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Purchasing and Marketing of Social and Environmental Sustainability in High-Tech Medical Equipment

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Abstract

As the functional capabilities of high-tech medical products converge, supplying organizations seek new opportunities to differentiate their offerings. Embracing product sustainability-related differentiators provides such an opportunity. Our study examines the challenge for organizations to understand how customers perceive environmental and social dimensions of sustainability. To achieve this, the study explores and defines these two dimensions based on, first, a review of extent literature and, second, focus group research within a leading supplier of magnetic resonance imaging (MRI) scanning equipment. The study takes place in the Netherlands in seven different types of hospitals and one private imaging center. Five social aspects, together covering eleven indicators, are identified. These are tested via 22 customer perception interviews with key decision making stakeholders (within the hospitals or imaging center) involved in purchasing of MRI scanning equipment. Respondents find environmental and social sustainability dimensions personally relevant, but professionally secondary to cost, performance, and ability to use MRI scanning equipment within organizations' physical infrastructure. Finally, incorporating a product's environmental and social credentials within marketing of MRI scanning equipment enhances the perception of the product offering in decision making stakeholders' minds and provide differentiation.

Keywords: High-tech medical equipment; purchasing process; decision making stakeholders; environmental sustainability; social sustainability.

Purchasing and Marketing of Social and Environmental Responsibilities in High-Tech Medical Equipment

Introduction

This article examines a given product's (high-tech medical equipment) social and environmental sustainability and its potential to support a product purchasing process. Sustainability describes how an organization integrates social, environmental, and economic activities in pursuit of outcomes beyond generating profit (Amaral and La Rovere, 2003; Cowell et al., 1999). Historically, companies focused on the economic dimension, which is to utilize resources to maximize the company's profit (e.g., Friedman, 1970; Gauthier, 2005; Walker, 2002). In response to the view that "companies do not only serve shareholders, but are embedded in their economic, ecological and social environment, which they must take into consideration when doing business" (Seuring et al., 2003: p. 204), however, companies should pursue other aspects of sustainability, balancing economic prosperity with environmental protection and social equity to meet the principles of sustainable development (Isaksson and Garvare, 2003; Keeble, Topiol, and Berkeley, 2003). Customers' perception of a product's social and environmental sustainability influences their purchase choice, as they seek offerings compatible with their views of sustainable development (Isaksson and Garvare, 2003). Whilst this influence has been identified, its nature is yet to be defined making the use of environmental and social sustainability to support product purchasing and marketing problematic. For example, few offerings are labeled to highlight social sustainability credentials (Isaksson and Garvare, 2003) although when such credentials are perceived as relevant by customers this may provide marketing opportunities. Whilst economic and environmental dimensions of sustainability are reasonably well understood,

social dimensions of sustainability remains novel and little explored (e.g., Amaral and La Rovere, 2003; Keeble, Topiol, and Berkeley, 2003).

An example of the rising importance of social sustainability can be found in the high-tech medical equipment industry. Philips Medical Systems introduced MRI scanning equipment in 1983, and currently commands 25% of the worldwide market, equating to 24.8% of the company's total sales. With annual growth levels of 6% plus, the European market for high-tech medical equipment is both attractive and strategically important for Philips and its competitors including GE Healthcare and Siemens Medical Solutions. Increasingly, as the technological capabilities of MRI scanners converge, companies use social and environmental responsibility standards to influence customers' purchasing decision making. Within the Netherlands, four types of institutions purchase MRI scanning equipment—academic, teaching, and community hospitals in addition to private imaging centers. Additionally, the purchasing decision making process in each was broadly similar and was influenced by three types of stakeholder—clinicians, operators, and business managers (van Heesch, 2006). The influence that each stakeholder has during the different stages in purchasing MRI scanning equipment has been summarized into a customer purchasing framework (Figure 1).

Insert Figure 1 about here

The study has three objectives. First, we provide clearer insights into what a product's environmental and social sustainability is. Second, we identify whether, and how, social and environmental sustainability influences the purchasing processes of high-tech medical equipment. Third, we consider how social and environmental sustainability can enhance the

marketing of such products. To address these objectives, the remainder of the article is structured as follows. First, a literature review explores environmental and social dimensions of sustainability to conceptualize a theoretical framework. Second, findings are reported of an empirical study that qualitatively explores the influence of social and environmental sustainability within the purchasing of MRI scanning equipment. Third, an analysis and discussion of these empirical findings is presented. Finally, the study's theoretical and managerial contributions are identified, limitations addressed, and avenues for further research suggested.

Theoretical Background

Dimensions of environmental and social sustainability concern with how these impact on society's future needs (e.g. Cowell et al., Fiksel, McDaniel, and Spitzley, 1998; 1999; Seuring et al., 2003; Veleva and Ellenbecker, 2001). This means satisfying present needs without compromising needs of future generations (e.g., Cowell, 1999; Ottman, 1997). A sustainable company is one "whose characteristics and actions are designed to lead to a 'desirable future state' for all stakeholders" (Funk, 2003: p. 65). Stakeholders are "those groups who can affect or are affected by a firm's objective" (Seuring et al., 2003: p. 205). These definitions provide a context to consider social and environmental sustainability.

Environmental sustainability relates to a company's use of natural resources and its ecological impact (Isaksson and Garvare, 2003; Veleva et al., 2000). Whilst environmental sustainability is reasonably well understood in the literature, social sustainability is not thereby making the nature of 'social matters' unclear (Littig and Griessler, 2005). Because social sustainability is intangible and qualitative in nature, a consensus about what its

dimensions are is difficult to reach, though it is related to how a company impacts on individuals' or society's well being (von Geibler et al., 2006). As depicted in the framework in Appendix 1, however, by adapting a concept specification model to show different aspects and their sub elements (termed indicators) of social sustainability some clarification has been achieved (von Geibler et al., 2006).[2] This study explores the nature of sustainability indicators (second objective), then considers how these might be summarized into sustainability aspects to provide insights into what a product's social and environmental sustainability is (first objective), and finally examines how social and environmental sustainability can enhance product marketing (third objective).

