Drivers for implementing environmental requirements – An international explorative study in manufacturing

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Abstract
Manufacturing companies need to respond to a sustainable development in view of the limitations of planet Earth. This paper explores driving forces for environmentally driven change by gathering interview data from 27 manufacturing plants in Europe and America. A proposed model connects external change triggers with required change actions within organizations.

Keywords: Drivers, Sustainable Operations, Change Management

Introduction

Manufacturing companies must become better at managing the needs coming from environmental requirements in order to establish a sustainable world for future generations. Environmental issues such as energy, natural resources, pollution and waste offer both competitive opportunities and constraints, and are changing the competitive landscape in many industries. For the companies, this will require a responsiveness to external events that leads to the implementation of, and adaptation to, the new environmental requirements. The companies need to respond both by eco-efficiency in business models, in performance measurements and eco-efficiency in products and production (EU 2011). This paper responds to changes towards eco-efficiency in production. Different factors that trigger the change have been explored by authors within the field (Florida et al. 2001; Luken and Van Rompaey 2008; Mittal and Sangwan 2014; Post and Altma 1994). Considering this literature, but also theories from the change management field, this research finds its foundation in the change management framework of Oakland and Tanner (2007). The framework presents a view of relating the external event to the internal need for change in the organization. How the internal need is translated from the external event impacts the process and the final outcome of the change (Oakland and Tanner 2007).

The paper contributes to operation management by exploring changes triggered by environmental requirements in production. While previous research has mainly focused on the external pressures on the organizations, this paper focuses on the sets of drivers that create an implementation process in the production organization. An international explorative multiple

case study has been performed with the objective to respond to the following questions "What triggers changes based on environmental requirements?" as well as "What are the drivers for implementing them?".

For operations managers in practice the study should provide support by identifying the different driving forces that can be used as means of creating motivation for internal change projects. The research conducted forms a part of an overall research project aiming to facilitate the implementation of environmental requirements in manufacturing.

Environmental needs and impact

There is a long-seen need for an environmental, economic and socially sustainable society – a society meeting the present needs without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development 1987). Several efforts have been made both in industry and research (Angell and Klassen 1999; Nunes and Bennett 2010). Nevertheless, new types of products, operations and organization models will be needed to comply with the new constraints and the new objectives of sustainable manufacturing as sustainability itself is dynamic *"a certain situation valid at a certain time can change because of external factors"* (Garetti and Taisch 2011). While the literature in the field has considered drivers from cost advantages, market awareness, life cycle implications and lean and quality integration (Sannö et al. 2014), the future need for change will be derived from earth's capacity and resource depletion (Clift 2005; Perdan 2011).

Post and Altma (1994) provide a view of three drivers for environmentalism: compliance-based, market driven as well as value driven. The value-driven driver provides the understanding that consumers are willing to act on their environmental values. Aligned with this, Luken and Van Rompaey (2008) conclude that the drivers for environmentally sound technology adoption are dependent on subsector, country variations but also the closeness of end-customers. This means that an appropriate strategy to drive environmental change must do more than rely on a traditional regulatory approach; it must also leverage market and community pressures. The community pressures are important for the internal organizations too; Khanna and Anton (2002) find that differences in the environmental practices adopted depending on the incentives were created to meet regulatory threats or to see market opportunities. A third factor, apart from institutional pressure and the ability for organizations to adopt environmental management practices, are the organizational characteristics (Delmas and Toffel 2004). Bey et al. (2013) are also considering the sustaining drivers that are important to keep an implementation going.

