

Book review

Whole System Design an Integrated Approach to Sustainable Engineering

Peter Stasinopoulos, Michael H. Smith, Karlson 'Charlie' Hargroves and Cheryl Desha. Earthscan, 2008, ISBN 978-1-84407-643-7, **£19.99, 208 pp.**

This book is developed very much as a higher educational resource, taking the reader through the reasoning behind and principles of whole system design (WSD) and illustrating these through a number of case studies.

Chapter one is considered (by these reviewers) to be the most readable part of the book, presenting a powerful argument for changing the approach to design. The need to 'critically evaluate efficiency and function' more than ever before in the face of environmental pressures seems to be the central reasoning to the WSD approach. It is argued that environmental impacts can be reduced with more consideration at the design phase through front-end loading (i.e. stronger emphasis on investment at this stage). It presents commonly held views about environmental performance improving competitiveness through improved productivity and reduced costs, and that decoupling economic growth from environmental pressure can be achieved through more holistic design.

This chapter also introduces the problem of specialisation and individual component optimisation within complex projects and suggests that, to improve performance, there is a strong need for overviews of the whole system. This point is illustrated by looking at the early engineering practice of the Victorian age, when individual engineers had a grip of the whole system and could make informed decisions based on more holistic knowledge. WSD for sustainability promotes an approach well beyond what many today see as best practice in not only reducing impacts on natural systems but also, more ambitiously, playing a restorative role. This is usefully illustrated through a case study on fabric production. This appears to be – on the face of it – too ambitious, but the essence of this approach is that all possibilities should be on the table at the start of a design process.

Chapter 1 also highlights a number of cases in which productivity and cost savings can be achieved. It is sometimes not clear whether these cases are using WSD approaches or something similar. The key issue is that – irrespective of the system name – the principle of a more holistic design process considering environmental impacts and

opportunities based on lateral thinking and system analysis has to be commended.

Chapter 2 places WSD alongside its predecessors of systems engineering. It is suggested that many of what are considered ecological design goals are not adequately geared towards systems thinking, hence the need for WSD. Descriptions of systems analysis provide useful insights, although the length of the section on natural systems (although very interesting) seemed a little out of place. This chapter is not succinct enough – the gems of Hitchin's list of systems engineering tenets and the inspiration of Commoner's 'technology can be a successful part of the earth's natural systems' provide as good a guide as anything. It is noted that social systems are only brought in at the latter stage of chapter 2. If this approach is proposed to be relevant to all designers – from architects to transport planners – this aspect should have been strongly stated earlier in the book.

The later chapters highlight the key aspects of WSD, including needs definition, research, streamlining and testing, through the basic structure of a design process. These sections are more abstract and seem to provide logical guidance for those who want to follow the detail (which at times is a little mind-numbing, to put it mildly!). The message here is that while the principles may be of help to a wide variety of practitioners, the prescriptive detail may be too onerous.

The detailed nature of the book seems more appropriate to traditional product engineering, although many of the simple principle lists could be of significant use to other professionals involved in design (e.g. the ten elements in chapter 3). However, for accessibility to other professions, these need tailoring to improve uptake.

In conclusion, the book's overall format provides easy reading and there is logic to the chapter structures. However, the strong message that this book is trying to convey could be lost in the volume of words. There appears to be considerable repetition of points in the indistinct chapter reviews that could be more powerfully discussed once rather than reworded. Chapter 2 does not seem to start until four pages in! The sections of educational aims could have just occupied a section at the beginning, providing a clearer succinct map of the book.

Whilst WSD appears to be geared towards engineering products, it was interesting to apply the concept to other areas such as the extensive delivery of structures within society that are possibly subject to more unpredictable influences. Perhaps a lesson for WSD is

therefore to consider not only retirement, but also how a system can be adapted with changing circumstances; this would be a considerable challenge in the typical fields highlighted, but nevertheless one worth considering. WSD is definitely promoting best practice within individual settings, for example the manufacture of a product. However, it does less to challenge the very essence of, say, why that product should be generated in the first place. So, for example, the production of a car may be carried out with all sustainability considerations taken into account but, in terms of the whole system of a city, is this the right choice for transport? It could be said that the scaling at which WSD is applied will, as it increases, throw up more challenging analysis and decisions.

Leadership needs to provide for integrative working and creative input to achieve these greater environmental gains both within and between organisations. These approaches are only as effective as the time allowed for their delivery. Like any complex system, particularly those embedded into something as complex as a city, ensuring a sustainable future will need more holistic approaches. It will also

depend on the rigour that is attached to environmental considerations and how much of a challenge it is to apply to a process within an economic context.

The principle of WSD is very logical if we are to deliver a more sustainable planet. The book provides a strong argument for a more considered approach to the design stage of projects, when so many of the decisions affect a project's performance and environmental impacts. The actual methodology presented did not necessarily immediately jump out as useful to these reviewers; however, this may prove not to be the case had its strengths been illustrated through application to a relevant project.

If this book can stimulate companies and groups of people from multiple disciplines to stand back, respect all views and consider new angles to problems, then it will have succeeded on a wider path of change.

Roger Nowell and Richard Ashley