# How do Quality Requirements Contribute to Software Sustainability?<sup>\*</sup>

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Abstract. The concept of sustainable development has become an important objective of policy makers in the software industry. The most used definition of sustainability refers to dimensions of economic sustainability to ensure that software services can create economic value; technical sustainability that their technical assets actually enable the software services to cope with changes and evolution; environmental sustainability to avoid that software services harm the environment they operate in; and social sustain-ability to ensure software services provide fair exchange of information between par-ties [2]. According to Lago et al [1], "sustainability related requirements. In order to investigate which relevant requirements are related to sustainability concerns of service-based software systems and how they contribute to social and technical sustainability, we propose an online survey plan to be conducted during the REFSQ conference.

## 1 Research problem

The goal of the survey is to determine to which extent quality requirements contribute to the sustainability of service-based software systems with respect to social and technical sustainability dimensions; from the viewpoint of requirement engineering researchers and practitioners, in the context of volunteering REFSQ- conference participants willing to contribute to the definition of a software sustainability model. By means of the survey, we aim to provide a software sustainability model that can be

useful for supporting relevant activities of the services-based systems development process, such as quality requirements definition and negotiation, or quality assurance.

The following research questions are addressed: RQ1: to which extent can quality requirements contribute to the social and technical sustainability of software sys-

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tems?. RQ2: Is the Software Sustainability model perceived as useful for designing service-based applications?

#### 1.1 Population of interest and intended subjects

We plan for 30 participants as a minimum number of subjects to conduct the survey. As prior knowledge on service-oriented requirements engineering is required, PhD students, senior researchers and practitioners are very welcome. Prior knowledge on sustainability is not required.

# 2 Research design

## 2.1 Method and Plan

We plan to conduct a survey (online questionnaire) within the REFSQ conference. The survey will be designed based on the outcome of a first empirical study conducted from 08 December 2015 to January 2016. As it is shown in Figure 1, the main outcome is a first version of the sustainability model, which consists of four dimensions. For building the model with respect to technical and economical sustainability dimensions, we counted with subjects that have an expertise in the area of software architecture. Whereas for building the social and environmental sustainability model, subjects with skills on sustainability and working in IT Industry in the Netherlands were recruited from LinkedIn.



Fig. 1. Survey implementation process for improving the software sustainability model

It is important to remark that the first survey was designed with a double objective: i) identify the relevant software qualities that contribute to the four dimensions of software systems sustainability; and ii) determine the degree of inter-rater agreement when software qualities are related to each sustainability dimension. The instrument for the second survey, the one to be conducted at REFSQ, is organized in 5 parts. The demographic part consists of four close-questions, which will be formulated with respect to i) the sector of the current job (Academia, Industry, Government, Other), ii) domain where the practitioners have more experience (e.g. Telecommunications, Entertainment, Automotive), iii) number of years of working experience in the domain, and iv) and number of years of working experience in the requirements engineering area. The other two parts corresponds to questions related to the relevant quality requirements for each respective sustainability dimension. Table 1 shows the five parts of the survey as well as respective questions and scale type.

 Table 1. Questions and scale type of sustainability survey

Survey	Questions	Scale type
Introduction	General instructions	
Demographic part	2 closed questions	Nominal scale
	2 closed question (experience)	Ratio scale
Social sustainability	10 Closed questions	5 points-ordinal scale
Technical sustainability	15 Closed questions	5 points-ordinal scale
Perceived usefulness	2 Closed questions	5 points-Likert scale

A web-based questionnaire will be provided by means of a link, by using the Surveygizmo tool (http://www.surveygizmo.com/). It should be completed within 20minutes. The venues for publicizing the study to attract participants would be: the RE groups in LinkedIn and the social media channels of the conference. Moreover, in coordination with the REFSQ organizing chairs, attractive flyers would be distributed in the registration desks.

## 2.2 Benefits to the subjects

Given requirements are the key leverage point for practitioners (e.g. software architects) who want to design software systems with an acceptable sustainability level [1][3], we think that this survey might benefit to the participants by getting acquainted with the topic on software sustainability (in particular on quality requirements that contribute to the social and technical dimensions). Moreover, we will provide participants with a report on the survey results.

#### 2.3 Threats to validity

This section discusses the possible issues that threaten the validity of our study.

**a. Reliability of results** could be affected due to flaws in the instrument design. To detect this threat, we will conduct a reliability analysis on the survey with a pilot study performed prior to the REFSQ conference, within the Software and Services (S2) research group of the VU University Amsterdam.

b. There is a threat due to **heterogeneity of subjects**, which could bring greater variability in measures (e.g. participants' background). However, this heterogeneity would also contribute to the external validity of our study. In order to mitigate this threat to internal validity, we will include some demographic questions in order to interpret better our results according to the profile of our participants.

c. Another threat is that the perception of the participants on the usefulness of the sustainability model could be influenced by any subjective issue (e.g. colleagues of the article's authors). To mitigate this threat, the survey will be anonymous just to avoid feelings or biases.

#### 2.4 Evaluation of ethical aspects

With the purpose of facilitating that respondents may make an informed judgment about whether they wish to participate, we will provide a detailed description about the purpose, content and sponsorship of the survey. Moreover, confidentiality or anonymity will be also kept. The data will be collected and managed automatically by the Surveygizmo tool.

# **3** About the researchers

**Dr. Nelly Condori-Fernandez** is an Assistant professor at the VU University Amsterdam (The Netherlands). Her research interest includes software measurement, service-oriented requirements engineering, empirical software engineering, software testing, and social sustainability. She serves as reviewer in program committees of various international conferences (e.g. ESEM, REFSQ, EASE).

**Dr. Patricia Lago** is full professor at the VU University Amsterdam, leading the group on social and sustainable software and services. She is chair of the IEEE/IFIP WICSA Steering Committee, member of the IFIP 2.10 Working group on Software Architecture, the IFIP 2.14 Working group on Services-based Systems, and the Dutch Knowledge Network on Green Software. She is Area Editor Service Orientation of the Elsevier Journal of Systems and Software.

**Dr. Coral Calero** is professor at the University of Castilla-La Mancha in Spain and has a PhD in Computer Science. Her research interests include: software quality, software quality models, software measurement, Web and portal quality, data quality and software sustainability definition, evaluation, measurement and assessment.

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