The external event and the need for change in the operations form a part of the context of the implementation project (Oakland and Tanner 2007). Jacobsen and Thorsvik (2013) identify three levels influencing the organization. Level 1 is the closest domain including customers, partners and competitors as well as the laws and regulations that only apply to the type of business organization involved. Level 2 comprises the national circumstances consisting of the general political conditions, economic and cultural conditions as well as laws and regulations that apply to all within the nation's borders. Level 3 represents the international and global conditions that are affecting the organization more indirectly but significantly, such as international economic agreements, political events in other countries, climate change and technology. The effect from this level is hard to predict but it also depends on the different pressures and how strongly the organization is affected by the technological and institutional environment. The organization responds to the outside world into three bases for institutional

pressure –regulative (legislation), normative (values and norms of society) or cognitive (obvious ideas in the same industry) (Jacobsen and Thorsvik 2013). Organizations that are proactive anticipate changes in the world and are able to act before the pressure to change becomes immediate. However, when acting proactively, even if first move advantages provide competitive opportunities, it is difficult for change agents to create a perceived pressure. That means managing proactive changes is often met with resistance because the members of the organization simply question whether it is necessary (Jacobsen and Thorsvik 2013). Hence, one of the important steps for a successful project is to *"create a sense of urgency"* (Kotter 1996).

This *"sense of urgency"* can be created by legislation (Bey, Hauschild, and McAloone 2013; Luken and Van Rompaey 2008; Mittal and Sangwan 2014). However, Gattiker and Carter (2010) conclude that *"regulation may be a way to force organizations to implement various measures but regulation alone is not sufficient when it comes to gaining buy-in at the level of an individual actor within an organization"*.

To summarize, see Figure 1, one can see that there are multiple ways of creating external and internal drivers for change triggered by environmental requirements. Scholars have explored the external factors or triggers as well as the organizational need for change. Less is done to connect these two driving forces. The external events that trigger the change as well as the related internal need for change are further explored in the conducted case study.
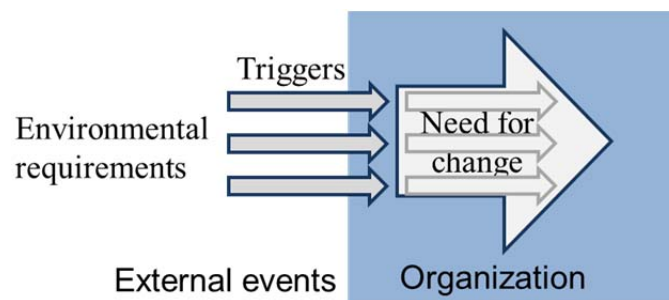

Figure 1 - The environmental requirements created by external events, have different triggers that impact the organization. Within the organization a need for change has to be created in order to create commitment and advancements in the change process.

Research Methodology –An industrial case study

A multiple, explorative case study has been conducted in order to create a better understanding of the external events that trigger environmentally driven change. The study also aims for a better understanding of the related need for change that is created in the organization. The methodology was chosen on the grounds of an explorative purpose; the researcher has no control over the events and has a focus on a contemporary phenomenon within a real-life context (Yin 2009). The unit of analysis is drivers for change in the initiation of a change process. The context is change processes within organizations at production plants, with a special interest in changes triggered by environmental requirements.

Description of research approach

The selection of sites was made to capture the purpose of the study with a focus on heavy vehicles in the manufacturing industry. The study included 26 plants and one head office, which in total employs about 43,000 people. At the plants 34 people were interviewed during the period

from 24 July 2013 to 26 June 2014. The criteria for selecting the cases were large, multinational companies. These companies have production and suppliers available worldwide. Company 1 manufactures vehicles; different business units as well as international production plants were surveyed within the company. As the driver is found to be dependent on the subsector (Luken and Van Rompaey 2008) two companies (7, 8) were chosen having a production of the main chemical processes which create a direct environmental impact in terms of chemicals, waste and emissions. In order to create an understanding of the environmental impacts in the value chain, two companies (6, 9) were selected. Table 1 displays the companies included in the multiple case study.

