Towards Maintainability Prediction for Relational Database-Driven Software Applications: Evidence from Software Practitioners

Mehwish Riaz, Emilia Mendes, and Ewan Tempero

Department of Computer Science,
The University of Auckland, New Zealand
mria007@aucklanduni.ac.nz,
{emilia,e.tempero}@cs.auckland.ac.nz

Abstract. The accurate maintainability prediction of relational database-driven software applications can improve the project management for these applications, thus benefitting software organisations. This paper presents an up-to-date account of the state of practice in maintainability prediction for relational database-driven software applications. Twelve semi-structured interviews were conducted with software professionals. The results provide both an account of the current state of practice in that area and a list of potential maintainability predictors for relational database-driven software applications.

Keywords: Maintainability, Relational Database-Driven Software, Prediction.

1 Introduction

Software maintainability is defined as “the ease with which a software system or component can be modified to correct faults, improve performance or other attributes, or adapt to a changed environment” [5]. Intrinsically associated with it is the process of software maintenance [15], which has long been known to consume the majority of the cost of a Software Development Life Cycle (SDLC) [1]. Software maintainability can significantly impact software costs [15]; therefore it is imperative to understand software maintainability in order to control and improve it.

In order to improve software maintainability, it is important to understand the factors that impact upon it and how they can be measured and used to predict it. A maintainability prediction model can enable organizations to make informed decisions about managing their maintenance resources and in adopting a defensive design [14].

Database-driven applications consist of a database, a database management system, and a set of applications that interact with the database through this management system [9]. When software requirements change, these applications undergo maintenance resulting in storing an increased number of data sources and relationships [11], leading to increased complexity of the database schema and coupling between the database and application [11]. Hence, both application-specific and database-specific features impact the maintainability of these applications.
Database-driven applications have gained substantial importance in the modern software development [2] and anecdotal evidence suggests that most commonly used databases are relational [4]. Due to the importance of relational database-driven applications within the scope of modern software development, it is imperative to be able to measure and forecast their maintainability. There is, however, little evidence in the literature relating to the maintainability of these types of applications [2]. The aim of this research is, therefore, to use evidence from industrial practice in order to help improve the field of maintainability prediction for relational database-driven applications. The evidence has been gathered from 12 interviews with software practitioners (six each from Pakistani and New Zealand organizations). This paper also extends the work in Riaz et al. [16] by combining their results with data obtained from six additional interviews conducted with software professionals in New Zealand.

The remaining of this paper is organised as follows. Section 2 presents the background, Section 3 details the research methodology, Section 4 gives results, and Section 5 discusses the results followed by conclusions and future work in Section 6.

2 Background

The research described herein was informed by the results of a Systematic Review (SR) on the topic ‘software maintainability prediction and metrics’ [15]. The results of the SR revealed very little evidence on software maintainability prediction. For detailed results of the SR, refer to Riaz et al. [15]. The 15 studies selected by the SR [15] were further analyzed to assess if the datasets used in these studies completely or partially comprised relational database-driven software applications. Only three of these studies [3, 6, 7] had used relational database-driven software applications where only one [6] presented a maintainability prediction model but did not provide its prediction accuracy; the other two presented measures [3] and factors [7] impacting software maintainability. None of these studies proposed predictors or factors related specifically to a back-end database or to the interaction between a back-end database and the front-end application.

In addition to the SR above mentioned, a complementary literature review was carried out focusing on the topic of relational databases, details can be found in Riaz et al [16], which suggested that there was no evidence on maintainability metrics or prediction for relational databases or relational database schema.

The lack of existing literature focusing specifically on maintainability prediction for relational database-driven software applications prompted us to carry out an investigation with software practitioners in order to gather data on relational database-driven applications maintainability predictors and metrics used in practice.

3 Research Methodology

The research methodology used herein was mainly qualitative in nature and is detailed in the subsequent sub-sections.