Managing greenness in technology marketing

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Abstract

Purpose – Technology product manufacturers and marketers must take into account that customers' awareness and appreciation of the benefits of green technology and products have increased. The purpose of this paper is to determine how technology firms can benefit from green marketing and what pitfalls there are to avoid.

Design/methodology/approach – Based on a review of green marketing literature, we introduce four approaches to green marketing by means of a matrix outlining four factors associated with perceived and actual greenness of new products and new technology. Then, for each of the four approaches, we propose an appropriate coping strategy that includes the issues that firms should consider when they use green marketing.

Findings – Customers' green values should be well understood when marketing plans for technology products are developed and implemented. Green marketing arguments should be communicated to customers in a coherent and truthful way to avoid customer scepticism or disbelief.

Research limitations/implications – The paper calls for an increased awareness of the way to utilize green marketing in technology firms. Supporting empirical evidence is still needed from future studies.

Originality/value – The contribution of the paper to academics and practitioners is increased understanding of how green marketing can be applied in technology firms.

Keywords – Green marketing, green technology and products, green marketing challenges and opportunities, marketing strategy.

Paper type – Conceptual paper.

1 Introduction

In the past decade, interest in more sustainable use of earth's resources has increased and has spanned a wide range of industries and academic disciplines. Green topics have been researched in marketing and engineering for decades under concepts such as sustainable solutions, green products, green marketing and green processes (Charter, Peattie, Ottman and Polonsky 2002, Ottman 1997). This research aims to increase understanding of what greenness actually is, its challenges and benefits, and how companies, as responsible actors, can make the most of developing, manufacturing and marketing sustainable solutions to benefit firms, the environment and society in general.

“Sustainable,” “environmentally friendly,” “green,” “pro-environmental” and “ecological” have often been used interchangeably to describe firms, products and production processes that use less energy, that recycle materials, that reduce waste and pollution and that preserve natural resources. Today, “green” is used most often to refer to new technology and new products that have a sustainable impact on nature and the environment. This paper takes a marketing perspective of green products, technology and especially information and communication technology (ICT) industries, although the majority of the ideas presented in this paper are applicable to other businesses too.

The overall purpose of this paper is to determine the role that “greenness” plays in marketing, based on current literature. The research problem addressed is how technology firms can benefit from green marketing and what pitfalls there are to avoid. The first part of the paper is an overview of existing literature. The second part introduces a conceptual matrix for green marketing that combines actual greenness with perceived greenness and, based on that matrix, presents four coping strategies. Recommendations for further research are also presented.

2 Green marketing

Marketing is in charge of collecting market data but is also responsible for disseminating information about the impact of products on the environment and society (UNEP 2007).

What is green marketing? Let's assume that an ICT firm whose offering portfolio has no distinguishably green products decides to "go green" via its marketing efforts. In doing so, the firm can, for example, reduce the amount of its physical marketing material, such as brochures and tradeshow giveaways, so that marketing itself achieves some level of environmentally positive results, although the advertised products are unchanged. Still, however beneficial it may be from an environmental point of view, just cutting down on advertising materials is not actually green marketing; green marketing is a much broader concept. Polonsky and Rosenberger (2001) stated that "green marketing is a holistic, integrated approach that continually re-evaluates how firms can achieve corporate objectives and meet consumer needs while minimizing long-term ecological harm." Peattie (2001) suggested that "green marketing has been used to describe marketing activities which attempt to reduce the negative social and environmental impacts of existing products and production systems, and which promote less damaging products and services." Charter (1992) defined green marketing as "a holistic and responsible management process that identifies, anticipates, satisfies and fulfils stakeholder requirements, for a reasonable reward, that does not adversely affect human or natural environmental wellbeing." Terms such as environmental marketing, ecological marketing, greener marketing, sustainable marketing and marketing of green products have also been used in the literature to describe similar activities (e.g., Coddington, 1993; Ottman and Herbert, 1993; Polonsky, 1994).

