THE ROLE OF HUMAN FACTORS IN THE ADOPTION OF SUSTAINABLE DESIGN CRITERIA IN BUSINESS

Experiences from practice

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Abstract

Implementing sustainability in business is steadily gaining more attention. A growing number of companies currently work on the implementation of sustainable criteria in the design related departments and their design processes. Although theory and methods are available, practice shows that this integration process of sustainability criteria is not straightforward.

In this paper, different cases from practice are described based on a study of five Flemish and three Dutch firms that are broadening their (sometimes already extensive) experience on this implementation process.

The emphasis of this paper is put on influential factors such as the presence of an implementation process of sustainability criteria inside a firm's product development department, with a focus on the need for a sustainability vision and strategy, resistance against sustainability and the link between internal communication and resistance. Our data suggest that a clear vision, mission, strategy and planning of the implementation process of sustainability criteria are needed, but not necessarily from the beginning of the process. Apart from that, factors of resistance appear to evolve throughout the implementation process that vary in nature (organizational versus personal) and content. Lastly, three types of communication are suggested that need to be considered and applied in order to involve, support and inform employees in order to positively progress into the direction of more sustainable products and processes.

Keywords

Sustainability criteria, implementation process, human factors, product development process

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1. Introduction

Changing customer demands, upcoming legislation, pressure from other stakeholders and different sides make quite some firms realize that action is needed in order to follow current developments towards sustainable consumption and production (Sarkis, 2010). Many firms realize this need and take action within product development and production, whereas others are not (yet) taking a proactive approach towards sustainability.

However, incorporating sustainable consumption and production in a firm is not something that happens from one day to the other. Different stages have to be passed by a firm in order to reach the new, sustainable goals. This often starts with the formulation of a more general, philosophical vision on sustainability, subsequently evolving towards more specified activities concerning social and/or environmental issues that support the fulfillment of this vision. This process can take place in different ways, one way turning out more successful than another one (Vinkenburg, 1995). One of the first steps that a firm often takes is the development of a strategy towards sustainable consumption and production and its specific goals. A next step is to implement this in order to reach the goals that have been set up. This implementation process turns out to be the difficult part: the theoretical strategy has to get translated into practice (Baumann *et al.*, 2002; McAloone *et al.*, 2002; Tukker *et al.*, 2001). A well-developed approach can support this translation process, but the changes are made by the people within the firm. However, the position and strength of the employees in this process is often neglected within the field of sustainable design, but it is considered as being of great significance within the field of change management (Verhulst *et al.*, 2007).

In this paper, empirical data from eight Belgian and Dutch firms is used to study this 'human side' of the implementation process of sustainable design criteria in firms. The results of the study of this people's side of the process can on its turn be translated into improved proactive strategies and approaches that can support firms in their own trajectory that will lead them towards more sustainable products.

2. Literature review

2.1 Pathways towards sustainable innovation

Transitions are needed in order to make innovations sustainable. This is also the case with firms that decide to start implementing sustainability criteria in their design and production processes. These transitions follow a pathway which, according to Dunphy *et al.* (2007), can be considered either as incremental or transformational. Several strategies, methods and tools are present in literature on sustainable design and production that can be applied by a wide range of firms (UNEP DTIE and DfS, 2009). These categories range from strategies

directed to a specific part of the life cycle of a product, e.g. energy-efficiency, focus on low-impact materials, end-of-life design strategies, cleaner production, green marketing, over life cycle thinking to broader system approaches such as corporate social responsibility or cradle-to-cradle (McAloone *et al.*, 2002; McAloone and Bey, 2000; Suttclife *et al.*, 2009; Tischner and Charter; 2001; UNEP DTIE and DfS, 2009; Van Hemel, 1998). The availability of this vast amount of strategies and frameworks in literature, which all aim at environmental and sustainable product development and production, shows that there are many different roadmaps possible for a firm in order to move towards more sustainable products and production. However, the choice of a strategy is only a starting point. The next phase is to implement this strategy in the product development process and the other departments and levels within the firm, in other words: to switch from a theoretical perspective into practical, tangible actions and results. White (2009) for example states that having a clear corporate sustainability strategy is one thing; implementing it across a whole firm, into the daily rhythm of the business, is something else. In order to reach such a level of integration, a firm may pass different phases: rejection, non-responsiveness, compliance, efficiency, strategic pro-activity, and the sustaining corporation (Dunphy, 2007). In order to reach the last stage, a firm needs an implementation approach that ensures a practical application of current available tools and methods that aim at the incorporation of sustainability criteria in the product development and production processes.

