

SUSTAINABLE INNOVATION IN METAL COMPANIES

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Abstract

Nowadays sustainability plays a crucial role in managing the companies. Metal industry organizations implement a variety of innovations paying special attention to sustainability, both in production and materials area. Continuous improvements in sustainability are challenging both technologically and in terms of management. In this paper sustainable innovation process management is described and evaluated. The period of analysis includes years 2010-2017.

Keywords: Metal companies, sustainability, innovation, management

1. INTRODUCTION

The beginning of 21st century was the time of changes in economic and development characters, whose continuation was supposed to take until now according to the program of Restructuring and Development of Steel and Iron Industry in Poland until 2006.

The increasing importance of knowledge as an economic driver has major implications for innovation management, which is, in turn, a key determinant of national and regional competitiveness in the global, knowledge-driven economy.[1] The contribution of knowledge to innovation is achieved in part by reducing transaction costs between firms and other actors, most notably in the areas of research and information, buying and decision-making, policy and enforcement. The systemic approach to innovation recognises that innovation and knowledge generation take place as a result of a variety of activities, many of them outside the formal research process. Knowledge is thus generated not just in universities and research centres, but also in a very wide variety of locations within the economy, and notably as a product (learning-by-doing) or of consumption (learning-by-using).

The main aim of current paper is focused on the sustainable innovation process management in metal companies. It was described and evaluated by the author's own research for years 2010-2017.

2. SUSTAINABILITY OVERVIEW

The general concept of sustainability is a dynamic equilibrium in the process of interaction between a population and the carrying capacity of its environment such that the population develops to express its full potential without producing irreversible, adverse effects on the carrying capacity of the environment upon which it depends.[2]

Sustainability can be thought of as the goal of 'sustainable development'. Sustainability is open to different interpretations and takes on different meanings not only between different interest groups within societies but also between different societies. Sustainability seeks an improved quality of life and embraces equality for all, and for this reason a key aim of sustainability is to enable multi-stakeholder groups to define their vision of sustainability and to work towards it. [3] From the point of view of neo-classical economic theory, sustainability can be defined in terms of the maximization of welfare over time. (This is assumed to be human welfare - the claims of the non-human world arise when we consider the ecological perspective.) Most economists simplify further by identifying the maximization of welfare with the maximization of utility derived from consumption. While this may be criticized as an oversimplification, it certainly includes many important elements of human

welfare (food, clothing, housing, transportation, health and education services, etc.) and it has the analytical advantage of reducing the problem to a measurable single-dimensional indicator. A formal economic analysis then raises the question of whether sustainability has any validity as an economic concept. According to standard economic theory, efficient resource allocation should have the effect of maximizing utility from consumption. If we accept the use of time discounting as a method of comparing the economic values of consumption in different time periods, then sustainability appears to mean nothing more than efficient resource allocation - a concept already well established in economics.[4]

Most forward-looking businesses understand that the traditional trade-off between sustainability and profitability is an outmoded perspective. They know that operating sustainably is a mind set with a focus on the creation of long-term shareholder value. That means adhering to the fundamental tenets of good entrepreneurship - identifying the changing needs and demands of society, and responding with successful business models. Business leaders who operate sustainably recognise that social, environmental, economic and ethical factors affect their core business strategies. These leaders evaluate the spectrum of sustainability issues and respond by mitigating risks and leveraging opportunities.

Operating sustainably does not only entail containing risks. For leading businesses, assessing the risks that all stakeholders face can yield rich opportunities. The growing number of consumers seeking healthy and sustainable lifestyles constitutes a potentially vast market for new products and services. Consumers' environmental, ethical and social concerns, for example, mean that their donations of quality extend to products' lives before and after their use. They may place a higher value on digital cameras built in plants where workers are protected from toxic components, whose parts are reusable and whose manufacturers take responsibility for the recycling of those parts. Wherever environmental, social or ethical issues can be addressed businesses have an opportunity to innovate, differentiate, create value and attract more customers. They are also opportunities to attract and motivate employees.

