Forum-based Online Knowledge Communities: Knowledge Processes and their Factors of Influence. An Empirical Study using Structural Equation Modeling

by


Dissertation submitted to the Faculty of the School of Humanities and Social Sciences at International University Bremen in partial fulfillment of the requirements for the degree

Doctor of Philosophy (Ph.D.)
in
Information Science

Approved – Thesis Committee:
Prof. Dr. Adalbert F.X. Wilhelm, International University Bremen, Chair
Prof. Dr. Petra Lietz, International University Bremen
Prof. Dr. Rosemary Luckin, Sussex University
Prof. Dr. Paula Swatman, University of South Australia
Prof. Dr. Sven Voelpel, International University Bremen

Keywords: Online Knowledge Communities, Knowledge Management, Knowledge Processes, Knowledge Creation, Knowledge Transfer, Collaborative Learning- and Work-Environments, Online Forums.

Date of Defense: November 8, 2005

Copyright © Felix J. Schmitz-Justen
ABSTRACT

Knowledge is becoming ever more important as an individual good, and as a social and economic resource.

The starting point of this research is the argument that future learning and knowledge work will be ever more influenced by inter- and transdisciplinary conditions, under both remote and co-located combinations of lifelong learning and knowledge work – conditions that are identified as being well addressed by Online Knowledge Communities (OKCs).

The research interest of this thesis is how knowledge processes can be optimally supported in the cooperative context of forum-based OKCs. The research focuses especially on the two key processes knowledge creation and knowledge transfer. The research question of this thesis has been formulated as follows: Which factors influence and support the knowledge-relevant usage of online forums and thus indirectly stimulate the two key knowledge processes “Knowledge Transfer” and “Knowledge Creation” within forum-based OKCs?

The starting point of the research is a literature review and the outline of individual hypotheses on the basis of an interdisciplinary body of research from the fields of computer science and management science, specifically knowledge management literature, community of practice literature, human-computer interaction literature, and collaborative systems literature.

Following the literature review, the empirical part of the research is based on an in-depth study of the users of the electronic communication forums at International University Bremen (IUB). Based on a log-file analysis, an online questionnaire survey, and direct observation, the empirical part of the research outlined in this thesis consists of two main parts of research – an ANOVA-based and a SEM-based analysis.
Both empirical parts of research – the ANOVA-based calculation of type of content-based knowledge process values and the SEM-based hypotheses testing of individual factors of impact on an individual’s knowledge process contribution – could be shown to be in line with the theoretically deduced hypotheses.

Besides the careful selection of a forum-platform (factor service quality) and carefully drafting of the initial content in the case of newly established online knowledge communities (factor perceived quality of content), the best strategy to stimulate participants to contribute a larger share of knowledge-process-relevant content appears to be the emphasis of the online forum as an online knowledge community, with a focus on professional as opposed to social content (factors social vs. professional affiliation motivation). These four factors could presumably not only be positively influenced, but also represent the three largest factors of influence (in absolute terms) plus the fifth largest factor of influence on a participant’s relative share of knowledge process-relevant contributions. As far as “investments” in the degree of trust and care among members of the community and the degree of cooperation and sense of community are concerned, further research is required.

As one of the first comprehensive studies covering not only both key knowledge processes (knowledge creation and knowledge transfer), but also the entire range of potential input factors that might potentially impact on these processes (system, content, social, and user aspects), the thesis integrates existing, fragmented research with a limited focus on a restricted number of input aspects and / or knowledge processes into an integrated model of forum-based collaborative knowledge management. Future research, for which hypotheses are already outlined in the respective part of the thesis, is particularly required to analyze the impact of participants’ frequency of contribution as one aspect of individuals’ absolute knowledge process contribution.
ACKNOWLEDGEMENT

This work could not have been finalized without the support and guidance of my committee members, colleagues, friends, and family.

First and foremost, I would like to thank my supervisor and mentor Prof. Dr. Adalbert F.X. Wilhelm for his unconditional support, guidance, incisive comments, and encouragement. Prof. Dr. Wilhelm offered me a great deal of inspiring freedom; his relaxed aura helped to ease any stress and tension; and his positive influence helped me keep an open mind during my research.

I would also like to thank Prof. Dr. Petra Lietz (International University Bremen, Bremen, Germany), Prof. Dr. Rosemary Luckin (Sussex University, Brighton, United Kingdom), Prof. Dr. Paula Swatman (University of South Australia, Adelaide, Australia), and Prof. Dr. Sven Voelpel (International University Bremen, Bremen, Germany) for agreeing to join my dissertation committee.

Together with Prof. Dr. Wilhelm they created an interdisciplinary expertise necessary for the given field of research. In particular, I would like to emphasize my dear admiration for Prof. Dr. Rosemary Luckin’s willingness to take up the role of an external member of the committee, despite her time restrictions as Pro-Vice-Chancellor of Sussex University and director of the Human Centred Technology Research Group’s IDEAS Research Lab. I would also like to thank Prof. Dr. Paula Swatman, Professor of Information Systems in the School of Computer & Information Science at University of South Australia for her enthusiasm in joining the committee as an external member. Furthermore, I would like to thank Prof. Dr. Petra Lietz for providing specific methodological expertise, and Prof. Dr. Sven Voelpel whose thought-provoking comments contributed to ideas for further work.
My acknowledgement also goes to the numerous people at conferences with whom I discussed my research, and who inspired my thinking; to the participants of the online survey conducted in the context of this research; to Susann Kern from UNIpark for supporting specific issues in the creation of the online questionnaire; and to Missing Link for sponsoring the survey.

I would like to thank all colleagues from IUB’s School of Humanities and Social Sciences for creating such a nice working environment and supporting me in various ways. In particular, I am sincerely grateful to my fellow student Stefan Rach for the nice coffee breaks, providing the light moments that made this experience so pleasant. I would also like to acknowledge the strongly positive effect that the spirit of IUB, as a newly founded institution with its effective ways of solving organizational and administrative issues, had on my spirit and motivation – and thus into finalizing this research in less than two years.