Sustainability, which is often used in unison with greenness, includes issues such as population pressure and increased consumption, globalization, global warming and climate change, ozone depletion, acid rain, genetic engineering and loss of habitats and species diversity (Charter et al., 2002). According to the United Nations' Brundtland Report, sustainable development "meet[s]

the needs of the present without compromising the ability of future generations to meet their needs” (United Nations 1987). The three main dimensions of sustainability are environmental (planet), economic (profit) and social (people), also known as the “triple bottom line” (UNEP 2007). Charter et al. (2002) combined the concept of sustainability with marketing to define sustainable marketing as “a broader management concept which focuses on achieving the ‘triple bottom line’ through creating, producing and delivering sustainable solutions with higher net sustainable value whilst continuously satisfying customers and other stakeholders.” Chen, Boudreau and Watson (2008) discussed the aspects of sustainability in relation to information systems (IS) in detail and proposed a model through which IS automation can be leveraged to achieve eco-efficiency. They also proposed that ISs be used to build environmental awareness in organizations and the community to transform organizations and industries so they achieve eco-effectiveness.

Peattie and Crane (2005) suggested that “all labels [greener marketing, environmental marketing, sustainable marketing] which describe a form of marketing which represents progress towards sustainability” be considered as green marketing. This paper uses the term green marketing to refer to the holistic process of improving the effectiveness and efficiency of technology companies’ marketing activities from a green perspective.

2.1 Reasons to go green

According to Bansal and Roth (2000), there are three primary reasons for a firm “go green”: competitiveness, legitimation, and ecological responsibility. Improved competitiveness includes energy and waste management and process intensification. Legitimation refers not only to complying with legislation but also to additional actions that target long-term sustainability, avoid fines and penalties and lessen risks. Ecological responsibility is “a motivation that stems from the concern that a firm has for its social obligations and values” (Bansal and Roth, 2000).

However, profit-seeking firms are often unwilling to sacrifice time and effort to create more environmentally friendly products unless there is clear business benefit to doing so or they are forced by legislation to do so (Peattie and Crane 2005). If there are not enough buyers, green products simply do not make sense to most firms (Kassaye, 2001). Kassaye's 2001 study found that US-based consumer firms have mainly gone green for the expected financial reward related to green. A related reason is pressure created by competitors. Kassaye also found that the motivations for going green tend to vary with the size of a firm: large firms go green mainly because of consumer requests and community relations and consider environmental concerns to be low on their priority lists, whereas small firms' primary concerns are costs, customer requests and fear of governmental intervention. Unfortunately, there is hardly any studies on this topic in the field of information technology (Chen et al. 2008).

Environmental legislation, a separate topic, creates boundaries, not only on the product but on the whole firm level. As Peattie and Crane (2005) argued, the free market will never be able to turn every firm toward greener products, so legislation forces them to undertake more sustainable business practices. However, regulations should still leave room for innovations and "create maximum opportunity for innovation by letting industries discover how to solve their own problems" (Porter and Linde, 1995). Legislation that protects the environment is often seen as a black-and-white issue, where strict environmental control policies do little more than create extra cost for firms, reducing their global competitiveness by making them invest in costly technologies to prevent pollution and waste. However, firms that act proactively in creating greener products and processes before legislation forces them to do so can reap first-mover benefits. Examples are found in the car industry, where Japanese and German automakers designed light-weight, highly fuel-efficient cars while US auto makers were fighting the inevitable new regulations and, in the meantime, losing their advantage and momentum (Porter and van der Linde, 1995). Thus, being the first to meet new regulations and standards can be an advantage in business and in marketing. In

addition to legislation, there are competitors, customers, trade associations and other pressure groups that demand that firms come up with more green solutions (Kassaye, 2001).

2.2 Approaches to greenness

There are three primary approaches to greenness from the product point of view: (1) The process or design approach, which considers the environmental aspects of product design phase, material sourcing and production; (2) the product itself as an outcome of the process and the use of that product; and (3) the effect of that product after it becomes obsolete, which can be expanded to cover the previous phases by taking the whole life cycle into account. These approaches form the basis for product greenness and have an effect on how a firm can and should utilize it in marketing communications. Plepys (2002) discussed the same phenomena in the context of the ICT industry and labelled these phases as resource extraction and manufacturing, the user phase and the end-of-life phase.

2.2.1 The Process and design approach

Fuller and Ottman (2004) listed several ways a firm can achieve lower production costs by engaging green processes and design principles: reducing the use of raw materials, reducing inventories of hazardous materials, reducing energy usage, reducing the volume of hazardous wastes that require terminal disposal, increasing productivity of operations and utilizing cost offsets (revenues) from sales of recycled materials, waste as resources, and reuse of parts/components. While these activities are also cost-cutting drivers, their results can be used to promote greenness of the firm. However, Fuller and Ottman (2004) stated that “sustainable products must retain the level of primary attributes and cost structure that enable them to compete in markets where the rule is survival of the economic fittest.” Mraz (2008) acknowledged the dilemma of firms that try to be greener but know that they would be better off selling products that need to be replaced frequently.