Much attention often goes to this process and the used methodologies, but less research has been performed on the human dimension of this implementation process. Zilahy (2004) for example studies restrictive and incentive motivational factors for employees that can hinder the implementation of energy related measures. Whereas Cohen-Rosental (2000) approaches the human dimension and its role as a success factor. social-psychological factors have been suggested by Boks (2006) as a factor of influence for adoption that needs further study. The main focus thereby was on a departmental level, which has been consented by Driessen (2005). He observes different levels of manageability in the various aspects of sustainable design implementation. Holton *et al.* (2010) studied the management of sustainability in four firm case studies in the concrete sector, in which they present encountered barriers to change and other human factors such as the role of the managers as a change agent. However, empirical studies such as the latter, in which the role of the human dimension is studied as a potential obstacle or success factor, are still rare. Moreover, very few implementation approaches for sustainable product development have so far incorporated this human perspective. In contrast, the human dimension is considered as very significant within the change process in the field of change management. In this field,

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changes are considered as processes that can be planned by one person, but they need the support of and should be carried out by many others. Humans and their interactions may thus have a significant impact on the course and progress of implementation processes, also on sustainability issues (Verhulst *et al.*, 2009).

2.2 Human factors in the implementation process

In change management, a process of planned change is divided into different stages. There are different ways of dividing this process in stages, such as the three stages of Lewin (1951): unfreezing, changing and refreezing. Other authors however divide the process in more stages, e.g. de Caluwé and Vermaak (2006) who distinguish five phases: diagnosis, core of the change assignment, change strategy, plan of intervention and the interventions. However, in general there is a high consensus in literature on Lewin's three stages model of the process of organisational change (Lewin, 1951; Beckhard and Harris, 1987; Kanter et al., 1992; Garside, 1998). Within the light of this research, the broader knowledge and insights in other elements that influence the progress and success of the change process are highly relevant. Pettigrew and Whipp (1991) for example developed the 'Model of strategic change', in which essential dimensions of strategic change are divided in three main groups: process related, content related and context related dimensions. Five other dimensions of critical factors are proposed by Vinkenburg (1995): social dimension, content, significance, process and a conditional dimension.

In each of these dimensions there are many factors which can support or hamper the change process. Participation and empowerment, the creation of a change culture, a clear presentation of purpose and vision, the presence of a champion and good communication are some of these factors that are generally accepted as necessary to emphasize in a change process (Lewin, 1951; Beckhard and Harris, 1987; Kanter et al., 1992; Garside, 1998). Many of these factors are related to people, e.g. empowerment, organisational culture, participation and communication, resistance to change, etc. The latter factor, resistance, is often –if not always- present when changes occur. Insights in the various restraining forces and their underlying reasons, may help reducing them. Lewin (1951) thoroughly studied factors for resistance and found that a decrease in resisting forces will, rather than an increase of the driving forces, lead to a higher chance on successful change. Prosci (2005) however states that resistance to change is often not specifically caused by the reason for 'change' itself, but rather by leaving the comfort of the 'current state'. Schein (1995) calls this the state of quasi-stationary equilibrium, and it has to get pulled down to make people successfully accept change.

Some recent literature is available on change specifically oriented towards sustainability issues, in which different authors incorporate some of the knowledge of change management in newly proposed approaches towards sustainability. An example thereof is Dunphy *et al.* (2007), who translated a generic change approach into a change approach for incorporating sustainability in business. This approach consists of eight steps of incremental change: begin with future workshops/search conferences, assess the organisation's position, evaluate the type of change programme needed, identify change agents, pilot new practices and innovations, harness further resources, communicate and extend the program, and as a last step align organizational systems. However, the authors state that this approach by itself cannot guarantee the success of an incremental change programme, but that a great deal depends on the support given by senior management to the changes, the readiness for change on the part of the work force and the skills of change agents. These can all be considered 'human factors'. These human factors are also mentioned by Doppelt (2003), who defines different sustainability blunders as a result of his study of twenty-five organizations and their approach on sustainability issues. More than half of these blunders are related to people related issues, such as the firm's culture, learning mechanisms and internal communication.