Last but not least, a heartfelt “thank you” to my mother, sister, and brother for their continuing support and encouragement! I dedicate this work to the memory of my father.
RESEARCH NOTE

Outlines of the research approach and selected results of the research have been presented at conferences (Schmitz-Justen & Wilhelm, 2005b); presented at conferences and published in the respective conference proceedings (Schmitz-Justen & Wilhelm, 2005a, 2005c); accepted for publication in scientific journals (Schmitz-Justen & Wilhelm, in press); submitted for presentation at conferences (Schmitz-Justen & Wilhelm, accepted); and submitted for publication in scientific journals (Schmitz-Justen & Wilhelm, under review).
TABLE OF CONTENT

Abstract III
Acknowledgement V
Research Note VII

Table of Content IX
List of Tables XV
List of Figures XVII
List of Acronyms XIX

I. INTRODUCTION AND BACKGROUND 1
1 Introduction 3
2 Motivation, Relevance, and Original Contribution 9
3 Organization and Structure of the Thesis 11

II. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT 13
4 Introduction and Research Question 15
5 Context – Changing Learning & Work Environments 17
   5.1 Knowledge Economies 18
   5.2 Knowledge Corporations, Institutions, and Organizations 19
   5.3 Knowledge Communities – Lifelong Learning and Knowledge Work 22
6 Key Research Topics and Key Terms 29
   6.1 Collaborative Systems 30
   6.2 Knowledge Management 35
   6.2.1 Knowledge – The JTB-conception 35
### III. RESEARCH METHODOLOGY

**12 Introduction**

**13 Sample and Data Collection**

13.1 *Online Questionnaire – Details*  
13.2 *Control Variable Forum Categories*  
13.3 *Data Collection Procedure and Sequence of Events*  
13.4 *Response Rates by Usergroup*  
13.5 *Sample and Random Sub-Samples (I.) – 827 vs. 297 vs. 192 Data Sets*

**14 Focus of the Model – RKPC instead of AKPC**

**15 Indirect Measurement of Knowledge Process Contribution**

15.1 *Research Question and Hypothesis*  
15.2 *Descriptive Statistics*  
15.3 *Assumptions*  
15.4 *Model 1 – Type of Content as Fixed Factor*  
15.5 *Model 2 – Forum Category as Random Factor*  
15.6 *Retrospective Power Analysis*  
15.7 *Type of Content-based Knowledge Process Measures*

**16 Scale Development and Measures**

16.1 *Unidimensionality – Exploratory Factor Analysis*  
16.2 *Unidimensionality – Confirmatory Factor Analysis*  
16.3 *Construct Reliability – Reliability Analysis*

**17 Measures – Overview**

**18 Summary and Overview**

### IV. ANALYSIS AND RESULTS

**19 Introduction**

**20 Descriptive Statistics – Log-file Data**

20.1 *Analysis of Usergroup / Account Status Data*  
20.2 *Posts and Views by Forum Categories*
20.3 Distribution of Active Forum Category Sets 160
20.4 Matrix Data – Usergroup / Forum Categories 161

21 Descriptive Statistics and Correlations – Questionnaire Data 163
21.1 Respondents Demographics – 330 Participants 163
21.2 Sample and Random Sub-Samples – 827 vs. 297 vs. 192 Data Sets 165
21.2.1 Distribution of Usergroups along Forum Categories 166
21.2.2 Perception of Types of Content along Forum Categories 168
21.3 Descriptive Statistics – 192 Data Sets / SEM Model Variables 169
21.4 Correlation – 192 Data Sets / SEM Model Variables 171

22 Structural Model Analysis 173
22.1 Validation of the Measurement Model 175
22.2 Results of the Structural Model and Goodness of Fit Measures 177
22.3 Model Optimization Using Modification Indexes 178
22.4 Results – Direct, Indirect, and Total Effects on RKPC 179

23 Summary and Overview 183

V. DISCUSSION AND CONCLUSION 185

24 Introduction 187

25 Discussion and Implications 189
25.1 System Aspects 193
25.2 Content Aspects 194
25.3 Social Aspects 195
25.3.1 Cooperation and Sense of Community 195
25.3.2 Trust and Care 197
25.4 User Aspects 198
25.4.1 Experience 198
25.4.2 Social- and Professional Affiliation Motivation 199
25.5 Practical Implications 200

26 Contributions and Significance 201

27 Limitations of the Research 203
27.1 Focus on Relative Knowledge Process Contribution (RKPC) 203
27.2 Sample – Aspects of Generalizability 206
28 Future Research Directions

28.1 Incorporation of Frequency of Contribution

28.2 Cross-Validation and Screening-out of Sample-Effects

28.3 Improvement and Extension Potential for Future Research

28.4 Alternative Research Approaches

29 Summary of Research Findings and Conclusion

REFERENCES

APPENDICES

A. Online Questionnaire

B. Questionnaire – Overview of Structure & Abortion-Ratio by Page

C. CD-ROM
LIST OF TABLES

Part II

Table 6-1: Time / Space Classification of Collaborative Systems ............................................ 32
Table 6-2: Framework for Knowledge Management Support ................................................... 39
Table 6-3: Practices and Processes used in Knowledge Management ....................................... 39
Table 7-1: Research Approach – This Thesis’ Specifications Underlined .................................. 50
Table 8-1: Overview of Comparable Empirical & Theoretical Model Approaches.................. 59
Table 9-1: Knowledge Processes in the Literature and Proposed Framework .......................... 64
Table 9-2: Identified Conceptual Knowledge Cycle ................................................................. 68
Table 9-3: Synonyms and Analogies of Knowledge Creation .................................................. 69
Table 9-4: Synonyms and Analogies of Knowledge Transfer .................................................. 69
Table 9-5: Type of Content Indicators for Knowledge Distribution ....................................... 72
Table 11-1: Knowledge Process Factors: Summary of Hypothesized Relationships ............. 99
Table 11-2: Input Factors: Summary of Constructs, Hypotheses, and Key Sources ............. 101

