Model-Driven Ethical, Social and Environmental Accounting

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ABSTRACT

Ethical, social and environmental accounting is the practice of assessing organisations' performances in sustainability and business ethics topics. The organisations typically publish the results in a sustainability or non-financial report. We aim at offering a novel perspective from which researchers investigate, practitioners apply and policy-makers regulate ethical, social and environmental accounting (ESEA). The large quantity of ESEA methods and tools causes managerial problems, affecting the identity of social enterprises and complicating policy making. We will develop a domain-specific modelling language to specify existing ESEA methods and capture the advantages of model-driven engineering. We will create a repository where method models can be stored. These models contain the data structure and configuration of the methods. We will also develop openESEA, a run-time model interpreter that automatically executes ESEA method models. We will offer features to allow organisations to tailor the methods to their needs, to support model management operations, and to compare existing methods to inform policy makers about their similarities and differences. This project combines expertise in information science and social entrepreneurship with the intention to pave the way to future research avenues in ESEA and, eventually, to profound changes towards a fair and sustainable economy.

CCS CONCEPTS

• **Information systems → Information systems applications**; *Collaborative and social computing systems and tools*; Open source software.

KEYWORDS

Model-driven engineering, domain-specific language, method engineering, ethical, social and environmental accounting, social entrepreneurship

ACM Reference Format:
Vijanti Ramautar. 2020. Model-Driven Ethical, Social and Environmental Accounting. In *7th International Conference on ICT for Sustainability (ICT4S2020), June 21–26, 2020, Bristol, United Kingdom.* ACM, New York, NY, USA, 4 pages. https://doi.org/10.1145/nnnnnnn.nnnnnnn

ICT4S'20, June, 2020, Bristol, UK

ACM ISBN 978-x-xxxx-xxxx-x/YY/MM…$15.00
https://doi.org/10.1145/nnnnnnn.nnnnnnn

1 SITUATIONAL SKETCH

This research is executed in the Organisation and Information research group within the department of Information and Computing Sciences at Utrecht University in the Netherlands. The university's doctoral programme has a total duration of five years, based on 40 working hours per week. Every year the PhD student has to dedicate 30% of their time on teaching obligations and 70% of the time is dedicated to research. This doctoral research started on December 1st 2019, thus this is the first year of study.

2 INTRODUCTION

Ethical, social and environmental accounting (ESEA) methods can be applied for systematically measuring the sustainability performance of organisations. These methods allow organisations to assess their current situation by means of scoring sustainability and business ethics topics (e.g. worker satisfaction, governance structure, energy efficiency).

After the accounting, potential improvements and ideas for action can be defined which can be implemented in an organisational re-engineering phase. The accounting is typically repeated over a set period of time to assess the situation after the ideas for action have been implemented. An accounting typically results in a sustainability report.

Sometimes organisation apply more than one ESEA method. There are many reasons why organisations might be willing to apply multiple methods. For instance, to become part of social markets or to use the official label of a network, such as the United Nations Global Compact label [5, 10].

2.1 Background

In this research we define ethical, social and environmental accounting as the process of assessing and reporting the ethical, social and environmental effects of an organisation's actions to particular interest groups and to society as a whole [9]. For defining the difference between ethical, social and environmental accounting and ethical, social and environmental auditing we adopted the definitions stated by Gray [9].

Accounting is the practice of preparing and often publishing an account about an organisation's social, environmental and other stakeholder's interactions and activities. Where possible, the consequences of those interactions and activities are included in account as well [9]. The results from the accounting are captured in a report. Auditing we define as the attestation to some characteristic(s) of a report [9].

For guiding the process of preparing and publishing the accounting results, networks of responsible enterprises have created ESEA methods (e.g. B Impact Assessment, ISO14001, GRI Standards, UN Global Compact). There is a large quantity of these methods [7].