Other authors specifically focus on sustainability criteria within the product development process, such as Le Pochat *et al.* (2007), who incorporate factors from change management into their proposed implementation approach, such as the formation of a project team, building awareness and strategy definition. Schiavone and Pierini (2008) on the other emphasize the importance of creating a new culture inside an organization. Reyes (2009) proposes an integration trajectory that combines three complementary mechanisms: methodological aspects, relational aspects and decision-making and informational aspects.

2.3 Conclusion of literature review

Literature suggests that researchers within the field of sustainable design focus on a range of different aspects to further the implementation of sustainability criteria in design. Some proposed approaches already take account of elements of change management. However, whereas these researchers each propose their own implementation approach, little research has been done that effectively studies the application of these approaches in practice and the human related factors that -positively or negatively- influence the progress of such a process. These human related factors, their influence on the process and how these can incorporated into existing implementation approaches for sustainable consumption and production, are the core of a broader research project providing the context for this paper.

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Here, a selection of the results of this study are presented with a focus on sustainably vision and strategy, personal resistance on a departmental level, and internal communication.

3. Lessons from practice

3.1 Research methodology

This paper focuses on three propositions that consider the strategy for sustainability, resistance against sustainability issues, and internal communication on the changes.

- **Proposition 1**: A clear vision, mission, change strategy and planning of interventions on sustainable innovation need to be formulated on a general level before implementation of sustainability criteria can start in the NPD process.
- **Proposition 2:** Resistance against the implementation of sustainability criteria on a departmental level (such as R&D) is both of practical and personal nature.
- **Proposition 3**: Structured internal communication on the value of integrating sustainability criteria, the planned interventions and provisional results lowers the (personal) resistance on a departmental level.

Eight firms cooperated in the study, from which empirical data has been gathered with the aim to find support for the propositions. The firms all have an own product development department and are situated in Belgium or the Netherlands. Another common factor is that all the firms are currently incorporating sustainability criteria; however the firms are not necessarily on the same levels of maturity concerning sustainability in the firm and the product development process.

A set of empirical data has been gathered by performing interviews, observations during work meetings and through documentation (website, sustainability report, folders …) on each firm, its implementation process and the influencing human related factors. Interviews were taken from people that are actively involved in the implementation process of sustainability criteria in the design process. In the analysis of the assembled data, the researchers coded the empirical data with the corresponding proposition, thereby first analyzing each case individually and subsequently by performing a cross-case analysis in order to support, adapt or reject the presented propositions.

3.2 Results

In the research, fourteen persons cooperated from eight different firms, in total spread over sixteen sessions of interviews and observations during work sessions. For all the cases, these data are complemented with data from company folders, websites, etc that cover

issues concerning sustainability. Five of the firms have their headquarters situated in Belgium; the three other firms are situated in the Netherlands. From the persons that cooperated, eight have clearly defined responsibility in implementing sustainability within the firm and the product development process. The functions of these people vary within the different firms: as a coordinator of CSR, coordinator of quality, health and environment, communication manager, or R&D manager.

Table 1: overview of starters versus more experienced firm concerning sustainability issues

	Firm 1	Firm 2	Firm 3	Firm 4	Firm 5	Firm 6	Firm 7	Firm 8
starter		X		X	X		X	X
experienced	X		X			X		

As indicated, not all firms are at the same maturity level of implementing sustainability. Within this paper, we make a distinction between starters and experienced firms. The starters are considered as firms that recently started their explorative trajectory, trying to find out what fits best to the firm and its products, which should lead them towards more sustainable products. This however does not necessarily mean that each firm undertook exactly the same actions. On average, these firms started incorporating sustainability criteria within the last two years. The 'experienced' firms mostly have been incorporating sustainability aspects for more than ten years. This does not mean that all the work has been done, as all of them are currently working on improvements in order to reach a higher level of maturity when it concerns sustainability. Next to these two groups, it was also considered to include a third group of firms that have 'medium' experience on the implementation process, but based on the empirical material available, this was not considered meaningful.

3.2.1 The need for a vision, change strategy and planning

The first proposition is based on theory from change management, in which the first – preparatory- stage of a change programme consists of the development of a vision, mission, change strategy and the planning of actions on a general level within the firm. Although this might seem an obvious first step to take, we wanted to see if this is the way the implementation process actually starts in practice and to what extent it is considered essential.

