Do We Squash Innovation with Our 'Sustainable Product' Standards?

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Introduction

It is innovation that brings each of us "game changer" products, solutions and services. And today, more than ever, we want our products to be sustainable. But given the way we currently measure sustainability, are we driving or stifling innovation? If "sustainability is a global imperative" and "the clarion call is for innovation, innovation, innovation" we must examine both today's innovation processes and today's techniques for sustainability measurement. This paper summarises the way we currently use standards to measure the sustainability of our products (goods and services), and provides a detailed look at how the innovation process works – from evolutionary to revolutionary to disruptive. What fosters innovation and what stifles it? How does our approach to measuring sustainability ensure that our innovation process brings significant leaps instead of only incremental changes? The answers lead us away from setting new product performance criteria, toward processes that promote sustainable innovation going forward.

What are sustainability standards and how do they work?

These days, where sustainability is a common criterion for evaluating a company's product performance, many organisations have devised criteria intended to guide the development of more sustainable products. These benchmark criteria, or standards, exist as both regulations and as voluntary programs. Criteria such as greenhouse gas emissions from a product through its life cycle, product recycled content or recyclability, water use, pollutants released to water, the presence of hazardous chemicals, emissions to indoor air, or design-for-repair or disassembly comprise today's most widely recognised criteria and standards. Some standards only address a single product attribute. For example, the US Energy Star program focuses on the energy consumption of electronic equipment. Others, such as Japan's Top Runner program, reward products that meet best-in-class performance levels.

In many cases, product sustainability criteria and programs have been developed following the ISO 14020 series of standards – Type I, Type II or Type III (figure 1). The ISO 14020 series were created through stakeholder consultation and the involvement of many nations, organizations and thought leaders. Programs and criteria not developed following these standards, but still considered successful, have usually also been through an extensive stakeholder engagement process.

Environmental labels, declarations and statements are all attempting to encourage demand for and supply of products that are more environmentally preferable.

Regulatory initiatives also aim to improve the sustainability performance of products and include compliance and enforcement provisions. Consequently, regulations can have a pronounced effect on markets in terms of broad product coverage as well as implications for product design. The European Union has put forth now familiar initiatives affecting several sectors and phases of the product life cycle: vehicle end of life (ELV, directive 2000/53/EC); take-back legislation governing waste electrical and electronic equipment (WEEE, directive 2002/96/EC) and material restrictions in electronics (RoHS, directive 2002/95/EC). Another piece of legislation shaping the landscape addresses chemical management in practically all sectors not already covered (REACH, regulation EC No 1907/2006). The Eco-Design Directive for energy-using products (EuP, directive 2005/32/EC) takes a comprehensive view, providing a framework under which manufacturers must address product life cycle impacts during the design phase. Legislation with similar intent is being promulgated internationally. As a result, many companies are re-examining the way they measure product sustainability in light of the performance criteria put forth in regulations, voluntary labels and programs. Do these criteria and standards promote or hinder innovation? First, we should clarify our meaning of innovation.

