CIRP Annals - Manufacturing Technology 62 (2013) 43–46

Contents lists available at SciVerse ScienceDirect

CIRP Annals - Manufacturing Technology

journal homepage: http://ees.elsevier.com/cirp/default.asp

Drivers and barriers for implementation of environmental strategies in manufacturing companies

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ARTICLE INFO

Keywords:
Lifecycle
Decision making
Strategy implementation

ABSTRACT

In order for environmental strategies to come into effect in industry practice, they need to be implemented and applied in daily business routines. Based on a dedicated comprehensive international survey in product developing and manufacturing companies, this paper identifies major current drivers for implementing product life cycle oriented environmental strategies but also barriers and obstacles that need to be addressed. On this basis it provides a number of recommendations for manufacturing companies as well as policy makers to consider for a successful implementation of strategic environmental goals in manufacturing industry.

1. Introduction

As a general tendency during the last decades, environmental issues are receiving a continuously increasing amount of attention in society at large and within many markets and supply chains in particular. Many manufacturing companies see a potential business implication in this tendency and embark on strategy development and implementation processes to "go green" in their activities. As part of the same tendency, authorities set increasing demands on environmental performance of companies and their products, in the EU for instance in the form of Directives from the European Commission.

Consequently, there is a need for environmental decision-making in industry related to a number of issues in product development, manufacturing technology application, supply chain collaboration, customer communication (incl. environmental labelling) and many other areas. Both in company contexts and authority contexts it is established state-of-the-art to do such environmental decision making in a product life cycle perspective [1].

Concurrently with this tendency, a large number of methods and tools have been developed by researchers in companies and research institutions to support life cycle based decision-making. However, comparing early (e.g. [2]) and current research (e.g. [3,4]) the industrial state-of-the-art still shows lacks in application of tools and low degrees of implementation in "real life" industry. This in turn poses the question, what barriers seem to keep environmental decision support tools from broad application in industry. In the light of this situation, the central research questions addressed in this paper are:

- Which concrete incentives drive industrial manufacturing companies to implement environmental strategies?
- Which barriers keep industry from starting to implement environmental strategies and approaches in their organisation?
- Which barriers keep industry from keeping such a process running, so that environmental activities become part of the daily routine?
- What can be done to help manufacturing companies overcome those barriers?

In this context, pursuing "environmental strategies" is understood broadly as planning and promotion of targeted activities that support environmental improvement in a long-term life cycle perspective. Particularly in manufacturing companies, this requires a holistic view covering not just the product and the manufacturing processes involved in its fabrication, but also the entire supply chain, including the manufacturing systems across multiple product life cycles [5]. Within industrial companies, this can include activities in all parts of the organisation (marketing, production, purchase, research & development, sales, logistics, etc.), and a strategy can for instance be energy and resource efficient manufacturing [6] or, more generally, waste minimisation, material efficiency, resource efficiency or eco-efficiency [7]. In terms of companies, the focus in this paper is on environmental strategies applied in product developing and manufacturing companies.

The research presented here is done as part of an on-going project for the Danish Environmental Protection Agency (Danish EPA) dealing with the question of how to most effectively implement environmental strategies in industry. Motivators for the project were industrial companies which are seeking for approaches to get beyond one-time environmental events (e.g. R&D workshops) or short test development projects to ensure a long-term, daily-business implementation in their respective organisation.

The paper is laid out as follows: Section 2 gives an overview over the basis for addressing the research questions, namely an international survey in industry performed as part of the above-mentioned project. Section 3 addresses the results from the survey

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0007-8506/$ – see front matter © 2013 CIRP.
http://dx.doi.org/10.1016/j.cirp.2013.03.001

which relate to the research questions on incentives and barriers. Section 4 concludes on the previous parts and offers recommendations to help strengthen implementation of environmental strategies in manufacturing companies.

2. Method

The key method chosen to address the research questions was an international survey [8], supported by observations from a series of R&D workshops with representatives from Danish and US industry. The questionnaire employed an internet-based questionnaire with 34 questions regarding among others the company as such (sector, size, location, etc.), the individual respondent (experience, position, etc.), the organisational experience (tools and approaches tried out, in which contexts, sources of information used, etc.) and dedicated drivers and barriers perceived.

The questionnaire was provided both in Danish and English, targeting as well Danish as international companies. The questionnaires were sent out to more than 500 individual representatives of product developing manufacturing companies, mainly through three channels: (a) through an existing international industry-academia internet group on environmental product development (LinkedIn group on ecodesign and related issues), (b) through an existing network under the Confederation of Danish Industry (DI) on ecodesign and related issues and (c) through personal e-mails.

The ensuing sections of this paper focus on the results related to drivers and barriers in manufacturing companies.

3. Results and discussion

3.1. Overall characterisation of the survey responses

The survey questionnaire was filled in by 80 companies, corresponding to an overall response rate of some 16%. The companies were from nine countries, and over half of them were according to the EU definition large with more than 250 employees (see Fig. 1).