Part III

Table 13-1: Categorization of IUB-Forums in Forum Categories ........................................... 112
Table 13-2: Survey Period and General Sequence of Events .................................................. 113
Table 13-3: Response Rates by Usergroup – OPST® Panel Statistic ........................................ 115
Table 15-1: Perceived Knowledge Transfer / Creation Factor per Type of Content ............. 124
Table 15-2: Model 2-based Estimated Marginal Means .......................................................... 134
Table 16-1: Steps & Types of Analysis of Scale Development ................................................ 137
Table 16-2: Final Constructs and their Statistical Determinants ............................................. 138
Table 16-3: Cooperation & Sense of Community – Bivariate Correlations ......................... 140
Table 16-4: Trust & Care – Bivariate Correlations ................................................................. 141
Table 16-5: Intercorrelations Among Constructs ................................................................. 142
Table 17-1: Constructs and Items for Relative Knowledge Process Contribution ..........146
Table 17-2: Constructs and Items for Input Factors ..................................................148
Table 18-1: Input Factors: Hypothesized Relationships Among Latent Variables ....150

Part IV
Table 20-1: Total Posts per Month ‘09/2001 – ‘09/2004.................................................156
Table 20-2: Matrix Usergroup / Account Status – Descriptive Data .........................157
Table 20-3: Length of Membership – Overall Distribution .........................................158
Table 20-4: Number of Postings per Month per Account Holder ..............................158
Table 20-5: Posts and Views by Forum Categories .......................................................159
Table 20-6: Number of Users with Active Forum Category Sets .................................160
Table 20-7: Matrix Data – Usergroup / Forum Categories ........................................162
Table 21-1: Usergroup-Structure of Participants ..........................................................165
Table 21-2: Age-Structure of Participants ..................................................................165
Table 21-3: Usergroup / Forum Category Crosstabulation – 827 Data Sets .................167
Table 21-4: Usergroup / Forum Category Crosstabulation – 297 Data Sets .................167
Table 21-5: Usergroup / Forum Category Crosstabulation – 192 Data Sets .................167
Table 21-6: Types of Content / Forum Category Crosstabulation – 827 Sets ..............168
Table 21-7: Types of Content / Forum Category Crosstabulation – 297 Sets ..............169
Table 21-8: Types of Content / Forum Category Crosstabulation – 192 Sets ..............169
Table 21-9: Mean, Std. Dev., Variance, Skewness- & Kurtosis Values (N=192) .........170
Table 21-10: Intercorrelations Among Individual Model Variables (N=192) ............172
Table 22-1: Steps & Types of Analysis of Structural Equation Modeling .................174
Table 22-2: Measures of Fit for Measurement and Structural Model .......................178
Table 22-3: AMOS® Modification Indices (sorted by M.I.) ........................................179

Part V
Table 25-1: Direct, Indirect, and Total Effects on RKPC .............................................190
Table 27-1: Hypothetical RKPC and AKPC of an OKC – Example 1 .......................204
Table 27-2: Hypothetical RKPC and AKPC of an OKC – Example 2 .......................205
LIST OF FIGURES

Part I

Figure 1-1: PhD Thesis – Fields of Research and Key Research Topics ....................... 6
Figure 3-1: The Conceptual and Empirical Levels of the Thesis .................................. 12

Part II

Figure 5-1: Knowledge Communities as Constituents of the Knowledge Economy ........ 18
Figure 5-2: S&P 500 Market-to-Book Ratio 1982-2002 w. 5-Yr. Moving Average .......... 22
Figure 6-1: Key Research Topics of Online Knowledge Community Research ............. 30
Figure 7-1: Gallupe’s (2001) General Systems Framework ......................................... 54
Figure 7-2: Abstract Causal Path Model based on Gallupe’s (2001) Framework .......... 54
Figure 7-3: Measurement and Structural Model .......................................................... 56
Figure 9-1: Indirect derivation of individual actors’ KP-contributions ....................... 73

Part IV

Figure 22-1: Standardized Estimates of Path Model ..................................................... 182
## LIST OF ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGFI</td>
<td>Adjusted Goodness of Fit Index</td>
</tr>
<tr>
<td>AKPC</td>
<td>Absolute Knowledge Process Contribution</td>
</tr>
<tr>
<td>ANOVA</td>
<td>Univariate Analysis of Variance</td>
</tr>
<tr>
<td>CFI</td>
<td>Comparative Fit Index</td>
</tr>
<tr>
<td>CmC</td>
<td>Computer-mediated Communication</td>
</tr>
<tr>
<td>CoP</td>
<td>Communities of Practice</td>
</tr>
<tr>
<td>CSCW</td>
<td>Computer Supported Collaborative Work</td>
</tr>
<tr>
<td>EFA</td>
<td>Exploratory Factor Analysis</td>
</tr>
<tr>
<td>FAC</td>
<td>Factor Analysis Scores</td>
</tr>
<tr>
<td>FC</td>
<td>Forum Category</td>
</tr>
<tr>
<td>FoC</td>
<td>Frequency of Contribution</td>
</tr>
<tr>
<td>GFI</td>
<td>Goodness of Fit Index</td>
</tr>
<tr>
<td>HCI</td>
<td>Human-Computer Interaction</td>
</tr>
<tr>
<td>H&lt;sub&gt;FreqN&lt;/sub&gt;</td>
<td>Hypothesis n regarding Frequency of Contribution</td>
</tr>
<tr>
<td>H&lt;sub&gt;indirect KPC&lt;/sub&gt;</td>
<td>Hypothesis n regarding indirect RKPC effects</td>
</tr>
<tr>
<td>H&lt;sub&gt;KPC&lt;/sub&gt;</td>
<td>Hypothesis n regarding direct RKPC effects</td>
</tr>
<tr>
<td>IFI</td>
<td>Incremental Fit Index</td>
</tr>
<tr>
<td>IUB</td>
<td>International University Bremen</td>
</tr>
<tr>
<td>KC</td>
<td>Knowledge Creation</td>
</tr>
<tr>
<td>KCF</td>
<td>Knowledge Creation Factor</td>
</tr>
<tr>
<td>KM</td>
<td>Knowledge Management</td>
</tr>
<tr>
<td>KP</td>
<td>Knowledge Processor(s)</td>
</tr>
<tr>
<td>KT</td>
<td>Knowledge Transfer</td>
</tr>
<tr>
<td>KTF</td>
<td>Knowledge Transfer Factor</td>
</tr>
<tr>
<td>MI</td>
<td>Modification Index</td>
</tr>
<tr>
<td>OKC</td>
<td>Online Knowledge Community</td>
</tr>
<tr>
<td>OPST</td>
<td>Online Panel Site Tool</td>
</tr>
<tr>
<td>RKPC</td>
<td>Relative Knowledge Process Contribution</td>
</tr>
<tr>
<td>RMSEA</td>
<td>Root Mean Square Error of Approximation, also referred to as RMS</td>
</tr>
<tr>
<td>SEM</td>
<td>Structural Equation Modeling</td>
</tr>
<tr>
<td>ToC</td>
<td>Type of Content</td>
</tr>
</tbody>
</table>
I. INTRODUCTION AND BACKGROUND
1 INTRODUCTION