Table 1 - Overview of the companies included in the multiple case study

Case Company	Subsector	Country (number of plants)	Main Processes	Number of respondents
1	Heavy vehicle	US (1), Brazil (1), Europe (3), Sweden (4)	Assembly, drive train, cab	12
	Trucks & Buses	US (1), Brazil (1), Europe (1), Sweden (4)	Assembly, drive train, cab	9
2	Heavy vehicle	Sweden (1)	Assembly, Component	1
3	Car	Sweden (4)	Assembly, drive train, component, cab	4
4	Trucks	Sweden (1)	Drive-train	1
5	Train	Sweden (1)	Drive-train	2
6	Supplier	Sweden (1)	Component	1
7	Pulp and Paper	Sweden (1)	Chemistry based	2
8	Pharmaceutical	Sweden (1)	Chemistry based	1
9	Retail company	Sweden (1)	No production	1

The interview study has included semi-structured interviews conducted by one of the authors. This method for data collection was chosen on the basis of and developed by principles of Lantz (2013). The key respondents are the environmental coordinator or expert at each production plant. The interview material was first divided into three parts; a background to form an understanding of environmental work, a change project description as well as the future outlook. The interviews lasted for approximately one hour. The interviews have been recorded and transcribed. The use of multiple sources of evidence is used to increase the construct validity according to Yin (2009). Notes, presentations made as well as observations from participation in projects in Company 1 are included in the study in order to triangulate the findings (Yin 2009). The data analysis, within case and cross case analyses of the interviews have been done by the first author and a research colleague by a data analyzing process consisting of pre-coding, categorization and explanation building (Blessing and Chakrabarti 2009; Yin 2009). The results below present a summary of all the responses, and the cross case findings are highlighted in the

text. The results and description of each category have been validated by the respondents and also discussed with senior researchers.
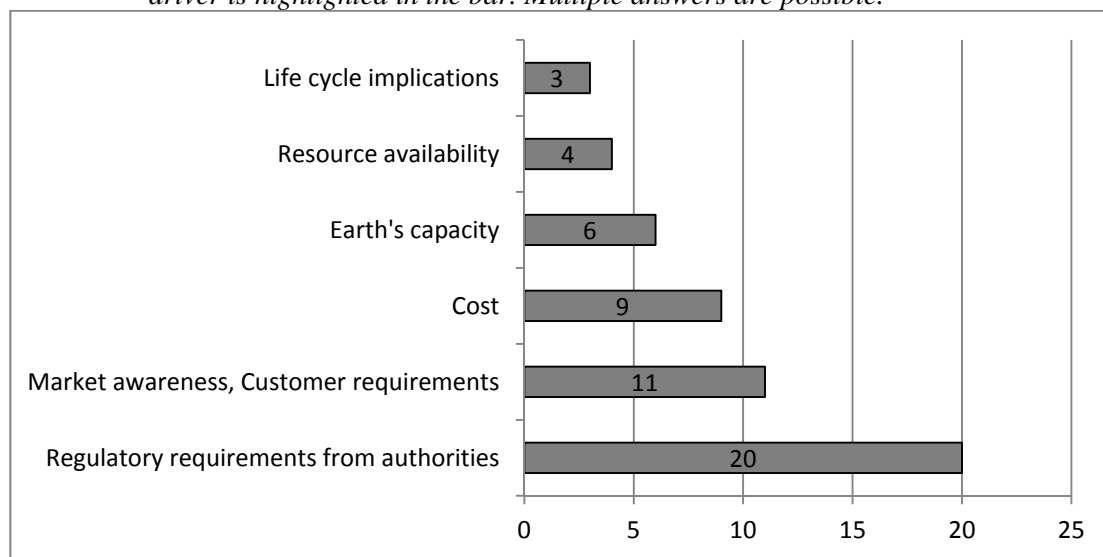
Empirical findings and discussion

Within the organizations, several parallel projects are ongoing such as energy reduction, waste reduction, change of process technology, implementing control systems as well as having projects to create cultural change. For twenty-six of the respondents the future main focus is predicted to be energy efficiency. With continuously increasing demands on environmental issues, attention is directed towards maintaining productivity and reducing the cost, global warming and carbon dioxide emissions, waste, chemicals, water, resources and, as some of them state, *"everything"*.

