3 Web Productivity Measurement and Benchmarking

Emilia Mendes, Barbara Kitchenham

Abstract: Project managers use software productivity measures to assess software development efficiency. Productivity is commonly measured as the ratio of output to input. Within the context of software development, output is often assumed to be product size and input to be effort. However, Web applications are often characterised using several different size measures and there is no standard model for aggregating those measures into a single size measure. This makes it difficult to measure Web application productivity.

In this chapter, we present a productivity measurement method, which allows for the use of different size measures. An advantage of the method is that it has a built-in interpretation scale. It ensures that each project has an expected productivity value of one. Values between zero and one indicate lower than expected productivity; values greater than one indicate higher than expected productivity. We demonstrate how to use the method by analysing the productivity of Web projects from the Tukutuku database.

Keywords: Web productivity measurement, Productivity measure, Manual stepwise regression, Size-based effort model, Data analysis.

3.1 Introduction

Productivity is commonly measured as the ratio of output to input. The more output per unit of input, the more productive a project is assumed to be. Within the context of software development the output of the software production process is often taken to be product size and the input to the process to be effort. Therefore, productivity is represented by the following equation:

\[ \text{Productivity} = \frac{\text{Size}}{\text{Effort}} \]  

Equation 3.1 is simple to apply when product size is represented by a single dominant size measure (e.g. product size measured in lines of code or function points). However, there are circumstances when there are several different effort-related size measures and there is no standard model for aggregating these measures. When we have more than one size measure related to effort and no theoretical model for aggregating those measures, it is difficult to construct a single size measure. In these circumstances,
Eq. 3.1 cannot be used to measure productivity. This is exactly the problem we face when attempting to measure Web application productivity. The majority of studies published in the Web sizing literature have identified the need to use a variety of different measures to adequately characterise the size of a Web application, but there is no widely accepted method for aggregating the measures into a single size measure.

In this chapter we describe a case study that analyses the productivity of 87 Web projects from the Tukutuku database. This is the same subset of projects used in Chap. 2. We adopt the productivity measurement method suggested in Kitchenham and Mendes [2], which allows for the use of several effort-related size measures, and also provides a productivity baseline of one. Thus, productivity values between zero and one indicate lower than expected productivity, values greater than one indicate higher than expected productivity.

Section 3.2 presents the method used to build the productivity measure and the assumptions underlying the productivity measure. The results of our productivity analysis using the new productivity measurement method are described in Sect. 3.3, followed by our conclusions in Sect. 3.4.

3.2 Productivity Measurement Method

The productivity measurement method employed in this chapter allows for the use of multiple effort-related size measures. It is based on the idea that any size-based effort estimation model constructed using the stepwise regression technique is by definition a function of effort-related size measures. Thus the size-based effort estimation model can be regarded as an AdjustedSize measure, and used in the following equation to represent productivity [2]:

\[
\text{Productivity} = \frac{\text{AdjustedSize}}{\text{Effort}}
\]  \hspace{1cm} (3.2)

The AdjustedSize measure contains only size measures that together are strongly associated with effort. In addition, the relationship between these size measures and effort does not need to be linear.

The benefits of using this method for measuring productivity are as follows [2]:

- The standard value of productivity is one, since it is obtained using the ratio of estimated to actual effort.
- A productivity value greater than one suggests above-average productivity.
- A productivity value smaller than one suggests below-average productivity.