Sustainability indicators

Sustainability indicators are specific, measurable product attributes that characterize contribution to social and environmental sustainability (Fiksel, McDaniel, and Spitzley, 1998). Such indicators should be relevant, understandable, robust, and limited in number; they should be easy to use, collect, and reproduce; they should complement existing legal follow-up programs; financially feasible; and, finally, they should be useful as a management tool and able to protect company data, as well as adaptable to future developments (Amaral and La Rovere, 2003; Isaksson and Garvare, 2003). Indicators should take account of a

[2] It has been suggested that the term "aspect" be changed to "focal area" to reflect its use as a summarizing label of indicators (von Geibler et al., 2006). This is in line with Philips Medical Systems' incorporation of environmental sustainability in its marketing of high-tech medical equipment, which the company refers to as "green focal areas" (Philips Sustainability Report, 2006). In this article, however, we use the term aspect.

product's resource consumption and value creation throughout the whole of its life cycle (Fiksel, McDaniel, and Spitzley, 1998; Gauthier, 2005; Seuring et al., 2003). The lifecycle in this respect includes extraction of raw materials, as well as manufacture, packaging, storage, distribution, recycle, and destruction of product (Gauthier, 2005), which in turn requires that companies' social and environmental indicators relate to internal and external stakeholder needs throughout product production, consumption, and disposal (Amaral and La Rovere, 2003; Funk, 2003; Global Reporting Initiative; Seuring et al., 2003). The broad nature of sustainability (Fiksel, McDaniel, and Spitzley, 1998) suggests companies risk generating too many indicators, obscuring those most relevant to the product (Isaksson and Garvare, 2003).

Environmental aspects

With environmental sustainability well understood, at Philips Medical Systems, the company's environmental credentials have been defined within five aspects: reducing products' energy consumption, packaging materials, hazardous substances, and weight, whilst increasing levels of recycling and safeguards during disposal of products (Philips Sustainability Report, 2006). Governments, companies, and other organizations adopt sustainable development to address concerns about climate change and depletion of natural resources though this is reinforced by consumers and activists pushing large companies to develop such practices (Cowell et al., 1999; Keeble, Topiol, and Berkeley, 2003). Companies failing in this often become the target of activist pressures (Gauthier, 2005).

Social aspects

As discussed, social sustainability is less well understood. Adding to the Brundtland Commission's (WCED, 1987) view on social sustainability, it has been suggested that this term relates to how companies contribute to the well being and quality of life of society and

individuals for current and future generations (Steurer et al., 2005). Product-related social aspects, therefore, summarize how production, use, and disposal satisfy such conditions. Social aspects conceptualized and derived predominantly from studies linked to the chemical industry can be identified in literature. These aspects differ in level of focus. For example, some discuss "taking employees into consideration" to summarize how an organization supports employees (e.g., Gauthier, 2005), whilst others separate this into "working conditions," "education and training," and "equity" (Tanzil and Beloff, 2006; von Geibler et al., 2006). The differentiation in level of focus suggests that the nature of production, product characteristics, and product use influence level of focus.

Various social aspect themes can be identified in literature. For example, one theme relates to health and safety (Gauthier, 2005; von Geibler et al., 2006); this theme is also referred to as safety and well-being (Tanzil and Beloff, 2006) or accident and injury reduction (Fiksel, McDaniel, and Spitzley, 1998). All are based on the premise that the supplying company should minimize potential for a product to harm an individual throughout the product's lifecycle.

Another theme is product usage within the product's operating context. The quality of the working environment, for example issues of noise level and room temperature, is discussed in literature as a factor that impinges on how individuals perform (Gauthier, 2005; Tanzil and Beloff, 2006; von Geibler et al., 2006). Such issues have been related to how user "peace of mind" is created (Fiksel, McDaniel, and Spitzley, 1998). A product has to answer stakeholders' needs (Gauthier, 2005; Seuring et al., 2003), for example a MRI scanning equipment providing quality images of the internal workings of a body. The product generates employment or wealth in different social environments (Steurer et al., 2005).

Ethical production relates to treating employees and those within the supply chain fairly (Gauthier, 2005; Seuring et al., 2003; von Geibler et al., 2006); ensuring production protects individuals and does not violate human rights or uses child labor (Fiksel, McDaniel, and Spitzley, 1998; Gauthier, 2005: Steurer at al., 2005; Tanzil and Beloff, 2006). Social sustainability is seen as a force for good including equity transfer, which refers to that profit should be more evenly distributed between those involved in their manufacture within the organization and those within the supply chain (Seuring et al., 2003). For Philips Medical Systems, greater use of social sustainability in the marketing of products would require a more complete understanding of the social sustainability dimensions—hereunder aspects and indicators—that stakeholders of MRI scanning equipment view as important.

Methodology

Qualitative methods are appropriate when studying complex phenomena, and when there is a need to take into account numerous variables for studying the issue(s) at hand (Eisenhardt, 1989; Matthyssens and Vandenbempt, 2003; Yin, 1994). To enable a focus on social sustainability, this exploratory study adapts von Geibler et al.'s (2006) concept specification model. The adaptation of the model is based on social sustainability aspects and indicators identified in literature; customer perception interviews with key decision making stakeholders involved in purchasing of MRI scanning equipment; interviews with marketing and other functional managers in Philips Medical Systems; and secondary research of this company.

The study identified how decision making stakeholders (both purchasers and users) perceive sustainability indicators; this identification is undertaken in two stages. The first stage involves a focus group with a range of marketing and other functional managers from Philips

Medical Systems to evaluate potential sustainability aspects and indicators. The second stage employs customer perception interviews supported by a short questionnaire to enable theory to be built, tested, and validated (Newman and Benz, 1998, Onwuegbuzie and Leech, 2005).