The external events that will trigger change

With regard to the future events, the respondents respond to what will trigger the changes in the future from an external perspective, see Table 2.

Table 2 - The external event that is predicted to trigger future changes where regulatory, legal requirements are predicted to be the main external driver for change. The number of responses for each driver is highlighted in the bar. Multiple answers are possible.

The regulatory requirements from authorities constitute the dominating answer. These requirements are dependent on national and regional legislation. This trigger is also stated to be personal dependent; it is considered to be important to keep good relationships with the personnel at the authorities.

There is a distinction between the different organizations and closeness to the end-customer. For the companies whose products, such as automobiles, pulp and paper to consumer products, the triggers from customer requirements are mentioned as highly important but also the supplier of automotive components.

Cost is also important from two aspects: the respondents mention avoiding penalties but also finding cost advantages. By being recognized as taking environmental responsibility, the companies maintain competitiveness.
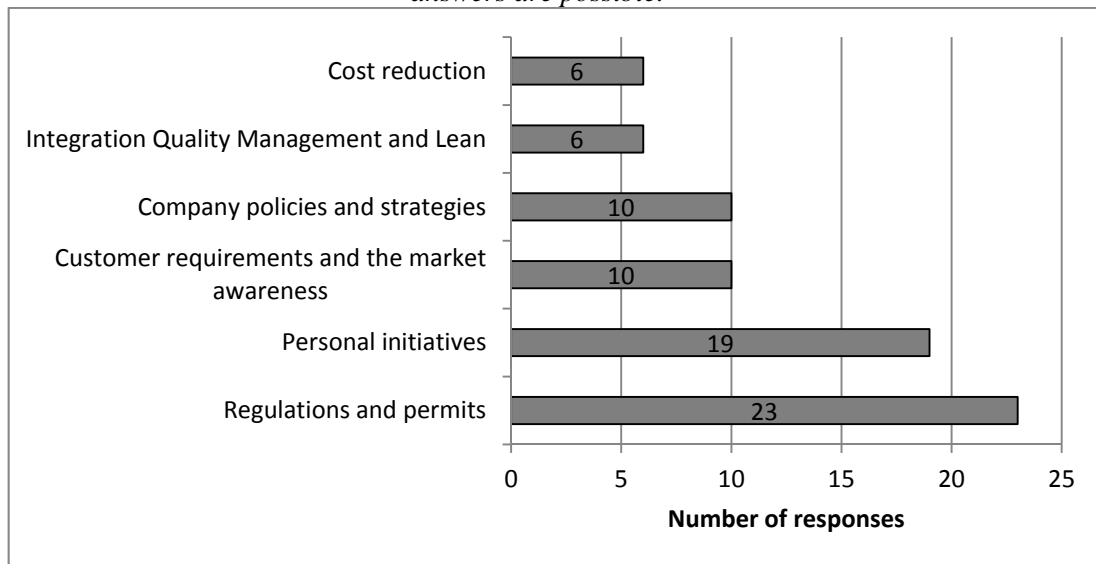
In contrast, the interviewees that mention the earth's capacity and limitations of resources stress this as the driving force that will arise primarily through public opinion. As stated by one of the respondents in the automotive industry, *"What will drive the changes are deficiencies, lack of resources, combined with serious environmental impacts that generate a strong public opinion"*.

That the life cycle implications will drive change is mentioned only in three cases. It is related to having control over the hazardous waste but also the eco-design point of view. Control over the supply chain is of great importance in order to avoid hazardous components in the end-product.

The need for change

The respondents also respond to what is creating a drive for change within their production plant. Table 3 displays what is creating the need for change within the production plant.

Table 3 - The drivers for creating a need for change within the production plants. Multiple answers are possible.

