Chapter 21
Validation and Design Science Research in Information Systems

Rafael A. Gonzalez
Javeriana University, Colombia

Henk G. Sol
University of Groningen, The Netherlands

ABSTRACT

Validation within design science research in Information Systems (DSRIS) is much debated. The relationship of validation to artifact evaluation is still not clear. This chapter aims at elucidating several components of DSRIS in relation to validation. The role of theory and theorizing are an important starting point, because there is no agreement as to what types of theory should be produced. Moreover, if there is a theoretical contribution, then there needs to be clear guidance as to how the designed artifact and its evaluation are related to the theory and its validation. The epistemological underpinnings of DSRIS are also open to different alternatives, including positivism, interpretivism, and pragmatism, which affect the way that the validation strategy is conceived, and later on, accepted or rejected. The type of reasoning guiding a DSRIS endeavor, whether deductive, inductive, or abductive, should also be considered as it determines the fundamental logic behind any research validation. Once those choices are in place, artifact evaluation may be carried out, depending on the type of artifact and the type of technique available. Finally, the theoretical contribution may be validated from a formative (process-oriented) or summative (product-oriented) perspective.

INTRODUCTION

For researchers in computer science and information systems, carrying out their work and presenting their results in a scientific way has been a long-standing concern. A significant contribution in this sense was submitted by Denning *et al*. (1989) as the result of the Task Force on the Core of Computer Science, which precisely stems from the question "Is computer science a science?" They presented the computer science (CS) discipline as resting on three paradigms: theory (rooted in mathemat-

DOI: 10.4018/978-1-4666-0179-6.ch021

ics), abstraction (rooted in the scientific method) and design (rooted in engineering). As such, they determine CS as sitting at the crossroads between those processes and thus being inherently, yet not totally, scientific. In fact, more recently, Denning (2005) still poses the original question in the title of a paper which establishes CS as a science, but with a credibility problem; in other words, CS as a science is seen as a work in progress. From an information systems perspective, around the same time as the Denning *et al*. paper, Nunamaker *et al*. (1990) contributed an influential paper concerned with a similar question. They support systems development as a research methodology in its own right, providing the process and the criteria required for this purpose. In their view, systems development results in an artifact that is the proof of concept for fundamental (design-oriented) research as well as potentially the focus of further (behavioral-oriented) research. Some years ago, a contribution by Hevner *et al*. followed a similar approach in presenting their proposal for a design science in information systems research (Hevner & March, 2003; Hevner, March, Park, & Ram, 2004). This will be the focus of the present chapter with an emphasis on the logic and process of validation within such a framework.

Design science seeks to create innovations that define the ideas, practices, technical capabilities, and products through which the analysis, design, implementation, management, and use of information systems can be effectively and efficiently accomplished (Hevner, March, Park, & Ram, 2004). As such, a design science research in information systems (DSRIS) contribution requires identifying a relevant organizational information and communication technology (ICT) problem, demonstrating that no solution exists, developing an ICT artifact that addresses this problem, rigorously evaluating the artifact, articulating the contribution to the ICT knowledge-base and to practice, and explaining the implications for ICT management and practice (March & Storey, 2008).

The genesis of design science may be placed in Herbert Simon's The Sciences of the Artificial (first published in 1969) in which he stated the difference between natural science, concerned with how things are, and design science, concerned with how things ought to be (Simon, 1996, p. 114). Following Simon's problem-solving tradition, design science was introduced to information systems researchers most clearly by March and Smith (1995) – notwithstanding the aforementioned related contributions by Denning *et al*. and Nunamaker *et al*. which do not explicitly use the term "design science" – who presented it as prescriptive research aimed at improving ICT performance, as opposed to natural science, corresponding to descriptive research aimed at understanding the nature of ICT. An important point was that information systems research should actually integrate both perspectives, an argument that came back on Hevner *et al*. (2004), establishing DSRIS as an adequate way of carrying out research with both relevance and rigor. This 2004 paper was the main thrust behind a strong DSRIS movement in the information systems and computer science fields, which has resulted in numerous journal special issues, a special conference (DESRIST), a book (Hevner & Chatterjee, 2010) and a rapidly increasing number of research articles claiming to use design science. This growth is probably due to the fact that design science research has been carried out for some time now, but without a common vocabulary and without widespread acceptance from publications emphasizing more traditional research approaches. With a DSRIS framework in place and an increasing openness from several publication targets, it is now possible to present the results of DSRIS in a more straightforward manner and without the need to force what is essentially the design of an artifact as the result of a kind of research that does not fit its nature. Nonetheless, in this short time of almost exponential growth many issues remain open to discussion, including agreement on the ontological and epistemological foundations of design science, the relationship