Selection of case company

The study is based on Philips Medical Systems that is considered an excellent vehicle to explore the idea of sustainability, in particular social sustainability. The company generally has a good reputation in undertaking sustainability projects, for example replacing the traditional lamp bulb (environmental sustainability), as well as purchasing costs, exploitation costs, etc. (economic sustainability). It is less clear, however, what the social sustainability aspects are though as a company Philips Medical Systems appreciates that its product offerings have a social sustainability dimension. Apart from its sustainability reputation, the simplicity of the company's competitive scenario and strategic response relative to larger and more complex manufacturers of high-tech medical equipment makes Philips Medical Systems attractive. Finally, the company is chosen because its MRI scanning equipment is likely to have a number of identifiable social sustainability indicators potentially perceivable by customers.

The selection of the case study as a research methodology and the associated techniques of this method comply with Yin's (1994]) principles. First, a comprehensive understanding of Philips Medical Systems' contextual setting is important, as analytical criteria are developed with respect to the company's industry sector, in this instance the high-tech medical equipment sector. Second, one of the authors works within the company, offering a unique opportunity to access otherwise unobtainable data.

The use of secondary data and multiple interviews are used to develop rich insights, and provide the basis for greater transferability of the study's findings to other contextual settings (Eisenhardt, 1989). Specifically, a stakeholder assessment (e.g., Seuring et al., 2003) is undertaken to clarify hospitals' and imaging scanning centers' view of social sustainability aspects and indicators, with key decision making stakeholders plus a customer context person from the hospital or imaging center. The inclusion of a variety of stakeholders with different points of view enhances the overall validity of model development stage.

A literature review enables the conditions under which social sustainability indicators can be established and potential aspects identified. These are combined with company specific data and information gained from marketing and other functional managers to help develop a framework to assess the perception of key decision making stakeholders involved in the purchase and use of MRI scanning equipment. This approach is undertaken to develop an in-depth understanding of what social sustainability aspects and related indicators are, and to identify how these can be used to support the marketing of MRI scanning equipment (see Appendix 2 for the development of conceptualized social aspects and potential indicators).

Data collection and analysis

To build the case, data is collected using a number of methods. First, to increase the familiarity with the issues at hand, from Philips Medical Systems a variety of written documentation is available, including annual reports, research and development reports, promotional materials, benchmark studies, and business customer records. Also financial and other data relating to the subject of the study are accessible. In addition, the study involves a

widespread search for industry and consulting reports and academic papers. Over 90 documents are reviewed for the study. This data is comprehensive, particularly in outlining the company's social sustainability values and how these translate into activities, for example the ethical treatment of suppliers and the sustainability criteria used when sourcing inputs into the business.

A focus group research is used to gain a complete understanding of Philips Medical Systems' view of sustainable aspects and indicators. The focus group research consists of 24 representatives from marketing, sales, medical systems customer visitor center, X-ray total quality management, corporate sustainability office, and eco-facilitators from different functional areas within the company. Representatives also include individuals responsible for managing customers' purchasing to identify the type of social sustainability indicators used in the production and marketing of MRI scanning equipment. Discussion points in the focus group research focus on social sustainability aspects and indicators of MRI scanning equipment and how these are communicated to institutions (purchasers and users). Also, hospitals and imaging centers suitable for interviewing are identified during this stage.

Customer perception interviews are conducted to identify how different key decision making stakeholders (purchases and users) value environmental and social sustainability indicators. The study takes place in the Netherlands at two academic hospitals, three teaching hospitals, two community hospitals, and one imaging center. At each institution, interviews are conducted with key stakeholders involved with MRI scanning equipment—the responsibilities of these stakeholders se are summarized as clinicians, operators, and business managers. In total, 22 interviews are conducted with these stakeholders in addition to a focus group with the institutions; the length of interviews and focus groups lasts between 60 and 90

minutes. The use of multiple data collection methods adds to the robustness of the study's findings; compensates weaknesses of a specific data collection method, improves final interpretation quality, and helps ensure triangulation (Jick, 1979; Strauss and Corbin, 1998; Yin, 1994). The unit of analysis is the case company or each of the institutions and their decision making unit. Finally, information from each set of interviews and the secondary sources are combined into one final case manuscript.

At the formulation of the study stage, data gathered from Philips Medical Systems is analyzed in order to confirm the research problem. This, together with data gathered by a literature review, is then analyzed to suggest additional areas to von Geibler et al.'s (2006) social sustainability dimensions model. In the confirmatory phase, data reduction is largely done by within-case analysis, supported by data from the customer perception tool. This approach allows insight into how different decision making stakeholders view social sustainability aspects and indicators within their job role to be identified for subsequent use in data displays. The data is also compared to the adapted social sustainability model, which is used as the frame of reference (Yin, 1994). The hospital cases are then compared to analyze similarities and differences, and to gain greater understanding of the phenomenon. Theoretical categories are expanded during open and axial coding procedures (Strauss and Corbin, 1998). Throughout the analysis, the authors' tack back and forward between literature on sustainability and the data. This integration leads to the development of a number of theoretical categories and sub-categories (Spiggle, 1994). Such practices are consistent with case studies in general, as well as studies on corporate social responsibility (e.g., Beverland and Lindgreen, 2006; Maon, Lindgreen, and Swaen, 2008; Wood, 1996).

Throughout the study, a number of methods for improving the quality of the research are adopted. Industry experts are used to help select the case company and, subsequently, institutional customers; four researchers provide independent interpretations of the findings; multiple interviews are conducted; and interviewees are given the opportunity to provide feedback on initial findings, all of which reinforce reliability. Interviews are conducted by the same interviewer, thereby reducing the role of bias (Lincoln and Guba, 1985; Strauss and Corbin, 1998).

