RESEARCH

Tobias Ackermann

IT Security Risk Management

Perceived IT Security Risks in the Context of Cloud Computing

Springer Gabler

IT Security Risk Management

Tobias Ackermann

IT Security Risk Management

Perceived IT Security Risks in the Context of Cloud Computing

Springer Gabler

Tobias Ackermann
Fachgebiet Wirtschaftsinformatik
TU Darmstadt
Darmstadt, Germany

Dissertation Technische Universität Darmstadt, 2012

D 17

ISBN 978-3-658-01114-7 ISBN 978-3-658-01115-4 (eBook)
DOI 10.1007/978-3-658-01115-4

The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at http://dnb.d-nb.de.

Library of Congress Control Number: 2012955651

Springer Gabler

Printed on acid-free paper

Springer Gabler is a brand of Springer DE.
Springer DE is part of Springer Science+Business Media.
www.springer-gabler.de

Foreword

Since many years, IT outsourcing is a widespread and actively used opportunity to transfer IT functions to third parties and thereby reduce costs. In recent years, the current trend in the form of Cloud Computing, i. e., the sourcing of applications, computing power and storage space over the Internet, is increasingly discussed by scientists and practitioners. However, the promised benefits of Cloud Computing are accompanied by a growing number of IT security incidents that are, on the one hand, a problem for the users, as they may not be able to access and use the service or because the confidentiality of their customer data may be compromised. On the other hand, such security incidents are also a problem for the service providers as they may jeopardize their reputation and may lose customers.

Therefore, the research objective of this thesis is to analyze the perception and effect of IT security risks of Cloud Computing in detail. First, the relevant IT security risks of Cloud Computing are identified and systematized in a structured process, in order to later use them as a part of an empirical survey. A quantitative empirical survey is used to examine how potential users perceive IT security risks as well as how these risk estimations affect the adoption of Cloud Computing. At the end, using a mathematical model specifically designed for the characteristics of Cloud Computing scenarios, it is investigated how parameters of a scenario affect the distribution of potential losses.

This thesis's first part addresses the analysis of the various IT security risks of Cloud Computing and their perception. In order to identify the individual components of the concept "IT security", Mr. Ackermann first presents a structured literature review. The iterative refinement of search results and the following process of extracting all relevant individual risks and clustering them to risk dimensions are thoroughly described. Mr. Ackermann uses the Q-sort method to systematically evaluate the resulting taxonomy. In order to further refine and evaluate the individual risk descriptions, he conducts qualitative interviews with 24 IT security

experts. Thereby, the exhaustiveness of the list of risks is ensured and it is possible to discover five previously not published individual risks. Subsequently, the formal specification of the latent construct "Perceived IT Security Risk" is described and the relationships and effects between the individual constituting dimensions and their risks is discussed. Finally, after describing the setup of the quantitative empirical survey, the validation of the developed scale is presented. In addition to traditional tests of the goodness of fit and the validity and reliability of indicators and constructs, the scale is also tested using more advanced tests, such as known-groups comparison or tests for nomological and multidimensional validity.

Mr. Ackermann makes several significant contributions to information systems science: In addition to the developed scale, the analysis of the effects of the perceived IT security risks on the potential users' adoption decisions contributes to information systems literature. Based on the theory of reasoned action and previous studies, he derives hypotheses about the decision processes of IT executives. The hypotheses are analyzed in the form of structured equation models and their validity is confirmed using the responses of the quantitative study. The results show that the perceived IT security risk has a double detrimental effect on Cloud Computing adoption decisions.

In this thesis's second part, Mr. Ackermann develops a mathematical risk quantification framework which can be used to support the IT risk management process for Cloud Computing scenarios. He describes methods with which it is possible to identify the individual risk or component that introduces the biggest share of the overall aggregated risk distribution. The results of the sensitivity analysis indicate that scenarios are more sensitive to changes in the amount of the potential losses, while changes to the occurrence probabilities or the number of risks have a smaller effect on the resulting distribution. Moreover, the framework is applied to an existing e-commerce system where two alternative security levels are compared to each other in order to find the most economically reasonable countermeasures. Additionally, the cost drivers of the scenario are identified with the help of the presented methods.

The entire scale development process as well as the mathematical model's analysis show a great degree of methodological rigor and provide many interesting results. This thesis will be valuable to readers in both, academia and practice, as it suggests concrete recommended actions for users and providers of Cloud Computing services that can be applied during IT risk management. Therefore, I wish this thesis a widespread distribution.

Darmstadt, September 2012 *Prof. Dr. Peter Buxmann*

Preface

This thesis was written during my work as a research assistant at the chair of Information Systems | Software Business & Information Management at the Technische Universität Darmstadt.

I am especially grateful for my supervisor Prof. Dr. Peter Buxmann, who greatly supported me and gave me many helpful suggestions. Likewise, I would like to thank my second referee Prof. Dr. Alexander Benlian for his valuable advises.

Furthermore, I thank the CASED graduate school for the granting of a PhD scholarship as well as numerous CASED postdocs and PhD students with whom I conducted the qualitative interviews.

My special thanks go to my friends and colleagues Alexander, André, André, André, Andreas, Anne, Anton, Björn, Christoph, Cornelia, Daniel, Eva, Florian, Golriz, Janina, Jasmin, Jin, Kerstin, Leonardo, Mark, Markus, Markus, Michael, Oliver, Omid, Patrick, Ruth, Sebastian, Sebastian, Sheikh, Sonja, Stefan, Sunil, Thomas, Thomas, Thorsten, Tobias und Tolga, whom I thank wholeheartedly for their support.

Darmstadt, September 2012 *Tobias Ackermann*

Contents