The main factor for creating a need for change internally is the rules and laws, which are connected to the triggers for change being regulatory and to the requirements from authorities. One of the respondents explains this as: *"The simplest is based on legislation, there is no doubt, and we must do it. Not to say the best way to do it, but if there are laws behind they listen to you. The best way is that the act by thinking people, people feel that we need it. But today, legislation is the easiest way to get the people in production to listen to you. "*

Strongly related to regulations and permits, in eleven of the cases, regulation is mentioned as being supported by personal initiative within the organization and the ability to manage the work to meet the statutory requirement. The environmental legislation and controls

are continuously updated and the organizations must have procedures to bring in, spread and consider the consequences of the new requirements.

What will drive changes triggered by customer requirements will typically be both cost-related reasons and promotional reasons for increased sales. *"If you are not environmentally aware you will not be able to sell"*.

Company policies and strategies of these companies are created on a corporate level and then introduced at the plant level. Here it seems as if there is a difference between the international plants; in Brazil and Germany the company strategy requirements are creating the drive rather than the local laws. *"What is coming from the higher management is the reason why we are doing it. Yes it is. But not laws, we are already meeting the expectations for legislation here."*

Several of the plants have created the internal drive for change by identifying their own environmental aspects by principles within the lean production system. To promote environmental issues with quality - and with lean concepts - helps to bring up environmental issues on the agenda and that the facility may be a systematic approach to work through the process.

Cost reduction is considered to be a force for change to give attention to the change within the internal organization, as for projects related to reducing energy consumption and the amount of waste. These changes have an advantage in that they can get into the strategic plan with clear monitoring and measurable KPIs, and then it creates the attention and drive from management.

Identified differences between the nine case companies

The differences and similarities notified in the empirical study are presented in the bullets below:
- The subsector is important in relation to the end-customer. It is then competitiveness in the form of public opinion and ultimately the individual consumer choice and market forces that drive the change within the organization. For example, the drive from customer requirements is less mentioned as a driver for change in the production plant within the heavy vehicle sector.
- In Brazil and Germany, where local legislation is providing less drive compared to countries such as Sweden and France, the company policies and strategies are considered as an important driver for change.
- On a strategic level, the company policies and strategies are managed differently on the production plant level. There is more difficulty in driving change if the environmental policy or environmental strategy is introduced to the environmental coordinator. These persons must first gain management support. If strategies are directed to the plant management, the environmental coordinator acts as a support.
- The legal requirements are supported by personal initiatives and commitment.
- In the end, as stated by two of the respondents, the momentum will be the company's development. The development of the production system will be based on the product development towards less environmental impact, but also on the business and the results. The recession in 2008 is remembered as *"becoming a lesser focus on these issues apart from what is licensed and legally controlled"*.
- Multiple ways to drive change are considered by some of the respondents. *"You cannot say that it is the environment that drives, you cannot say that it is money that drives. You*

cannot say that it is quality that drives. Everything is connected. But when it comes to for example Best Available Technology, BAT, requirements then its demands come from the environment. "

- The facilities located at a smaller place gain from being located where employees both work and live. The culture for environmental commitment and a drive to manage environmental issues is stronger if the facility is located near summer cottages or the local school.

