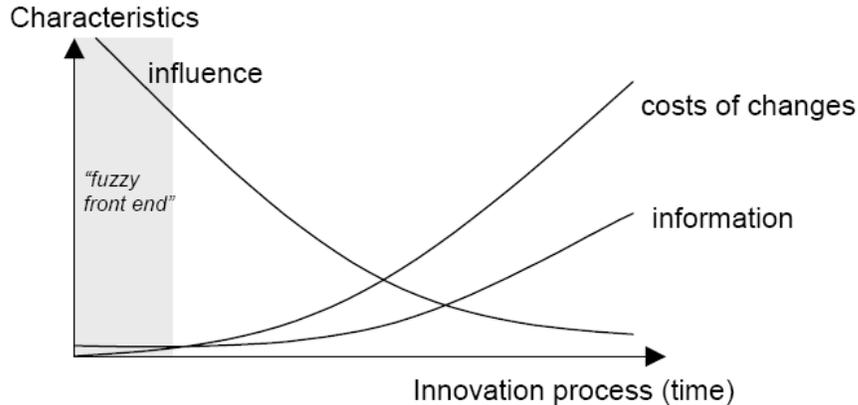


Figure 5: Evolution of influence, costs of changes, and information during the innovation process. (Hippel, 1993, modified by Herstatt & Verworn, 2001)

***Opportunity identification and idea selection for sustainable innovation***

Koen et al. (2002) define opportunity as “a business or technology gap, that a company or individual realizes that exists between the current situation and an envisioned future in order to capture competitive advantage, respond to a threat, solve a problem, or ameliorate a difficulty.” Opportunity identification is about discovering options the organisation might want to pursue, whether it concerns addressing a near-term response to a competitive threat, means to simplify operations, reduce costs, upgrade an existing product, new product platform, or an entirely new direction for business (Koen et al., 2001).

Companies such as IKEA and Amazon are well known for their innovative approaches in creating new value. IKEA identified an opportunity in transforming the furniture business by reorganizing the roles of the players in their business. Amazon, on the other hand, is an example of redefining the basic assumptions of traditional book selling industry. The ability to identify and create new value is important in the ever tightening global competition, and to do it with sustainability as a driver is becoming increasingly important. The question is how to come up with the IKEA or Amazon of sustainability?

To produce new value, innovations are required. Basic assumptions need to be questioned in order to do things differently. Kim and Mauborgne (1997, 1999, 2005) advice to, for example, “look across” current competition, current buyers, and substitute industries, to identify possibilities for innovations and to “create new market space”. Normann (2001) shows examples

of what he calls successful “Value Constallations” – the linking of assets from entirely different industries in order to create new value. For example EF education utilizes ordinary homes as the language school accommodation and JCDecaux utilizes bus stops as advertizing spots (ibid). MacMillan and McGrath (1997) point out the possibilities for innovation when a company constructs and analyzes the points where it comes in contact with its customers in the consumption chain – from the moment customers realize their need for a product to the time when they no longer want it and dispose of it. McGrath and MacMillan (2005) also discuss strategic moves in how to transform the customer’s experience and create new value by changing the consumption chain. These are just few examples of methods to view the current situation, question the current assumptions made, and identify opportunities for innovation that produce new value. How could these methods be adjusted to help in identifying opportunities for sustainable innovation?

In some cases, the problem is not to come up with new ideas, but rather, which ones to select for further development. Making a good selection from the ideas generated is critical for to the future success of the company. There is no single best process that would guarantee a good selection. The idea selection process is often iterative and likely passes through opportunity identification, opportunity analysis and idea generation and enrichment multiple times. (Koen et al. 2002) It’s a decision of strategic level to choose which ideas can best cope with competition and achieve most business value. Branderburger and Nalebuff (1995) suggest applying game theory to better understand the strategic implications a selection can have. Game theory can assist in understanding the “game” the business is a player in as well as how the “game” can be changed in favor of the company (ibid). Branderburger and Nalebuff (1995) also underline the importance of understanding how moves made in the “game” affect the “game” from the company’s point of view as well as from the point of view of other players. In the field of sustainable innovations better insight into the “game” and how it is played is needed. Determining which product development strategies are most appropriate for a company innovating for sustainability and how to translate the strategic goals of a company into products are also areas lacking proper support.