According to Fuller (1999), sustainable products “possess positive ecological attributes that are nothing more than enhanced waste management factors (eco-attributes) that have purposely been designed-in (embedded) through decisions concerning how products are made/manufactured, what they are made of, how they function, how long they last, how they are distributed, how they are used, and how they are disposed of at the end of useful service life.” According to Fuller and Ottman (2004), there are three key design scenarios for sustainable products: short-term eco-redesigns that involve low-functional changes of existing products, eco-innovations that provide complete new functionalities and ways to use the product for customers, and sustainable technology innovations that utilize emerging and sometimes even radical technology to provide new customer benefits and changes in how products are used. Naturally, the last category is the riskiest for small and even large firms.

The creation of sustainable solutions demands that firms pay attention to the green aspects of products already in their early design and technology-selection phase, including suppliers’ processes. A sustainable design can provide financial incentives to manufacturers in terms of cost savings and increased benefits to customers. For instance, according to Plepys (2002), resource extraction of electronic products is surprisingly highly material- and energy-intensive, and the majority of decisions that determine how a product affects the environment are fixed during its design. If creation of the green aspects of a product is postponed to the marketing phase, the effort is often little more than glazing the surface because the underlying features of the product are already frozen, and production-chain decisions have already been made (Bhat, 1993; Fuller and Ottman, 2002).

Bhat (1993) divided the sustainable considerations of the design phase into two parts, source reduction and waste management strategies, along with their respective subtasks, which are the most important ways to affect a product’s overall sustainability during the design phase. Charter et al. (2002) provided a list of questions that a developer of sustainable product should consider while

designing a green product. While these questions focus on usage and disposal/recycling of a product, the actual production process and design strategies have an important impact on the true greenness and sustainability of a product. Charter et al. (2002) advised the developer of a sustainable product to ask whether the product or service could be cleaner, more energy-efficient, quieter, and more intelligent; and whether its life can be extended through regular maintenance, whether it can be rented or leased, rather than purchased outright or whether shared ownership is an option, and whether higher levels of service could be added. These kinds of questions have great importance for the marketing team as well; since marketing and sales are in the front line of business, they should be able to validate and communicate customer values, in terms of these questions, to engineers.

Mraz (2008) pointed out that engineers often do not have much of a say in environmental choices if they are dictated by company philosophy and management prioritization. In fact, according to Pujari, Peattie and Wright (2004), barriers to sustainable development are actually more often due to organizational challenges than to technological limitations. To circumvent this type of barrier, cross-functional teams have been suggested as a way to incorporate market and engineering knowledge into product development in a balanced way (Fisher, Maltz and Jarowski, 1997; Griffin and Hauser, 1996; Moenaert, De Meyer, Souder and Deschoolmeester, 2003). External communication with partners is also important. For instance, large ICT firms such as Motorola, Nokia, Hewlett-Packard and Dell, just to name a few, have outsourced their design and production processes around the globe (Bohemia and Harman, 2008). In any case, green design is the starting point for green marketing (Bhat, 1993).

2.2.2 The product approach

ICT systems can be used to transform business process to be more efficient, to create new business models, and to reduce waste by improving production and automating tasks. Economic growth can often be traced back to novel use of various ICT products (Plepys, 2002), although the “greening”

of one product increases the demand for additional products, making it difficult to address the effect of the greenness of a single product. For instance in the context of ICT, creation of faster and more reliable computer networks requires more of servers, amplifiers, routers, filters, storage devices, UPSes, back-up generators and communication lines (Plepys, 2002).

Naturally, customers' use of products creates environmental concerns. For instance, with IT systems, the issue is the demand for increased energy production. To address the problem, Hewlett-Packard released new products that were promoted to be more energy-efficient and that thereby reduced data centers' carbon footprints (Preimesberger, 2008). It is not only hardware manufacturers who have taken greener products in their top management agenda; firms such as Autodesk, Microsoft, Google, SAP and Oracle have introduced software tools and systems that can be used to save energy or to analyze its usage (Ricadela, 2009).