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Proposition 1: *A clear vision, mission, change strategy and planning of interventions on sustainable innovation need to be formulated on a general level before implementation of sustainability criteria can start in the NPD process.*

In Table 2 you can see that three of the five 'starter' firms (shown in light gray) do not have a clear vision, mission and general strategy (yet) on sustainability within the firm. However, if we look at the product development department, it turns out that a strategy for improving their products on (mostly) environmental aspects has been formulated (Table 3).

Table 2: overview of data concerning vision and mission, strategy and planning

	Firm 1	Firm 2	Firm 3	Firm 4	Firm 5	Firm 6	Firm 7	Firm 8
Vision & mission	Yes	No	Yes	No	Yes	Yes	No	Yes
Strategy on general level	Yes	No	No	No	Yes	Yes	No	Yes
Strategy on product level	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Planning	No	Yes	Yes	No	Yes	Yes	Yes	Yes
(R&D) Projects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bottom-up (BU) vs top-down (TD)	BU -TD	TD	BU	TD	TD	BU-TD	TD	TD

This suggests that actions can be and are undertaken on the level of the product development process, without having a clear strategy and vision on firm level in place.

Table 3: overview of product strategy per firm

Firm	**Product strategy for (env.) sustainability**
Firm 1	PSS
Firm 2	Materials (REACH, WEEE)
Firm 3	Materials, recycling, closed-loop
Firm 4	Material and weight reduction
Firm 5	Materials (REACH)
Firm 6	Life cycle thinking, materials, lower energy consumption
Firm 7	Energy efficiency of products
Firm 8	Lower energy consumption

We also asked to the interviewees how the integration of sustainability criteria started within the firm. In six of the eight firms, it started with individual, independent projects that took place in different departments such as production or product development. An example thereof is given by one of the product developers of firm 7, who stated that:

'We first did some independent, smaller projects with external partners, more because we didn't really know what we wanted to do, so more isolated initiatives. But now there has been decided to take a look at sustainability more profound, especially towards the end of the lifecycle of our products. This direction comes from the top management, but the projects are proposed by the R&D managers.'

However, even when the introduction of sustainability has started from an individual or department level, it turned out that, in seven of the eight firms, the ideas and efforts that have been taken on sustainability issues on an individual or departmental level, are taken over by the general management. This switch in approach from bottom-up to top-down is shown in this quote made by one of the product developers in firm 8:

'The policy is given by the group, so it comes from top-down. These days it is surely top-down because it is not an individual decision of a branch. But the ideas always grow somewhere and then find their way to the top.'

What we also learned from the interviews is that this switch is needed at a certain moment in order to be able to spread the ideas and the new –more sustainable- ways of designing, working and thinking broader within the firm. As the consultant for business processes and environmental coordinator of firm 2 states:

'You need to establish a policy: 'our firm wants to have green products and that's why we are doing different actions'. That comes from the very top. To not leave it open to everybody that they want to do it or not.'

The importance of a clear statement of the board of management was pointed out by different interviewees in six of the cooperating firms. A clear vision, focus and strategy was mentioned to speed up the process of integration, to make it easier for spreading the idea(s) behind sustainability within the firm, to connect existing projects, actions and behaviours to the broader strategy and framework and thus to see the big picture of where the firm is standing for. This is shown with some quotes of the respondents:

'It would all have happened much faster and more in width within the firm if there would have been a good green strategy that was presented and implemented from the top. What happened in our firm happened bottom-up, which means that when people or departments did not believe in my ideas, they did not adopt them. I

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supported the departments that were willing to cooperate.' (Responsible person for incorporating environment in NPD in firm 6)

'From the moment that the board of management subscribed the goals, we experienced this snow-ball effect within the firm, because all the initiatives that already existed in different departments of the firm could now easily be connected and/or adapted to this vision and strategy. It also makes it easier to see the big picture and it gives employees the feeling that the board understands the importance of their work.'
'Before there was this strategy, I didn't know where I could tell my story and ideas. The only important message was price...' (Coordinator health, safety and environment in firm 1)

In firm 3, many efforts are made within the product development department concerning environmental improvements of their products, but the idea of incorporating sustainability in a broader level within the firm is, in contrast to the other firms, not taken over by the general management. Within this firm, the interviewees emphasize the logic behind this idea by stating that the products have the greatest environmental impact, but the R&D manager also mentions the importance of a general vision and strategy from the management:

From the top it should be said <to the people from production>: 'this is what we stand for, all departments need to contribute their part. And that might mean that sometimes a single part of our product is not perfect, but we do it for a good cause. No, it is often that we <from product development> come up with something new and we have to try to incorporate it into the firm from within our department. That is sometimes difficult.'