The front end of the innovation process is of a strategic nature. It is argued that successful sustainable design requires both strategic and operational activities (Ölundh & Ritzin, 2004), i.e. to be taken into account in both FFE and NPD. The essence of the opportunity identification phase is the sources and methods used (Koen et al., 2001). Search for better techniques and tools to

support bringing sustainability considerations to the FFE are called for, in order to help companies achieve greater success in their efforts to develop new sustainable products.

## 5. BRIDGING THE 'WHO AND THE 'WHAT'

The key link between the 'who' and the 'what' is represented in Figure 6 as the engine of transformational change. The outcome to the fuzzy front end activities is a factor of the attitudes and behaviours that those conducting such activities have. If the leaders and change agents have 'T shaped – alchemist' behaviours then the likelihood of more effective outputs in the sustainable context is greatly increased.

One of the challenges in the move towards sustainable innovation is that the vast majority of the accepted innovation change and leadership literature is based upon un-sustainable contexts. In the model shown in Figure 6 the two large central arrows indicate the attitudes and behaviours that emerge out of the changed and evolving cultural system. Attitude is used here to summarise all the separate elements of the organisational culture that then manifest themselves and impact on the behaviours of both individuals and groups. It is perhaps useful to present an overview of the constituent elements of culture (Burnes, 2004). In 1985 Schein proposed a three level model with *basic assumptions* at the deepest level, *beliefs, values and attitudes* at the intermediate level and *artifacts* at the top level (Schein, 1985). In 1989 Cummings and Huse added a level and defined culture as follows; *Basic assumptions, norms, values and artifacts* (Cummings & Huse, 1989). It is the basic assumptions and value / attitude aspects that it is proposed will need to both modified and focused on in the context of the sustainable challenge. This 'new' set of attitudes will then allow a set of people with the 'right' behaviours ('who') to fully realize and develop a 'right' set of techniques ('what'). The 'what' in Figure 7 consists of the activities in the early phase of the innovation process, before the NPD (the 'how') begins. Figure 7 is built upon the New Concept Development Model (NCD) introduced by Koen et al (2001).