Charter et al. (2002) listed the characteristics of a sustainable product: It should satisfy a genuine human need and not be harmful to human health; be green throughout its life cycle; be energy-efficient (i.e., result in reduced CO₂ emissions), non-polluting, easily repairable, designed to last, re-usable and recyclable; use minimal packaging; be free of hazardous materials and manufactured from renewable resources from locally sourced material to minimize transport costs; and not use animals in testing, child labor, or forced labor in manufacturing, whether that labor is in-house or contracted out.

2.2.3 The effect approach

According to UNEP (2007), "sales and marketing have an important role in a life cycle initiative, ensuring a good flow of information to and from the customers." A firm needs market knowledge in order to design products that address customers' values and are aligned with customer preferences and priorities. In responding to its customers' demands for green products, in order to communicate proper marketing messages, a firm must know how its products affect the environment during their life spans. Organizations can apply many approaches related to product life cycle management

when they want to increase their products' overall greenness, but the planning and implementation of these efforts should align with marketing initiatives.

Life cycle management is especially relevant for the ICT industry. For example, Plepys (2002) pointed out that “the total material intensity along the life cycle of a personal computer can be as large as 16–19 metric tons, of which just 0.1% is the computer's mass.” Recycling of hardware is a relevant issue because performance requirements quickly make ICT infrastructure obsolete. Increased energy consumption by ICT also needs to be addressed by taking the effect approach into consideration. The British Government (2008) revealed that ICT is “responsible for up to 20 per cent of carbon emissions generated by Government offices - around 460,000 tonnes a year.”

Life cycle management is fundamental to achieving real greenness. One of the central concepts related to life cycle management is life cycle thinking, which is often seen as the parent to the other concepts. According to the United Nations Environment Programme (UNEP 2003), “life cycle thinking is a way of addressing environmental issues and opportunities from a system or holistic perspective. In this way of thinking, a product or service is evaluated or designed with a goal of reducing potential environmental impacts over its entire life cycle. . . . The main goals of life cycle thinking are to reduce a product's resource use and emissions to the environment as well as improve its socio-economic performance throughout its life cycle” (UNEP, 2003).

2.3 Benefits and challenges of green marketing

The benefits of green products and green marketing are led by the assumption that consumers and industrial customers are environmentally aware, are cognizant of ethical and environmental factors among their purchase criteria, and are also willing to pay more for greener products (Charter et al., 2002; Bloom and Ginsberg, 2004). In addition, cleaner production processes can yield resource savings and better margins, while better environmental management and constant improvements in

that area can positively impact a firm's reputation and brand image. Sustainable products can also be a source of competitive advantage and increased revenue and profit (UNEP, 2007). Decreased energy consumption, optimization of material flows, and reduction of pollution and waste all have positive effects on the environment and result in cost savings for companies (Porter and van der Linde, 1995, Polonsky, 1994).

Polonsky (1994) listed five of the most important reasons cited by organizations for pursuing green marketing: 1) help in achieving their objectives; 2) a moral obligation to be socially responsible; 3) governmental regulation; 4) competitors' environmental activities; and 5) cost factors associated with waste disposal or reductions in material usage.

Despite its many benefits, green marketing has encountered some headwind. Some firms have used false promises and misleading advertisements to make their products look green, which actions have damaged customer trust in green claims (Davis, 1991). Riding the green wave but not fulfilling its promises can erode the benefits from green investments. Despite enthusiasm at the beginning of the 1990s, the concept of green marketing is still struggling, and overall progress has been slower than first anticipated. According to Mathur and Mathur (2000), news regarding green marketing activities is not valued by investors in general. Their study of wealth effects revealed that announcements related to green products did not affect stock price and that announcements of green promotional or marketing efforts produced significantly negative stock price reactions. In other words, investors think green promotional strategies destroy value. According to Peattie and Crane (2005), many firms that produce green products have left the market, and the number of green product launches has decreased. In addition, some firms have actually become more cautious about using environmental claims for several reasons. A lack of interest within the company and clashes with corporate cultures has also hindered the greening progress after the first green initiatives were implemented (Peattie, 2001). According to Peattie and Crane (2005), most of green marketing's

uneven performance can be attributed to five poorly conceived approaches: green spinning, green selling, green harvesting, “enviropreneurial” marketing, and compliance marketing.

