UTS UNIVERSITY OF TECHNOLOGY SYDNEY

How do Colombian software companies evaluate software product quality?

by Wilder Perdomo-Charry

Thesis submitted in fulfilment of the requirements for the degree of

Doctor of Philosophy

under the supervision of Associate Professor Julia Prior and Adjunct Professor John Leaney

University of Technology Sydney
Faculty of Engineering and Information Technology

February 2020

AUTHOR'S DECLARATION

I, *Wilder Perdomo-Charry* declare that this thesis, is submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the *School of Computer Science*, *Faculty of Engineering and Information Technology* at the University of Technology Sydney.

This thesis is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

This document has not been submitted for qualifications at any other academic institution.

This research is supported by Colfuturo Colombia and University of Technology Sydney.

This research is supported by the Australian Government Research Training Program.

Production Note:

SIGNATURE: Signature removed prior to publication.

[Wilder Perdomo-Charry]

DATE: 12th February, 2020

PLACE: Sydney, Australia

Abstract

Software developers confuse product quality with process quality, leading them to think they are measuring product quality when they are not. This is the main finding of this study of software developers in young small to medium companies in Colombia.

Software product quality reflects two perspectives: conformance to specifications, and satisfying expectations when it is used under specified conditions. Measuring product quality still remains a problem for software development companies in relation to factors such as cost, effort, time and competitiveness. There are few studies that show the current state of software product quality in companies, how companies evaluate product quality, and which measures they use to develop and launch products that meet high-quality criteria.

This research presents a study of software product quality in seven young software development companies in a developing country. The candidate used a qualitative research approach to understand, through their experiences and knowledge, how 20 employees—developers, testers, and project managers—and their companies evaluate software product quality, and which measures they apply in their companies.

The results demonstrate that software process quality is better understood, and applied, by these software companies than software product quality. A greater difficulty is that most study participants 'overlaid' the idea of product quality with process quality, i.e. they talked about product quality as if it were process quality. This confusion leads them to think that they are measuring product quality when they are not.

These findings have implications for companies that wish to increase competitiveness and productivity as they must develop a working knowledge of software product quality that is not confused with software process quality. It also has implications for educators, to ensure that the distinction between process and product quality is explicitly taught.

Dedication

To God who is present in every place, moment and circumstance, and who always accompanies me on the path of life. To my mother, my father (rip), and Maria my wife, who are proof of love, persistence, and family union. Fundamental criteria to achieve a goal.

Wilder Perdomo...

ACKNOWLEDGMENTS

Completion of this doctoral thesis would not have been possible without a number of people whom I would like to acknowledge and thank for their support, advice, and encouragement.

Firstly, an enormous thank you to the participant developers, testers, and project managers from the seven software development companies in Colombia who so generously allowed me to know their experiences in the companies. The CEO from each company gave exceptional help and was present during our contact with good enthusiasm and interest in this research, giving me access to whomever and whatever I deemed necessary to understand and carry out my fieldwork. I am extremely grateful to them all. I trust that the stories of their work experiences in this Phenomenological research and the findings of the research will make them proud to have played such a crucial part in the development of this project.

I also want to thank to Fedesoft (Federación Colombiana de la Industria de Software), Procolombia, and MinTIC (Ministerio de las Tecnologías de la Información y la Comunicación) in Colombia for allowing me to introduce my research and to be open to help me carry out my fieldwork with some Clusters and companies from different Colombian cities.

My UTS supervisor, Julia Prior who believed in me and recognised my research capabilities to develop this research and help me out to execute this journey. We know that this journey has had its up and down situations, but she was a good advisor in each step of my thesis. I would like to thank her for challenging me to think about epistemologies and research methodologies, interview techniques, reflection, software development in practice, software product quality, and a host of other disciplines. Her support and enthusiasm for my work never faltered. Most of all I would like to thank her for being able to readily understand my goal.

