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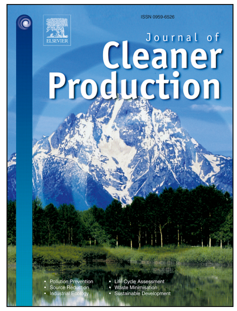

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A Framework for Design for Sustainable Future-Proofing

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Abstract

This paper presents an analytical design framework for sustainable future-proofing (DfSFP). The framework provides a systematic approach to deal sustainability and to address future requirements across the entire lifecycle of the system. Future-proof design is one way to obtain a design which defers obsolescence and extends the system's service life and generally includes additional elements in the current solution in order to accommodate future capabilities as projections of the future solutions required to meet those future requirements. However, not all long-life systems are sustainable. In the DfSFP process, future capability elements are integrated in the system capability model in such a way that the system is future-proofed and remains sustainable throughout the system lifecycle. We begin by examining the principles of future proofing and the principles of sustainable design and integrating them to obtain a set of sustainable future-proofing (SFP) design principles. The SFP principles address the entire system lifecycle and account for the impact on the system of additional future proofing elements. The impact is categorised in accordance with the system lifecycle and assessed using a rating system which has been developed to integrate future-proofing elements in the system ensuring overall system sustainability. In order to select the most-suitable design based on the principles developed in this work, a modified analytic hierarchy process is proposed. Finally, an illustrative example is presented where the proposed DfSFP methodology is used to design a house with sustainability and future-proofing requirements. It is shown that the framework provides a systematic analytical basis to assist the designer in addressing the future requirements.

1 Introduction

A system can be defined as a combination of interacting elements organized to achieve one or more stated purposes (ISO/IEC/IEEE15288, 2015)—that is, in the broadest sense, a system is something that provides a solution to a complex problem. Since the solution required is some form of operational capability, a system is often referred to as a capability system. Throughout the life of a system there are a number of phases and activities, each of which builds on the results of the preceding phase or activity—the sum all these activities is called a *system lifecycle*, which can be described using a model that represents the conceptualization of a need for the system, and for its realization, utilization, evolution, and disposal (ISO/IEC/IEEE15288, 2015).