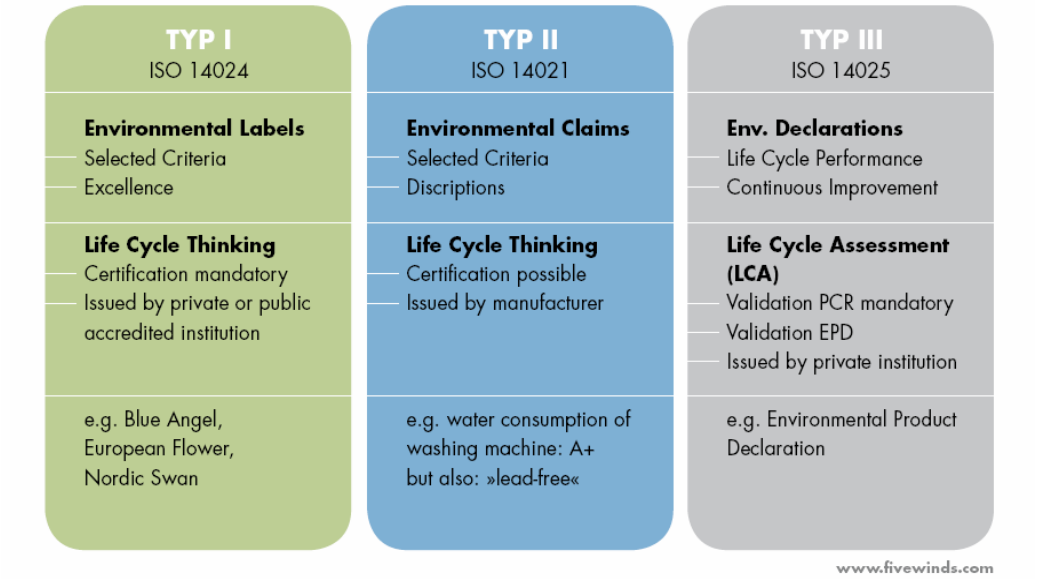

Figure 1. The ISO 14020 series defines rules for eco-labels and environmental claims.

What is innovation and how does it work?

Innovation is, in simplest terms, the implementation of a new idea. The idea may be an invention, that is, a first-of-its-kind device or thinking, or an improvement to an existing concept. Innovation is distinct from invention due to its focus on implementation; it must be reduced to commercial practice.

Innovation processes occur on three levels: basic, applied, and product development although the distinction between these levels is not always sharp. Basic research pursues long lead-time high risk ideas, and is sometimes characterized by scientists seeking knowledge for knowledge's sake. Information may be communicated and shared in open literature. Basic research is most often conducted in national laboratories and universities with government support. Applied research attempts to convert promising ideas into business opportunities. Concepts are refined and risks are identified and systematically reduced to acceptable levels. The private sector dominates at this level, although government funding is still frequently provided, creating a contentious situation at times. In product development, well developed, short lead-time low risk concepts are reduced to practice and

marketed by companies seeking to profit from them. Knowledge resides within organizations, and sharing between organizations is minimal in order to protect intellectual property.

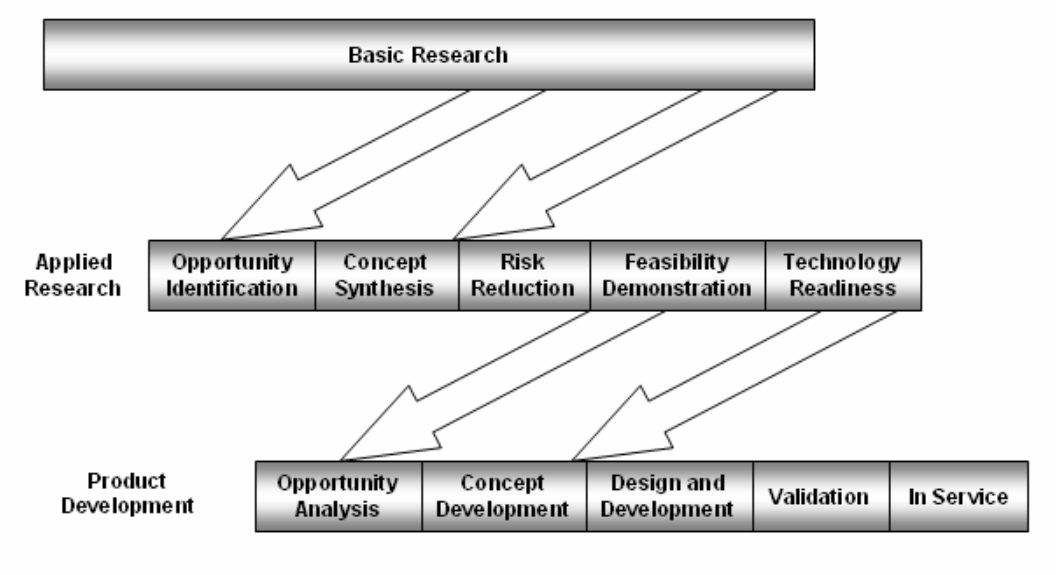

Figure 2. Levels of innovation and the stage gate process.

