Introducing a Taxonomy for Classifying Qualitative Spreadsheet Errors

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ABSTRACT

Most organizations use large and complex spreadsheets that are embedded in their mission-critical processes and are used for decision-making. Identification of the various types of errors that can be present in these spreadsheets is, therefore, an important first step to creating controls that organizations can use to govern their spreadsheets. While a considerable amount of research on quantitative error taxonomies exists, there is comparatively little research concerning qualitative error taxonomies. In this paper, we propose a taxonomy for categorizing qualitative errors in spreadsheet models that offers an exploratory framework for evaluating the quality of a spreadsheet model before it is released for use by others in the organization. The classification was developed based on types of qualitative errors identified in the literature and errors committed by end-users in developing a spreadsheet model for Panko’s (1996) “Wall Problem.” A principal component analysis of the errors reveals four logical groupings thereby creating four categories of qualitative errors. The usability and limitations of the proposed taxonomy and areas for future research are discussed.

Keywords: Organizational Controls, Qualitative Errors, Spreadsheet, Taxonomy, Usability

INTRODUCTION

The prevalence of errors in organizational spreadsheets that can lead to disastrous consequences is well documented, yet few organizations have formal policies for quality control in spreadsheets deployed for end-users (Caulkins, Morrison & Wiedemann, 2007; Gandel, 2013; Lawson, Baker, Powell & Foster-Johnson, 2008; Panko, 1998; Panko & Ordway, 2005; http://www.eusprig.org/stories.htm). As organizations seek to define appropriate development guidelines and more formal policies, they need to control for errors that occur during the de-
development and review of the model as well as during the later phases of the spreadsheet life cycle. It is, therefore, important to understand the various types of errors that can exist in a spreadsheet throughout its life cycle so that appropriate controls can be created before the spreadsheet is released for widespread use.

The literature on spreadsheet errors classifies errors into two general categories: quantitative and qualitative (e.g., Beaman, Waldmann, & Krueger, 2005; Kreie, Cronin, Pendley & Renwick, 2000; Kruck, 2005; Panko & Aurgemma, 2010; Powell, Baker, & Lawson, 2008, 2009; Teo & Tan, 1999). Quantitative errors result in immediate incorrect numerical values or logic in the current version of the spreadsheet. Quantitative errors created during the development phase usually occur as the result of an omission of part of the problem, erroneous logic or incorrect spreadsheet mechanics (Panko & Halverson, 1996). During the operational usage phase of a spreadsheet, quantitative errors can result from accidental deletion, alteration of formulas or from incorrect inputs provided by end users. While quantitative errors can occur at any phase of the spreadsheet life cycle, research lab studies have focused primarily on evaluating techniques to minimize or detect quantitative errors during the development phase (Galletta, Hartzel, Johnson, Joseph & Rustagi, 1996; O’Donnell, 2001; Panko & Halverson, 1997).

Qualitative errors, also sometimes referred to as dormant, or stealth, or latent errors do not result in immediate incorrect numerical values. They are the results of risky or poor design practices and are considered just as damaging to an organization’s productivity from a usability perspective as quantitative errors. Their presence increases the likelihood of an eventual quantitative error or misinterpretation occurring once the model is placed into operational use. They also make it more difficult to debug models with quantitative errors. In interviews with forty-five senior managers from various industry sectors, five of the seven most commonly mentioned types of spreadsheet errors reported were associated with potential qualitative errors, including inaccurate data (76%), errors inherited from reuse of spreadsheets (49%), misinterpretation of outputs or reports (27%), broken links (22%), and copy/paste errors (22%) (Caulkins et al., 2007). For example, while templates can enable sharing of domain expertise as well as spreadsheet skills, some of the interviewees felt “reused spreadsheets were difficult to control, since updating worksheets can introduce more errors” (Caulkins et al., 2007, p. 7). Similarly, even when the spreadsheet was correct, several interviewees cited instances where the output had been misinterpreted by a person who did not correctly understand the model’s assumptions or limitations, resulting in a bad decision.

To fully assess the quality of a spreadsheet model from a usability perspective and to certify it for operational use, it is therefore necessary to identify and classify both quantitative and qualitative errors in the model. There is, however, a scarcity of formal taxonomies for classifying qualitative errors in the literature. Powell et al., (2009) observed in their audit of 50 operational spreadsheets that “the category of poor practices was so ill-defined that no two auditors could agree in specific instances” when it came to identifying and placing a qualitative error in the same category. Since managers do not know what to look for, it is easy for qualitative errors to go undetected. In this exploratory study we propose a taxonomy for classifying qualitative errors that can alleviate this problem by guiding managers to determine whether a spreadsheet without quantitative errors is still qualitatively robust enough to support meaningful decision-making or be considered for reuse in other applications in an organization’s mission-critical processes. The paper first provides some background on the various types of spreadsheet errors and existing taxonomies as a preamble to a detailed description of our own proposed taxonomy. This is followed by a discussion of the taxonomy’s usability, limitations and our conclusions.
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