Green spinning is an inward-looking, reactive approach placed in the public relations function. This approach is geared to reputation management instead of to market- and customer-orientation. Misleading or false environmental claims are also called green washing (Ginsberg and Bloom, 2004). According to Polonsky (1994), marketers have to be able to state a product’s environmental benefits clearly, explain how these benefits are achieved, explain the product’s environmental characteristics, and ensure that comparative differences are justified. Firms also have to be able to ensure that negative factors are taken into consideration. Peattie and Crane (2005) observed that, “green spinning was always going to fail because, unless they are involved and consulted, contemporary consumers and pressure groups are unlikely to be fully convinced by the protestations of commercial enterprises.”

Green selling is another short-sighted approach that resulted from market studies in the 1990s that reported increased environmental concerns among customers and led firms to conclude that “green sells.” Sometimes far-fetched environmental benefits were ferreted out from existing products and used in campaigns to benefit from customers’ environmental concerns. Firms that wanted to prove that their products actually were green created various certification programs that, unfortunately, led to creation of an array of eco logos and certificates that further confused customers (Peattie and Crane, 2005).

Green harvesting is associated with a corporate culture that fosters short-term profitability and a financial orientation to green issues instead of radical change. The green harvesting approach hampers market penetration because green products come to be perceived as expensive products for niche markets. Firms that use this approach take advantage of the fact that green products could initially be priced higher, even when the environmental aspects achieved resulted in internal cost savings. Once the low-hanging fruit from using this tactic is collected, firms using the green

harvesting approach have little motivation to make strategic investments in developing truly green products and often abandon the green marketing agenda (Peattie and Crane 2005).

Enviropreneurial marketing occurs when start-ups, as well as large firms, increase the number of green products available because market research tells them to do so. However, the reality is more complicated than the hypothetical situations often presented in the market studies. Much of the research has focused on general environmental concerns and has neglected to investigate what kinds of green products customers are really willing to buy (Peattie and Crane, 2005). Finally, compliance marketing occurs when firms do not bother to go further in product development than what is minimally required by legislation. Some firms even adopt an approach wherein they provide the mandatory green product while simultaneously lobbying against further legislation (Peattie and Crane, 2005).

The benefits of green marketing are many, but so are its challenges and counter-efforts. Table 1 summarizes the benefits and challenges of green marketing based on the previous literature.

Table 1. Summary of the benefits and challenges of green marketing.

Benefits of green marketing	References	Challenges of green marketing	References
Better brand image and reputation among targeted customer segment.	UNEP (2007), Lawrence (1991), Porter and Linde (1995)	Sometimes non-green products have superior attributes, and it is a challenge to overcome this fact in an honest way.	Davis (1991)
Environmental excellence as a good management practice.	Porter and Linde (1995)	The customer may get confused about the true nature of green marketing messages.	Polonsky (1994), Bloom and Ginsberg (2004), Peattie and Crane (2005)
Better profitability and increased revenue if customers are willing to pay premium for green products.	Charter et al. (2002) Bloom and Ginsberg (2004), Kassaye (2001)	Customers believe that greener products are somehow inferior.	Peattie (1991), Bloom and Ginsberg (2004)
There is possibility for continuous support from loyal customers and communities.	UNEP (2007)	To reach a smaller and/or scattered target audience creates extra cost and, therefore, can make green marketing more expensive.	Peattie and Crane (2005)
A way to differentiate from competitors.	Bloom and Ginsberg (2004), UNEP (2007)	Customers may have lost their faith in green marketing because of previous green wash, green spinning and green harvesting issues.	Davis (1991), Bloom and Ginsberg (2004), Peattie and Crane (2005)
Increasing goodwill by doing more than legislation requires.	Porter and Linde (1995), Bloom and Ginsberg (2004)	Organizational issues create barriers such as how to integrate sustainable thinking into the overall company culture. Green marketing is not seen as a strategic imperative but something that has to be done.	Pujari et al. (2004), Peattie (2001)
A firm can response to social and environmental responsibility requirements.	Polonsky (1994)	Customers and investors does not value green marketing.	Polonsky (1994), Mathur and Mathur (2000), Bloom and Ginsberg (2004), Peattie and Crane (2005)

2.4 Practices of green marketing

Green marketing practices include several attempts to segment and classify consumers in terms of how they value (or fail to value) green product attributes, but the results have been contradictory (Peattie, 1999). Ginsberg and Bloom (2004) referred to a Roper survey that divided U.S. consumers into segments based on their receptivity to a green appeal and found that between 15% and 46% of the overall consumer market are potentially responsive to green marketing. Peattie (1999) referred to Kardash (1974), who stated that, all things being equal, every customer would choose green alternatives by default. In reality, however, the situation is more complex and buyers who opt for green products often must pay a premium, accept a lower level of actual or perceived technical performance, or travel to specialist stores that carry these items (Peattie, 1999).