Within today’s emerging knowledge societies and their economies, the lifetime of learning cycles decreases and knowledge, particularly tacit knowledge, becomes a strategic resource. As the lifetime of knowledge decreases, the necessity for lifelong learning increases. Knowledge is becoming ever more important as an individual good, a social resource, and an economic agent of production (Drucker, 1994; Reinmann-Rothmeier, 2000; Reinmann-Rothmeier & Mandl, 1999).

Both learners and knowledge workers are confronted with the challenge of generating output from a body of previously unknown knowledge, confronting them with the paradox of how one can learn something one knows nothing about (Laurillard, 1996).

Knowledge management mainly referred to the management of explicit or codified knowledge, until around 1990/1995, when Nonaka published his famous paper “The Knowledge-Creating Company” in the Harvard Business Review (Nonaka, 1991) and, together with Takeuchi, a book of the same name (Nonaka & Takeuchi, 1995). Knowledge management research thus focused mainly on aspects of knowledge acquisition of previously solved problems, targeted at problem solving through tools for the management of sources including electronic documents, email, and document repositories like GroupWare databases and data warehouses. Researchers and practitioners alike criticized the restrictions of these knowledge management approaches and the development of Knowledge Management Systems (KMS) based on them. Aspects of problem solving for new and unique problems through knowledge creation were hardly addressed, and the comparatively soft issues of the transfer of implicit knowledge were largely disregarded.

In recent years, researchers around the world have realized the necessity for, and the potential of, a shift towards research into the management of tacit knowledge; a shift from a computer-centered approach, towards a human-centered approach, to knowledge management. Research in recent years addressed the challenge in two main areas:
research on expertise profiles and databases, focusing on sources such as subject matter experts and specialist skills and expertise; and electronic discussion forums with the individual and system user as the focal points of knowledge (Hahn & Subramani, 2000; Papargyris & Poulymenakou, 2003; Schatten, Biffl, & Tjoa, 2003; Waltert, 2002).

At the same time, as knowledge management approaches and foci shifted, the rise of the Internet led to the shift of what had been local and separated learning and work environments, towards networks and the constellation of virtual, distributed, and networked learning and work environments in addition to co-located ones, under both remote and co-located collaborative settings.

Online forums became popular as a system of choice to implement the new knowledge management approaches targeted at overcoming the problems and shortcomings of previous approaches and systems (Kuhlen, 2001). Online forums, also referred to as electronic communication forums, forum messaging systems, or simply forums, generate time- and location-independent, continuous and digitally stored knowledge bases that are open to all members of the knowledge community, and are a powerful tool for knowledge management in increasingly networked and distributed corporations, institutions and organizations. Forum-based Online Knowledge Communities (OKCs) soon became common tools for knowledge management. A huge potential is relegated to forum-based online knowledge communities as a means of managing knowledge within collaborative, distributed and networked environments such as universities, research institutions or other knowledge-based environments, by fostering the communication between knowledge “carriers” (Waltert, 2002).

However, recent research also emphasizes the particular need for empirical studies to enhance the data basis and to allow the comparison of results in different contexts, since so far only a few empirical studies exist that scientifically test the assumed advantages of forum-based systems (Waltert, 2002).

The challenges to overcome are the following: First, knowledge springs from and evolves only in its social context (Brown, Collins, & Duguid, 1989). Second, distributed and networked learning and work environments imply a lower degree of cooperation compared to co-located Shared Social Spaces (Rauterberg, Sperisen, & Dätwyler, 1995).
This raises the question how the high degree of collaboration required for a stimulation of knowledge processes can be supported in a remote environment.

In the field of knowledge management research, four central key knowledge processes can be distinguished: Knowledge Creation, Knowledge Capture, Knowledge Transfer, and Knowledge Utilization (McElroy, 2002; von Krogh, Ichijo, & Nonaka, 2000; Weber & Kaplan, 2003). Because knowledge capture is an inherent feature of collaborative systems such as online forum software packages (i.e., a system-based process), and since knowledge utilization depends on the context of the user and her/his ability to apply cooperative content directly or indirectly within this personal context (i.e., an individual-based process), knowledge creation and knowledge transfer (as community-based processes) are the knowledge processes most relevant to collaborative system research.


Research integrating these two core knowledge process perspectives in the context of collaborative systems in a common model is still due, in particular research targeting the question – how these knowledge processes can most effectively be stimulated – from a broader, integrated perspective.

A preliminary review of the research and theoretical literature led to the following guiding research question for the empirical research:

Which factors influence and support the knowledge-relevant usage of online forums and thus indirectly stimulate the two key knowledge processes “Knowledge Transfer” and “Knowledge Creation” within forum-based Online Knowledge Communities?

The ultimate purpose of the project, the theoretical foundations and subsequent empirical investigations of which are being outlined in this thesis, is thus the identification of factors that stimulate individual actors to contribute to the key knowledge processes of
knowledge creation and knowledge transfer within forum-based Online Knowledge Communities (OKCs). Knowing the underlying factors of impact, these can potentially be influenced in order to maximize the knowledge process-relevant usage of forum-based online knowledge communities.

Based on the integration of research from multiple sub-disciplines of computer sciences and management sciences, this study derives potential input factors from an interdisciplinary body of research and develops and presents an integrated Measurement and Structural Model.

