

Agile Software Development

Torgeir Dingsøyrr · Tore Dybå · Nils Brede Moe
Editors

Agile Software Development

Current Research and Future Directions



Editors

Torgeir Dingsøyr
SINTEF
Dept. Information & Communication
Technology (ICT)
PO BOX 4760 Sluppen
NO-7465 Trondheim
Norway
torgeir.dingsoyr@sintef.no

Tore Dybå
SINTEF
Dept. Information & Communication
Technology (ICT)
PO BOX 4760 Sluppen
NO-7465 Trondheim
Norway
Tore.dyba@sintef.no

Nils Brede Moe
SINTEF
Dept. Information & Communication
Technology (ICT)
PO BOX 4760 Sluppen
NO-7465 Trondheim
Norway
Nils.b.moe@sintef.no

(cc) Improve IT 2007

This image was originally posted to Flickr as <http://www.flickr.com/photos/improveit/1574931134> by Improve IT on 14 October 2007, and licensed under *Creative Commons Attribution-Share Alike 2.0 Generic License*

ISBN 978-3-642-12574-4 e-ISBN 978-3-642-12575-1
DOI 10.1007/978-3-642-12575-1
Springer Heidelberg Dordrecht London New York

Library of Congress Control Number: 2010925896

ACM Computing Classification (1998): D.2, K.6

© Springer-Verlag Berlin Heidelberg 2010

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilm or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer. Violations are liable to prosecution under the German Copyright Law.

The use of general descriptive names, registered names, trademarks, 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.

Cover design: KüinkelLopka GmbH, Heidelberg

Printed on acid-free paper

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

Foreword

Agile software development is the most important paradigm that has swept the software development world over the last decade. Even if it does not represent the most popular software development approach in actual use, it has certainly become of the most talked about. Its vocabulary and prime ideas have already started spilling over into other fields, project management in particular.

Agile software development also carries the unique distinction of being the source of continued debate since its inception. The controversy surrounding it simply doesn't want to die out. Few other movements have pitted detractors and advocates against each other so passionately, so religiously.

But why? Shouldn't a decade be enough to settle at least the fundamental arguments? Those arguments should be getting pretty old by now if it were not for two reasons that still fuel the debate.

The first reason is the inherent fuzziness of the topic. Agile software development is multi-faceted and poorly delimited. As such the paradigm doesn't lend itself to a crisp definition, let alone straightforward study. Is agility a general development philosophy? Is it about dealing with change and uncertainty? Is it a project management philosophy? A way of working with software development teams? A way of working inside software development teams? A way of thinking about software? A set of technical practices that target better quality and higher productivity? A set of collaboration practices that cater to the needs of customers and end users? A set of principles and values of professional conduct? A way of life? A rebellion? A religion? A cultural revolution of the software intellectuals? Well, it's all of the above and none of the above at the same time. That the scope of agile software development is nebulous and dependent on personal and contextual interpretation makes it a hard nut to crack in systematic means. Misconceptions both by detractors and advocates find fertile ground to take hold, amplify and multiply in an unproductive cycle. When a topic is that fuzzy, understanding the boundaries and what lies inside those boundaries become almost as important as understanding the intricacies of the individual constituents.

The second reason is poor dissemination and insufficient synthesis of fragmented research results. It's not that our knowledge of the different facets of agile software development has not expanded significantly over the past years. It has, thanks to the still ongoing research efforts that have undertaken the difficult task of dissecting the elastic anatomy of agile software development. Alas, the scattered results of these efforts are neither well publicized nor readily available to the questioning reader. The world simply doesn't know what we collectively know about agile software development. Worse it doesn't know what we still don't know about it.

This book contributes to the agile debate by addressing both sources of the agile confusion: fuzzy, multi-faceted scope and poor, unconsolidated dissemination of efforts representing the collective understanding of an expert community. The

book represents a comprehensive snapshot of the knowledge accumulated over many years of research by those working closely with the industry, collecting data, observing practitioners in the field, synthesizing insights, devising theories, trying new methods to investigate core issues, and gathering clues to overcome outstanding challenges. It's your one-stop resource to agile software development research with contributions by the best people in the community, by people who know what they're talking about. Enjoy it. Digest it. Use it.

Ottawa, March 2010

Hakan Erdogmus, Kalemun Research Inc.

Preface

Principles of agile software development have a large impact on how software is developed. Some have characterized the change towards agile development as a paradigm shift, leading the focus to topics that have not been addressed or understood in traditional development.

It is therefore important to address what defines and characterizes agile development, what are the historical roots? How do the different principles, processes and methods work in practice, how does agile development affect various groups who are participating in software development? What new challenges arise when using agile development, and what challenges will the methods be unable to solve?

The transition to agile software development has been driven by practitioners, more or less informed by research results, mainly from fields not traditionally focusing on software development. However, researchers focusing on agile software development have a role in developing an understanding of how agile development methods work. Further, why they do or do not work, and in which situations or environment they work better or worse.

This book seeks to show the current state of research on agile software development through an introduction and ten invited contributions on some of the main research fields and by some of the main researchers. The chapters both show the main results in each subfield, and in addition explain what these results mean to practitioners as well as for future research in the field.

