



Review

A systematic literature review of resilience engineering: Research areas and a research agenda proposal

Angela Weber Righi¹, Tarcisio Abreu Saurin^{*}, Priscila Wachs

Industrial Engineering and Transportation Department, Federal University of Rio Grande do Sul, Av. Osvaldo Aranha, 99, 5. Andar,
Porto Alegre CEP 90035-190, RS, Brazil

ARTICLE INFO

Article history:

Received 3 December 2013

Received in revised form

16 January 2015

Accepted 4 March 2015

Available online 12 March 2015

Keywords:

Resilience engineering

Safety management

Systematic literature review

ABSTRACT

Resilience engineering (RE) has been advocated as a new safety management paradigm, compatible with the nature of complex socio-technical systems. This study aims to identify the research areas and to propose a research agenda for RE, based on a systematic literature review that encompasses 237 studies from 2006 to 2014. Six research areas are identified: theory of RE; identification and classification of resilience; safety management tools; analysis of accidents; risk assessment; and training. The area “theory of RE” accounted for 52% of the studies, and it indicates that research has emphasized the description of how resilient performance occurs. The proposal for a research agenda is focused on: refining key constructs; positioning RE in relation to other theories; exploring other research strategies in addition to case-based studies; investigating barriers for implementing RE; and balancing the importance on describing and understanding resilience with the emphasis on the design of resilient systems, and the evaluation of these designs.

© 2015 Elsevier Ltd. All rights reserved.

Contents

1. Introduction	143
2. Research design	143
2.1. Steps of the systematic literature review	143
2.2. Framework for addressing the research questions	143
3. Results	144
3.1. Main characteristics of the selected studies	144
3.2. Methodological approaches	144
3.3. Research areas	144
3.3.1. Theory of RE	144
3.3.2. Identification and classification of resilience	146
3.3.3. Safety management tools	147
3.3.4. Risk assessment	147
3.3.5. Analysis of accidents	147
3.3.6. Training	148
4. Discussion and conclusions	148
4.1. Research areas	148
4.2. Research agenda proposal	149
4.3. Limitations of this study	150
References	150

^{*} Corresponding author.E-mail addresses: angelawrighi@yahoo.com.br (A.W. Righi), saurin@ufrgs.br (T.A. Saurin), priscilawachs@ig.com.br (P. Wachs).¹ Tel.: +55 51 3308 4299.

1. Introduction

Over the last decade, resilience engineering (RE) has been advocated as an alternative for the management of safety in complex socio-technical systems (CSSs) [1]. According to Woods [2] RE “uses the insights from research on failures in complex systems, including organizational contributors to risk, and the factors that affect human performance to provide systems engineering tools to manage risks proactively”. As the name indicates, the assumption is that resilience can be engineered into a CSS, in order to support the use of adaptive capacity. RE recognizes that a portion of variability is unavoidable and beneficial, and due to this fact it should be managed rather than dampened [8].

The first publications mentioning the term RE can be traced back to 2003 [2,12]. However, RE became more widely known to the academic community in a meeting in Sweden in 2004 (the 1st RE Symposium), and also due to the publication of a book based on that meeting [1]. Since then, the interest in RE has grown as a result of both the theoretical merits of this discipline and the failure of existing approaches to move CSSs beyond the existing plateau of accident rates. Thus, in spite of being a fairly new discipline, the assumption of this paper is that studies on RE already exist in substantial quantity, quality and diversity. Therefore, it is necessary to make sense of the existing knowledge, characterizing what has been produced and identifying the main opportunities for future studies. Based on a systematic literature review, two research questions are addressed by this paper: (a) what are the main research areas of RE? (b) How should a research agenda for RE be structured? To the authors' knowledge, this is the first broad systematic literature review of RE, thus it has an exploratory nature. Previous to this, Van der Vorm et al. [34] had conducted a more limited systematic review, focusing on how the concept of resilience has been applied at the organizational, team and individual levels. Systematic reviews are strongly recommended for supporting the theoretical progress of scientific disciplines in general, as they identify over as well as under explored areas, in addition to constructs that should be refined [15,17].

