Research Methodologies, Innovations and Philosophies in Software Systems Engineering and Information Systems

Manuel Mora
*Autonomous University of Aguascalientes, Mexico*

Ovsei Gelman
*Center of Applied Sciences and Technology Development of the National Autonomous University of Mexico, Mexico*

Annette Steenkamp
*Lawrence Technological University, USA*

Mahesh S. Raisinghani
*Texas Woman's University, USA*
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## Preface

Section 1
Foundations of Research Methods and Paradigms

Chapter 1
Philosophical Framing and Its Impact on Research

*Eileen M. Trauth, The Pennsylvania State University, USA*
*Lee B. Erickson, The Pennsylvania State University, USA*

This chapter examines the influence of philosophical framing on the way in which research is conducted and the findings that result. It does so by considering choices with respect to five dimensions of research: epistemology, theory, review of literature, stakeholder perspective, and rigor-relevance.

Chapter 2
Rigor and Relevance in Information Systems Research: A Comprehensive IS Research Process Model

*Damodar Konda, RGIS, LLC., USA*

This chapter proposes several models to guide IS researcher to help appropriately position the research using Rigor and Relevance Quadrants Model, triangulate the research using Triangulation Model and achieve the right balance using a comprehensive IS Research Process model.

Chapter 3
Postmodernism, Interpretivism, and Formal Ontologies

*Jan H. Kroeze, University of South Africa, South Africa*

This chapter investigates the relationship between postmodernism, interpretivism, and formal ontologies, which are widely used in Information Systems (IS). Interpretivism has many postmodernist traits. It acknowledges that the world is diverse and that knowledge is contextual, ever-changing, and emergent.
Chapter 4
Critical Realism and IS Research: Some Methodological Implications .................................................. 63
Philip J. Dobson, Edith Cowan University, Australia

This chapter discusses some of the practical implications consequent from adopting critical realism in terms of philosophy, theory, and methodology.

Chapter 5
Practice vs. Possession: Epistemological Implications on the Nature of Organizational Knowledge and Cognition .................................................................................................................. 82
Lucio Biggiero, L'Aquila University, Italy

Organizational knowledge is at the center of the debate focused on the nature of knowledge, where the perspective of knowledge as possession opposes the perspective of knowledge as practice. These two views are rooted in the radical versions of realist and constructivist epistemology, respectively, according to which knowledge is an object or a practice.

Chapter 6
Software Engineering Research: The Need to Strengthen and Broaden the Classical Scientific Method .................................................................................................................................................. 106
Gonzalo Génova, Universidad Carlos III de Madrid, Spain
Juan Llorens, Universidad Carlos III de Madrid, Spain
Jorge Morato, Universidad Carlos III de Madrid, Spain

Qualitative (i.e. meta-methodical) reasoning plays the directive role in scientific activity. In this chapter the authors claim that acknowledging a plurality of research methods in software engineering will benefit the advancement of this branch of science.

Chapter 7
Process Theory: Components and Guidelines for Development .................................................................. 126
Martha García-Murillo, Syracuse University, USA
Ezgi Nur Gozen, Syracuse University, USA

In this effort, the purpose of this chapter is to provide scholars with a general understanding of process theories and a taxonomy to provide some direction about how to make contributions to the theoretical legacy, particularly through often-ignored process theories, which are also relevant to practice.

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On IT and SwE Research Methodologies and Paradigms: A Systemic Landscape Review .................. 149
Manuel Mora, Autonomous University of Aguascalientes, Mexico
Annette L. Steenkamp, Lawrence Technological University, USA
Ovsei Gelman, CCADET-UNAM, Mexico
Mahesh S. Raisinghani, TWU School of Management, USA
In this chapter, the authors review the landscape of research methodologies and paradigms available for Information Technology (IT) and Software Engineering (SwE). The aims are two-fold: (i) create awareness in current research communities in IT and SwE on the variety of research paradigms and methodologies, and (ii) provide an useful map for guiding new researchers on the selection of an IT or SwE research paradigm and methodology.

Section 2
Contemporaneous Research Methods and Techniques

Chapter 9
Contemporary Reporting Practices Regarding Covariance-Based SEM with a Lens on EQS
Theresa M. Edgington, Baylor University, USA
Peter M. Bentler, University of California – Los Angeles, USA

This chapter contributes to the literature by providing an overview of important considerations in reporting results from covariance-based structural equation modeling execution and analysis. It incorporates models and other examples of EQS, one of the leading SEM software applications. While EQS is increasingly used by IS researchers, exemplars of its code and output have not been well published within the IS community, overly complicating the reviewing process for these papers.

Chapter 10
Variance-Based Structural Equation Modeling: Guidelines for Using Partial Least Squares in Information Systems Research
José L. Roldán, Universidad de Sevilla, Spain
Manuel J. Sánchez-Franco, Universidad de Sevilla, Spain

In this chapter, the authors propose both the theory underlying PLS and a discussion of the key differences between covariance-based SEM and variance-based SEM, i.e., PLS. In particular, the authors: (a) provide an analysis of the origin, development and features of PLS; and (b) discuss analysis problems as diverse as the nature of epistemic relationships and sample size requirements. In this regard, the authors present basic guidelines for the applying of PLS as well as an explanation of the different steps implied for the assessment of the measurement model and the structural model. Finally, the authors present two examples of Information Systems models in which they have put previous recommendations into effect.

