

Exploring Ergonomic Lens to Sustainable Design: A Literature Review

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ABSTRACT

Objective: The aim of this study is to provide a future direction for human factors/ergonomics (HFE) discipline and profession to deal with sustainable design problems. **Background:** The well distinguished fame of Sustainable Development (SD) among local and worldwide organizations and individual researchers have led the literature of sustainability to blossom. Majority but not all of the disciplines have developed their own perspectives or “lenses” to handle at SD problems (note in this paper terms sustainable development and sustainable design were used interchangeably). However human factor/ergonomics have been borrowing others perspectives on SD and seems like it does not have its own “lens”. **Method:** Academic papers, books and public internet sites were reviewed to explore different perspectives on sustainable design from various disciplines including HFE. **Results:** The literature shows that engineering design, politics and economics solve SD problems leaning onto their own tools and methods. HFE has a big potential and it is not fully exploited. **Conclusion:** One of the main reasons for the HFE to face challenges in setting its own direction is that it confronts the problems in the supply of high-quality applications. **Application:** The results of the publishing might help guide researchers from HFE to solve problems of sustainable design with their own tools.

Keywords: Human factors/Ergonomics (HFE), Sustainable Development, Sustainable Design

1. Introduction

Sustainable development has become a widely used term for novice and professional researchers and practitioners in various organizations in all over the world (Pezzoli, 1997). For the past two decades, planners and researchers from various disciplines have made enormous efforts to look at sustainable development problems with their own perspectives and provide better solutions to solve them. Meister (1999) in his book argued that human factors/ergonomics (HFE) is a subspecies of another discipline and considered to be an interdisciplinary field. Thus, for the interdisciplinary area it is more likely to borrow methods and concepts from other disciplines. The author mentions several disciplines that have made significant contributions to HFE, for example psychology, engineering, physiology and etc.

Throughout more than 50 years, human

factors/ergonomics has gained promising rigid body of knowledge in anthropometry, physical ergonomics cognitive ergonomics and etc., which can be used in SD. However HFE is not fully developed yet to address major business and social demands associated with work and product/service systems, because it is small comparing to well-recognized disciplines like engineering and psychology (J.Dul, et al 2012). This appears to make HFE researchers borrow tools and methods from other disciplines to look at SD. Some researches (e.g. Kazmierczak et al 2007) on SD in HFE are less distinctive from ones in Engineering Design field. They dealt with recycle, reuse and disassembly of car materials etc. which are the major concerns in Engineering Design. Some researches (e.g. Scott and Charteris, 2004) dealt with social and cultural issues while talking about HFE issues with SD, which seems not to be covered by HFE but by Industrial Design/Politics. Can HFE develop its own lens or

perspective to look at SD instead of borrowing them from other disciplines?

Human factors/ergonomics (HFE) already possesses enough potential to build its own lens looking at SD, regarding its big achievement and rigid body of knowledge.

This paper aims at providing a future direction of human factors/ergonomics (HFE) discipline and profession to look at sustainable development problems and search solutions in their own way with “Ergonomics Lens”.

2. Method

Academic papers discussing sustainable development and HFE domains were collected across disciplines. Additionally books and Pezzoli’s (1997) list of public internet sites dealing with sustainable development were reviewed. Once the data sources were found, the authors examined each article to explore different perspectives on sustainable design from various disciplines including HFE.

3. Results

3.1 Disciplines and their roles in sustainable design

Sustainable development is a broad study field where lots of disciplines are involved. Through paper review we explored more than fifteen major disciplines contributing to sustainable development; ten from Pezzoli’s research (1997) and the rest from various studies.

In this paper, due to (1) time limitation, (2) exclusion of disciplines that overlap with HFE, we will focus on mainly four (two areas related to HFE and the other two from totally unrelated to HFE) disciplines in SD:

1. Engineering
2. Industrial Design
3. Politics
4. Economics

The role of each disciplines and

their contribution towards sustainable development are explained in separate sections. The four disciplines and their direction areas contributing to SD are summarized in figure 1.

3.1.1 Sustainable development in Engineering

With its long and rich history, engineering has implemented various scientific theories to develop and analyze technological solutions to sustainable development problems. McIsaac and Morey (1998) studied about the need of engineering culture in sustainable development. They argued that engineers could play an important role in SD by means of developing more efficient and effective technology. Engineers play a positive role in designing and developing eco-friendly materials that preserve both energy and environment (Azapagic et. al. 2005).

The characteristics of engineering perspective on SD mainly lie in developing energy preserving and eco-friendly technology and materials. Such outcomes are achieved using traditional engineering tools.

3.1.2 Sustainable development in Industrial design

Belvis (2007) believes that product design provides big value to sustainable development by designing and creating products that can be easily recycled, reused and remanufactured.