In this paper we explain the B Impact Assessment in detail, to serve as an example. The B Impact Assessment consists of categories (e.g. governance, workers, consumers and environment). Each category has indicators (e.g. gender equity, water preservation practices, health, wellness and safety measures). Organisations report on these indicators by answering questions. Based on these questions a total score is calculated. If a minimum score is obtained the organisation can become certified. Note that not every method quantifies the assessment by means of a score. In some cases reporting on the indicators is sufficient and no scores will be assigned. Likewise, not all methods issue certification. In the B Impact Assessment the set of indicators is predefined and cannot be extended. In some methods the set of indicators has to be defined by the organisation that applies the method. In that case, the relevant indicators usually result from a materiality assessment.

2.2 Problem statement

To perform an ethical social and environmental accounting, organisations can use information communication technology (ICT) tool support. The methods and ICT tools are often tightly coupled. This means that the tools are developed for one specific ESEA method and therefore only support one method. The online B Impact Assessment tool, for instance, can only support the B Impact Assessment accounting method. In earlier research we discovered that many tools cannot be extended with additional topics or additional methods. A reason why organisations might be willing to extend the tool with additional indicators is so they can assess sector industry specific indicators (e.g. the CO_2 emission associated with import). A versatile tool could solve this limitation of current tool support.

Another reason for the development of a versatile tool could be to avoid redundancy. When organisations apply more than one method they might have to enter the same data in multiple ICT tools (e.g. the number of employees, the annual energy consumption or the average employee satisfaction). This increases the barrier for applying multiple methods. An example of overlapping activities is shown in Figure 1.

Additionally in the domain of ESEA there is a lack of transparency. There is no overview of what each method entails in comparison to other methods. Therefore, organisations might lack the information to choose a method that fits their situation best.

The final issue we hope to resolve is the lack of benchmarking. Since there is no comparison between methods, the results from one accounting cannot be benchmarked against the results from another accounting.

3 RESEARCH OBJECTIVES AND QUESTIONS

The research objective is to offer a novel perspective from which researchers investigate, practitioners apply and policy-makers regulate ethical, social and environmental accounting.

The goal in this project is to apply model-driven engineering to solve problems related to the variability in ethical, social and environmental accounting methods. It is intended to alleviate problems related to the transparency and comparability of methods. A model-driven approach should eliminate redundancy and save time when applying multiple methods. We chose for a model-driven approach because (i) it allows organisations to create their own

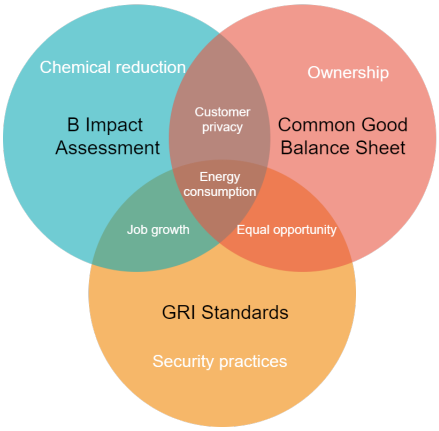

Figure 1: An example of overlapping topics

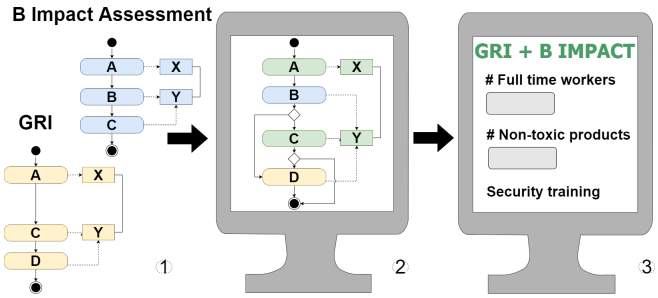

Figure 2: A simplified overview of modelling and storing (1), merging (2) and executing (3) ESEA methods

method models for internal use, (ii) networks can create method models and request their members to assess their performance using these methods (iii) organisations can combine method models to assess their performance based on multiple ESEA methods, without redundancy, (iiii) organisations can extend a method model with additional categories and indicators. The tool allows users to select or create models, these are then merged and finally executed. A simplified overview of how the tool should interpret method models is shown in Figure 2.

