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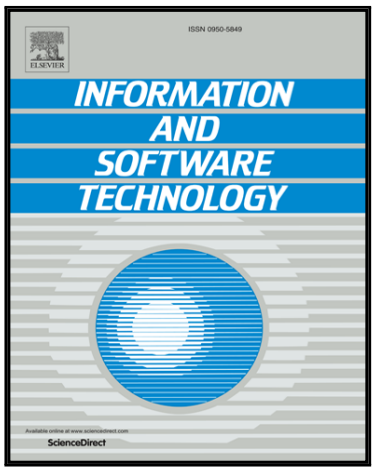

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Gabriel Alberto García-Mireles , Mª Ángeles Moraga , Félix García , Coral Calero , Mario Piattini

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Interactions between environmental sustainability goals and software product quality: a mapping study

Gabriel Alberto García-Mireles[1], Mª Ángeles Moraga[2], Félix García[2], Coral Calero[2] and Mario Piattini[2]

[1]Departamento de Matemáticas, Universidad de Sonora Blvd. Encinas y Rosales s/n col. Centro, 83000 Hermosillo, Sonora, México
mireles@mat.uson.mx

[2]Instituto de Tecnologías y Sistemas de Información, Universidad de Castilla-La Mancha, Paseo de la Universidad 4, 13071, Ciudad Real, España, Tel. +34 926295300
{MariaAngeles.Moraga, Felix.Garcia, Coral.Calero, Mario.Piattini}@uclm.es

Abstract

Context: Sustainability is considered as either a quality requirement or a quality characteristic that should be included in software when environmental protection concerns are being taken into account. However, addressing sustainability in software projects might have an impact on the quality of the software product delivered. Conflicting goals between sustainability and particular software product characteristics should be studied when developing application software, since achieving users' requirements can be a hindrance in the quest to meet sustainability goals.

Objective: This paper aims to provide an overview of the approaches found in the literature for dealing with interactions between software product quality and sustainability in the context of application software.

Method: A systematic mapping study is conducted to identify practices for managing interactions between software quality characteristics and sustainability. The selected papers are classified according to the quality characteristic considered and their influence on sustainability.

Results: Most of the 66 selected papers focused on validating current technologies concerning their support for sustainability (46%). The interaction between performance efficiency and energy efficiency is what is reported most and there is a fairly positive interaction. In addition, reliability and usability point to a positive interaction with energy efficiency, while security shows a conflicting interaction with energy efficiency. Functional suitability and maintainability can present both positive and negative interaction, with different goals derived from environmental sustainability.

Conclusions: Interactions between software quality and sustainability have been addressed within an explorative approach. There is a need for additional research work to characterize the impact of interaction on both software quality and sustainability. Furthermore, proposals should be validated in industrial settings.

Keywords: environmental sustainability, greenability, interaction, software product quality, ISO/IEC 25010.

1. Introduction

In recent years, software engineering has focused on developing sustainable software, which is defined as "software, whose impacts on economy, society, human beings, and environment that result from development, deployment and usage of the software are minimal and/or which have a positive effect on sustainable development" [1]. The impacts can be studied in three distinct scope levels [2]: direct (e.g. energy consumption), indirect (e.g. reducing energy consumption when supporting a business process), or rebound effect (e.g. optimizing energy efficiency of a product could have the effect of increasing its demand and therefore the overall energy consumption due to such product).

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