

Editorial Board

Simone Diniz Junqueira Barbosa

*Pontifical Catholic University of Rio de Janeiro (PUC-Rio),  
Rio de Janeiro, Brazil*

Phoebe Chen

*La Trobe University, Melbourne, Australia*

Alfredo Cuzzocrea

*ICAR-CNR and University of Calabria, Italy*

Xiaoyong Du

*Renmin University of China, Beijing, China*

Joaquim Filipe

*Polytechnic Institute of Setúbal, Portugal*

Orhun Kara

*TÜBİTAK BİLGEM and Middle East Technical University, Turkey*

Igor Kotenko

*St. Petersburg Institute for Informatics and Automation  
of the Russian Academy of Sciences, Russia*

Krishna M. Sivalingam

*Indian Institute of Technology Madras, India*

Dominik Ślęzak

*University of Warsaw and Infobright, Poland*

Takashi Washio

*Osaka University, Japan*

Xiaokang Yang

*Shanghai Jiao Tong University, China*

Fergal McCaffery Rory V. O'Connor  
Richard Messnarz (Eds.)

# Systems, Software and Services Process Improvement

20th European Conference, EuroSPI 2013  
Dundalk, Ireland, June 25-27, 2013  
Proceedings

## Volume Editors

Fergal McCaffery  
Dundalk Institute of Technology, Ireland  
E-mail: fergal.mccaffery@dkit.ie

Rory V. O'Connor  
School of Computing  
Dublin City University, Ireland  
Email: roconnor@computing.dcu.ie

Richard Messnarz  
ISCN, GesmbH  
Graz, Austria  
E-mail: rmess@iscn.com

ISSN 1865-0929	e-ISSN 1865-0937
ISBN 978-3-642-39178-1	e-ISBN 978-3-642-39179-8
DOI 10.1007/978-3-642-39179-8	
Springer Heidelberg Dordrecht London New York	

Library of Congress Control Number: 2013941144

CR Subject Classification (1998): D.2.9, K.6.3, D.2, K.6, J.1, H.3.5, H.4

© Springer-Verlag Berlin Heidelberg 2013

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed. Exempted from this legal reservation are brief excerpts in connection with reviews or scholarly analysis or material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work. Duplication of this publication or parts thereof is permitted only under the provisions of the Copyright Law of the Publisher's location, in its current version, and permission for use must always be obtained from Springer. Permissions for use may be obtained through RightsLink at the Copyright Clearance Center. Violations are liable to prosecution under the respective Copyright Law.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

*Typesetting:* Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

# Preface

This textbook comprises the proceedings of the 20th EuroSPI Conference, held during June 25–27, 2013, in Dundalk, Ireland.

Since EuroSPI 2010, we have extended the scope of the conference from software process improvement to systems, software and service-based process improvement. EMIRAcle is the institution for research in manufacturing and innovation, which came out as a result of the largest network of excellence for innovation in manufacturing in Europe. EMIRAcle key representatives joined the EuroSPI community, and papers as well as case studies for process improvement on systems and product level will be included in future.

Since 2008, EuroSPI partners have packaged SPI knowledge in job role training and established a European certification association ([www.ecqa.org](http://www.ecqa.org)) to transport this knowledge across Europe using standardized certification and examination processes.

Conferences were held in Dublin (Ireland) in 1994, in Vienna (Austria) in 1995, in Budapest (Hungary) in 1997, in Gothenburg (Sweden) in 1998, in Pori (Finland) in 1999, in Copenhagen (Denmark) in 2000, in Limerick (Ireland) in 2001, in Nuremberg (Germany) in 2002, in Graz (Austria) in 2003, in Trondheim (Norway) in 2004, in Budapest (Hungary) in 2005, in Joensuu (Finland) in 2006, in Potsdam (Germany) in 2007, in Dublin (Ireland) in 2008, in Alcala (Spain) in 2009, in Grenoble (France) in 2010, in Roskilde (Denmark) in 2011, and in Vienna (Austria) in 2012.