The book is aimed at reflective practitioners and researchers, and we hope the book also can serve for graduate courses at universities.

We are very grateful to the chapter authors who have contributed with important overview articles in their own research areas, and also are presenting their chapters at the 11th International Conference on Agile Software Development (XP2010). The editing of this book was supported by the EVISOFT project, which is partially funded by the Research Council of Norway under Grant 174390/I40.

Trondheim, March 2010

Torgeir Dingsøy
Tore Dybå
Nils Brede Moe

Contents

- 1 Agile Software Development: An Introduction and Overview1**
 - 1.1 Introduction.....1
 - 1.2 What is Agile Development?2
 - 1.3 Research on Agile Software Development2
 - 1.4 Main Themes in this Book7
 - 1.5 Conclusion11
 - References.....11
 - Author Biographies12
- 2 Towards an Understanding of the Conceptual Underpinnings of Agile Development Methodologies15**
 - 2.1 Introduction.....15
 - 2.2 The Challenges of Contemporary Software Development16
 - 2.3 What’s New About Agile Development?19
 - 2.4 Principles of Sociotechnical Systems21
 - 2.5 ADM and the System of Systems Methodologies (SOSM)23
 - 2.6 Implications for Research and Practice25
 - 2.7 Conclusion26
 - References.....27
 - Author Biographies29
- 3 Agile Software Development Methods: A Comparative Review.....31**
 - 3.1 Introduction.....31
 - 3.2 An overview of agile methods33
 - 3.3 Comparative review of the existing agile methods36
 - 3.4 Discussion49
 - 3.5 Conclusion52
 - Acknowledgements.....53
 - References.....53
 - Author Biographies58
- 4 Three ‘C’s of Agile Practice: Collaboration, Co-ordination and Communication61**
 - 4.1 Introduction.....61
 - 4.2 Fieldwork62
 - 4.3 Results.....69
 - 4.4 Discussion79
 - 4.5 Conclusion82
 - Acknowledgements.....82
 - References.....83
 - Author Biographies85

5 From Exotic to Mainstream: A 10-year Odyssey from Internet Speed to Boundary Spanning with Scrum	87
5.1 Introduction.....	87
5.2 Research Methodology	89
5.3 Study One Results: Racing the E-bomb	94
5.4 Study Two Results: A New Software Development Process	97
5.5 Study Three Results: Balancing Speed and Quality	100
5.6 Study Four Results: Boundary Spanning with Scrum	103
5.7 Discussion and Conclusion	106
References.....	108
Author Biographies.....	109
 6 An Ideal Customer: A Grounded Theory of Requirements Elicitation, Communication and Acceptance on Agile Projects	 111
6.1 Introduction.....	111
6.2 Research Method	112
6.3 What is the Experience of the Customer?.....	114
6.4 Is the Customer a Single Person or a Team?	115
6.5 What practices enhance the effectiveness of the customer?	123
6.6 Discussion and Conclusion	134
References.....	139
Author Biographies.....	141
 7 Pair Programming: Issues and Challenges	 143
7.1 Introduction.....	143
7.2 Horse Trading Problem: Understanding Pair vs. Solo.....	145
7.3 Pair Programming Studies	147
7.4 Repeat Programming	156
7.5 Conclusion	160
References.....	160
Author Biographies.....	162
 8 Architected Agile Solutions for Software-Reliant Systems.....	 165
8.1 Introduction.....	165
8.2 Key Principles.....	168
8.3 How Much Architecting is Enough?	172
8.4 Early Architected-Agile Success Cases	173
8.5 Implications for Practice and Future Research	180
8.6 Conclusion	180
References.....	182
Author Biographies.....	183

9 Agile Interaction Design and Test-Driven Development of User Interfaces– A Literature Review	185
9.1 Introduction.....	185
9.2 Agile Interaction Design	186
9.3 User Interface Test-Driven Development	191
9.4 Conclusion	199
References.....	199
Author Biographies	201
 10 Organizational Culture and the Deployment of Agile Methods: The Competing Values Model View	203
10.1 Introduction.....	203
10.2 Organizational Culture and the Competing Values Model	204
10.3 Organizational Culture and the Deployment of Agile Methods	208
10.4 Conclusion	217
References.....	218
Author Biographies	222
 11 Future Research in Agile Systems Development: Applying Open Innovation Principles Within the Agile Organisation	223
11.1 Introduction.....	223
11.2 Innovation in Agile Development – The Current State of Research	224
11.3 Contemporary Thinking on Innovation – Open Innovation	225
11.4 Project Management in An Open Agile Environment	227
11.5 Conceptual Framework to Guide Future Research	227
11.6 Conclusion and Implications for Future Research	230
Acknowledgements	232
References.....	232
Author Biographies	234
 Index	237

List of Contributors

Pekka Abrahamsson
Department of Computer Science
University of Helsinki
PO Box 68
FI-00014 University of Helsinki, Finland
pekka.abrahamsson@cs.helsinki.fi