All this is closely related to the need for support of the management, which has already been mentioned in previous research (Boks and Pascual, 2004), and which was strengthened here by all interviewees. However, from our data we learned that a vision and general strategy, and thus also the support of general management, is not needed from the very beginning; in the early stages, a product development department can initiate the whole process. This invalidates our first proposition. However, one should keep in mind that, in order to bring sustainability to a higher, broader level within the firm, the elements taken from change management such as a clear vision, mission, strategy and planning, need to get developed and supported by the top management.

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3.2.2 Resistance against incorporating sustainability

Proposition 2: *Resistance against the implementation of sustainability criteria on a departmental level (such as R&D) is both of practical and personal nature.*

This proposition is based on literature on change management, where a distinction is made between sorts of resistance depending on the level and position within the firm, and on conclusions from a preliminary study.

> *'In general, 95% of the people [inside the firm] have a positive attitude when it concerns environmental and sustainable issues, even people that know nothing about the occupation.'*

This quote of the coordinator for incorporating environmental issues in NPD in firm 6 represents the reactions that were given in five of the participating firms. Although the interviewees were asked about resistance on the introduction of sustainability issues in all interviews, our data suggest that –on the contrary- enthusiasm is often present on a general level, especially when employees see the added value of incorporating sustainability issues within the firm. This positive attitude seems to change in the next stage of the implementation process, when people have to start adapting their daily habits and working procedures. These changes mostly take place on a departmental level. By studying the moment and place of resistance against incorporating sustainability criteria within the working procedures, our data suggest that a distinction can be made between employees from product development and R&D, and employees from other departments such as sales or production (Verhulst and Boks, 2010). This is illustrated in some quotes of our respondents:

> *'The people that work within the product development process are used to think out-of-the-box. So for these people, a change is less drastic than it would be for someone that is less educated. The less educated people are, the more difficult it is to make them change. For them, change is equal to wrong.'* (Firm 7)

> *'As product development department you are constantly working on new things. So in principle, we like everything that is new.' (*Firm 3)

> *'In our firm, the people from production are the hardest to convince, the people that work with the machines. … they also don't have direct connection with the firm. They come here to do their job, their daily work activities.' (*Firm 1)

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A pro-active attitude of the product developers was pointed out in half of the cases, but also several obstacles were mentioned by the respondents, as shown in Table 4. A distinction can be made between two types of resistance:

- factors related to practical, organisational aspects, e.g. trade-offs have to be made in the product development process, legislation has already high demands, etc. (upper group)
- personal, human factors, e.g. lack of involvement, fear of getting a work overload, responsibility for an intangible subject, etc. (lower group)

Both types of factors were mentioned, almost equal in number, as shown in Table 4. Furthermore, the data suggests that human factors occur as frequent as practical obstacles in the product development department. However, differences between the occurrence of these two types of obstacles can be noticed when the participating firms are compared to each other.

Table 4: Obstacles on sustainability issues in product development department

Obstacle	Firm 1	Firm 2	Firm 3	Firm 4	Firm 5	Firm 6	Firm 7	Firm 8
Time limit	-	X	X	X	-	-	-	X
Trade-offs	-	-	X	X	-	X	X	X
Legislation	-	-	-	-	-	-	X	X
New (external) data and information needed	-	-	X	X	-	-	-	-
Much time and energy needed	X	-	X	X	X	X	-	-
Complexity/width of topic	X	-	X	X	-	-	-	-
Other threats (personal)	-	-	-	-	-	X	X	-
No responsibility	-	X	-	-	-	-	-	X
Lack of involvement	-	X	-	-	-	-	X	X
Intangible subject	-	-	-	-	X	-	X	-
Fear of work overload	X	-	X	X	-	-	-	-
Fear of limitations (creativity)	-	-	-	X	X	-	-	-
Dislike orders/loss flexibility	-	-	-	X	X	X	X	-
Ownership of procedures	-	-	-	-	-	X	-	-

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Factors of resistance occur in both starter firms as inside the more experienced firms. This might be explained by the fact that also the experienced firms are currently improving or changing processes inside their firm, thereby affecting the employees' daily habits. The quotes below show some examples of personal factors of resistance:

' … I fear that it will cost a lot of time and energy. In our product we have one hundred thirty components made from six to seven different materials, and from fifteen manufacturers...I already loose the courage when thinking of it...' (Firm 3)

'It's difficult if you just say 'ok here is new version of your procedure, implement it'. The product developers will say it's not possible, not feasible, too difficult and it will cost us a lot of money and so on.' (Firm 2)

'You need to know who will be affected, and then you think of that concerning to what extend do I need to involve at what time, because if a person feels that he is not involved, if you're doing without him having a word into that, he might oppose that at a certain moment.' (Firm 2)

'Even if a new procedure or tool was developed by me, someone within the firm, I was not 'one of them', as I came from another department.' (Firm 6)

Our data gives some valuable input and indicates that our second proposition can be considered valid. The data indicate that both practical and personal factors of resistance occur and, moreover, that both types are important for firms to take account of when implementing changes. An important refinement of the proposition should be made that indicates that resistance mostly occurs in stages of the implementation process where the daily routines or processes need to be adapted.

This second proposition gives input for the third proposition in this paper, in which a link is made between the manner internal communication on sustainability issues is structured and personal obstacles (human factors) that occur within the product development department.

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3.2.3 Internal communication to lower personal resistance?

Proposition 3: *Structured internal communication on the value of integrating sustainability criteria, the planned interventions and provisional results lowers the (personal) resistance on a departmental level.*

In this proposition there are three main items that need to be linked: How is the internal communication on sustainability issues structured in the different firms? What is the content of the communication? And what is the effect of this on the (personal) resistance on departmental level, with a focus on the product development department? We start with describing our results in order to offer some insights on this third proposition.

Three types of internal communication

Table 5: overview of communication methods and tools

Communication methods and tools
Involvement & empowerment
Believers
Core team
Direct communication/internal network
Steering committee
Regular meetings/community or committee
Ambassadors
Adapted information/communication style per department
Process supporting tools
Example products/projects
Pilot projects
Guidelines, checklists, templates, etc.
Database
External consultant
Spreading of information
Own label
Existing labels and framework
Item in internal firm magazine/newspaper
Item on intranet
Dedicated mailings
Dedicated presentation/seminars
Dedicated training/ workshops sessions
Dedicated brochure

Table 5 shows the wide variation of communication methods and tools that were mentioned in the different firms as being used in order to structure internal communication on sustainability issues. Five of these individual methods and tools are applied most often in our

cases for communication on sustainability issues: the presence of strong-believers in the ideas behind sustainability, the presence of a core team, sustainable product and project examples, guidelines and checklists, and training and workshops that focus on certain sustainability issues.

The methods and tools can be divided in three main groups, of which each group has other goals: a first group of methods focuses on the involvement and empowerment of employees. A second group is more directed to communication tools that can support the product development process. A third group is directed to the spreading of information inside (and outside) a firm. Table 6 shows the application of each of the three types of communication in the eight participating firms.

Table 6: amount of applied communication methods and tools per communication type

Communication type	Firm 1	Firm 2	Firm 3	Firm 4	Firm 5	Firm 6	Firm 7	Firm 8
Involvement & empowerment (7)	7	2	4	2	6	7	1	2
Process supporting tools (5)	3	4	3	3	4	3	3	3
Spreading of information (8)	6	4	5	2	6	5	5	5

Involvement and empowerment

Firms that use many communication tools and methods directed on involvement and empowerment are firm 1, 5 and 6, of which firm 5 is in an early stage of implementing sustainability criteria (starter). This forms a big contrast compared to some of the other firms, such as firms 2, 4, 7 and 8, which only use one or two tools or methods with the same aims. The difference in attention for people-related communication is impossible to neglect.

These results suggest that there might be a link between the stage of implementation (starter versus experienced) and the attention that is focused on people-related communication. A possible explanation is that a firm first focuses on the development of a sustainability strategy, often in a limited group. In the subsequent stage, the focus can be shifted from content-related subjects to the involvement and empowerment of a wider group of employees. However, the assumption of this link needs to be put in perspective. Firm 3 for example is considered as experienced, and they use more than the average amount of communication tools, but so far it has not focused strongly on communication with the aim to involve and empower employees.

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Process supporting tools

Of all the participating firms, firm 2 and firm 5 use most tools for communication on sustainability issues in order to support the product development process. However, the difference between the firms in amount of used tools is very small – in comparison to the difference in number on communication tools directed to raise involvement. This might suggest that firms often focus on incorporating sustainability in the design process from the beginning of the implementation process of sustainability criteria.