Buchanan (1995) argued that design thinking, which the core of design discipline plays a great role when it comes to

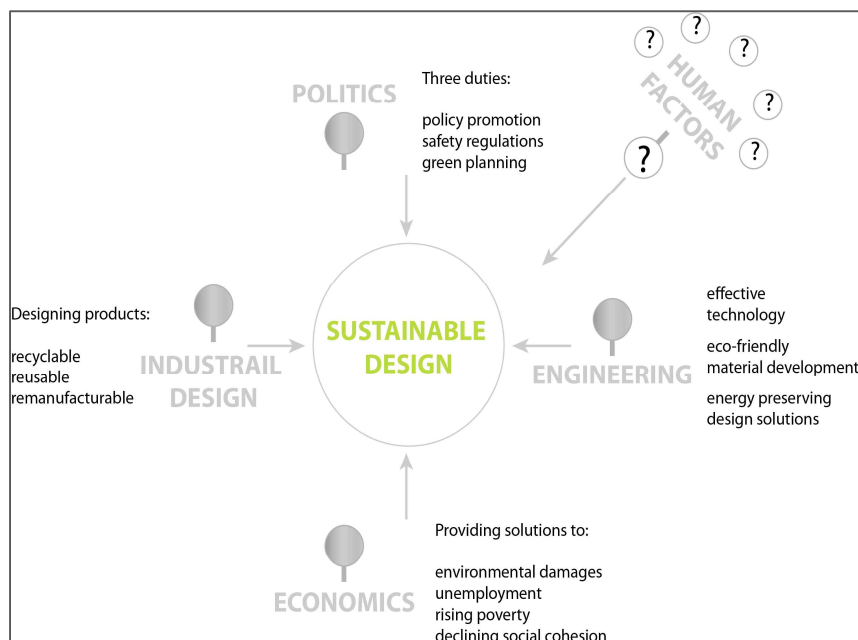


Figure 1. The disciplines and their contribution to sustainable

solve wicked sustainable design problems.

In contrast to engineering, industrial design views SD issues dealing with mode of usage which is creating products with recyclable, reusable and remanufacturable features.

3.1.3 Sustainable development in Politics

The political perspective of sustainable development was well presented by Lafferty et al. (2000). The authors argued that when solving sustainability problems politicians and government officials have three duties: promoting better policies run environmental safety regulations and developing the future green planning.

Like engineering and industrial design, politics seems to have its traditional approach in dealing with SD problems. They promote new policies and run safety regulations based on SD problems they face.

3.1.4 Sustainable development in Economics

According to Robertson (2000) the economics, in contrast to other disciplines/areas within SD, mainly focuses on effectively dealing with problems of environmental damages, unemployment, rising poverty and declining social cohesion. The author argues that economics in sustainable development mirrors the increasing sustainability demand for a people-centered and earth-centered economic development.

From the above information we can illustrate the “economic lens” at SD as a discipline that mainly concentrates on unemployment, poverty and social issues.

Based on the discussions about four disciplines’ perspectives on SD, we can conclude that each discipline looks at SD problems in its own perspective and provides solutions based on what it can do best comparing to others.

3.2 Resources of HFE to sustainable development

In the history of ergonomics, Jastrzebowski (1857) made the first attempt to define the ergonomics’ capabilities of contributing to sustainability. In his paper, published in the journal *Nature and Industry*, the author classified HFE into physical, aesthetic, rational and moral work, where each and every notion tries to improve things and people.

In 20th century, the contemporary ergonomics was

known as a discipline of applied science and technology ((Edholm and Murrell 1974). The HFE discipline develops a human-centered approach by considering social, organizational and environmental factors (Chapanis 1996, 1999, Salvendy 1997, Karwowski 2001, Vicente 2004).

Karwowski (2005) proposed ten distinguished features of human factors and ergonomics disciplines in the 21st century. He predicted that HFE would mainly focus on the design and management systems that satisfied various types of demands. Similar perspective can be seen in the view of International Ergonomics Association. Ergonomists contribute to the design and evaluation of environments and systems in order to fulfill the needs and demands of the society (IEA, 2003).

According to discussion above the HFE discipline mainly focuses on improving system effectiveness, productivity, safety and contribution to overall human well-being and quality of life. HFE contributes to the organizational environment a lot by improving sub-optimal systems quality, evaluating products’ efficiency and preventing human and system dissatisfaction.

Thus ergonomic lens to sustainable development should be equipped with notions of system effectiveness, productivity and safety, evaluating products’ efficiency and quality, while at the same time contributing to the human being and quality of life.

4. Conclusion

This paper aimed at providing a future direction of human factors/ergonomics (HFE) to deal with SD problems in its “ergonomic lens”.

The numbers of disciplines who possess their own perspective on SD issues and HFE’s specific methods and areas to target in SD are explored.

We saw that engineering, industrial design, politics and economics are looking at SD with their own tools, in contrast with HFE where other disciplines tools and methods are used to look at SD.

Through literature review, direction of ergonomic lens toward SD was proposed. That is HFE should mainly focus on evaluating the safety and efficiency of products and keep human-centered approach when solving SD problems.

The research will provide a value of guiding HFE

researchers to explore the “ergonomic way” of dealing with SD problems, rather than borrowing others perspective.

Due to the time limitation, the study only covered four areas and reviewed limited number of papers making the validity of the results poor.

Further investigations must be done to review bigger amount of paper draw concrete conclusion to support our argument.

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