EuroSPI is an initiative with the following major action lines <http://www.eurospi.net>:

- Establishing an annual EuroSPI conference supported by software process improvement networks from different EU countries
- Establishing an Internet-based knowledge library, newsletters, and a set of proceedings and recommended books
- Establishing an effective team of national representatives (from each EU-country) growing step by step into more countries of Europe
- Establishing a European Qualification Framework for a pool of professions related with SPI and management. This is supported by European certificates and examination systems

EuroSPI has established a newsletter series ([newsletter.eurospi.net](http://newsletter.eurospi.net)), the SPI Manifesto (SPI = Systems, Software and Services Process Improvement), an experience library ([library.eurospi.net](http://library.eurospi.net)) that is continuously extended over the years and is made available to all attendees, and a Europe-wide certification for qualifications in the SPI area ([www.ecqa.org](http://www.ecqa.org), European Certification and Qualification Association).

A typical characterization of EuroSPI is reflected in a statement made by a company: “... the biggest value of EuroSPI lies in its function as a European knowledge and experience exchange mechanism for SPI and innovation.”

Since its beginning in 1994 in Dublin, the EuroSPI initiative has outlined that there is not a single silver bullet with which to solve SPI issues, but that you need to understand a combination of different SPI methods and approaches to achieve concrete benefits. Therefore, each proceedings volume covers a variety of different topics, and at the conference we discuss potential synergies and the combined use of such methods and approaches. These proceedings contain selected research papers under seven headings:

- Section I: SPI Safety and Regulation Issues
- Section II: SPI Lifecycle and Models
- Section III: SPI Quality and Testing Issues
- Section IV: SPI Networks and Teams
- Section V: SPI and Reference Models
- Section VI: SPI and Implementation
- Section VII: Selected Key Notes and Workshop Papers

Section I presents three papers related to “SPI Safety and Regulation Issues.” Nevalainen et al. discuss formal assessment techniques applied to safety-critical systems. Mayer et al. highlight issues of risk management processes in the context of telecommunications regulation, and Flood et al. approach these issues from a medical device perspective dealing with the ISO 62366 standard.

Section II presents three papers under the umbrella topic of “SPI Lifecycle and Models.” Firstly, Monasor et al. describe a feasibility study simulating global software development processes for use in education. Winkler et al. identify risks, challenges, and candidate solutions to identify how to bridge the gap from research to industry. The final paper of this section by Krishnamurthy and O’Connor presents an analysis of the software development processes of open source e-learning systems.

Section III presents papers related to “SPI Quality and Testing Issues.” In the first paper, Toroi et al. present the first official version of SAWO, a functional defect classification scheme developed to enable the usage of defect data for SPI purposes. Petrova-Antonova et al. propose an approach based on a fault injection technique for generation and execution of fault tolerance test cases, which is automated through the implementation of two software tools for fault injection and test case generation and execution. In the final paper, Gabriel Alberto García-Mireles et al. describe a framework to support software quality trade-offs from a process-based perspective.

Section IV explores the theme of “SPI Networks and Teams.” In the first paper Jermakovics explains that collaboration is important to software development processes and collaboration networks help us understand its structure and patterns. Ponisio et al. present an approach that uses techniques from network analysis to support organizations in processing and understanding this information. In the third paper, Petri Kettunen discusses the many facets of

high-performing software teams and takes a capability-based analysis approach to investigating teams.

Section V presents three contributions dealing with associated issues surrounding the topic of “SPI and Reference Models.” In the first paper, Jeners and Lichter take an automated comparison approach to the smart integration of process improvement reference models. In the second paper, Fricker et al. examine how an existing reference model can be tailored to a domain it has not been designed for initially, in this instance the healthcare sector. In a second paper from Jeners et al., the authors describe mapping in the complex world of software processes with the context of software development projects and discuss their initial mapping efforts.

