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Integration of stakeholder perspectives for development of sustainable automation components

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Components of automation technology have a special position in the area of sustainability. Each component has limited impact on sustainability indicators and business-to-business customers only have a small physical and emotional involvement with the product. However, interesting leverage might be given since the components are sold in large numbers and influence the system they are built in. Based on this background information, this paper provides a framework to consider all stakeholders perspectives in order to avoid trade-offs between them and to push “win-win-win-situations”. Concrete measures for automation technology are allocated to the sustainability strategies and quantified through a product example.

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1. Introduction

Automation components play a significant role when it comes to improving the productivity of production systems. On the one side this trend will continue as manufacturers using automation technologies are faced with global competition. On the other side suppliers of automation components such as pneumatic and electric systems aim to consider energy efficiency, resource conservation, reliability and safety for their customers during product development. [1] Often these goals are unified under the concept of sustainability targets, which may lead to confusion. Due to the fact that sustainability recently acts as an omnipresent buzzword, a clarification of the supposed impact of a sustainable product as well as the absolute quantification of the impact should be indicated. Since the business-to-business sector is very much cost-driven, many companies adopted eco-efficiency as their guiding principle for environmental sustainability. [2]

However this perspective neglects the three dimensions of sustainability (economical dimension, environmental dimension and social dimension) as well as the following definition of sustainability: “Sustainability grounds the development debate in a global framework, within which a continuous satisfaction of human needs constitute the ultimate goal (Brundland, 1987). When transposing this idea to business level, corporate sustainability can accordingly be defined as meeting the needs of a firm’s direct and indirect stakeholders [...]” [2]. Bringing this down to the product level, a sustainable product should meet the needs of all direct and indirect stakeholders who are involved in the value chain of the product (raw material, product development, production, transportation, use and end of life) and to whom the product has a direct or indirect impact on - in all three dimensions of sustainability.

2. State of the Art

The development of sustainable products has to be supported by the corporate sustainability strategy as well as by their business model.

2.1. Corporate sustainability

Translating the challenges of a sustainable development to the company level innovation plays a key role. In 1992 it became clear that sustainable development requires extensive long-term changes of technologies, infrastructures, lifestyles and organizations [3]. A well renowned concept that defines sustainable development is the triple bottom line of sustainability. It postulates the integrated view on social (People), ecological (Planet) and economic (Profit) perspectives [4]. In the assessment of organizational performance, the triple bottom line thinking extends the traditional shareholder focus to a holistic stakeholder view [5]. Despite being widely accepted as a fundamental pattern in organizational and policy contexts, e.g. sustainability reporting, the triple bottom line has to withstand criticism regarding its operability in decision-making [6]. According to Hubbard, one challenge would be the reflection of organizations' responsibilities to a complex and dynamic stakeholder environment with limited influence [5].

Dyllick and Hockerts created a framework for the strategic implementation of the triple bottom line in corporate settings (see Fig. 1). While eco-efficiency is well established, due to its direct benefit to the companies' economical performance, other strategies are less likely to be followed. Effective strategies (also referred to as consistency) are required since efficient approaches are limited to relative improvements. Effectiveness requires a systems perspective to be focused on making the right decisions for a given context. A sufficient approach takes into account consumer behaviors, while the boundaries of company policies regarding individual choice are respected. The concept is completed with the societal case, taking into account basic needs as well as a fair distribution of natural resources [2].



Fig. 1. Six criteria of corporate sustainability [2]

2.2. Development of sustainable products

Nidomoulu describes becoming a sustainable company as a five-stage process with innovation as the key to progress [7]:

1. Stage: Understanding compliance as opportunity
2. Stage: Making value chains sustainable
3. Stage: Designing sustainable products and services
4. Stage: Developing new business models
5. Stage: Creating Next-Practice Platforms

Current research places stages 3 and 4 at the centre of attention. From an environmental perspective, many companies are in the process of tailoring and integrating respective methods and tools in their product development process. These range from qualitative approaches to life cycle assessments (LCA) [8]. Regarding the societal case, it is widely known that companies have their own department for corporate social responsibility (CSR). But, even if a corporate social responsibility strategy already exists in a company, there is a difference between CSR tasks and the companies core business model. A common corporate responsibility task requested of departments is aiming to anchor a moral obligation in the people's behaviour, minimizing negative impact in order to meet today's laws and requirements [9] or fulfilling marketing aims.

2.3. Sustainable business model innovation

The goal of corporate social entrepreneurship (CSE), however, is that employees adapt entrepreneurial attitudes and create a bridge between core business and product innovations that have a positive impact [9]. Sustainable business models (SBM) are based on the triple bottom line approach, which allows for a broad range of stakeholder interests to be integrated into the way business is conducted and furthermore stimulates innovation [9,10]. According to Bisiaux a business model has the ability to act as an intermediary tool for compromises. It can be used as a sustainable innovation support tool since it provokes reactions from all stakeholders and therefore helps to avoid trade-offs. [11] Bocken defined eight groups of mechanisms and solutions that contribute to sustainability. The listed solutions in the following paragraph (Table 1, 2, 3) are based on those groups. They are called "sustainable business model archetypes". The aim of these archetypes is to develop a common language that can be used to accelerate the development of SBMs in research and practice. [10]

3. Sustainable measures for automation components

For specific industry sectors a pre-filtering of the archetypes might be reasonable. The following tables represent an overview of archetypes, approaches and measures that lead to sustainable products, specifically filtered for automation components (based on [10]). For companies that work in the sector of automation components, seven relevant archetypes (e.g. create value from waste) have been identified. Within each archetype there are several approaches (e.g. remanufacturing, reuse) which aim to achieve a similar effect. The realization of an approach results in concrete measures on the operational level (e.g. tools and guidelines for design for recycling). For a more general classification of the archetypes, approaches and measures, the archetypes have been assigned to the sustainability strategies of consistency (Table 1), efficiency (Table 2) and sufficiency (Table 3). Schmidt, citing Huber, highlights that realizing consistency seems to be the most relevant challenge and goal for society because ensuring the quality of energy and material flows (consistency) has a greater impact than minimizing existing energy and material flows by an arbitrary factor (efficiency). Therefore the priority of "consistency before efficiency before sufficiency" has been

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