Many large corporations use a stage gate process to manage innovation. Development proceeds through a logical series of steps, each with pre-defined deliverables and achievement criteria, with management reviews between each step. This process is well-suited to producing *evolutionary* innovation, that is, incremental advances in product performance resulting from continuous improvement over time. The path most innovations follow has distinct characteristics which are shown in the S-curve in Figure 3. There is frequently a significant time period between an invention, depicted in the figure by a diamond, and its widespread adoption. This incubation period can be several decades, as in the case of the transistor. The first transistor patents were granted in the 1920s. The device was reduced to practice in the 1940s, first marketed in the 1950s and was widely available in everyday products in the 1960s. Innovation led to continued and rapid improvement in performance which was exemplified by Moore's law, Intel co-founder Gordon Moore's observation that the number of transistors that can practically be placed on an integrated circuit doubles every two years (Intel 2005). This period of rapid advance is represented by the steep portion of the S-curve. For mature products, the rate of performance improvement slows as the technology is optimized and the business focus shifts to productivity improvements.

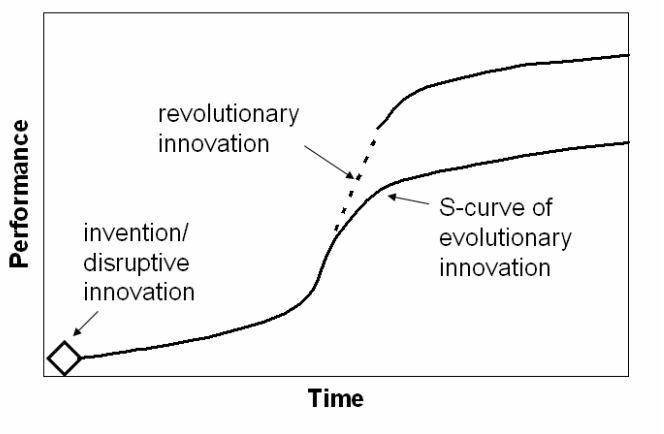

Figure 3. The innovation S-curve (adapted from Fussler, James 1996).

In Figure 3, the dotted line represents a step change in performance resulting from a *revolutionary* innovation altering the "normal" progression of evolutionary innovation. For example, Pratt & Whitney (a unit of United Technologies) is developing the PurePower PW1000G geared turbofan engine which is substantially quieter and will deliver a 12% reduction in fuel consumption to an airline industry that considers savings less than one-tenth as much to be significant. The gains are due to the incorporation of a speed reduction gearbox between the engine's low-pressure turbine and fan that allows each to rotate at different speeds closer to their optimal. Gearboxes are a feature of many everyday products, but due to a jet engine's severe operating and high reliability requirements, this innovation will take over 20 years to commercialize. Pratt & Whitney is pursuing the innovation expecting it will have a pronounced effect on the industry.

Evolutionary and revolutionary innovation are both directed at enhancing a company's products and market position. In contrast, *disruptive innovation* is characterized by changes in technology or methods that displace existing approaches, and in most cases, the dominant market incumbents. There is little incentive for companies with established markets to pursue disruptive innovation. Disruptive innovations commonly target the low end of a market, offering lower cost and lower performance solutions to consumers neglected by entrenched players seeking higher margins from technically advanced products. A contemporary example is the mobile phone camera displacing sales of digital cameras (Innosight 2005).

What stimulates or hinders innovation?