Spreading of information

A third group of communication tools dedicated to sustainability issues was detected that has a focus on the spreading of information inside the firm. Eight different methods and tools were mentioned in the different firms, and many varying combinations occurred in all firms, without showing a clear 'red line', i.e. from our data, a distinction between starters and experienced firms cannot be made. However, when the size of the firms is considered, a distinction can be observed between the smaller/medium sized firms (firms 3 and 4) versus the bigger firms. In the latter group, more tools are used, and thus structure can be found.

Content of internal communication

Considering the spreading of information on sustainability issues, it appears that it is difficult to define which and how information should be spread, to whom and when. This is shown in some quotes of our respondents:

<u>How</u>: *'The information is made on management level. It needs to get translated in another sort of language that is used for example on the production floor. … it turns out to work very well e.g. translation of the goals of energy-reductions to what this means in real actions within the factories.'* (firm 1)

<u>Who</u>: *'The discussion is who needs to get involved and who doesn't. And then you invite people to involve in it. But others hear about it and reactions occur such as* 'why that other person and not me?*'. It is and stays very difficult to deal with this. There are always people that feel passed by or that interpret things in a different manner than you meant.'* (firm 5)

<u>When and who</u>: *'This week I gave an internal presentation to auditors. It took me 45 minutes to pass the first slide … after that, they started asking why they didn't know this all earlier and wanted to know all that is changing. I told them that it is a process*

that goes top-down that needs to spread slowly and steadily. ... Yes, it is difficult to do this in a good way and to get the information to the right people.' (firm 1)

What and how: *'First you need to say why the change is needed. Then you communicate what will change. Then you need to make it feasible, which means that you put it into documentation, already prepared for them, and then you need to train them.'* (firm 2)

This paragraph will focus to the content of communication. Within literature on change management, the importance of clear and regular communication on the value of the changes, planned interventions and provisional results gets often repeated. How this should be done in practice is often not discussed. However, our empirical data suggest many options, which are presented in Table 5. Considering the content of the change, we verified if the three subjects -value, planning and results- are effectively spread in practice inside the participating firms.

Table 7: content of internal communication on sustainability issues towards R&D

Content	Firm 1	Firm 2	Firm 3	Firm 4	Firm 5	Firm 6	Firm 7	Firm 8
Added value for firm	X	X	X	-	X	X	X	X
Added value for R&D	X	-	X	-	X	X	-	-
Planned interventions	X	X	X	-	X	X	X	X
Planned interventions in R&D	X	-	X	-	X	X	-	X
Results	X	X	X	X	X	X	X	X

In almost all firms, the added value of sustainability in general gets communicated in a structured way to the employees. Table 7 presents that this content specifically directed towards R&D is less wide-spread. A possible explanation for this difference is that a firm perceives not to be mature enough within the process of implementing sustainability criteria in order to communicate about it to their product development department (e.g. firms 2, 4 and 7). Another explanation is that there are other aspects that are considered as more stringent, e.g. legislation or specifications that are inherently connected to the products (such as energy-efficiency; e.g. in firms 7 and 8).
Subjects that were mentioned as a part of their communication on the added value of sustainability are: the need for and importance of incorporating sustainability, the goals, links with other advantages, previous actions and projects and the results that have been achieved, and how these previous activities and results fit into the (new) framework for

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sustainability inside the firm. These last elements are important in order to show employees that they are already doing a good job and that the changes are not necessarily equal to more work. Attention for improvements thereby approaches the changes in a constructive manner. From our data it appears that showing results is a method that is used in all firms, and it has been mentioned by several of our respondents as a very effective and motivating course to follow, e.g.:

'I see the need to bring the story on sustainability, to tell it in a good way. But in order to do that, it needs to become more tangible. … from the moment that we have enough concrete examples, we can also convince the non-believers.' (firm 5)

In five of the firms, the planned interventions are communicated towards employees in R&D. However, significant differences occur between the frequency of communication and the methods used.

From our data, it appears that the added value is indeed considered as an important aspect to define and communicate in all firms and from the start of the implementation process. Explaining the added value is supported with the use of example products and projects and aims at the formation of a 'burning platform' in the first stages of the change process. Communication on upcoming projects and other plans appears to be less common and often also less frequent, although our data suggest that there is a link with the experience of the firm on either sustainability issues or knowledge on change management. This latter group of firms might have less experience on sustainability matters, but they already have a more structured communication strategy in place, which makes it possible to focus on the content.