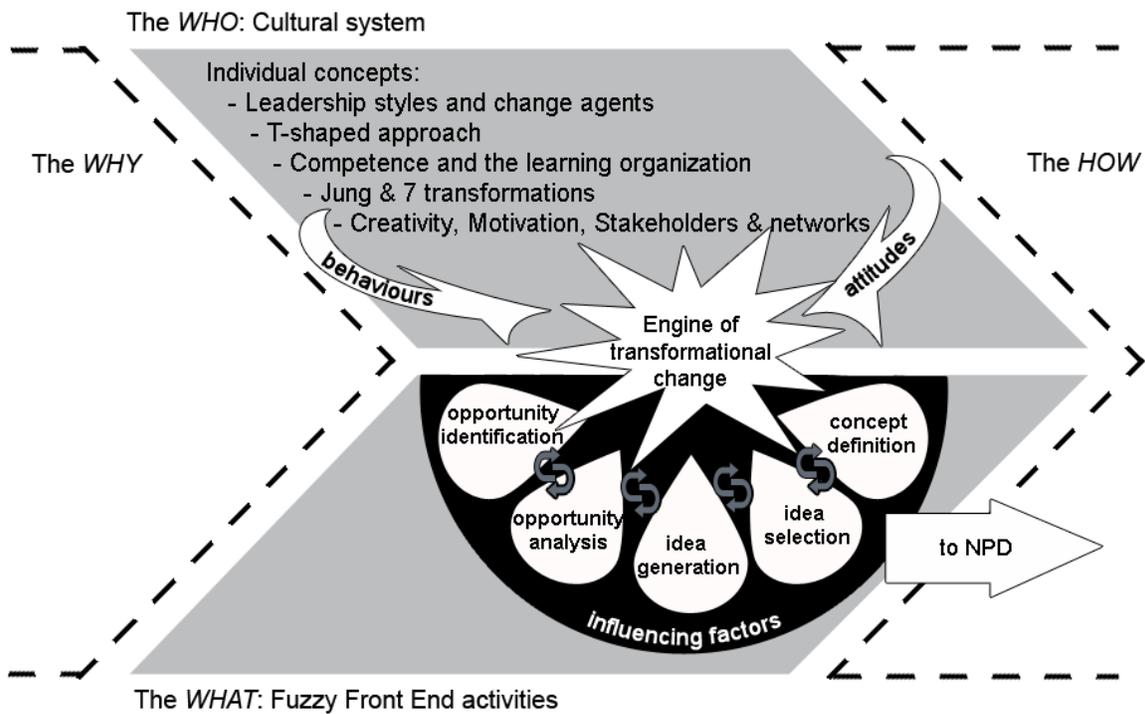


Figure 6 The 'who and what' (building on the NCD model of Koen et al., 2001)

'Serious Gaming' in the context of Sustainable Product Innovation appears to be almost non-existent. The complex and multidisciplinary character of sustainable product innovation provide incentives for experimentation with this relative new technique. Using games have a number of advantages, including (Boks, McAlloone, 2009):

- The ability to encourage small-group interaction ensuring participation by all players (Repenning& Lewis, 2005);
- The necessity to master a variety of skills and to combine them in a context that typically includes collaborative and interdisciplinary work styles (Repenning & Lewis, 2005);
- The ability to create and use metaphors for elements, actions and processes in real life situations, shedding light on complex problems (Mabugunje et al. 2008, Gómez-Martínet al, 2007);
- The experience that this type of activity makes participants experience positive emotions such as fun and enthusiasm (Mabugunje et al. 2008).

Edutainment can maybe play an important role in bridging the 'what' and the 'who' together. The Industrial Design Center in the University College of West-Flanders, Belgium, is currently developing a hardware role playing board game with 'Sustainable Product Innovation' as the main subject. The game will be used as empirical material in researching the 'who' and 'what'.

The game could be played on a general strategic level (radical innovation in the FFE, showing business opportunities) or in the context of a certain product (incremental innovation). One of the purposes of the game is stimulating employees from various departments in view of different creativity techniques to brainstorm about opportunities for sustainable product innovation. The chosen audience should be a multidisciplinary group of for example managers, product developers, engineers, marketing people and financial people. The first prototypes of the game will be tested in different companies in autumn and winter 2009. The game itself will be available on the market in March 2010.

## **6. RESEARCH PROPOSALS**

This paper has shown that, in order to innovate for sustainability, further research is needed in the people behind the 'transformational change' and in activities of the front end of the innovation process. What is now required is the questioning of the basic assumptions made about designing currently existing solutions. This requires a set of people with the 'right' behaviours ('who') and a 'right' set of techniques ('what').

The research on the 'who' presented in this paper looks into identifying organisations that demonstrate 'Ehrenfeld' characteristics (culture, leadership, ethos, etc.), 'Distill' a set of generic profiles (T shaped alchemists), approaches and outcomes. Then go on to test these generic profiles, approaches and outcomes to establish their validity.

The research on the 'what' suggested in this paper looks into cases of innovations to identify elements of a successful sustainable FFE process. The research focus is two-fold: first, to create better understanding of the role sustainability has and could have at the FFE, and two, to understand how sustainability considerations could be brought upstream in the innovation process. Due to the dual focus, there are both descriptive and prescriptive parts to this research.

The descriptive part of the research for the 'what' will begin by creating understanding of the current situation. In order to support innovating for sustainability at the FFE, it is crucial to understand the innovation process taking place in organisations and how sustainability is currently

viewed and taken into consideration in that process. In other words, in which ways are companies innovating for sustainability at the FFE and are there best practices? The research aims to trace typical characteristics and elements of a FFE process leading to sustainable innovation and factors that are considered essential in the successful processes. Equally interesting are the drivers that initiate an innovation process with sustainability ambitions, the obstacles and enablers of sustainable innovation in the FFE, and the decisions that affect the progression of the sustainable idea within the process.

The prescriptive part of the research for the 'what' aims to provide recommendations on how to bring sustainability considerations upstream in the innovation process. The aim is to generate methods to support innovating for sustainability at the FFE - a framework to facilitate sustainable ideation and to support idea selection. This will be carried out through a set of case studies, including prototyping and testing.

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