2. Research design

2.1. Steps of the systematic literature review

A systematic literature review differs from a conventional review due to the use of a research protocol, so that readers can assess its rigor, completeness and repeatability; hence it reduces the effects of chance and increases the legitimacy and authority of the evidence found [17]. This review's starting point was the definition of the research questions, and subsequently three steps were followed: (a) defining criteria for selecting the studies; (b) defining the databases and selecting the studies based on the criteria; and (c) data analysis and discussion of selected studies. Regarding step (a), inclusion and exclusion criteria were defined as follows:

- (i) Inclusion: the search was limited to papers in English, and “resilience engineering” was used as the keyword in the on-line search for papers. That keyword could appear in the title, abstract or the main body of the text. The keyword “resilience” was not adopted as the search would result in a much greater number of studies, since that concept has been investigated by several different disciplines, such as sustainability, psychology, economy and sociology. The search encompassed papers that had been published or were in press until October 2014. Moreover, the proceedings of the 2nd, 3rd, 4th and 5th

Symposiums of Resilience Engineering were included, as they were the main academic events fully dedicated to RE so far.

- (ii) Exclusion: conferences other than the RE symposiums, books, dissertations, thesis, and studies that only referred to the existence of RE, but did not focus on that subject. Moreover, both the annual workshops on the Functional Resonance Analysis Method (www.functionalresonance.net), and the annual meetings of the Resilience Health Care Network (www.resilienthealthcare.net) were not included, as they have not produced full papers.

The exclusion of certain sources from the on-line search for papers does not mean these sources were neglected by this review. It only means that these contributions were not included in the databases developed for supporting data analysis (see step “c”, below), and therefore not included in the calculation of the distribution of papers according to categories such as the domains in which RE has been applied, and the adopted research designs. In fact, a number of additional sources, such as the books on RE e.g. [1,3,18,116,130], were used to support the analysis of the results obtained from the on-line search. In other words, although these sources did not count as “data”, they had an important role both to enrich data analysis and characterize the research areas. Two papers published in this special issue were also cited [134,135] although they were not regarded as “data”.

Regarding step (b), the chosen databases were those available from the authors' institution, namely: ACM Digital Library, ACS Journals Search, Academic Research Premier, Cambridge Journals Online, Emerald Fulltext, Highwire Press, IEEE Xplore, IOPscience, Nature, Oxford Journals, Royal Society of Chemistry, Science, ScienceDirect, Scielo.org, SpringerLink, and Wiley Online Library. Based on the inclusion criteria, 637 studies were identified, from 9 databases and the 4 Symposium proceedings. After checking for studies present in more than one database and applying the exclusion criteria, 237 studies remained.

Regarding step (c), a spreadsheet was developed to facilitate data analysis, including the fields presented below:

- (i) Identification data: database(s) from which the paper was identified, journal's name, title, year of publication, institution of the first author, sector in which the study was developed;
- (ii) Contents of the study: objectives, techniques for gathering and analyzing data, research strategy (e.g. literature review, case study, ethnography, experiments, etc.) and main results. Based on this information, six research areas associated with RE were identified, and the proposal for a research agenda was developed.

2.2. Framework for addressing the research questions

In order to address the research questions, it is necessary to develop operational definitions of what counts as a research area within RE as well as what characterizes a research agenda. A research area is defined mostly by the similarity of the objectives and the types of outcomes produced by a set of studies, regardless of the adopted research design. In turn, a research agenda refers to guidelines for the development of innovative practical and theoretical knowledge within and across research areas. To some extent, such an agenda is the result of the patterns identified in the research areas, and may also reflect the authors' biases. A source of bias is related to the fact the authors are industrial engineers conducting research in an Industrial Engineering program, and therefore concerns with the design of artifacts are possibly more natural than for researchers with other backgrounds.

Download English Version:

<https://daneshyari.com/en/article/807731>

Download Persian Version:

<https://daneshyari.com/article/807731>

[Daneshyari.com](https://daneshyari.com)