As will become clear in Part II, this thesis project, with its research in the field of online community-based knowledge management, takes an inter- to transdisciplinary approach, integrating various disciplinary perspectives from the fields of Computer Science and Management Science research, supported by Statistics for methodological purposes.

**Figure 1-1: PhD Thesis – Fields of Research and Key Research Topics**

Figure 1-1 provides an overview of the specific research the thesis draws from, including Human-Computer Interaction (HCI) from the field of Computer Science; Knowledge Management (KM) from the field of Management Science; and finally, Univariate Analy-
sis of Variance (ANOVA) and Structural Equation Modeling (SEM) from the field of Statistics.

The empirical part of the research is based on an in-depth study of the users of the forum-based online knowledge community at International University Bremen (IUB). Data collection techniques applied within the study include log-file analysis, questionnaires, and direct observation. The study is based on internal and external users of the IUB forums, including members of the faculty, research students, and graduate and undergraduate students of IUB.

The approach of using the IUB forums as an exemplary case for an in-depth single study was chosen for two reasons. First, evaluations of collaborative technology are best done through field- or case studies, because field- or case studies can be used to assess social, psychological and anthropological effects of the technology, among other things (Grudin, 1988). Second, one possible alternative to field- or case studies, running a “controlled” experiment, is typically not a valid option in information science research, mainly due to the impossibility of obtaining enough participants for a long enough time to control for the hugely different backgrounds and skill levels of the participants (Lethbridge, 1994).

Field- and case studies can be distinguished in descriptive studies (illustrative, with a means to add information to the body of examples); exploratory studies (descriptive, aimed at generating hypotheses for future research); and explanatory studies (descriptive, usable for causal investigations and confirmation of hypotheses based on a previously developed theory) (Yin, 2003). As far as the method of data analysis is concerned, two methods can be distinguished: pattern-matching, which tests a preliminary model derived from theory and logic and tries to improve it; and explanation-building, which uses data to derive hypotheses as the method of data analysis (Myers, 1997a).

The given research is an explanatory (i.e., confirmatory or pattern-matching) study that tests a preliminary model derived on theory and logic and tries to improve it, using pattern-matching procedures as the method of data analysis.

Following Chapter 2, which provides an overview of the motivation, aims, and objectives for writing the thesis, and the relevance, purpose, and original contribution of the
thesis, this part concludes with Chapter 3, with its outline of the organization and structure of the thesis.
2 MOTIVATION, RELEVANCE, AND ORIGINAL CONTRIBUTION

My personal interest in online knowledge communities, with their communication-based, market-like approaches to knowledge management, was initiated through my positive experience as a member of such a community during my work at a large German investment bank in the City of London.

Online forums are used by major corporations, institutions, and organizations to support knowledge communities, but without much empirical evidence for how a knowledge process-relevant usage through online forums could be effectively stimulated. As Waltert (2002) pointed out, the base of empirical research on online forums should therefore be broadened.

The large size of IUB’s online knowledge community, the high level of usage of the IUB forums, and their disposal for further necessary research in this area offered an excellent opportunity for applied research in the field of online community-based knowledge management. At the same time, it provided the possibility to integrate my previous work experience at one of the largest European research institutes with research in knowledge management in both learning and work environments.

The purpose of this research is to obtain a means by which to increase knowledge-process-relevant activity in forum-based online knowledge communities (OKCs) through the study of factors impacting on knowledge-process-relevant contributions in such OKCs. Knowing which factors influence the knowledge-relevant usage of forum-based online knowledge communities offers an opportunity to influence at least some of the identified factors in order to increase key knowledge processes. Knowing the factors might also allow the active steering of a particular online knowledge community in a
particular knowledge process direction: towards an increased stimulation of either knowledge transfer, knowledge creation or a combination of both processes.

The original contribution of the research consists of three elements. First, the study will integrate existing theoretical research on aspects of knowledge creation and knowledge transfer, so far separated. Second, the project will develop a theory-based, integrated and empirically testable model, based on a Knowledge Management General Systems Framework. Finally, the project will evaluate the derived integrated model empirically, thus reducing the “gap” of empirical research in the field of online forums as recognized by Waltert (2002).
3 ORGANIZATION AND STRUCTURE OF THE THESIS

The thesis consists of the following theoretical components: (1) identification of key knowledge processes, (2) identification of a framework model, (3) identification of potential input factors, (4) derivation of an indirect method for measuring individual actor’s knowledge process contributions, and (5) the integration of these theoretical aspects in an integrated Structural and Measurement Model.

Empirical components consist of (1) the test of the aforementioned indirect method for measuring individual actor’s knowledge process contributions outlined in this paper, and (2) the investigation of the aforementioned Structural and Measurement Model by the use of Structural Equation Modeling (SEM) methodologies, integrating all of the previously mentioned theoretical components and building on the results of the first empirical component. Both empirical parts of the research project are based on an online survey of the users of an online forum at International University Bremen (IUB).

The current Part I provided an introduction to the dissertation with a description of prior and current research of the relevant fields of research and an outline of the research agenda and the research objective. Furthermore, it described the context of the study and the methods used, and outlined the significance of the study and research, as well as the motivation, aims, and objectives to do a doctorate within the chosen field.

Thereafter, Part II begins with an outline of the context of the study and its argumentation that, supported by online knowledge communities, future learning and knowledge work will continue to integrate. This is followed by an introduction of key research topics and terms. The key element in this part is the review of the literature that informs this study, followed by an integration of the derived aspects and an outline of the individual hypotheses.
Part III describes the empirical study and its methodological approach, presents the data collection, outlines the research design of the empirical study, and presents the identification of indicators on the basis of the prior part of the thesis.

Next, Part IV presents the data analysis and discusses the results of the data analysis.

Part V discusses the results of the study with reference to the concepts derived, discusses implications and contributions of the findings for theory and practice, and ends with suggestions for future research directions.