Section VI discusses issues in “SPI and Implementation.” In the first paper, Sussy Bayona et al. review the critical success factors related to people in software process improvement. In the second paper, de Souza Cavalcanti Rocha et al. present a proposal for the improvement predictability of cost using earned value management and quality data. In the final paper of this section, Munoz et al. discuss the involvement of stakeholders in software processes improvement to reduce change resistance.

Section VII presents selected keynotes from EuroSPI workshops concerning the future of SPI. From 2010 onwards, EuroSPI invites recognized key researchers to present work on new future directions of SPI. These key messages are discussed in interactive workshops and help create SPI communities based on new topics.

Five invited papers concerning “Agile Development Paradigms” discuss experiences with the adoption of agile development paradigms in software engineering and in product developments for the market, as well as how SPICE-based assessment methods need to be tailored to accept agile approaches in capability assessments. Schweigert et al. discuss the needs for an agile maturity model and analyze how maturity models would really measure agility. The paper by Schweigert, Ekssir-Monfared, and Ofner describes an approach to forming an agile management process and uses the example of a Test SPICE implementation to outline how this would work. Papatheocharous and Andreou describe how agile approaches have been adopted in organizations based on an empirical analysis. Laanti et al. discuss the different interpretations of agile approaches, since teams who implemented agile approaches in projects have placed emphasis on different key issues in the past. In the next paper, de Amescua et al. outline how agile software developments are adopted in application areas where the products are used in a large market.

Three invited papers concerning “Creating Environments Supporting Innovation and Improvement” illustrate that SPI is inherently linked to innovation and that innovation requires a transfer of ideas to an exploitation, a strategy for valorization of new ideas and products or services, and an understanding of a networking on a multicultural scale. Sheriff et al. analyze the relationship between innovation, value creation, and the sustainability of values created, and they view the understanding of this relationship as a driver for innovation. Marek Gavenda et al. outline that the sustainability of an innovation is inherently linked

with entrepreneurship and describe a set of competencies needed to achieve this. Finally, Georgiadou and Siakas propose defining valorization as a process and implementing an innovation- and valorization-specific maturity model for continuous improvement of the valorization process.

One invited paper concerning “SPI and Measurement” by Thomas Fehlmann and Eberhard Kranich illustrates that Six Sigma is not just a tool for production capability but that it can also be applied for software development using the mobile phone application development as an example.

Four invited papers on “Risk Management and Functional Safety” illustrate experiences from the medical device and automotive industry in the implementation of recent risk management and functional safety standards. Finnegan, McCaffery, and Coleman describe an assurance and assessment framework for networked medical devices integrating the concepts from ISO/IEC 15504 with medical device standards. Messnarz et al. describe experiences with the implementation of functional safety standards in the automotive industry and what level of know-how is needed by functional safety managers and functional safety engineers to effectively implement risk management and functional safety. Kreiner et al. describe a new initiative of automotive clusters in Europe with an integrated view of product development and process quality based on ISO/IEC 15504 (Automotive SPICE), Lean Six Sigma, and functional safety standards. Finally, Botond Tényi et al. describe experiences in the implementation of risk management in a leading medical device engineering company.

June 2013

Fergal McCaffery  
Rory V. O’Connor  
Richard Messnarz

# Recommended Further Reading

In [1] the proceedings of three EuroSPI conferences were integrated into one book, which was edited by 30 experts in Europe. The proceedings of EuroSPI 2005 to 2011 have been published by Springer in [2], [3], [4], [5], [6] [7] [8] and [9], respectively.