VenuGopal Balijepally
Department of Accounting, Finance & MIS
Prairie View A&M University
Prairie View, Texas 77446-0519, USA
vebalijepally@pvamu.edu

Kyle Atikus Barnes
Seattle Software Solutions
1969 SW Hillcrest Road
Seattle, WA 98166, USA
kyle@seattle-software-solutions.com

Richard Baskerville
Department of Computer Information Systems
Georgia State University
University Plaza, Atlanta
Georgia 30302, USA
baskerville@acm.org

Robert Biddle
School of Computer Science
Carleton University
214C, Social Sciences Research Building
Ottawa, ON K1S 5B6, Canada
robert_biddle@carleton.ca

Barry Boehm
Center for Systems and Software Engineering
University of Southern California
941 W. 37th Place, SAL Room 328
Los Angeles, CA 90089-0781, USA
boehm@usc.edu

Philip L. Bond

Department of Information Systems and Operations Management
University of Texas at Arlington
Arlington, TX 76019, USA
philip.bond@mavs.uta.edu

Alan Cannon

Department of Information Systems and Operations Management
University of Texas at Arlington
Arlington, TX 76019, USA
acannon@uta.edu

Keith C.C.Chan

Department of Computing
The Hong Kong Polytechnic University
Hungghom, Kowloon, Hong Kong
cskcchan@comp.polyu.edu.hk

Kieran Conboy

Department of Accounting and Finance
National University of Ireland, Galway,
Galway, Ireland
kieran.conboy@nuigalway.ie

Torgeir Dingsøyr

SINTEF
NO-7465 Trondheim, Norway
torgeir.dingsoyr@sintef.no

Tore Dybå

SINTEF
NO-7465 Trondheim, Norway
tore.dyba@sintef.no

Theodore D. Hellmann

Department of Computer Science
University of Calgary
ICT 602, 2500 University Drive NW
Calgary, Alberta, T2N 1N4, Canada
tdhellma@ucalgary.ca

Ali Hosseini-Khayat
Department of Computer Science
University of Calgary
CT 602, 2500 University Drive NW
Calgary, Alberta, T2N 1N4, Canada
hosseisa@ucalgary.ca

Juhani Iivari
Department of Information Processing Sciences
University of Oulu
P.O. Box 3000, 90014 Oulun yliopisto, Finland
juhani.iivari@oulu.fi

Netta Iivari
Department of Information Processing Sciences
University of Oulu
P.O. Box 3000, 90014 Oulun yliopisto, Finland
netta.iivari@oulu.fi

Supannika Koolmanojwong
Center for Systems and Software Engineering
University of Southern California
941 W. 37th Place, SAL Room 328
Los Angeles, CA 90089-0781, USA
koolmano@usc.edu

Jo Ann Lane
Center for Systems and Software Engineering
University of Southern California
941 W. 37th Place, SAL Room 328
Los Angeles, CA 90089-0781, USA
jolane@usc.edu

Kim Man Lui
Department of Computing
The Hong Kong Polytechnic University
Hung Hom, Kowloon, Hong Kong
csmklui@comp.polyu.edu.hk

Sabine Madsen
Department of Communication, Business and IT
Roskilde University
Universitetsvej 1
DK- 4000 Roskilde, Denmark
sabinem@ruc.dk

Angela Martin
Department of Computer Science
The University of Waikato
Private Bag 3105
Hamilton, 3240, New Zealand
angela@cs.waikato.ac.nz

Frank Maurer
Department of Computer Science
University of Calgary
2500 University Drive NW
Calgary, Alberta, T2N 1N4, Canada
fmaurer@ucalgary.ca

Nils Brede Moe
SINTEF
NO-7465 Trondheim, Norway
nils.b.moe@sintef.no

Lorraine Morgan
LERO - The Irish Software Engineering Research Centre
University of Limerick
Limerick, Ireland
lorraine.morgan@ul.ie

Sridhar Nerur
Department of Information Systems and Operations Management
University of Texas at Arlington
Arlington, TX 76019, USA
snerur@uta.edu

James Noble
School of Engineering and Computer Science
Victoria University
PO Box 600
Wellington 6140, New Zealand
kjx@ecs.vuw.ac.nz

Nilay Oza
VTT Technical Research Centre of Finland
PO Box 1000
FI-02044 VTT, Finland
nilay.oza@vtt.fi

Jan Pries-Heje
Department of Communication, Business and IT
Roskilde University
Universitetsvej 1
DK- 4000 Roskilde, Denmark
janph@ruc.dk

Hugh Robinson
Mathematics, Computing and Technology Faculty
The Open University
Walton Hall
Milton Keynes, MK7 6AA, UK
h.m.robinson@open.ac.uk

Helen Sharp
Mathematics, Computing and Technology Faculty
The Open University
Walton Hall
Milton Keynes, MK7 6AA, UK
h.c.sharp@open.ac.uk

Mikko Siponen
Department of Information Processing Science
University of Oulu
PO Box 3000
FI-90014 University of Oulu, Finland
mikko.siponen@oulu.fi

Richard Turner
Stevens Institute of Technology
Hoboken, NJ 07030, USA
rtturner@stevens.edu