

WHITEPAPER FRONTENDART



COST OF SOFTWARE DEVELOPMENT

Willing to know how much software
development will cost you?

Estimating development costs could be a problematic task. There are a huge number of details that should be taken into account for the calculation, the most important of which probably being the maintainability of the source code. It is axiomatic that maintainability has an immediate effect on development cost, because the less maintainable the software system is, the more expense is needed to develop it.

It should now be clear how maintainability is a necessary component of cost estimation and a generally important software quality characteristic as well. But how is maintainability calculated in the first place and what is its direct relation to development costs? Software quality models typically calculate the maintainability value from low-level source code attributes (or metrics) and cost estimation is calculated using linear regression. But are these methods adequate for an accurate estimation of the expected development cost?



The problem with linear regression estimation is that being linear, it doesn't take the maintainability decay into account at all, despite Lehman's laws clearly stating that the maintainability of a software system under evolution continuously decreases over time. In case of an enormous software system, and especially during a bigger maintenance, refactoring or development task, the aforementioned maintainability decay may render the result of a linear cost estimation totally useless.

A research of the Department of Software Engineering, University of Szeged around the connection of software maintainability and development cost evinced proof that the developed quality model calculating with the constant source code deterioration (maintainability decrease) can make future development cost estimates with an impressively high accuracy compared to the linear regression method.

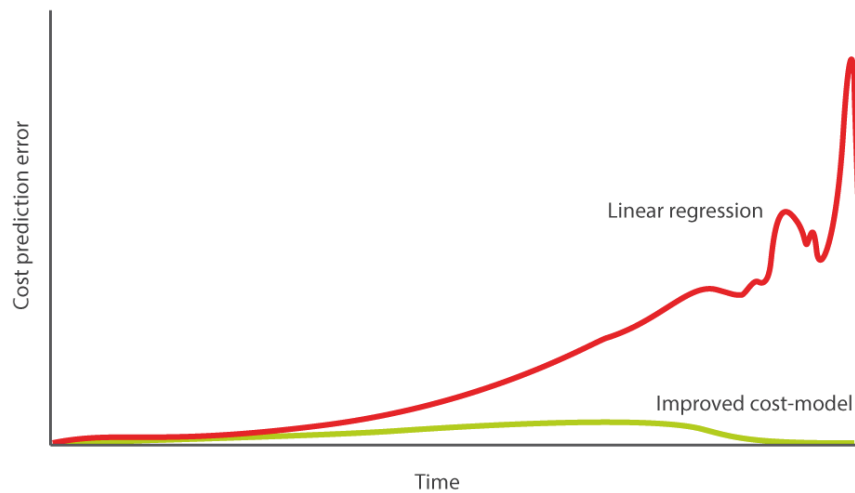


Illustration: Prediction error in one of the five examined software system

The research examined more than 4400 source code revisions (dated between 2000 and 2011) of five different software systems. Our sophisticated quality model could estimate the development costs of these software projects with an average accuracy of 96%. The cost prediction error over time compared to the error of the widely used, but far less precise linear prediction can be viewed on the Illustration above. It is clearly visible that the linear prediction has an exponentially growing error rate. This seems to be the effect of the exponentially deteriorating maintainability of the software project during its evolution phase. The results confirm that the linear prediction technique is less suitable for cost prediction because of the lack of calculating with aforementioned maintainability decay.¹

The research shows that the reviewed software quality model is able to predict future development costs based on estimated change rate of the code, with high accuracy.

¹ <http://www.computer.org/csdl/proceedings/icsm/2012/2313/00/06405288-abs.html>