## References

1. Messnarz, R., Tully, C. (eds.): Better Software Practice for Business Benefit – Principles and Experience, 409 pages. IEEE Computer Society Press, Los Alamitos (1999)
2. Richardson, I., Abrahamsson, P., Messnarz, R. (eds.): EuroSPI 2005. LNCS, vol. 3792. Springer, Heidelberg (2005)
3. Richardson, I., Runeson, P., Messnarz, R. (eds.): EuroSPI 2006. LNCS, vol. 4257. Springer, Heidelberg (2006)
4. Abrahamsson, P., Baddoo, N., Margaria, T., Messnarz, R. (eds.): EuroSPI 2007. LNCS, vol. 4764. Springer, Heidelberg (2007)
5. O'Connor, R.V., Baddoo, N., Smolander, K., Messnarz, R. (eds.): EuroSPI 2008. CCIS, vol. 16. Springer, Heidelberg (2008)
6. O'Connor, R.V., Baddoo, N., Cuadrado Gallego, J., Rejas Muslera, R., Smolander, K., Messnarz, R. (eds.): EuroSPI 2009. CCIS, vol. 42. Springer, Heidelberg (2009)
7. Riel, A., O'Connor, R., Tichkiewitch, S., Messnarz, R. (eds.): EuroSPI 2010. CCIS, vol. 99. Springer, Heidelberg (2010)
8. O'Connor, R.V., Pries-Heje, J., Messnarz, R. (eds.): EuroSPI 2011. CCIS, vol. 172. Springer, Heidelberg (2011)
9. Winkler, D., O'Connor, R.V., Messnarz, R. (eds.): EuroSPI 2012. CCIS, vol. 301. Springer, Heidelberg (2012)



# Organization

## Board Members

EuroSPI Board Members represent centers or networks of SPI excellence having extensive experience with SPI. The board members collaborate with different European SPINS (Software Process Improvement Networks). The following six organizations have been members of the conference board for the last 12 years:

- ASQ, <http://www.asq.org>
- ASQF, <http://www.asqf.de>
- DELTA, <http://www.delta.dk>
- ISCN, <http://www.iscn.com>
- SINTEF, <http://www.sintef.no>
- STTF, <http://www.sttf.fi>

## EuroSPI Scientific Program Committee

EuroSPI established an international committee of selected well-known experts in SPI who are willing to be mentioned in the program and to review a set of papers each year. The list below represents the Research Program Committee members. EuroSPI2 also has a separate Industrial Program Committee responsible for the industry/experience contributions.

Alain Abran	ETS-University of Quebec, Canada
Alberto Sillitti	Free University of Bolzano, Italy
Anca Draghici	Universitatea Politehnica din Timisoara, Romania
Andreas Riel	Grenoble Institute of Technology, France
Antonia Mas Pichaco	Universitat de les Illes Balears, Spain
Antonio De Amescua	Carlos III University of Madrid, Spain
Bee Bee Chua	University of Technology Sydney, Australia
Christian Kreiner	Graz University of Technology, Austria
Christiane Gresse von Wangenheim	Federal University of Santa Catarina, Brazil
Darren Dalcher	Middlesex University, UK
Dieter Landes	Fachhochschule Coburg, Germany
Dietmar Winkler	Vienna University of Technology, Austria
Fergal McCaffery	Dundalk Institute of Technology, Ireland
Javier Garica-Guzman	Carlos III University of Madrid, Spain
Jose Antonio Calvo-Manzano	Universidad Politecnica de Madrid, Spain
Keith Phalp	Bournemouth University, UK
Kerstin Siakas	Alexander Technological Educational Institute of Thessaloniki, Greece

Luigi Buglione	Ingegneria Informatica, Italy
Marion Lepmets	Dundalk Institute of Technology, Ireland
Markku Oivo	University of Oulu, Finland
Michael Reiner	IMC Fachhochschule Krems, Austria
Patricia McQuaid	California Polytechnic State University, USA
Paul Clarke	Dundalk Institute of Technology, Ireland
Paula Ventura Martins	FCT University of Algarve, Portugal
Ricardo Colomo Palacios	Universidad Carlos III de Madrid, Spain
Rory V. O'Connor	Dublin City University, Ireland
Serge Tichkiewitch	Grenoble Institute of Technology, France
Timo Mäkinen	Tampere University of Technology, Finland
Timo Varkoi	Tampere University of Technology, Finland
Torgeir Dingsøyr	SINTEF ICT, Norway
Valentine Casey	Dundalk Institute of Technology, Ireland

## General Chair

Richard Messnarz

## Scientific Chairs

Fergal McCaffery  
Rory V. O'Connor

The experience portfolio of the Chairs covers different market segments, different sizes of organizations, and different SPI approaches. This strengthens the fundamental principle of EuroSPI to cover a variety of different markets, experiences, and approaches.