We will create an open-source software tool that can in principle support all ESEA methods. A proof of concept of this tool was already created during earlier research [7]. We will extend this proof of concept with additional functionalities. Moreover, we execute this research in collaboration with the Fair Trade Software Foundation (FTSF). The doctoral research provides the knowledge necessary to engineer the model-driven tool and the FTSF assures that it can be used in practice. We deliver proof of concepts that demonstrate that implementing a certain idea or technology is possible. The current proof of concept has a Technology Readiness Level (TRL) of 4. Since the doctoral research and the tool development by the FTSF will be executed in parallel we expect to deliver a software tool with, at least, TRL 7 by the end of this research.

To realise our objectives seven research question must be answered, these can be found below.

RQ1 What are current problems that are preventing the adoption of ESEA methods, hindering their application, or complicating the use of their results? We will investigate the problematic phenomena experienced by organisations and practitioners in this domain. We will deepen into the nature of the information they need to conduct their work and the extent to which current methods and tools are able to produce that information.

RQ2 How can model-driven engineering alleviate or solve a subset of such problems? We will develop a domain-specific modelling language to allow specifying existing ESEA methods and create a repository of method specifications. We will also develop an open-source online tool offering features to the different stakeholder groups. Certain issues cannot be alleviated using model-driven engineering, therefore we aim to solve a subset of the discovered problems.

RQ3 How can we compare ESEA methods and manage variability within and between the methods? So far we have identified two types of variability. When an ESEA methods has multiple versions, variability within one method exists. The second type of variability we distinguish focuses on the the differences and similarities between different ESEA methods. When modelling ESEA methods we discovered several levels at which variability can exist. The process, data structures, instances and roles can all vary. The modelling language should allow variability management on all level. This allows the model interpreter to merge methods. Existing situational method engineering solution that fit this need will be adapted.

RQ4 Which modelling languages of ESEA methods fits the research best? We will discover, create or extend a modelling language that is executable, allows human comprehension and enhances usability. Ideally users would be able to create their own methods or combine methods by selecting method fragments from a repository of models.

RQ5 How can the decision-making process of a set of ESEA methods be improved? We expect the decision-making process to differ per stakeholder group. We aim to investigate the factors that determine the current decision-making process per stakeholder group and we aim to discover possibilities for improving the process using model-driven engineering. We will discover which factors influence and determine the current decision-making process and analyse principles, concepts, and theories that enable improvements in decision-making. Based on this we can discover how adequate ICT support can improve the decision-making process. For this we will configure Farshidi et al.'s Decision Support System (DSS) [8].

RQ6 How can the contributions by this research be generalised to other domains? We will create a modelling language and model-driven tool that allows for the comparison and execution of methods. In this research we use ESEA methods. In principle every domain with the same method structure could use the same platform and approach. We will investigate the benefits of applying our contributions to other domains and determine how we can make broader contributions to information science and/or business informatics.

4 RESEARCH APPROACH

For this research we use the design science paradigm. We will apply an overarching engineering cycle and nesting empirical cycles when needed [16]. Design science consists of three phases, the problem investigation, treatment design and treatment validation. During the problem investigation a literature review is performed. From the literature review a conceptual framework is derived. This allows us to better understand the ESEA domain. We are interested in analysing ESEA methods and tools by modelling the methods and tools. The models enable mapping the similarities and differences between ESEA methods. The models are created using Process Deliverable Diagrams (PDDs) [15], since it allows us to link data structures to activities and it shows us which role can execute a certain activity. ESEA tool analyses are performed by modelling the tool's functionalities, applying Feature Modelling [1], by evaluating the usability using heuristics evaluations [13] and by examining the architecture by creating UML Component Diagrams [14]. When investigating ESEA method application under conditions of practice, we are interested in analysing the ESEA-related problems at three levels: organisational, network and institutional. For this purpose, we will perform observational case studies exploring the impact of the variability of ESEA methods and tools at these levels. At the organisational level, the unit of analysis will be non-profit and for-profit social enterprises adopting or applying ESEA practices. At the network level, the unit of analysis will be networks of social enterprises that certify their members using an ESEA method. Examples of such networks are B Corporations, Economy for the Common Good, the Spanish Network of Networks of Alternative and Solidarity Economy (REAS RdR), and the Fair Trade Software Foundation network. We will interview founders and managerial staff, and we will review statutes and other relevant documentation. At the governmental level, the unit of analysis will be policy-making initiatives related to social enterprise legal recognition (e.g. Social Enterprise NL, a foundation lobbying the Dutch government to enact laws in this area) and ethical public procurement. Interviews and legal document reviews will be the main research methods. The results of the case studies will be analysed individually and jointly, with the aim of developing a theory on the factors influencing the existence of ESEA method variability, as well as the problems that variability entails.