Link between structured internal communication and (personal) resistance

A presumption has been made in proposition 3 that the use of tools and methods in order to structure internal communication on sustainability issues would lower the personal resistance of employees. When we link the data from propositions 2 and 3, our data show a small tendency towards lower resistance from a personal level, as well as from a practical level, in the firms where communication on sustainability matters is most structured (such as in firms 1 and 5). However, little resistance also occurs in the other firms with less communication methods and tools. Moreover, clear differences between the effect of the different communication types (aiming at empowerment, process support or information spreading) on personal resistance are not visible from our data. With the current data, this proposition can neither be supported nor dismissed. Extra data therefore needs to be

gathered. Based on the current data, the authors however suggest that taking account of the three types of communication tools will eventually improve the implementation process:

- <u>spreading information</u> on sustainability is important in order to inform the employees about the 'why' of incorporating sustainability, but also about 'how' this will happen, 'when' and by 'whom';
- using <u>methods and tools that support the product development process</u> is necessary in order to streamline the process, to make it possible for the product developers to focus on the content, to make the changes measurable and to provide examples from practice;
- focusing on <u>involvement and empowerment</u> is important in order to get a growing group of employees enthusiastic about the changes, to make employees participate actively and to let a new (sustainable) culture grow inside the firm.

4. Discussion

Our empirical data suggest that a well-developed vision, strategy and planning do not necessarily form the starting point of the introduction of sustainability in a firm. The starting point is suggested to be one (or some) believer(s) that strongly support(s) the idea behind sustainability and that repeatedly communicate(s) it towards colleagues and the management. Setting up and performing individual, independent initiatives thereby appears to be a successful way to do this.

Whilst resistance can be expected when changes take place, our data suggest that sustainability as a subject and the need for it in the work environment, are generally understood and supported by most people within the firms. Although the resistance in this first stage appears to turn out to be lower than expected although clearly present, our data suggest that there are different reasons for resistance. Moreover, the sorts of resistance appear to differ in the next stages of the implementation process. After the development of a general vision on sustainability and an according strategy and planning, factors for resistance are suggested to be both practical and personal in the product development department. These practical factors might be lowered by the development of a good strategy and planning on the changes, by providing tangible tools and indicators and relevant trainings for these employees. Personal resistance on the other hand might become lower when relevant information and successful examples from practice are provided, but also when efforts are made to involve employees in the process by letting them participate and giving them responsibility.

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Our data suggest that product developers in the firms often become supporters of the incorporation of sustainability early in the implementation process. However, this positive attitude towards sustainability needs to get motivated (communication in order to empower people), supported (communication tools that support design process) and fed (informative communication) in order to keep this enthusiasm alive. Communication tools that appear to get applied most often focus on the added value of sustainability for the firm, often in the form of example products and projects. Other common communication methods seem to focus on the product development process. This was suggested by our respondents as an important aspect of communication on sustainability in the R&D department, especially when it concerns the translation of knowledge on sustainability into tangible, practical design tools. Less common are communication tools directed towards empowerment and involvement. These types of tools appear to be equally important as process supporting tools inside the product development department. Moreover, this sort of communication appears to become more important when sustainability issues are to be spread towards bigger groups of employees. However, resistance appeared to be lowest in firms where all three types of communication were applied in a balanced way.

5. Conclusion

In this paper, we studied the implementation process of sustainability criteria in the firm and its product development process with empirical data that has been assembled within Flemish and Dutch firms. We thereby focused on factors that influence this process, especially those factors that are related to people. Our data suggest that a clear vision, mission, strategy and planning of the implementation process of sustainability criteria that are developed and supported by the top management support the introduction process. However, our data also suggest that this vision is not necessarily needed in the beginning of the implementation process, where small seeds –in the form of individual, independent projects and individual believers- form the germs of sustainability inside the firm. Our data also suggest that factors of resistance evolve with the implementation process from more general to specific factors that vary in nature (organizational versus personal) and content. When it considers communication on sustainability issues inside the firm, and specifically within the product development department, our data suggest three types of communication that need to be considered and applied in order to involve, support and inform employees in order to positively progress into the direction of more sustainable products and processes.

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