**Figure 3-1: The Conceptual and Empirical Levels of the Thesis**
II. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT
4 INTRODUCTION AND RESEARCH QUESTION

In Part II, the literature that informs this study is being reviewed, beginning with this introduction and overview, and the definition of the research question. Following an outline of the problem space of the thesis in Chapter 5 and a definition of key terminology in Chapter 6, Chapter 7 provides an overview of knowledge management research frameworks and argues for the selection of one of these frameworks in the given context of the study. Chapter 8 summarizes existing theoretical and empirical research comparable to the given research.

The following two chapters of this part, Chapter 9 and Chapter 10, provide an interdisciplinary review and synthesis of collaborative systems literature, online communities literature, and knowledge management literature whose intersections inform the topic of this thesis on forum-based online knowledge communities. Both chapters, which are summarized in Chapter 11, are organized to mirror the proposed conceptual framework and outline the specific hypotheses to be addressed in the context of the empirical study, based on the following guiding research question:

Which factors influence and support the knowledge-relevant usage of online forums and thus indirectly stimulate the two key knowledge processes “Knowledge Transfer” and “Knowledge Creation” within forum-based Online Knowledge Communities?

The chosen field of research of forum-based online knowledge communities and its research question is fundamentally based on the key research topics of Collaborative Systems, Knowledge Management, and Online / Knowledge Communities, outlined in detail in Chapter 6. As will become obvious in Chapters 9 and 10, the literature review triggered the review of a number of related fields of research to be examined with regard to the relationship of potential antecedent factors of knowledge process contribution within a forum-based online knowledge communities context.
5 CONTEXT – CHANGING LEARNING & WORK ENVIRONMENTS

Within today’s emerging knowledge societies and their economies, the lifetime of learning cycles decreases and knowledge, particularly tacit knowledge, becomes a strategic resource. Lifelong learning will become ever more important, and learning and knowledge work will integrate and become ever more influenced by inter- and transdisciplinarity conditions of lifelong learning under both remote and co-located collaborative-cooperative settings (OECD, 1999; UNESCO, 1998).

This chapter (Chapter 5) describes the problem space of this thesis in the form of the characteristics of changing learning and work environments of prospective and current knowledge workers.

The term “knowledge work,” is hereby used in the sense of Kidd’s (1994) specified definition of Drucker’s (1959) initial definition of the term, which defines knowledge work as the process of adding value by processing existing information to create new information that could be used to define and solve problems.

Kidd (1994) specified this broad definition and distinguishes three basic types of knowledge-based work, differentiating knowledge workers, who are “changed by the information they process” (Kidd, 1994, p. 186); “communication workers,” who “use material to inform others” and to “change other people’s understanding” (Kidd, 1994, p. 188); and “clerical workers,” who “apply information which is extrinsic to them and which does not change them” (Kidd, 1994, p. 188).

Examples of knowledge work-executing knowledge workers include academic professionals, researchers and scientists, consultants, software developers, programmers, systems analysts, technical writers, lawyers, doctors, diplomats, lawmakers, marketers, managers, and bankers.
Given the broad context that is potentially being addressed by the use of (online) knowledge communities for knowledge processing, this chapter is to be understood as a means to describe the context of the thesis rather than a comprehensive review.

As symbolized in Figure 5-1, this chapter starts out from a brief outline of the characteristics of knowledge economies. The chapter moves forward to knowledge corporations, institutions, and organizations, and finally to knowledge communities, a subgroup of which, forum-based online knowledge communities, represents the topic of this thesis.

![Knowledge Communities as Constituents of the Knowledge Economy](image)

**Figure 5-1: Knowledge Communities as Constituents of the Knowledge Economy**

### 5.1 Knowledge Economies

Knowledge products and services are becoming an ever-bigger part of today’s economies. In The Economist’s special survey “The Near Future,” Drucker (2001) outlines that over the past four decades the relative purchasing power of manufactured goods has fallen by 75%. Drucker continues: “Whereas manufacturing prices, adjusted for inflation, are down by 40%, the prices of the two main knowledge products, health care and education, have risen about three times as fast as inflation. In 2000, therefore, it took five times as many units of manufactured goods to buy the main knowledge products as it had done 40 years earlier.” (Drucker, 2001, para.2).

Two years earlier, the Organization for Economic Co-operation and Development (OECD) published detailed information in its bi-annual survey “Science, Technology and
Industry Scoreboard” (OECD, 1999) confirming the global trend towards knowledge-based economies by comparing the relative output of knowledge-based industries (products and services) as part of the total business output. The 1999 survey covers all 29 member states that had joined the OECD by 1996, except the Czech Republic, Hungary, Ireland, Luxemburg, Poland, Switzerland, and Turkey, that is, 22 countries in total. (At the time this thesis was written, the OECD had 30 member states, 29 joining between 1961 and 2000, with the Slovak Republic joining after the publication of the 1996 OECD survey, in 2000.)

The values of the survey are based on a relatively broad definition of the term “knowledge economy,” comprising both knowledge-intensive products and services, to ensure an optimal comparability of results across countries: Besides high-technology industries, such as computing and telecommunication, the OECD’s interpretation includes sectors with a highly skilled workforce, such as finance, health, and education (OECD, 1999).

According to the survey, knowledge-based industries accounted for 50.9% of the total business output of the 22 member countries of the OECD taken into consideration in the survey in 1996, up from around 45% in 1985 (OECD, 1999). With 48.4%, the European Union’s share in knowledge-based industries was slightly below the average level of the OECD member countries considered. The five countries with the highest levels – and in all cases the absolute majority – of output based on knowledge-based industries were Germany (58.6%), United States (55.3%), Japan (53.0%), United Kingdom (51.5%), and Canada (51.0%).

5.2 Knowledge Corporations, Institutions, and Organizations

As knowledge-based industries come to represent ever-larger portions of the global economy, the importance of knowledge increases for knowledge-based corporations, institutions, and organizations as a source of competitive advantage (Drucker, 1992).

As more companies have adapted to the trend towards knowledge-based- and knowledge-driven organizations, more methodologies were developed to capture intellectual capital. Because the term “Knowledge Capital®” is a registered trademark of Strassmann, Inc., the term “Intellectual Capital” is commonly used for communication within the
research community and thus applied in the given research. The term “Intellectual Capital” was termed by the economist John Kenneth Galbraith in 1969 (Edvinsson, 2001).