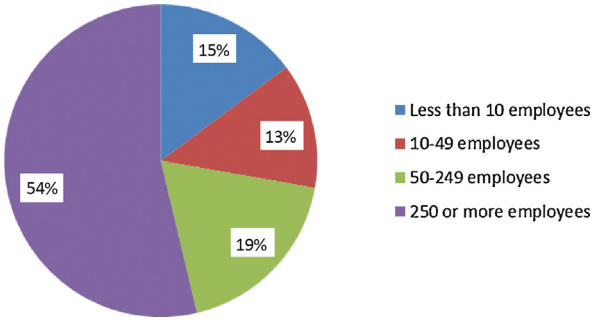

Fig. 1. Distribution of company size among the 80 respondents.

The majority (over 50%) of all respondents were from companies with major in-house manufacturing facilities, the remaining ones were mainly product developing companies that have outsourced their manufacturing activities to sub-contractors.

A general limitation of questionnaire results is the potential lack of insight by the particular individual that answers the questionnaire – i.e. the respondent may not possess the complete knowledge to fully answer all questions with respect to the whole company. However, judging from the information that respondents left regarding their position, role, etc., we consider the survey results as valid for the purpose of this article.

3.2. Identified barriers

The key question analysed here is about the four main barriers experienced by the company when launching environmental initiatives (see Table 1). The diversity of the responses underlined the existence of a large number of initial barriers for the implementation of eco strategies. Firstly, all of the 15 "initial implementation barriers" offered in the questionnaire were selected, i.e. all 15 were seen as relevant by one or more respondents, even though each respondent could only select a maximum of four barriers. Secondly, around 25% of the respondents also used the optional text field to indicate "Other" barriers which informed us of a number of additional "initial implementation barriers". This variety of initial implementation barriers confirms the complexity of the issue and the variability across the different types of companies that participated in the survey.

The concrete question and selectable options for answers are given in Table 1. Please note that – for reasons of easier reading and space allocation in this paper – the wording of questions and answer options may be shortened in this table as well as in the similar tables regarding other questions and in the text in general. Thus, the wording of questions and answer options is not always exactly the same as in the questionnaire but conveys the meaning in the context of this paper.

Table 1
The pre-defined answer options of initial implementation barriers. (Sequence as in questionnaire, partially in shortened terms).

Question: When you started your environmental initiatives, What were the four most difficult barriers to overcome? (maximum 4 answers to be selected)
• No extra time allocated to new environmental initiatives
• No extra resources allocated to new environmental initiatives
• Difficulties in finding information on environmental impact
• Sub-suppliers lacked willingness to cooperate
• It required too much specialist knowledge
• Difficulties in finding lower-impact materials/components alternatives
• Difficulties in finding lower-impact manufacturing process alternatives
• No relevant/suitable tools found to help start our environmental initiative
• The environmental tool(s) we tried did not fit to our product development
• The environmental tool(s) we tried did not give trustworthy results
• It was difficult for us to identify goals for our improvements
• When the easy environmental improvements ("the low hanging fruits") had been carried out it became very difficult to continue to the next level
• The environmental improvements resulted in an unwanted or compromised product
• Trade-off too difficult to balance (e.g. lower chemicals use bring higher energy use)
• Don't know
• Other reasons, please specify (free text field)

Fig. 2 gives a ranked overview over the identified main barriers.

Among the 15 pre-defined initial implementation barriers, "Difficulties in finding information on environmental impact" was selected most often–namely by a third of all respondents (32%).

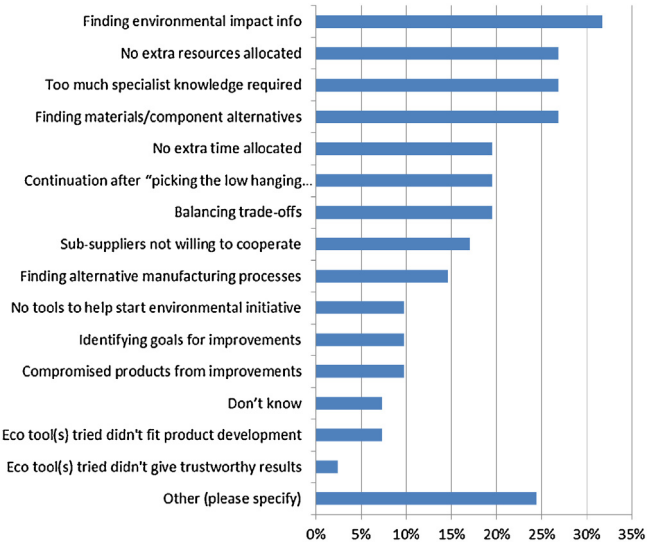

Fig. 2. Ranked summary of identified main barriers.