An effective green marketing practice should cover a broader range of the business than just the individual activities of designing or promoting less environmentally harmful products (Polonsky and Rosenberg, 2001). Firms need a strategy with which to fully leverage “green thinking” in their business. To achieve the goal of an effective green marketing strategy, Bloom and Ginsberg (2004) suggested that firms address the size of the green customer segment and whether the brand can be differentiated on the green dimension. If the majority of a firm’s customers are not interested in green products, then the firm must think carefully about how much they use green messages in their marketing. This is a fundamental issue in the greenness matrix we present below.

An effective green marketing practice is based on developing or applying the most suitable green technology and creating innovative applications and products based on that technology. In addition, technology selection has a natural effect on the green attributes of a final product. Concepción et al. (2002) proposed a “Green Technology Guide” which the pharmaceutical industry could use to incorporate environmental, health and safety aspects from the very beginning of the development phase so firms could rank and select the best alternatives among different

technologies, based on their greenness. Firms should be aware of technology changes that can be used to alter their production processes to benefit from green opportunities, and they should understand how competitors operate in the green realm. According to Bloom and Ginsberg (2004), “companies should consider the likely size of the green market in their industry as well as their ability to differentiate their products on "greenness" from those of competitors.”

3 A proposed framework for green marketing

Peattie and Crane (2005) suggested several key topics that firms should understand in order to be able to raise green marketing to its full potential: Firms should place the customer first, have a long-term focus in their business, and nurture a holistic approach throughout the firm; and innovation and radical change should be well regarded and cultivated. Green marketing strategy has been studied from the perspectives of stakeholder management (Rivera-Camino, 2007) and green products (Ottman and Terry, 1998), but the literature is missing an effort to combine how greenness is perceived by buyers and sellers in one framework. To fill this gap, we propose a conceptual perceived-versus-actual greenness matrix, followed by a second matrix that outlines suitable coping strategies for each quadrant.

3.1 The perceived-actual greenness matrix

Firms may not always understand what their customers see as the most important sustainable features and benefits of its offerings. To overcome this dilemma, we propose that firms first evaluate their customers’ attitude towards greenness, and then incorporate that input into the early phases of product development. This approach will ensure that the right green attributes are in place and that a product meets the expectation of buyers. It will also decrease the risk of green-washing while preventing extra costs if (more expensive) green products are not what the buyers want. We emphasize that a firm should pay close attention to matching the product image and the true content

of the product in order for the green marketing to make sense, which can accomplish by using pre-marketing campaigns, focus group interviews, and other strategies. The key is to understand the customers' opinions and perceptions about the product as early as possible. For instance, a survey among Australian IT professionals studied their attitudes about and actions regarding green IT (Molla, 2009) and revealed a wide range of awareness and concerns for green IT among the respondents. This type of information can be used to gain insight into the perceived greenness of certain customer groups, especially if combined with more focused data that deals with the firm's products.

The role of actual versus perceived product greenness is illustrated in Figure 1. Actual greenness refers to the objective greenness of the product, and perceived greenness refers to how customers see the product. In general, the three approaches to greenness—the process and design approach, the product approach, and the effect approach—can be used as sources for green marketing and these approaches should all be addressed at the same time. In other words, all those three approaches should also be evaluated in each of the quadrants of the greenness matrix. For the sake of simplicity and applicability of the model, those approaches are embedded in the matrix but are not elaborated in detail.

Figure 1, The greenness matrix

3.1.1 An honest, non-green product

An honest, non-green product is that whose greenness, as perceived by the customer, is low and whose actual greenness is also at low, so both the customer and the firm agree that greenness is not present in the product. A firm that markets a product without any real green benefits is better off not inventing green features; in other words, if the process, product and effect produce no green features or function for the product, then artificial green marketing arguments may do more harm to than good.