Discussion and Conclusions

As a result from the study, it seems that for the multinational companies in the study it is the regulatory events that bring the most pressure on the production plants but also create the need for change internally. This is aligned with the findings in literature (Bey, Hauschild, and McAloone 2013; Luken and Van Rompaey 2008). The result from the case study also clarifies that regulation is linked with personal initiatives, which is aligned with the conclusion by Gattiker and Carter (2010). However, the increased general awareness of the climate change and resource depletion can create personal engagement and public opinion both outside and within the company. The model developed based on the literature and the empirical findings is presented in Figure 2. The model describes the different triggers for change, identified in the literature.
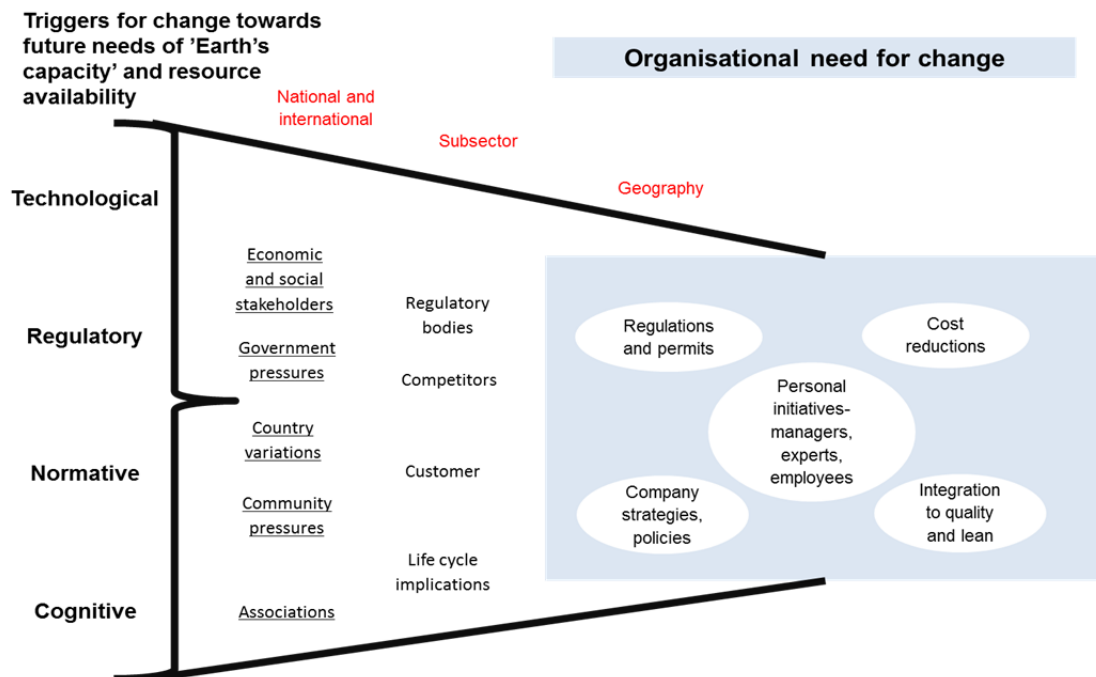

Figure 2 - Visualisation of the production plants' responsiveness for future environmental requirements. From the left the four bases for pressure are shown as technological pressure, regulative (legislation), normative (values and norms of society) or cognitive (obvious ideas in the same industry). The pressures from regulation, customers and the need for considering the life cycle implications are dependent on the subsector. The geography surrounding the plant influences the organizational focus for different environmental issues.

Four pressures will influence the organization directly or indirectly. The pressures will come from different levels, national, international as well as the influence of the environmental requirements from the different subsectors. The geography influences the culture of the organization according to the empirical findings. The model also presents the organizational need for change, where the drive for change is created by regulations and permits, company strategies and policies, cost reductions, integration with quality and lean systems. However, the main driver for change as well as to regulations is seen to be personal initiatives at different levels of the company.

A concern of validity is seen by only including key informants as being the environmental professionals at each site. The perception of this professional group might differ from the perception of plant managers and other stakeholders within the large plants (Luken and Van Rompaey 2008). On the other hand, these environmental professionals initiate a great number of the environmental projects in the organizations studied. By including different subsectors in the analysis, the findings are considered to be generalizable to several subsectors.

Contribution and Future research

This paper presents different triggers based on environmental requirements and related drivers for implementing them. A model, combining theory and a multiple case study is developed. The contribution to academia is a better understanding of the sets of drivers that create an implementation of change, triggered by environmental requirements. The contribution to practice is a model that could support operational managers in their corporate foresight as well as better understand what drivers can create an internal need for change. It is recommended to conduct further empirical research to validate the model by empirical studies as well as research on how to apply theories from organizational change management within this, in the authors' opinion, important field of operations management.

Acknowledgements

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