## Acknowledgments

Some contributions published in this book have been funded with support from the European Commission. European projects (supporting ECQA and EuroSPI) contributed to this Springer book including SafeEur (ECQA Certified Safety Manager), SIMS (ECQA Certified Social Media Expert), VALO (ECQA Certified Valorisation Expert), I2E (Idea to Enterprise), AQUA (Knowledge Alliance for Training Quality and Excellence in Automotive), LSSH (Lean Six Sigma for Health Care).

*In this case the publications reflect the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.*



Education and Culture DG

Lifelong Learning Programme

# Table of Contents

## SPI Safety and Regulation Issues

Making Software Safety Assessable and Transparent . . . . .	1
<i>Risto Nevalainen, Alejandra Ruiz, and Timo Varkoi</i>	
Sector-Based Improvement of the Information Security Risk Management Process in the Context of Telecommunications Regulation . . . . .	13
<i>Nicolas Mayer, Jocelyn Aubert, Hervé Cholez, and Eric Grandry</i>	
A Methodology for Software Process Improvement Roadmaps for Regulated Domains – Example with IEC 62366 . . . . .	25
<i>Derek Flood, Fergal McCaffery, Valentine Casey, and Gilbert Regan</i>	

## SPI Lifecycle and Models

Simulating Global Software Development Processes for Use in Education: A Feasibility Study . . . . .	36
<i>Miguel J. Monasor, Aurora Vizcaíno, Mario Piattini, John Noll, and Sarah Beecham</i>	
Research Prototypes versus Products: Lessons Learned from Software Development Processes in Research Projects . . . . .	48
<i>Dietmar Winkler, Richard Mordinyi, and Stefan Biffel</i>	
An Analysis of the Software Development Processes of Open Source E-Learning Systems . . . . .	60
<i>Aarthiy Krishnamurthy and Rory V. O'Connor</i>	

## SPI Quality and Testing Issues

Identifying Process Problems with the SAWO Functional Defect Classification Scheme . . . . .	72
<i>Tanja Toroi, Anu Raninen, Hannu Vainio, and Lauri Väättäinen</i>	
An Automated Approach for Fault Injection Testing of BPEL Orchestrations . . . . .	84
<i>Dessislava Petrova-Antonova, Sylvia Ilieva, Vera Stoyanova, Irina Manova, and Valentin Pavlov</i>	

A Framework to Support Software Quality Trade-Offs from a Process-Based Perspective .....	96
<i>Gabriel Alberto García-Mireles, Ma Ángeles Moraga, Félix García, and Mario Piattini</i>	

## SPI Networks and Teams

Discovering and Studying Collaboration Networks in Software Repositories .....	108
<i>Andrejs Jermakovics, Alberto Sillitti, and Giancarlo Succi</i>	
Using Network Analysis to Discover Cooperation Opportunities in Inter-organizational Networks .....	119
<i>Laura Ponisio, Pascal van Eck, Lourens Riemens, and Noriyuki Matsuda</i>	
The Many Facets of High-Performing Software Teams: A Capability-Based Analysis Approach .....	131
<i>Petri Kettunen</i>	

## SPI and Reference Models

Smart Integration of Process Improvement Reference Models Based on an Automated Comparison Approach .....	143
<i>Simona Jeners and Horst Lichter</i>	
Tailoring the Software Product Management Framework for Use in a Healthcare Organization: Case Study .....	155
<i>Samuel A. Fricker, Marie Persson, and Madelene Larsson</i>	
Harmonizing Software Development Processes with Software Development Settings – A Systematic Approach .....	167
<i>Simona Jeners, Paul Clarke, Rory V. O'Connor, Luigi Buglione, and Marion Lepmets</i>	