Findings

Customer perception analysis

The customer perception questionnaire contained 11 social and 5 environmental sustainability indicators derived from literature and interviews with Philips Medical Systems' personnel. The interviewees were asked the following question: "When purchasing MRI scanning equipment, do you think "X" is important, and why?" The results were recorded as "1" if important and "0" if unimportant, supported, where relevant ,by quotes from interviewees who were asked to elaborate on their answers.

Insert Table 1 about here

None of Philips Medical Systems' five "green focal areas" indicators were universally seen as important in influencing the purchasing decision of interviewees. 63% of interviewees stated that "hazardous substances" should be minimized. The business managers' felt this was their duty of care toward employees and patients, whilst operators' concern was for their

personal's welfare. Information minimizing "harm" to individuals outweighs the need for information on environmental impact. Weight was the second most important indicator with interviewees' concern for moving and installing heavy equipment considered above environmental factors associated with raw material consumption. 50% of interviewees mentioned weight determined the location within a hospital that scanning equipment could be sited and transported to safely.

> "Weight places restrictions on the room an MRI scanner can be put in. On the one hand, it concerns floor pressure per square meter; on the other hand, it's whether there is a transport route through the hospital." (Operator, teaching hospital)

Environmental damage caused by inappropriate recycling and disposal was seen as important by 45% of interviewees though increasing government legislation and taxation will make this more relevant. Packaging was not seen as important because the benefits of using the scanner far outweigh environmental concerns about packaging used. Finally, energy was seen as important by 27% of the sample although unexpectedly only by one business manager. Knowledge of energy usage was less relevant than scan quality, and perceived as a minor cost compared to purchasing and running costs, which were subsumed into the hospitals' overall electricity costs. The business manager's view was moderated by the desire to apportion actual energy cost per patient.

Social sustainability aspects

Five social aspects were derived from literature, as well as company-based focus group combined with production and usage attributes of MRI scanning equipment: customer health

and safety; customer comfort; ethical production; product accessibility; and contribution to society (see Figure 2)**.**

Insert Figure 2 about here

Customer health and safety

"Health and safety" summarizes how product usage can harm individuals and producer initiatives to minimize such harm. All interviewees identified this as an important influence. Philips Medical Systems was perceived proactively engaged in enhancing safety during usage and equipment maintenance based on the assumption of duty of care rather than tangible evidence. The complexity of MRI scanning equipment meant users were reliant on the company's expertise to guarantee safeness:

> "I assume the producer pays attention to that so that it will be OK, I hardly can know if a system is safe or not; we don't have that level of knowledge." (Clinician, academic hospital)

In a similar vein, the indicators "health complaints operators" and "health complaints patients" influenced purchase in three ways. First, safety of use:

> "You cannot allow it to do something medical which gets the patient hurt… I cannot imagine that a client would get a health complaint and not get a lawyer." (Operator, imaging center)

Second, continued exposure to the scanning equipment should not cause health problems. Concern exists that the long term impact on operators from continual use of scanning equipment was unknown:

> "Field strength health complaints, we still assume that it has no short term consequences, but the real long term consequences are still a little unknown." (Clinician, teaching hospital)

Third, scanning equipment had to be maintained by hospital employees. Injury could result in loss of working days impacting on the institution's ability to treat patients, and potentially result in claims for compensation for industrial injury:

> "I find this very important; several repair positions are not nice. The coils are not good from an ergonomic point of view, and are often too big and heavy to easily move—more attention should be paid to this." (Operator, academic hospital)

Customer comfort

"Customer comfort" is concerned with the physical interaction between scanning equipment, patients, and operators during usage to create peace of mind. Whilst "operator comfort" and "patient comfort" were universally perceived as important, their influence was different due to timescale of involvement. Operators spend their working day with scanning, whilst patients spend a fraction of that time, but have to be "comfortable" to ensure scan quality. Business managers' and clinicians' view of operator comfort was tempered by a belief that its lack would result in diminished work performance:

> "Of course, this aspect is important. Not as important as operator comfort because these patients are only in the scanner for half an hour to 45 minutes." (Clinician, academic hospital)

> "It is very important because if operators don't work very hard or well then the quality of the scans will decrease." (Clinician, teaching hospital)

Operator comfort's influence on the decision making process was secondary to quality and safety. Factors that created operator "discomfort" also had a bearing on the patent, for example noise, ergonomics of the scanning equipment, and operating environment. Pragmatically, patient comfort was considered in relation to the scan quality:

> "I find this important, but it still has to be practical. Patients don't come for a beauty session. Issues like less noise and a more comfortable table are very important, but we have to remain realistic." (Operator, community hospital)

Interestingly, these different views require a range of information to help address the concerns of the stakeholders, for example information about the task of maintenance, the level of noise created during operation, and the impact on the operator after a number of hours of usage. This suggests comfort indicators should be included within promotional material to create differential advantage.

Ethical production

"Ethical production" is relevant because an MRI scanner's production consumes raw materials sourced from global markets and requires the application of human capital. "Ethical production" and "ethical production at the producer's suppliers" were considered synonymous by the interviewees. Surprisingly, given that unethical production has high media impact, only 68% of interviewees found this indicator professionally important, though the majority considered it personally so. Interviewees believed Philips Medical Systems was an ethical producer and used ethical suppliers, eliminating the need to seek for this information. If the company was shown producing unethically it would become an issue:

> "We never really think about this aspect and assume that it is ok. But I think that if I found out and it's in the media, for example, child labor or forced labor, then I would not want to work with the scanner of that supplier." (Operator, imaging center)

The fact that 32 % of interviewees did not see ethical production as important can perhaps be explained by a difference between personal and professional views. Professionally, the first priority was that the scanner had superior performance:

> "As a person of course I would totally disagree, even in my function this matters to me. But it is difficult, even if I knew, I don't know if it changes my perception of the scanner, because I know how good the system is." (Operator, imaging center)

Currently, the ethical standing of Philips Medical Systems and of other suppliers negates the need for such information. However, its inclusion during the purchase process could provide a base for comparisons between competitors.

