15th Global Conference on Sustainable Manufacturing

Social Sustainability in technologically-supported product realisation process

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Abstract

The social aspect of sustainable manufacturing is not as well addressed as the environmental and economical. This paper is an exploratory study to consider this neglected aspect of sustainability. One problem addressed in the paper is the lack of consensus on the several frameworks, methods and standards proposed for social sustainability (such as Social Life cycle Assessment, S-LCA). A coherent framework is proposed and used to evaluate the social sustainability impacts of technology support applied in the product lifecycle. Social effects on technical skill improvement/impairment, judgment and situational awareness are identified using the framework and how to evaluate these social effects are proposed. An interesting result is that social sustainability also leads to environmental sustainability (e.g. situational awareness leads to energy awareness) and economic sustainability. This may indicate that sustainability consideration may be more effective by starting from the social aspect-i.e. a socially responsible/sustainable product/system/service/lifecycle is necessarily environmentally and economically responsible as well.

1. Introduction

The environmental dimension of sustainability has been considered in great details. Methodologies such as Life Cycle Assessment, LCA and International standards (e.g. ISO 14000, ISO 50000, ISO 14955 series) have also been proposed. A wide range of academic research has been carried out, with interesting insights and consensus emerging. Also, there have been several attempts to disseminate these academic environmental sustainability results in industry

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[1]. However as identified by other researchers [2], the widespread adoption of results obtained from environmental sustainability research in industry and society seems to require the social dimension of sustainability. One reason for this is because these adoption depend on social factors such as sense of individual responsibility, sense of locus of control and human response to feedback on consequence of behaviour.

The importance of the social dimension has been mentioned with the environmental and economic pillars from the beginning of sustainability discourses. It is, however, only within the last 10 years that more detailed considerations have been given to the social dimension of sustainability. These detailed considerations of social sustainability have been in the form of guidelines and frameworks such as UNEP-SETAC guidelines [3] and Social Life Cycle Assessment, S-LCA frameworks. Contributions are being made to apply the existing social sustainability frameworks in various sectors [4]. There are also ongoing attempts to integrate social sustainability along with environmental and economic dimensions (e.g. Life Cycle Sustainability Assessment, LCSA= Environmental Life Cycle Assessment, E-LCA + Life Cycle Costing, LCC + Social Life Cycle Assessment, S-LCA).

Social sustainability is still at an exploratory stage and would need contributions from more researchers for issues that are being raised. Some of these issues include the need for theoretical underpinning, more rigorous methodology, better consensus on indicators, and ensuring emerging contributions do not result in fragmentation in the field. This paper is an attempt to make a contribution to this need in the field. From previous environmental sustainability research by the author [5], it was observed that human factors (e.g. skill dimensions like situational awareness) influences awareness to energy consumption, and technologically supported work appears to introduce a further layer of complexity to this problem. This paper is the result of an attempt to investigate this aspect of social sustainability.

1.1. Aim, research questions and structure of the paper

The specific research question considered in this paper is: How can we critically assess and improve the dimension of social sustainability relating to quality of work skill in the product realisation process, particularly looking at sub-dimensions such as task autonomy, task discretion, skill improvement/impairment and situational awareness? This question is addressed in the context of the other need in the field for theoretical grounding, rigorous research methodology and contribution towards a cohesive body of knowledge.

After presenting the literature review in section 2, the research methodology employed in this paper is considered in section 3. The research methodology is one of the contributions of the paper as there is a dearth of methodologies that combine social science methods with engineering. Section 4 then considers the set of investigations carried out to address the social sustainability issues in technologically supported product realisation process.

2. Review of the literature

A number of maxims, laws, philosophy, theory and models could be drawn on to underpin social sustainability. These include ancient laws and maxims, dating to 1000 of years, from different cultures such as Hammurabi's code, Moses laws and the concept of "human well-being" attributed to Aristotle [3, 6]. Theories and models which engineering practitioners and researchers could relate to include socio-technical theory [7], human-centred design work dating to the 1970s and more modern forms [8]. Even early works in manufacturing research such as F. W. Taylor's publications on scientific management and shop management considered social concepts such as encouraging employee participation, rest period, fair pay, well-paced work and correct working procedure.

International standards and guidelines relating to social sustainability have been proposed. These include UNEP/SETAC guidelines [3] and ISO 26000 on social responsibility. ISO 26000 is mentioned [9] as the first international standard with multi-stakeholder participation. This is expected to give it better legitimacy. It is however only a voluntary guideline, not used for certification or regulatory purposes.

Social sustainability indicators identified in the field come from a number of contributions on Social Life Cycle Assessment, S-LCA or Social Impact Assessment, SIA, research. The contributions such as the UNEP-SETAC