Intellectual capital measurement models and valuation techniques commonly applied to measure the intellectual capital of corporations, institutions, and organizations include: Balanced Scorecard; Baruch Lev’s Knowledge Capital® Valuation; Calculated Intangible Value; Citation-weighted Patents; Economic Value Added (EVA™); Intangible Assets Monitor; Karl Sveiby’s Intellectual Assets Monitor; Leif Edvinsson’s Skandia Navigator; Market Value Added (MVA); Market-to-Book-Valuations; Paul Strassmann’s Knowledge Capital® Valuation; Real Option Theory; Sveiby’s Intangible Asset Monitor (IAM); The Technology Broker’s IC Audit; and finally Tobin’s Q Ratio (North, Probst, & Romhardt, 1998; Westphal, 2000).

These methods and techniques vary in their complexity, the amount of time needed to capture the underlying data, and the fundamental purpose of the measurement. For example, in order to carry out large-scale comparisons between stock market listed companies, the Market-to-Book-Value methodology proved itself to be a useful method.

Market-to-book-value is a quick and easy method to apply (and thus particularly useful for large-scale comparisons between companies) to calculate the value of a company’s intellectual capital by calculating the difference between the market- and the book value of a company, based on the assumption that “everything left after accounting for fixed assets is intangible assets” (Westphal, 2000, para.1). The market-to-book-value is calculated, as the name implies, as the coefficient of the book value of a company (i.e., the value of the companies tangible assets such as land, equipment, inventory, net working capital and other tangible assets) and the market value of a company. The percentage of the market value not covered by the book value represents the investors’ valuation of the intangible assets of the company, such as patents, trademarks, business systems, distribution rights, brands, customer databases, and the quality of a company’s management and workforce (Knowles, 2003).

Tobin’s Q essentially follows the same approach as the market-to-book-value methodology, with the difference of Tobin’s Q being based on replacement costs of tangible
assets instead of the book value of these assets, thus neutralizing the effects of depreciation policies varying between companies and countries, an effect not taken into consideration by the market-to-book-value approach (Roos, Roos, Edvinsson, & Dragonetti, 1998; Stewart, 1997). However, the disadvantage of Tobin’s Q is the problematic nature of quantifying the replacement costs, making the method difficult to apply compared to the market-to-book-value approach (Westphal, 2000).

Alan Greenspan, the current Chairman of the US Federal Reserve Bank, has noted that both high market-to-book values and high Tobin’s Q ratios reflect the value of investments in technology and human capital (Stewart, 1997).

As this chapter’s purpose is to describe the context of the thesis (i.e., to embed the thesis topic of forum-based online knowledge communities in the wider context of knowledge economies; knowledge corporations, institutions, and organizations; and finally, knowledge communities), the market-to-book ratio – with its aforementioned property to allow the carrying out of large scale comparisons among stock market listed companies – shall be used as a means to present the increase of the importance of knowledge for the knowledge-based corporations, institutions, and organizations of an entire market.

Figure 5-2 represents the aggregate market-to-book valuations of the S&P 500 companies over a 20-year period (1982-2002) and provides an impression of the market’s valuation of intangible assets – and the trend of the increase of the annual values by calculating the 5-year moving average – as an exemplary indicator for the increase of intellectual capital. (The Standard & Poor’s [S&P] 500 is a broad-based index of the 500 leading publicly traded US Corporations, mostly listed on the New York Stock Exchange [NYSE].) The figure graphically represents the values of the aggregate market-to-book ratios, visualizing the peak of the “dot.com” boom of the nineties in the year 2000. The moving average strongly indicates a trend of rising market-to-book values and thus increasing valuations of intangible assets. A market-to-book ratio of 3 implies that the tangible assets (land, equipment, inventory, net working capital, etc.) of a company account for one-third of the market value of a company; the remaining two-thirds of the company’s value is placed on intangible assets (i.e., intellectual capital). Knowles (2003) observes that the S&P 500’s aggregate market-to-book ratio increased steadily from a value of around 1.4
at the beginning of the 1980s to around 3.5 in the mid-1990s, and that it falls/fell back to a value of around 4.0 after its peak during the “dot.com” boom in 2000 with a value of 7.3.

![Figure 5-2: S&P 500 Market-to-Book Ratio 1982-2002 w. 5-Yr. Moving Average](image)

(Adapted: Knowles, 2003)

Both the previously cited figures of the OECD survey “Science, Technology and Industry Scoreboard” (1999) and book-to-market values visualized in Figure 5-2 make clear that intellectual capital becomes ever more important for today’s knowledge societies and knowledge-based economies: Knowledge plays an important role in generating and sustaining competitive advantage. Knowledge is a strategic resource, not only for knowledge-driven organizations such as research institutions, universities, consultancies, law practices, and software development companies, but – on an aggregated level – for the economy as a whole.

### 5.3 Knowledge Communities – Lifelong Learning and Knowledge Work

Changing market conditions decrease market entry barriers and increase market accessibility (Picot & Fiedler, 2000), driven by digitalization, increasing IT potential, virtualization of markets, and the emergence of new markets. Picot and Fiedler (2000)
argue that corporations, institutions, and organizations in turn face accelerating market
cycles and increasing risks and competition, all of which decreases the competitive edge,
concluding that knowledge is becoming the only sustainable competitive advantage and
central success factor.

Drucker (1994) extends this argument, suggesting that due to ever-faster innovation
cycles, knowledge becomes obsolete more quickly, requiring knowledge workers to learn
not just before their working life, but also at a later stage in their careers. Professional
activity has become so knowledge-intensive and fluid in content that learning will
become an integral and inseparable part of “adult” work activities.

“Increasingly, an educated person will be someone who has learned
how to learn, and throughout his or her lifetime continues to learn,
especially in and out of formal education.” (Drucker, 1994, p. 2)

Fischer and Scharff (1998) argue along the same line, stating that the notion of a sepa-
ration of thinking, doing, and learning has become obsolete, being replaced by the
integration of thinking, doing, and learning.