Product accessibility

"Product accessibility" is concerned with answering the needs of different stakeholders and providing availability in different markets. Only one interviewee thought this indicator professionally important. The majority found the issue too distant to impact on them, and that their concern was closer to home:

> "This is far beyond the scope of our organization, so from a functional perspective this is unimportant. Personally, I find this not important because in these markets other things, for example immunization programs and health education, are more important and have a much higher priority." (Clinician, teaching hospital)

Although not a direct influence on the purchase decisions, all the interviewees, due to conscience and job orientation, saw this issue as personally important. Indirect communication of how Philips Medical Systems improves developing countries' health care may enhance the company's reputation with health care professionals thereby providing subliminal differentiation between their products and those of competitors.

The notion of distance explains why all interviewees identified the indicator "accessibility for different types of patients" as important because it directly impacts on their ability to treat patients. Stakeholders wanted to identify at pre-purchase the scanners dimensions and ability to cope with different types of patients, for example claustrophobic or extremely overweight:

> "The people scanned here all have a certain physical problem; otherwise they would not be here… if these people that have a disability, walk with difficulty or are overweight, so that they cannot be scanned, then that's a problem. The gantry for each scanner differs. This can make a difference too if a patient can be scanned or not, even if it is only about a few centimeters." (Business manager, teaching hospital)

Contribution to society

"Contribution to society" describes the scanners' benefit to society through improved diagnosis techniques, illness reduction, knowledge development, and enhanced employment. 90% of the interviewees believed the indicator "contribute to science" was important because they perceived it to mean that the scanner advances the science of diagnosis. Hospital type influenced how interviewees interpreted this dimension. Academic and teaching hospitals wanted information that helped them understand the potential for research, whilst community hospitals and the imaging center wanted reassurance that the innovation and contribution to

science was an inherent quality of the scanner. The indicator “Increase level of living” was seen as irreverent by the respondents.

Summary

The findings above have identified that defining the social and environmental aspects a product might have is worthwhile because the majority of these are seen to influence the purchasing process of MRI scanning equipment. The implications of this are considered in the following section.

Discussion

The study identified that sufficient stakeholders view social and environmental sustainability aspects as influencing their perception of MRI scanning equipment. Additionally, considerable similarity between the customer institution and the three stakeholder groups in information sought and product requirements was identified. This suggests companies, which supply high-tech medical equipment, should incorporate social and environmental sustainability in their marketing effort. Whilst this finding is derived from a study conducted within a clearly defined and narrow context, the principle offers insights and possibilities for other businesses and product types.

The lack of a robust definition of social sustainability was identified within literature. Building on the work of von Geibler et al. (2006), the study identified that the majority of social sustainability indicators were known and understood and seen to influence the purchasing decision. In light of this it is possible to tentatively suggest a definition of social

sustainability: *A product or system that meets the performance requirements and expectations of customer stakeholders without causing harm to the wellbeing of society and its members over different time periods*. In addition to this, the identified indicators add to our understanding of what social sustainability is by, first, linking them to actual product function, for example the scanner's ability to produce quality images; and, second, by taking account that customers' views of social and environmental dimensions and indicators are personal, but that these inform how they think professionally about social sustainability. The study also demonstrated that society is about the impact on an individual and groups connected to the production, use, and disposal of the MRI scanner. Finally, and directly related to technology, which contains hazardous substances and emits radiation, is the idea that stakeholders are concerned about the long-term potential for harm. This has applicability beyond the production of high-tech medical equipment.

The concept specification model was used to conceptualize the social sustainability aspects and their linked indicators. The five social sustainability aspects were validated and can be considered relevant to high-tech medical equipment. The majority of the social sustainability indicators were also validated, providing a basis for measuring both the extent to which customers see these aspects as important, and their awareness of the product's relationship to these aspects. The aspects and indicators also comply with the success criteria's suggested in literature (Amaral and La Rovere, 2003; Fiksel, McDaniel, and Spitzley, 1998; Isaksson and Garvare, 2003) in that they are relevant, understandable for the users, limited in number, and adaptable to future developments.

The findings highlighted that not all indicators can be used as constructs to measure performance. First, because interviewees could not differentiate between ethical production

of the company and that of its suppliers this suggests that measuring beyond the “headline” title would not provide meaningful results although ethical production is important in the customers’ overall perception of the company and can be considered to influence at a holistic level as a brand attribute. Second, the indicators of “packaging,” “accessibility in different markets,” and “increase in living” were not seen as important in the context of purchasing MRI scanning equipment. This questions both these indicators’ inclusion within the model and their value as input into measuring performance. The implication is that the framework suggested by von Geibler et al. (2006) has provided a useful way to conceptualize both sustainability aspects and linked indicators and as such will have applicability beyond its current focus.

The hierarchy of influence of the social aspects and indicators could be identified. Whilst it is not possible to rank actual indicators, it is possible to define these into three levels. The cost and performance of the scanning equipment form the first level and provide the business context upon which all other levels exist. This is not surprising; the actual cost of scanning equipment is likely to constitute a major element of capital expenditure for a hospital or imaging center. Performance is concerned with its ability to fulfill core function, the higher the quality of the scan, the greater its use as a diagnosis tool. The second level comprises indicators, which were seen as professionally relevant because they had a direct or potentially direct impact on users of the scanning equipment, such as “hazardous substance,” “health complaints of operators,” and "patient comfort.” The third level is factors that matter personally, but have little direct influence on the purchasing decision, for example “packaging,” “accessibility to different markets,” and “increase in level of living.” Being able to see different levels of perceived importance of social and environmental sustainability dimensions enables companies to focus effort to dimensions valued by their customers. This

is in line with the view that too many indicators become hard to measure and organizations need to be selective when choosing social and environmental (Isaksson and Garvare, (2003).