Although businesses now understand that pursuing sustainability is a long-term investment, they constantly face the challenge of alleviating shareholder concerns about short-term results that may disappoint because of the company's longer-term objectives. Their continuing challenge is to clearly communicate that operating sustainably is an inescapable imperative for businesses that aspire to prosper on the only planet currently available to them.

Sustainability issues pose a unique set of challenges and afford a distinct set of opportunities to every sector. The global reach and complexity of supply chains, raw materials required for production, the nature of products and the special characteristics of a company's workforce all determine which risks play the most significant roles in any given sector, and which opportunities exist. We have highlighted these unique combinations for key sectors: energy, transportation and logistics, retail and consumer, technology, and banking and capital markets. In each, we've also included one or two brief case studies, describing how leading companies, with the help of PricewaterhouseCoopers, have successfully adopted the sustainability agenda. [5]

3. SUSTAINABLE INNOVATION

Innovation management is a discipline; it does not come about through a random or hit-and-miss approach, but it requires design. Innovation management involves focusing on the organisation's mission, searching for unique opportunities, determining whether they fit the organisation's strategic direction, defining the measures for success, and continually reassessing opportunities. Innovation does not require genius, but it does require total dedication in pursuit of a unique opportunity. In the current economic context, growth must mainly originate from increasing the productivity of knowledge work, and increasing this productivity is the most important contribution management can make. The most valuable assets of a 21st century firm are its knowledge workers and their productivity. Knowledge-intensive organisations, ranging from knowledge-

intensive service-providers to high-tech manufacturers, need to manage innovation processes so as to increase knowledge productivity.

In comparison to traditional mechanistic command and control management, these characteristics entail a fundamental change in the strategic perception of the organisation, which accordingly has to consider the following management challenges [6]:

- Manage human capabilities in a strategic manner. Modern management has to face the perpetual challenge to place the human being at the forefront of operations, and understand that an organisation is a collection of different human beings.
- Network with internal and external partners. People have different attitudes, different customs, different professional backgrounds - management should focus on integrating the web of formal and informal relationships inside and outside the company.
- Create adaptive and interactive organisational structures. If the organisation is to stay responsive to external change, a flexible and adaptable organisational structure is a necessity.
- Balance order and chaos - process efficiency versus destructive innovation. The balance between process efficiency in existing business models and process adaptation for destructive innovation to drive corporate change is a delicate one.
- Balance individual and corporate motivation.

The discussion about Sustainable Development also requires a closer look at the question of how to achieve this massive transition towards a new global paradigm. As mentioned, the world and our global society require a shift towards a more responsible treatment of environmental, social, and economic capital. For this reason, new ideas and innovations must be created. The concept of innovation in our present understanding is symbolically represented as society's "engine of growth" [7], illustrating the strong economic orientation of the concept of innovation. This characteristic has been solidified notably by the treatises of Joseph Schumpeter at the beginning of the last century, who defined innovation as "realisation of new combinations" and that this is "the overwhelming fact in the economic history of the capitalist society" [8]. Since then, the concept of innovation had led to a variety of possible definitions. For instance, Edison et al. identified 41 possible definitions for this term [9].

Nevertheless, the core characteristic of the term of innovation can be seen in the origin of the Latin verb of "innovare", which can be translated as "renew". Thus, innovation can be understood as "renewal". Renewals are mandatory not only to drive the engine of our economy, but also rather to keep the engine of our planet running. Therefore, the combination of sustainability and innovation is indispensable to realize new combinations, which can lead to an innovation process tackling the current sustainability challenges. Nidumolu et al. described sustainability as the relevant key driver for innovation in the 21st century [10].