3.1.2 Missed opportunity or strategic choice

A missed-opportunity product is one for which customers would value its green benefits but, for some reason, they do not perceive it as green, even though the product's actual greenness is high. In other words, a firm may have a product with real green benefits, but customers are not aware of them. If a firm does not realize that its customers are not aware of the green aspects of the product, even though greenness would be likely to affect customers' purchasing decisions positively, then there is a missed opportunity. It might also be the case that a firm does not know that its suppliers are using eco-friendly or green technology in production, so the firm does not use that fact in its marketing. The underlying assumption here is that the greenness of a product is of interest to customers, so it is recommended that firms work to understand fully the greenness of their products and how their customers perceive the underlying product benefits and greenness so that, if the customers are not aware of the product's green attributes, the firm can make the strategic decision to publicize the green attributes that are legitimately associated with the product. However, as explained in section 3.2.2, sometimes firms intentionally decide to keep a low profile on greenness.

3.1.3 Green-washed products

Products in the green-washed products cell are those for which the customer perceives that greenness is at high level, but actual greenness is at a low level. These are often the products that

have disappointed customers after false and misleading green marketing messages delivered by opportunistic firms (Peattie and Crane, 2005). In these cases, firms should align their green marketing according to the actual greenness of their product in order to ensure their credibility and longer-term customer commitment and loyalty. There is little to be gained in the long term from a green-washing strategy: a product can be temporarily perceived as green by the market but, if the product cannot live up to its promises, savvy customers and media will eventually discover the deception, and counter-actions can be strong and severe. The negative effects of this kind of event can also reflect on the other products of a multi-brand company, and the overall corporate brand will be stained.

3.1.4 Sustainable superiority

A product that falls into the sustainable superiority category has a high level of both customer perceived and actual greenness. Sustainable superiority is the most desirable situation from a green marketing point of view since customers are aware of the product's greenness and the firm can deliver on the greenness promise. A firm with true green products that are also perceived as green in a marketplace where customers value greenness has a great competitive advantage.

3.2 Coping strategies for different greenness cells

The matrix in Figure 1 can be applied to cases of product repositioning or during product development for products/prototypes that are already available for customers to evaluate. Based on the literature review and practical examples, Figure 2 presents four coping strategies, one for each of the four quadrants in the matrix.

Perceived greenness	high	<i>Making it real – or telling the truth</i>	<i>Being market-oriented and constantly monitoring how green marketing works</i>
	low	<i>Marketing as usual</i>	<i>Identifying and supporting green marketing efforts</i>
		low	high
		Actual greenness	

Figure 2, Coping strategies

3.2.1 Honest, non-green products → Marketing as usual

Green technologies and green products are not automatic “must haves.” Bloom and Ginsberg (2004) observed that “consumers are unlikely to compromise on product attributes such as convenience, availability, price, quality and performance to buy green products.” Therefore, to satisfy a majority of the customers, the product has to deliver core benefits first, and green attributes follow only once the core benefits are established. In the case of an honest, non-green product, customers do not actively perceive the firm’s product as green, and the firm should deliver marketing messages that promote topics other than greenness. It is better not to spoil the image of a good product by adding ingredients that are not there.

3.2.2 Missed opportunity/strategic choice products → Identifying and supporting green marketing efforts

Firms should take advantage of impartial, third-party-based information to support their green marketing efforts. This strategy is especially important for a firm that is perceived by green-oriented customers as too low on the greenness scale since increasing the awareness of the true nature of

firm's products among these customers is likely to improve sales. Despite the concern that people might get confused by the array of eco-labels (Peattie and Crane, 2005), there are also findings that support the use of these labels. A consumer agency in Denmark compared products in a certain category and nominated one that was eco-labelled as the most effective, cheapest, and most environmentally friendly product. Publicity about these results in Denmark's media not only provided new information about eco-labels to consumers but increased the product's firm's sales significantly (UNEP, 2007). The printing industry has not traditionally been considered to be very environmental because of its use of environmentally harmful inks. To overcome this issue, some printing industry firms have begun working with chemical providers to create more environmentally friendly vegetable-based inks (Smith, 2008). As a result of this kind of development, a firm may have an actual green product but the perceived greenness may still be low because of history and tradition. It takes time and effort to educate customers and other stakeholder about the improved situation.

ICT firms that sell their products to other firms are in a better position than are firms who sell directly to consumers because their buyers are professionals and are not often confused by labels. Industrial customers value industry experts' opinions, so firms should collect and disseminate positive customer testimonials. In addition, certificates granted by trustworthy certifying authorities are also good marketing assets.