Managerial implications

Marketing guidelines for each of the 11 social and 5 environmental sustainability indicators can be suggested based on answers to three key questions. First, which stakeholder should be targeted? Second, when within the purchasing process should marketing communication occur? Third, how should it be communicated? In answering these questions, note is taken of the importance attached to each aspect by the interviewees, and the communication tools used by Philips Medical Systems (Table 2).

Insert Table 2 about here

The similarity in the purchasing process of the institutions and their stakeholders groups provides common ground for marketing effort. The stakeholders should have general awareness of the products' social and environmental sustainability credentials for all indicators with the exception of "packaging," "availability in different markets," and "increase level of living" because these were not seen as important or professionally relevant by the interviewees and therefore do not currently have a role to play in influencing the purchasing process. To ensure that stakeholders gain an appropriate and complete understanding of the MRI scanning equipment's sustainability credentials, marketing should be focused on a more generic view of environmentalisms.

The interviewees' own "ethical" standpoint on social and environmental sustainability tended to be greater than their employers' view though for indicators related to the potential of the scanning equipment to do "harm" (socially or environmentally) views of importance were equal. Marketing of social and environmental indicators should focus on how the supplier minimizes potential for "harm" and reassure that scanning equipments are already safe and that adequate concern about the whole life safety is in place. However, the price of the scanning equipment and image quality were considered more influential in the purchasing decision than either social or environmental sustainability indicators. Reputation in these two areas might be used by stakeholders to differentiate between products and suppliers.

Getting the social and environmental sustainability credentials of the MRI scanning equipment known to the stakeholders requires a range of approaches and careful selection of media. The selection of media should be based on proximity to the purchasing decision combined with targeting of specific "concern" areas of stakeholders. For Philips Medical Systems this would be a function of its brand positioning used to reinforce at a holistic level that the company is concerned with sustainability. Opportunities to reinforce the company's general adoption of sustainability into its business practices could also be communicated through trade literature used by the stakeholders to keep abreast of developments in the field, and during meetings with customer stakeholders related to ongoing development and use of scanning equipment. The specific social and environmental sustainability indicators need to be communicated to support the sales process. Product brochures should address the key concerns related to the product's potential to harm and how the company minimizes this risk. This should also be incorporated into briefing sessions from the company.

Although the concept of companies' "doing the right thing" underpins corporate social responsibility of which the environmental dimension is integral, its use to support marketing activities has two commercial advantages. First, it increases the sustainability of the company by supporting the sales of its products. Second, it embeds the policies into the company helping to create a virtuous circle of improvement thereby further strengthening the company's reputation and generating a positive halo for its product offerings. Overall, the study has provided an embryonic overview of how social and environmental indicators of sustainability can be used to strengthen the marketing of high-tech medical products and provide differentiation within the minds of key customers stakeholders.

Limitations and further research directions

As in most research, this study has certain limitations that affect our interpretation of the results, while at the same time suggesting directions for further research. These limitations must therefore be considered. First, a limitation of the study arises from employing a single-case approach. Although the sample of customer institutions can be considered representative of Dutch hospitals that purchase MRI scanning equipment, a study which considered other European customers and North America ones where regulations and the customer institutions' operating environments are different would provide other insights. A second limitation was that the research focused on the purchasing stage despite the fact that the findings indicated that stakeholders formed personal opinions about social and environmental sustainability factors pre-purchase. This process needs to be better understood to enable ways in which to influence their development to support the purchase process stage to be determined. A third limitation is patients as customer stakeholders were excluded from the study. This limits understanding how their views on indicators such as safety and comfort can

influence the opinions of the decision makers, making it unclear as to the desirability and practicability of targeting marketing effort to them. A fourth limitation was that the context of the medical systems may limit transferability of the findings. Further studies in other business contexts would broaden understanding of the role played by social and environmental sustainability in influencing corporate purchasing decisions. Finally, the study relied on historical information and interviewees' recall; real time data collection could identify transitory influences on stakeholder's views, whilst a longitudinal research would distinguish how these impacted on company policy.

All of the limitations mentioned above should be kept in mind when considering our results. Despite the limitations, we believe that we have made a substantial step toward both understanding the social and environmental responsibilities that purchasers of high-tech medical equipment identify as important, as well as developing guidelines that can aid manufacturers to market such equipment.

