

Chapter 16

Developing Sustainable Processes Through Knowledge Management

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ABSTRACT

Sustainable development of a process depends on a harmonious association of three sustainable pillars: Economy, Society, and Environment. Yet, in case of DMAIC (Define-Measure-Analyze-Improve-Control) process, the combination is challenged by inefficient management of knowledge resource in the process. The potential economy resource is not preserved and renewed, and therefore influents on sustainability of the process. In this article, the authors present and discuss sustainable aspects of a knowledge management model for DMAIC in which knowledge resource is accumulated and reused efficiently. In particular, the key concepts of sustainable development are reviewed, a process of knowledge management based on Ontology Engineering is presented, and sustainable criterial and measures for the proposed model are applied. The authors find that preserving and renewing knowledge is an indispensable process of sustainable development of DMAIC process.

INTRODUCTION

Sustainable Aspects in Product Development

In 1987, the term of “Sustainable Development” is used to refer a long-term development, and stated in a Brundtland report titled “Our Common Future” that: “Sustainable development is a development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland, 1987). This conception is useful for organizations and society in order to aim at a sustainable development. Sustainable development is represented as a deep transformation about how

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to utilize natural resources, choose investment criterions, propose advanced technologies applied, and change administrative mechanism that accord with current and future needs (Harris, 2000).

However, notion of Sustainable development is very neutral (Hallstedt S., 2008). It needs to be concretized into principles or measures for business and society. It is recognized that three essential factors impacting on sustainable development are Economy, Environment, and Society (Harris, 2000) (Aparna & Keren, 2007). Basing on the factors, several sustainable measures and criteria have been presented in literature. Ritzen Rofia proposes five proactive measures for integrating environmental aspects into product development. (Ritzen, 2000). Ansari *et al* have mentioned seven sustainable measures for knowledge management (Ansari, Holland, & Fathi, 2010). Harris have pointed out principles for sustainable development in the three essential aspects or pillars.

In particular, goods and services need to be continuously developed without damaging agricultural or industrial production. A resource base need to be retained stably by preventing over-exploitation of renewable resource system and eliminating non-renewable resource. Biodiversity, stability of atmospheric, and other ecosystem function must be maintained. Social equity, adequate provision of social services, gender equity, and political accountability and participation must be assured. More importantly, a harmonious combination of sustainable aspects of development would guide products towards a greener, clearer and more equitable growth (Bleischwitz, Giljum, Kuhndt, & Schmidt-Bleek, 2009), (Roblek, Meško, Bach, & Bertoneclj, 2014) (Wu & Hans-Dietrich, 2013). However, the combination (or a balance) is one of primary challenges for product designers.

To be honest, a product such as a physical artefact, software, service, process, or combination of these (Hallstedt S., 2008) has positive and negative impacts on environment and society during its life-cycle through the activities such as energy or material consumption for production and delivery, emission to land, water or air, resource exploitation, and use and elimination of products (Ritzen, 2000). Yet, in order to gain economic benefits, the conventional approach of product designers is only to meet preference of customers based on functions, efficiency, and aesthetic elements of products. Supplementing new elements such as environmental requirements may complicate designing processes and increase producing and management costs. Hence, the designers become embarrassed with considering the sustainable aspect of environment (such as resource usage) in the process of designing their products (Nambiar, 2010).

Besides, not all types of resource are exploited and managed effectively. Knowledge is one of typical examples. Although knowledge is a type of resource that plays a vital role in creating organizational value and competitive advantage (Wu & Hans-Dietrich, 2013), it is difficult to verify a process or identify or methods that assure the capture and reuse of that knowledge (Hallstedt, Anthony, & Pia, 2013). With quality improvement processes such as DMAIC, the problem can affect negatively its sustainable development.

Environmental Sustainability of DMAIC Process

In Six Sigma system, DMAIC (Define-Measure-Analysis-Improve-Control) (Park, 2003) is a problem-solving process. Its ultimate aim is to produce 99.9996% defect-free products, in order to improve business profits, and business excellence (Yang, 2005), (Pande, Neuman, & Cavanagh, 2000). DMAIC deployment creates a favourable environment for managers, working teams, suppliers and customers to communicate, discuss, and propose ideas and insights with each other (Wu & Chinho, 2009). Consequence, new knowledge can be created in discussions such as gate review sections (Stevens, 2006) (Kifor & Baral, 2013) and improvement solutions (Zou & Lee, 2010).

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