Despite the clear benefits of ensuring that customers have accurate information about their products' greenness, sometimes companies intentionally choose not to use green attributes in their marketing for fear of its backfiring (Polonsky, 1994; Bloom and Ginsberg, 2004; Peattie and Crane, 2005). This type of strategic decision is not missed opportunity per se because "mistrust of green claims still endures to the extent that many firms . . . choose not to make any green claims at all for risk of alienating customers" (Peattie and Crane, 2005). Coca Cola and Budweiser, for example, have decided not to attach green attributes or to publish green activities (Bloom and Ginsberg,

2004), even though they may perform sustainable projects, because, as Polonsky (1994) stated, “given the limited scientific knowledge at any point in time, it may be impossible for a firm to be certain they have made the correct environmental decision.”

3.2.3 Green-washed products → Making it real or telling the truth

The “green-washing” strategy is definitely not a place to stay. If green-washing has taken place, the best solution is to change the product to align with customer beliefs and perceptions or, if this is not possible, to educate the customers about the true nature of the product. A firm should think green in product innovation and create products with real green attributes or move back to an honest, not-green product category and proactively remove false green perceptions about the product. In fact, some firms have been forced to withdraw products that have been marketed under green labels but that could not support the proposed claims in reality (Bhat, 1993). It is impossible to maintain a green image if a firm cannot live up to product expectations (Polonsky and Rosenberg, 2001). Delivering an inaccurate green message can lead to serious effects. For instance, Mobil faced several lawsuits for misleading advertising when the biodegradable plastic bag it introduced was not really biodegradable. Mobil volunteered to remove degradability claims, but the episode left a mark on the corporate brand (Lawrence, 1991). Green-washing was more prevalent in the 1980s and early 1990s, but it continues to cause concerns among customers (Bloom and Ginsberg, 2004; Peattie and Crane, 2005).

3.2.4 Sustainable superiority → Being market-oriented and constantly monitoring how green marketing works

Green products can be good business, and there are numerous cases of successful green projects in different industries. Firms that proactively seek innovative solutions in response to environmental regulations can achieve cost savings and production improvements, and improved product quality and consistency are likely to follow (Porter and Linde, 1995). Firms with products in the sustainable

superiority category understand what their customers value most and continually launch new products to meet those needs. This strategy can be achieved by involving customers in the new product development process at early stages. A firm may also choose to become part of industrial or firm-specific social networks in order to gain access to new ideas relating to greenness. By gaining such new ideas, a firm can develop production processes and technologies further to increase its green output. Sustainable superiority requires a corporate wide change in thinking, as well as the incorporation of greenness into current strategies. In order to keep the competitive advantage gained through sustainable superiority, this strategy requires constant monitoring of changes in the market and technology, as well as training of customers so false beliefs do not emerge.

4 Conclusions and recommendations for further studies

The literature on combining green marketing and green technology, especially green ICT, is scarce. As Allenby (2000) illustrated, “green technology” is an ambiguous and complex concept. Some attempts have been made to combine green marketing with other industries. For instance, Iles (2008) discussed how chemical manufactures should take advantage of green marketing, and Lynes and Dredge (2006) provided analysis of airlines’ motivations for going green and discussed how green topics are related to airlines’ images.

There are some business-to-business related studies in the context of technology firms but, considering the increased awareness of energy consumption and the recycling questions connected to the ICT industry, there is a demand for further research, both qualitative and quantitative, on how the ICT industry should utilize green marketing. While Chen et al. (2008) pointed out the importance of ecological sustainability and its understanding in the IS context, more studies are needed on green marketing in different ICT industries and in the IS usage context.

Our research was based on a literature review and was conceptual in nature. Thus, more empirically grounded insights are needed to test the categories of greenness in our matrix and the validity of our recommended coping strategies. In addition, future research could look into the

possibility of identifying how green marketing can be applied in the ICT business, since ICT products often have long value chains and overlapping value networks that could be evaluated from the green perspective. The question of whether there is a risk that the original green message from suppliers will be distorted when a product moves downstream and is assembled with other components is also one worth addressing. Since consumers differ in the way they value green attributes, it would also be important to study whether industrial ICT customers follow the same pattern. While studies of consumer businesses provide some indicators, research has not yet identified the most important green attributes that create value for industrial buyers, so more research among technology firms is called for. An in-depth case study of differences between ICT firms that are positioned in different corners of the greenness matrix presented in the figure 2 would be also valuable.

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