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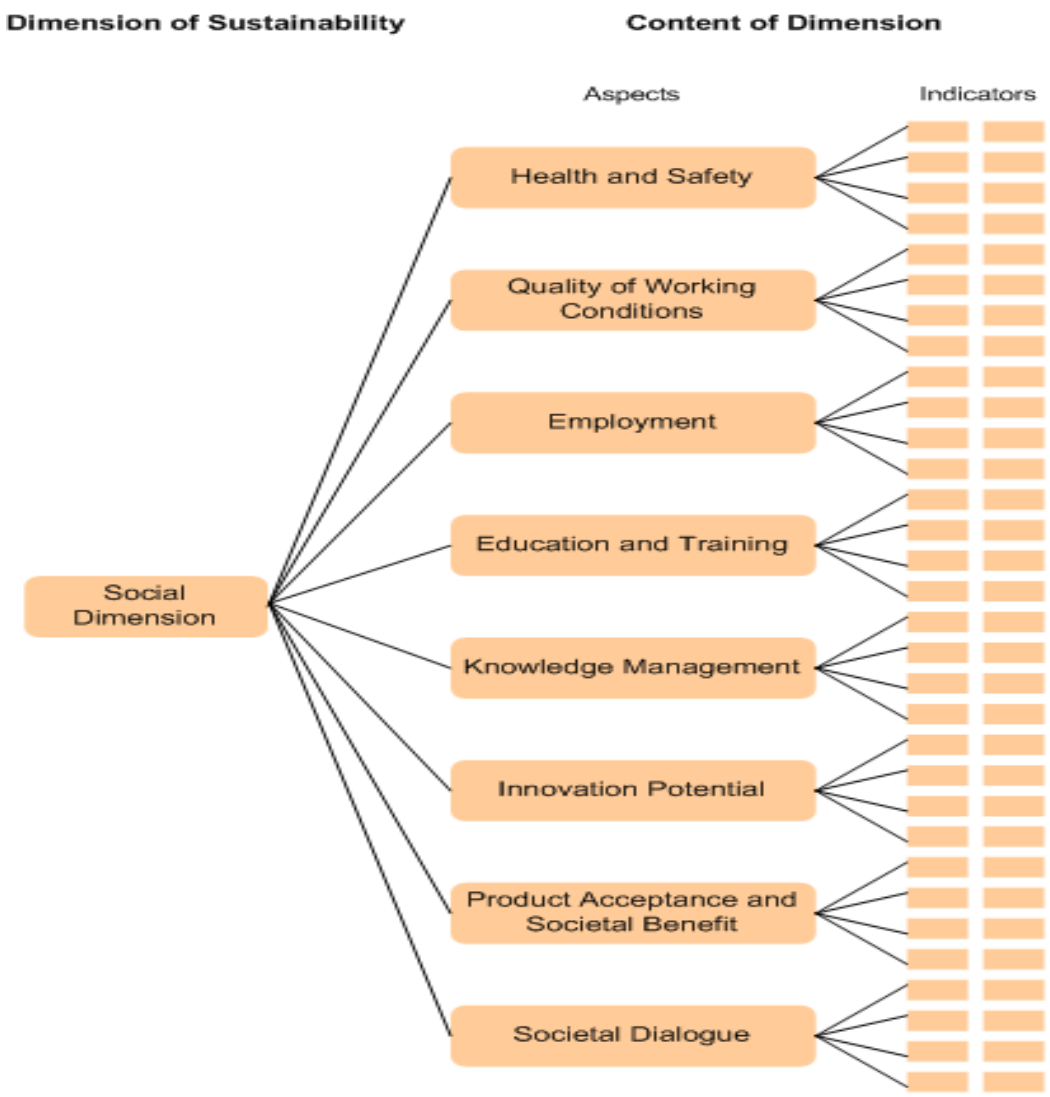
Appendix 1: Concept specification model to highlight social sustainability aspects and indicators (cf. von Geibler et al., 2006)



Appendix 2: Conceptualized social aspects with potential social indicators

Social aspects	Heading	Potential social indicators
Customer health and safety	Health complaints of operators because of use of equipment	Health and safety[1,7] Health[2] Quality, health, and safety[3] Peace of mind[4]
	Health complaints of patients because of use of equipment	Illness and disease reduction[4] Accident and injury reduction[4,8] Health and wellbeing[4]
	Proactive anticipation of safety regulations	External social improvements[5] Products and service labeling[7,8]
Customer comfort	Operator comfort	Quality of working conditions[1] Satisfaction of needs[2] Peace of mind[4]
	Patient comfort	External social improvements[5] Noise and pollution[8]
Ethical production	Ethical performance of the company	Quality of working conditions[1,6] Education and training[1,2] Health[2] Equity[2] Individual contentment[2] Taking employees into consideration[3] Quality, health, and safety at work[3] Quality of life[4] Illness and disease reduction[4] Equity within organization[5] Internal social improvements[5] Ethical production[8] Accidents or incidents[8] Supplier fairness[9]
	Ethical performance of the suppliers	
Product accessibility	Product accessibility for patients with physical or mental disadvantages	Equity[2] Quality of life[4] International equity[5] External social Improvements[5]
	Product availability at emerging markets and base of pyramid	Accessibility to key services[8] More equitable accessibility[9]
Contribution to society	Contribution to science (e.g., new health solutions)	Employment[1,9] Innovation potential[1] Product acceptance and societal benefits[1] International equity[5] Social impact of operations[6]
	Increase level of living	Quality of life in community[6] Community development[8] Regeneration and rebuilding of communities[8] Intellectual assets[9]

1: von Geibler et al. (2006)
2: Seuring et al. (2003)
3: Gauthier (2005)
4: Fiksel, McDaniel, and Spitzley (1998)
5: Steurer et al. (2005)
6: Tanzil and Beloff (2006)
7: Global Reporting Initiative (2006)
8: Sigma (2007)
9: Sherwin (2004)