My mentor and UTS co-supervisor, John Leaney, was essential in this journey, as his experience and rigour in the research were vital for developing my project. I would like to thank him for challenging me to think critically, focusing on my topic and how my contributions can help Colombia and the young software development companies. John is the type of supervisor who is dedicated, responsible, enthusiastic, generous, and with enough knowledge to share in areas related to software development and software quality. I am glad to find people like him who always keep an eye on my research and on

the clear cohesion of my problem with the research method, data analysis, and findings.

I have the honour to have been supervised in this research by two great people. Julia and John showed me alternative approaches to research in general, and software engineering practice in particular, two great aspects I had not previously experienced or had not realised were scholarly options. They were dedicated and engaged with me and my research topic with the best practice to advice PhD students from both professional and personal aspects. Thank you both for your commitment and belief in me.

I was privileged to share the joys and despairs of the PhD journey with my dear friends Muhammad Awais Bajwa and Avirup Dasgupta. We travelled this journey together over some years, although in different types of research. Muhammad's encouragement and advice helped me over many a hump in the road and Avirup and I debated software development topics and methodologies to apply in our studies. In particular, they helped me work through new ways of thinking about knowledge and our understanding of the world. I thank you all.

I also thank other members of UTS and friends for contributing to and being part of this research journey. I thank Marie Manidis for her role as my mentor during my hard days at UTS, her encouragement and advice helped me over many a hump in the road. MaryAnn McDonald from UTS:HELPS and Wendy Boynton from ABC News who believed in my English skills and helped me to improve those skills to increase my knowledge and understanding in this journey. Tom McBride for his role as my acting supervisor at the beginning of my candidature particularly, but also for his advice and determination. I would like to thank Jing Zhao from Graduate Research School (GRS) who listened to me when I was up and down and especially for her advice during my scholarship process. Thanks a lot to Carol Charman for your tremendous help during the reviewing of my thesis; she was incredible at checking my English and editing my draft and final thesis document. My dear friends, Nick, Asma, Tazin, Felipe, Luke, Wang, Federico, Kamal, Durga, Carlos, Suman, Gautum, Joanne, and James who helped me in different emotional, personal, and professional ways to focus my efforts on this PhD journey. Thank you all.

I want to thank to my principal sponsor, COLFUTURO Colombia (Fundación para el Futuro de Colombia) who award me a Doctoral Research Scholarship to do my PhD studies in Sydney and gave me the opportunity to live this fantastic experience in a developed and multicultural country. Furthermore, I would like to thank the University of Technology Sydney (UTS), especially to the Graduate Research Program for awarding me the UTS–International Research Scholarship to continue my PhD research.

I would like to thank and apologise to my family especially my beloved parents, Leo Charry and Serafin Perdomo (RIP) for my long absences —both physical and mental absences during these years when I could not drag my head out of the work. I am very grateful to them for inspiring me every moment of my life and showing me that education is an essential tool in life. Thank you all for your support and strength.

Finally, it is my privilege to thank my wife and hero, who gave me her unconditional support, experience, and knowledge to address this goal that we have always considered ‘ours‘. Thanks a lot. I have always thought that working as a team, with vision and persistence helps us move forward and achieve great goals.

List of Publications

Related to the Thesis :

1. Perdomo, W., Prior, J., Leaney, J. (2019), 'Software product quality (SPQ) evaluation at young software companies from a developing country.' In: *School of Computer Science HDR Student Research Showcase 2019*.

2. Perdomo, W., Prior, J. Leaney, J. (2020), *How do Colombian software companies evaluate software product quality?*, in Proceedings of the 30th international Workshop on Software Measurement (IWSM) and the 15th international Conference on Software Process and Product Measurement (MENSURA), CEUR-WS, Mexico City, pp. 1-16.

3. Perdomo, W., Prior, J., Leaney, J. (2020), 'Evaluation and measurement of software product quality in the new Colombian software companies —A Systematic Literature Review', *Ingeniare X(XX)*, *In review*.

TABLE OF CONTENTS

List of Figures

Figure **Page**

List of Tables