## SPI Implementation

Review of Critical Success Factors Related to People in Software Process Improvement .....	179
<i>Sussy Bayona, Jose A. Calvo-Manzano, and Tomás San Feliu</i>	
A Proposal for the Improvement Predictability of Cost Using Earned Value Management and Quality Data .....	190
<i>Adler Diniz de Souza and Ana Regina Cavalcanti Rocha</i>	

Involvement of Stakeholders in Software Processes Improvement to Reduce Change Resistance .....	202
<i>Mirna Muñoz, Jezreel Mejia, Jose A. Calvo-Manzano, and Tomás San Feliu</i>	

## Selected Key Notes and Workshop Papers

### Agile organisations and an agile management process group

Agile Maturity Model: A Synopsis as a First Step to Synthesis .....	214
<i>Tomas Schweigert, Detlef Vohwinkel, Morten Korsaa, Risto Nevalainen, and Miklos Biro</i>	
An Agile Management Process Group for TestSPICE: How to Assess and Improve Agile Management .....	228
<i>Tomas Schweigert, Mohsen Ekssir-Monfared, and Magda Ofner</i>	
Evidence of Agile Adoption in Software Organizations: An Empirical Survey .....	237
<i>Efi Papatheocharous and Andreas S. Andreou</i>	
Definitions of Agile Software Development and Agility .....	247
<i>Maarit Laanti, Jouni Similä, and Pekka Abrahamsson</i>	
Mass-Market Application Development Using Agile Techniques: How Agile Are We Really? .....	259
<i>Alberto Heredia, Roberto Esteban-Santiago, Javier Garcia-Guzman, and Antonio de Amescua</i>	

### Managing Diversity and Innovation

INCUIVA: A Meta-framework for Sustaining the Value of Innovation in Multi-cultural Settings .....	270
<i>Mohamed Sheriff, Elli Georgiadou, Geetha Abeysinghe, and Kerstin Siakas</i>	
Fostering Innovation and Entrepreneurship in European VET: EU Project “From Idea to Enterprise” .....	282
<i>Marek Gavenda, Andreas Riel, Ana Azevedo, Marisa Pais, Eva Homolová, Jiří Balcar, Alessandra Antinori, Giuseppe Metitiero, Giorgos Giorgakis, Photis Photiades, Damjan Ekert, Richard Messnarz, and Serge Tichkiewitch</i>	
VALO <sub>5</sub> – Innovation, Maturity Growth, Quality and Valorisation .....	294
<i>Elli Georgiadou and Kerstin Siakas</i>	

## SPI and Measurement

Customer-Driven Software Product Development Software Products for the Social Media World – A Case Study . . . . .	300
<i>Thomas Fehlmann and Eberhard Kranich</i>	

## Risk Management and Functional Safety Standards

Framework to Assist Healthcare Delivery Organisations and Medical Device Manufacturers Establish Security Assurance for Networked Medical Devices . . . . .	313
<i>Anita Finnegan, Fergal McCaffery, and Gerry Coleman</i>	

Implementing Functional Safety Standards – Experiences from the Trials about Required Knowledge and Competencies (SafeUr) . . . . .	323
<i>Richard Messnarz, Christian Kreiner, Ovi Bachmann, Andreas Riel, Klaudia Dussa-Zieger, Risto Nevalainen, and Serge Tichkiewitch</i>	

Automotive Knowledge Alliance AQUA – Integrating Automotive SPICE, Six Sigma, and Functional Safety . . . . .	333
<i>Christian Kreiner, Richard Messnarz, Andreas Riel, Damjan Ekert, Michael Langgner, Dick Theisens, and Michael Reiner</i>	

Experience with an Integrated Risk Management Process in the Medical Regulatory Environment . . . . .	345
<i>Botond Tényi, Adrien Csík, Ibolya Monoki, and Ferenc Tegzes</i>	

<b>Author Index . . . . .</b>	<b>355</b>
-------------------------------	------------