Table 1: Summary of social and environmental sustainability indicators

N = 22			Energy use	Weight	Packaging	Hazardous substances	Recycling and Disposal	Proactive safety regulation	Health complaints operators	Health complaints patients	Availability in different markets	Accessibility different patienttypes	Ethical production producer	Ethical production suppliers	Operator comfort	Patient comfort	Contribution to science	Increase level of living
Customer type	**Customer**	**Responsible Type**																
Academic Hospital	AZM	Business responsible	0	1	0	1	0	1	1	1	0	1	1	1	1	1	1	0
Academic Hospital	AZM	Operational responsible	0	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0
Academic Hospital	LUMC	Business responsible	0	1	0	1	0	1	1	1	0	1	0	0	1	1	1	0
Academic Hospital	LUMC	Clinical responsible	0	0	0	1	0	1	1	1	0	1	1	1	1	1	1	0
Academic Hospital	LUMC	Operational responsible	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0
Teaching Hospital	CWZ	Clinical responsible	0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	0
Teaching Hospital	CWZ	Operational responsible	1	0	0	1	1	1	1	1	0	1	1	1	1	1	1	0
Teaching Hospital	JBZ	Business responsible	0	1	0	0	1	1	1	0	0	1	0	0	1	1	1	0
Teaching Hospital	JBZ	Clinical responsible	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	0
Teaching Hospital	JBZ	Operational responsible	0	0	0	0	0	1	1	1	0	1	0	0	1	1	1	0
Teaching Hospital	Kennemer Gasthuis	Business responsible	0	1	0	1	0	1	1	1	0	1	0	0	1	1	0	0
Teaching Hospital	Kennemer Gasthuis	Clinical responsible	1	0	0	0	0	1	1	1	0	1	1	1	1	1	1	0
Teaching Hospital	Kennemer Gasthuis	Operational responsible	0	0	0	0	1	1	1	1	0	1	1	1	1	1	1	0
Community Hospital	Gelderse Vallei	Business responsible	0	0	0	1	1	1	1	1	0	1	1	1	1	1	1	0
Community Hospital	Gelderse Vallei	Clinical responsible	0	1	1	1	1	1	1	1	0	1	1	1	1	1	0	0
Community Hospital	Gelderse Vallei	Operational responsible	0	0	0	1	0	1	1	1	0	1	1	1	1	1	1	0
Community Hospital	St. Anna	Business responsible	0	1	0	1	1	1	1	1	0	1	0	0	1	1	1	0
Community Hospital	St. Anna	Clinical responsible	0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	0
Community Hospital	St. Anna	Operational responsible	0	1	0	1	0	1	1	1	0	1	0	0	1	1	1	0
Imaging Centre	DiaSana	Business responsible	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0
Imaging Centre	DiaSana	Clinical responsible	1	0	0	0	1	1	1	1	0	1	0	0	1	1	1	0
Imaging Centre	DiaSana	Operational responsible	0	0	0	1	0	1	1	1	0	1	1	1	1	1	1	0
		Total	6	11	1	14	10	22	22	21	1	22	15	15	22	22	20	0
		Percentage (%)	27.3	50	4.55	63.6	45.5	100	100	95.5	4.55	100	68.2	68.2	100	100	90.9	0

Table 2: Summary of social and environmental sustainability related marketing opportunities

	TO WHOM			WHEN		HOW				
	Business Responsibles	Clinical Responsibles	Operational Responsibles	Periodaically in time	During the purchase process	Customer magazines	Purchaser meetings	Brochures	White papers	Sales conversations
Energy use	X	X	X		X			X	X	X
Weight	X	X	X		X			X	X	X
Packaging										
Hazardous substances	X	X	X		X			X	X	X
Recycling and disposal	X	X	X		X			X	X	X
Environmental Aspects	X	X	X	X	X	X	X	X		X
Proactive safety regulation	X	X	X	X	X	X	X	X		X
Health complaints operators	X	X	X		X			X	X	X
Health complaints patients	X	X	X		X			X	X	X
Availability in different markets										
Accessibility different patienttypes	X	X	X	X	X	X		X	X	X
Ethical performance producer	X	X	X	X		X	X			
Ethical performance suppliers	X	X	X	X		X	X			
Operator comfort	X	X	X	X	X	X	X	X	X	X
Patient comfort	X	X	X	X	X	X	X	X	X	X
Contribution to science	X	X	X	X	X	X		X	X	X
Increase level of living										
Social Aspects	X	X	X	X	X	X	X	X		X
Sustainability Aspects	X	X	X	X		X	X			

Figure 1: Stages and key decision making stakeholders in the purchasing process

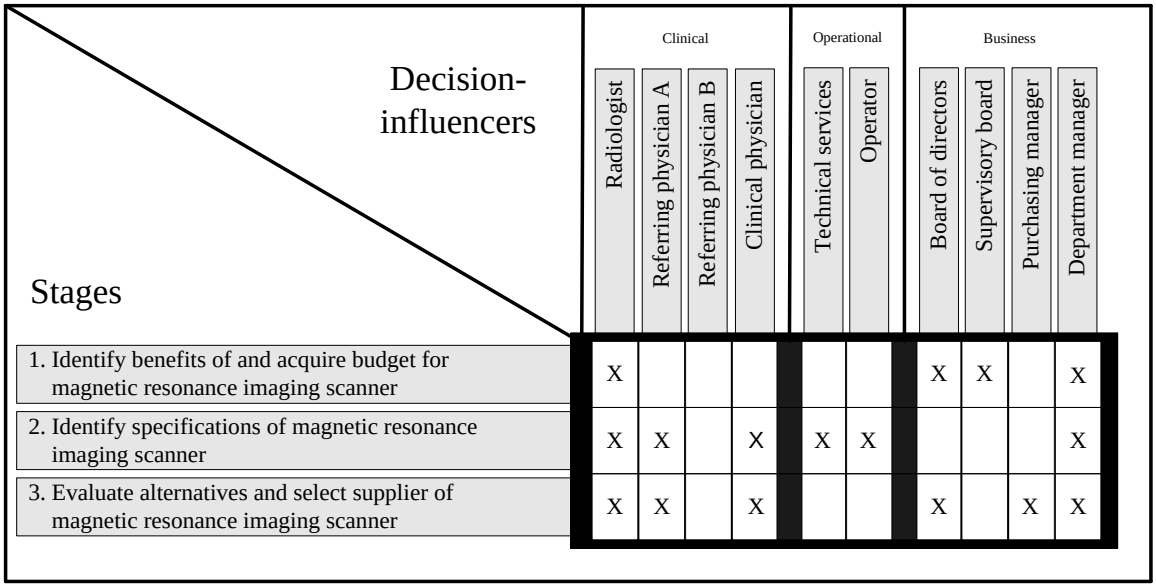


Figure 2: MRI scanning equipment social aspects and indicators