Disruptive innovation comes from individuals and governments, from small companies and enormous ones. Societies also innovate (Tischner 2006). Designer Ursula Tischner cites the birth of car sharing in Berlin as an example of citizens organising to fulfil their need for mobility without the expense and hassle of automobile ownership. From their early cooperative, a more formal professional and widespread business spawned. To further tap society as source of and a pull for innovation, governments and communities foster gentle, underground pressure for more sustainable products through awareness campaigns similar to those we have seen for litter and smoking in the past.

More obviously, innovation comes from within corporations. As many companies know, stimulating innovation requires that resources be balanced between open, creative research and solutions targeted at a customer need. Key to fostering innovation is corporate resolve and the organisation's ability to set a strategy that transcends separate interests, and to stick with it. In addition, because businesses exist to make money, many focus heavily on short term shareholder return. Innovation is best supported by a strategy that preserves longer term, open thinking, and resists the use of conventional metrics to maintain a narrow focus on productivity (Bone 2008). For example, some companies mandate employees take a few hours of free time each week to read, attend fairs, day dream and research ideas. Grants may be available for employees who have ideas they would like to take to the next level. Other firms offer competitions and awards for innovative ideas. Looking outside the organisation, innovation is stimulated by soliciting broader view points, from inter-company innovation workshops, to collaboration with non-governmental groups and citizens. Engaging multiple stakeholders, not at the point of product testing but much earlier in ideation, reveals important concerns, smart new ideas and provides insight into where demand is heading (Tischner 2006). Listening to a broad audience is critical. In fact, can the "wisdom of crowds" design our next-generation products?

The business magazine *Fast Company* asked this exact question of the Society for Sustainable Mobility, an open-source vehicle design project (Levine 2008). The project has 150 engineers working together, virtually and part-time, to create a seven-passenger SUV that gets 100 miles/gallon, sells for $30,000 (US) and performs like a Porsche Cayenne. An engineer in Malibu, California is working on the electrical architecture, while students at Rotterdam University are creating the chassis and suspension, and the list goes on. Open-source design is compared to wikipedia and Linux. Recognising how similar so many products are led one MIT student to ask "couldn't we get these people together to collaborate?" and then to establish an international, virtual open-source project with 200 students. Former GE firm, SABIC Innovative Plastics, is bringing open-source design into the

workings of business. SABIC operates an open-source project managed by three technical Universities in the Netherlands. “As a company, we do projects like this to stay in sync with what is going on in the world” (Levine 2008).

Finally, individuals drive innovation. Individuals with a creative spark who challenge everything and take nothing for granted. A pioneering, risk-taking spirit and willingness to try is what leads to unexpected outcomes, the discovery of disparate links and transferable lessons (Bone 2008). Companies that foster this “can-do” attitude and provide space for open, basic research without too many early constraints innovate. Societies that foster these attitudes also innovate, and our access to social networking is certainly expanding the ability for many people to get in the game.

Clearly, we are not innovating all the time, and many products haven’t changed for decades. What hinders innovation? Across the board, humans are generally creatures of habit, often tending to the familiar and known over the mysterious. While we as society can drive innovation as discussed, we also resist it. Consumers will reject a new product for a year or more, but then quickly adopt it into their mainstream purchases. In companies, managers can stifle creativity and new ideas in favour of keeping to what has always worked in the past to avoid disruption or uncertainty. Executives driven by short term shareholder interests and annual budgets – without balancing resources for pioneering research – can stick to conventional metrics for measuring productivity and output of employees, leaving no space for free thinking. This is especially true in economic downturns. Companies with a comfortable market position should not be expected to produce disruptive innovations.

How can sustainability standards stimulate innovation?

Standards can be effective in improving overall product sustainability. They help ensure that the products already on the market continuously perform better over time by raising the upper and/ or lower boundaries. Evolutionary innovation is promoted, resulting in a reasonably predictable increase in the aggregated performance of the product category. Sectors producing products with a very long life (e.g. aircrafts, cars) are challenged with anticipating what will be innovative and sustainable 10, 20 or 30 years out, at the time their products hit the market. For those companies, sustainability standards provide useful information. Standards developed over several years help to identify trends and set targets.