During the treatment design the model-driven engineering paradigm is applied [4]. A domain-specific language (DSL) will be applied [6] that allows modelling ESEA methods. Earlier versions of this language will be textual, specified with Extended Backus Naur Form grammars [11] and implemented in the Xtext Eclipse environment [3]. Later versions will integrate graphical modelling, in order to increase the usability of the language. We will also design a tool capable of interpreting the ESEA method models in run-time. Some features we intend to implement are a repository of ESEA method models, the automatic execution of ESEA method models, model management operations (e.g. match, merge, difference) [2], variability management operations (definition of variability points to define method variants, design- and run-time resolution or variability), surveys to collect data from stakeholder groups (e.g. to

assess employee satisfaction), and automatic generation of infographics showing the results of an ESEA process. We will refer to our proposal as openESEA.

We will validate the openESEA language and tool in several iterations. First we start demonstrating its capabilities in a laboratory setting, assessing the extent to which it can model and interpret the ESEA methods that we have analysed during the first phase. Then we evaluate the effectiveness and efficiency of openESEA by means of an experiment in which the subjects have to model a small ESEA method and then apply model operations; as an empirical research framework we will use the Method Evaluation Model [12], which allows us to also investigate the perceptions of the subjects on the method and their intention to use it in the future. To scale up to real conditions of practice we conduct technical action research; by applying openESEA to a real network of organisations (most likely, the Fair Trade Software Foundation, who plan to use openESEA to support their certification method). When possible, we will also approach other networks for similar studies and, to the extent that this becomes viable, also governmental institutions.

5 RESULTS TO DATE AND THEIR VALIDITY

We wrote a paper on ESEA method pain points and tool support limitations, which has been accepted by The Seventh ISBEE World Congress. This paper highlights the need for a versatile ICT tool for supporting ESEA methods. Furthermore some ESEA method have already been modelled using the process deliverable diagram (PDD) modelling language [15]. These artefacts are currently being validated by master students. The Fair Trade Software Foundation is in the process of recreating the current openESEA proof of concept. We are in the process of developing a roadmap,

At the moment, we are working on a paper on decision-making. For this we identify features that allow us to compare methods. The features are validated by means of expert interviews. The features are then used to configure Farshidi et al.'s Decision Support System [8]. The DSS configuration is validated with experts. We expect it will provide us with insights on the decision-making process in the ESEA domain. We aspire that it this will lead to more awareness and a better match between the wishes and needs of organisations willing to assess their sustainability performance and the available options. Another opportunity arose which led to us writing a book chapter on fair trade practices in software development.

6 CONTRIBUTIONS

We expect to contribute to the domain of information science, as well as to the social sciences domain. For the information science domain we expect to contribute to:

- Model-driven software development (e.g. by discovering a solution for interpreting graphical models and managing these model).
- Method engineering and variability management (e.g. by discovering new approached to model and manage method variability on all levels)
- Management of information systems (e.g. by applying new knowledge on how ESEA software tools are embedded in the current landscape of information systems).

The social sciences domain can benefit from:

- A better understanding on the similarities and differences of ESEA methods and tools.
- The rationale behind the existence of the abundance of ESEA methods.
- Insights in the decision-making process of practitioners regarding ESEA method selection.

The technology resulting from this thesis, openESEA, will be open source. Social enterprises will have a tool to assess their ethical, social and environmental performance. Innovative features of our technology can later be adopted by other ESEA tools in the market and organisations may be able to find an ESEA method that better suits their needs. Applying multiple ESEA methods will become less time consuming, hopefully lowering the barrier. The decreased effort for applying additional ESEA methods may result in organisations assessing more indicators, thus discovering more potential improvement points. In the long run smaller networks with very similar ESEA methods might merge their methods or offer combined memberships or certification, which can decrease the diversity in ESEA methods.

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