The expressions for combining innovation and sustainability include sustainable innovation, sustainability-driven innovation and eco-innovation. The concept of eco-innovation was firstly defined by James as "new products and processes which provide customer and business value but significantly decrease environmental impact" [11]. Complementary to this, the OECD defined eco-innovation as "the production, assimilation or exploitation of a novelty in products, production processes, services or in management and business methods, which aims, throughout its lifecycle, to prevent or substantially reduce environmental risk, pollution and other negative impacts of resource use (including energy)" [12]. In this context, the implementation of eco-innovations can address technological, organizational, social and institutional levels and involves all three pillars of sustainability [13]. Sustainability driven innovation is defined according to a report from Arthur D. Little as "the creation of new market space, products and services or processes driven by social, environmental or sustainability issues." [14]. The term sustainable innovation was defined by Horbach in the context of Sustainable Development as following: "Sustainable innovations not only comprise the environmental dimension but also economic, social and institutional aspects. They improve the realization of the aims of a sustainable development and represent a subset of all innovations." In conclusion, the

mentioned terms are strongly based on the same understanding and are focused on a holistic view of sustainability.

The innovation process itself can be divided into several phases, including sub-processes, from the generation of ideas, to developing the invention, and up to the diffusion process [15]. It can be described by a multitude of different process models [16-18]. Cooper describes the innovation process with his commonly used Stage Gate. Model covering five stages. This model is determined as a sequential process chain with precise milestones for the innovation process marked by so-called gates [16]. Due to the continuously decreasing timespan of innovation cycles, the model was lately adapted to the current understanding of innovation as a process with a stronger orientation towards the customer. Furthermore, Cooper identifies an initial starting point for any innovation in his process model, which he determines as the discovery and idea generation phase [19]. The established term for this phase is the so-called fuzzy front end of innovation (FFE). This is defined by Koen et al. as "those activities that come before the formal and well-structured New Product and Process Development (NPPD) or Stage Gate process.

Even though there is a continuum between the Front End of Innovation (FEI) and the NPPD, the activities in the FEI are often chaotic, unpredictable and unstructured" [20]. The FFE process is the first prerequisite for any innovation and addresses the generation of ideas [21]. Furthermore, the consideration of this phase has a decisive influence on the quality of innovation [22]. In the past, the scientific focus was predominantly on sustainable product design and thus on the NPPD process [23]. Consequently, it is now necessary to look more closely at the question of how sustainability values can be fostered throughout idea generation during the early phase of the innovation process.

Charter writes in this context: "Environmental considerations may be included early on in the idea generation stage as a stimulus to new or "out-of-the-box" thinking and/or it can be used as part of a conceptual refinement process. Inclusion of environmental aspects at this stage has significant potential to reduce life-cycle impacts." Every FFE process starts with an initiative based on creative observation and idea initiation. The impulse for an idea results from the deviation between the expectations of the initiator and an observed state. This leads to the intention to close this observation gap [21]. To do so, the process of analysing the gap and the generation of an exact problem definition should precede. This is followed by the generation of solution ideas. Subsequently, the FFE process is completed by assessing and selecting a most suitable solution idea. The overall process is based on an iterative procedure [23].

The initiation phase of sustainable innovations, with its strong problem-solving approach, must be taken into account in particular. Gassmann and Sutter already give an initial insight into the formability of the initiation phase of the innovation process: "The early stages require creativity and require a lot of patience. In such an environment, leadership means setting a vision, creating guardrails and leaving the detail work to the creative workforce. The later phases of innovation are to lead more than the early stages, as the demand for creativity decreases and the implementation becomes more important." [24]

4. CONCLUSIONS

Downward tendency in metal sector was considerably higher than in the case of other branches of the industry, where crisis was characterized only by a slowdown. However, in consideration of the decision about sector reorganizing in 2016, one can assume that the future of steel sector shows great promise for the domestic economy. Current and future projects and investments in infrastructure and construction impose high requirements on the levels of steel supply and provide an opportunity for revival of Polish metal industry. [25-27]

Current industrial development is faced by the global challenge to meet the continuously growing demand for capital and consumer goods in emerging countries while simultaneously ensuring a sustainable industrial growth in the social, environmental and economic dimension [28-29]. By means of market dynamics of

cooperation and competition in global value creation and knowledge networks, innovations geared towards sustainability can be essential drivers for realizing a sustainable development. The targeted development of new sustainable innovations is consequently a key activity in order to move towards sustainable industrial growth.

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