Usually, by the time a standard is adopted the basic design of the product is well established. However, standards can be written to provide space for innovative, entirely new solutions. Some of today’s sustainability standards recognise that a revolutionary or disruptive innovation will not fit within the criteria put forth in the standard – see LEED, EPEAT and Japan’s Top Runner program, at right. The menu-style standards of LEED and EPEAT set mandatory and optional performance criteria, but also offer some credit for “innovation and design”. However, there are shortcomings with the innovation credit; first it is a small percentage of the score required to achieve the standard, and second, the credit does not recognise approaches

Standards for Sustainability

Top Runner ~ LEED ~ EPEAT

The Top Runner Program is one of Japan’s primary approaches to reduce energy use (from non-industrial sectors) and aims to reduce energy consumption in households and private transport by reducing energy use of selected products. Eighteen product groups are covered. The ‘top runner’ is the product on the market (the year before the standard is set) with the highest use-phase energy efficiency. This becomes the basis of the standard and other producers must ensure the weighted average energy efficiency of their products meets that standard. The standard for each product group is revised, ranging from every 3 to 12 years. (Tojo, 2005)

The US Green Building Council LEED building rating system (v. 2009) is based on 100 points spanning 5 performance categories, from indoor air quality to construction materials. Building project leaders must meet certain mandatory prerequisites, and then can pick and choose amongst points to pursue with their designs. A USGBC committee reviews the project’s total point achievement and awards the building with certified, sliver, gold or platinum designation. There are open 2 credits for “innovation” and building project leaders apply for these credits with documentation demonstrating their green building innovation.

The Electronic Product Environmental Assessment Tool allows electronics manufacturers to rate the performance of their products against a selection of criteria. They must achieve certain prerequisites, but can then select amongst other environmental criteria, such as levels of recycled content or energy efficiency, to obtain a final rating from bronze to gold. Like LEED, EPEAT offers an open point for manufacturers that can demonstrate innovation.

that do not improve the product covered by the standard (the car sharing program that sprang up in Berlin was not dependent on more sustainable cars). While recognising disruptive innovation is not the mandate of LEED or EPEAT (market transformation is), the point illustrates how our sustainability standards for a house or a computer lock us into making a new home or computer in the image of what currently exists. Japan's Top Runner program is an open-ended approach to sustainability standards. The allure of this approach is using competition to drive and define what is innovative and sustainable. Europe and Canada are in the early days of considering how such a program could apply.

Standards also play a role in promoting challenging questions and enabling researchers, engineers and designers to think creatively (Tischner 2008). Sustainability standards use the lens of sustainability to challenge conventional assumptions, ponder future needs and most importantly to bring multi-stakeholder perspectives into ideation. In fact, the innovation process can learn from the process of sustainability standard setting – standards are created via a multi-stakeholder, consensus-based, open process. Innovation can likewise be informed when innovators listen closely to stakeholders within and outside their organisation. Also, the ability to see things from a whole system perspective, or life cycle perspective, is key to fostering the innovation of sustainable goods.

Closing remarks

Turning to the question that is the title of this paper – *Do we squash innovation with our sustainable product standards?* – we suggest the answer is yes, but it does not have to be that way. Sustainability standards can have a role in driving innovation and steadily improving product performance. While they probably cannot be relied on to address issues on the scale of climate change, future sustainability standards that are developed through a broader systems perspective, foster competition for excellence, and rely on less structure than those in place today, should encourage the revolutionary and disruptive innovations necessary to hasten society's move to sustainability.

The need to improve product sustainability is a small but vital part of the overall sustainability challenge facing society. We close with another question: "Do sustainable products lead to sustainable consumption?"

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