Chapter 11
Models for Interpretive Information Systems Research, Part 1: IS Research, Action Research, Grounded Theory – A Meta-Study and Examples
M. R. (Ruth) De Villiers, University of South Africa, South Africa

This chapter is a meta-research study that briefly explains the concepts of positivism, interpretivism, and qualitative and quantitative research, before over viewing the advent of interpretive IS research. The chapter then presents two interpretive models that can serve as research designs for postgraduate studies and ad-hoc research. Action research, which originated in the social sciences, involves longitu-
dinal studies, in which the researcher participatively investigates products or interventions that address real-world problems over several cycles, in a reflective and responsive way.

Chapter 12
Models for Interpretive Information Systems Research, Part 2: Design Research, Development Research, Design-Science Research, and Design-Based Research – A Meta-Study and Examples

M. R. (Ruth) De Villiers University of South Africa, South Africa

This chapter introduces interpretive research as a background to research that is time-and context-dependent. The study presents practical, yet theoretical, research approaches that are relevant to postgraduate studies and to ad-hoc research.

Chapter 13
Using Grounded Theory Coding Mechanisms to Analyze Case Study and Focus Group Data in the Context of Software Process Research

Rory V. O’Connor, Dublin City University, Ireland

The primary aim of this chapter is to outline a potentially powerful framework for the combination of research approaches utilizing the Grounded Theory coding mechanism for case study, and focus groups data analysis. A secondary aim of this chapter is to provide a roadmap for such a usage by way of an example research project.

Chapter 14
A Practical Approach to Theory Structuring and Analysis: A way to Structure Research and Perform Sub-Problem Solving in a Changing IS Landscape

T. Schwartzel, University of South Africa, South Africa
M. M. Eloff, University of South Africa, South Africa

A large proportion of students who enroll for postgraduate degrees never finish their studies, with non-completion rates yielding 30% for a sample size of 2000 students. A number of empirical studies have been conducted indicating the possible factors for the non-completion rate. This chapter briefly highlights such factors and proposes a possible solution to increase the number of successful studies using relevant philosophies and problem-solving to build insight in determining IS/IT solutions and innovations.

Chapter 15
Integrating Conceptual and Empirical Approaches for Software Engineering Research

Annette L. Steenkamp, Lawrence Technological University, USA
Theresa Kraft, University of Michigan-Flint, USA

This chapter addresses the systemic integration of conceptual and empirical methods in Software Engineering (SWE) research in terms of the systems approach, where theory, empiricism, and pragmatics are combined as required in the research phases.
Section 3
Innovative Research Methods and Techniques

Chapter 16
Visualization and Analysis of Frames in Collections of Messages: Content Analysis and the Measurement of Meaning ................................................................. 321

Esther Vlieger, University of Amsterdam, The Netherlands
Loet Leydesdorff, University of Amsterdam, The Netherlands

A step-to-step introduction is provided on how to generate a semantic map from a collection of messages (full texts, paragraphs, or statements) using freely available software and/or SPSS for the relevant statistics and the visualization. The techniques are discussed in the various theoretical contexts of (i) linguistics (e.g., Latent Semantic Analysis), (ii) sociocybernetics and social systems theory (e.g., the communication of meaning), and (iii) communication studies (e.g., framing and agenda-setting).

Chapter 17
System Approach to MIS and DSS and its Modeling within SD ................................................................. 340

Miroljub Kljajić, University of Maribor, Slovenia
Mirjana Kljajić Boršnar, University of Maribor, Slovenia
Andrej Škraba, University of Maribor, Slovenia
Davorin Kojjč, University of Maribor, Slovenia

In this chapter, the authors discuss system dynamics (SD) as a research methodology in Information Systems (IS). The goal is to demonstrate the usefulness of SD methodology in research and its implementation in IS and management Information Systems (MIS).

Chapter 18
Project Contexts and the Possibilities for Mixing Software Development and Systems Approaches ................................................................. 360

D. Petkov, Eastern Connecticut State University, USA
S. Alter, University of San Francisco, USA
J. Wing, Durban University of Technology, South Africa
A. Singh, Durban University of Technology, South Africa
O. Petkova, Central Connecticut State University, USA
T. Andrew, Durban University of Technology, South Africa
K. Sewchurran, University of Cape Town, South Africa

This chapter summarizes three software development and systems approaches that are often viewed as somewhat unrelated: soft system methodology (SSM), work system method (WSM), and agile development.

Chapter 19
Selecting Strategies and Approaches in Systems Engineering: Applying the Descriptive Research Method ................................................................. 376

Moti Frank, Holon Institute of Technology, Israel
This chapter presents a method of applying the principles of the descriptive research method to studies aimed at ascertaining the data needed for making a recommendation in regard to what strategy or approach should be chosen in a certain development stage of future projects.

Chapter 20
Engineering Design as Research

Timothy L.J. Ferris, Defence and Systems Institute, University of South Australia, Australia

This chapter shows how the actual design of engineered artefacts is research because it provides knowledge of the impact of the integration of various elements of existing knowledge, which demonstrates the properties of the designs achieved through the design work and leads to discovery of solutions to the various challenges of integration discovered through the project that attempts to achieve the integration.

Chapter 21
Validation and Design Science Research in Information Systems

Rafael A. Gonzalez, Javeriana University, Colombia
Henk G. Sol, University of Groningen, The Netherlands

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.

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About the Contributors

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