“The previous notion of a divided lifetime – education followed by
work – is no longer tenable. Learning can no longer be dichotomized,
spatially and temporally, into a place and time to acquire knowledge
(school) and a place and time to apply knowledge (the workplace).
[…] Seen in this context, working, learning, and collaboration become
intimately intertwined rather than being three different and distinct
activities.” (Fischer & Scharff, 1998, p. 2)

According to Kidd (1994), the defining characteristics of knowledge workers are the
diversity of their output which represents their value to their employers (and, it should be
added, to themselves); their low dependence on filed information once they have been
informed by some written material; and their reliance on spatial layout and materials as a
holding pattern for current inputs and ideas. The functions identified as key areas for
knowledge workers include management consultancy, broadcasting, law, finance and
research.
Kidd (1994, p. 186) identifies “the focus on the act of informing” as the key requirement for computer support tools for knowledge workers, stressing that “information in a disembodied form” is of no use to the knowledge worker since “knowledge workers cannot predict what will inform them or how it will inform them” (1994, p. 190), and suggests further research into new ways of “reproducing the appearance of marks made by knowledge workers rather than interpreting them” (1994, p. 190).

The fact that knowledge workers are generating output from a body of previously unknown knowledge confronts them with the same problem as the learner. Even though they are starting from a different knowledge level, both face the paradox of how one can learn something about which one knows nothing (Laurillard, 1996), which can be overcome by offering a clear structure for tasks as suggested by Laurillard et al. (1994). Also both the knowledge worker and the learner require a narrative which aids “reconstruction, retrospection, prediction and memory, as well as motivation” (Plowman, 1996, as cited in Plowman, 1998, para.13).

For learning to become a part of life, the behaviorist learning perspective of the industrial work based society must be overcome (Fischer, 1996). According to Fischer (1996), this involves a number of processes that must be applied and / or procedures that have to be changed, all of which can be summarized in the demand that the separation of thinking, doing, and learning has to be overcome and replaced by their integration, and the adaptation to the changing operational environment – from industrial work-based societies with their mass markets, simple products and processes, slow change, and certainty towards knowledge work-based societies with their customer orientation, complex products and processes, rapid and substantial change, and uncertainty. Fischer (1996) argues that the attitude that there exist objective ways to deconstruct problems, together with the attitude that there exists the approach to learning and working how to solve them – through, for example, programmed instruction, computer-assisted instruction, production lines, waterfall models – has to be replaced by the attitude that problems are generally subjective and ill-defined, and that approaches to solve those problems in real life are characterized by the perspectives and arguments of the respective stakeholders. Fischer (1996) further demands that society must come to understand that task domains cannot be completely understood, but that, instead, understanding is partial and complete coverage.
is impossible. Finally, Fischer (1996) argues that knowledge in the knowledge society is tacit and relies on tacit skills, as opposed to explicit knowledge predominant in the industrial work-based society – an aspect that will be referred to in the following chapter.

As learning becomes a process of knowledge construction and not just of knowledge recording or absorption, the openness towards new ideas and continuous learning must integrate with the willingness to share one’s own knowledge, to learn from others, and to apply this knowledge in daily work.

Besides the integration of working and learning, the aspect of collaboration mentioned by Fischer and Scharff (1998) is becoming ever more important. The ever-increasing complexity of the work environment will extend the trend of individual knowledge-based work towards knowledge based collaborative work, since, as Kling and Star (1997, para.2) note, “individual intellectual disciplines have become dwarfed by complexity, dynamism and scale.” This leads us to some remarks about the individual participants of any knowledge community: the knowledge worker.

Within the corporate-, institutional-, and organizational contexts outlined in this and the previous sections, knowledge communities, such as Communities of Practice (CoPs) (Lave & Wenger, 1991; McDermott, 1999; Wenger & Snyder, 2000) and Communities of Learning (CoLs) (Bielaczyc & Collins, 1999), become more important on the corporate, institutional, and organizational levels. As Stephen Denning, Program Director of Knowledge Management and Chair of the Knowledge Management Board at the World Bank puts it: within knowledge communities, learning and knowledge work change from “learning without doing” and “doing without learning”, towards “doing while learning” and “learning while doing” (Denning, 1999, p.23ff). The aspect of collaboration addressed by Fischer and Scharff (1998) is intertwined within such knowledge communities and plays an important part in online-based approaches to lifelong learning, which represent a key aspect of the forum-based online knowledge communities studied in the given research.

Without anticipating the detailed theoretical examination of Online Knowledge Communities provided in the following chapter, the following paragraphs support the argument that (online) knowledge communities can help to address demands for lifelong
learning and the integration of working and learning in today’s knowledge societies. The examples provide a snapshot of the corporations, institutions, and organizations that utilize forum-based online knowledge communities in their respective context to support learning and knowledge work processes through the support of knowledge transfer and knowledge creation processes, thereby emphasizing the arguments raised previously regarding the use of (potentially online-based) knowledge communities for the integration of learning and knowledge work.

As far as specialist communities are concerned, UK-based *Doctors.net.uk* is the UK’s largest and most active online knowledge community for UK-based medical professionals, numbering more than 100,000 registered qualified medical subscribers, including over 30,000 GPs and 23,000 Hospital Consultants (Parexel International, 2004). Professional news and “accredited continuing medical education” are made accessible to the knowledge community through the online forum (Parexel International, 2004, para.7).

Forum-based online knowledge communities are also empowering research networks of scientists and scientific organizations. According to the Pharma Marketletter of 29th March, 2004, global companies such as Eli Lilly and Procter & Gamble confidentially post problems on the online forum *InnoCentive* in order to collaborate on solving scientific problems in their domain. InnoCentive, an e-business venture of Eli Lilly and Company, is described as “the world’s first online forum established to allow scientists to work together on solving complex challenges” (Pharma Marketletter, 2004, para.3). While companies sign up on InnoCentive as so called “Seekers,” which can post research and development opportunities linked to a pre-determined award (typically ranging from USD 5,000 to USD 100,000; Inouye, 2004), scientists register as “Solvers” trying to solve the problems posted. Seeker companies review the submissions of Solvers and select the best submission, which is given the award. The forum-based system allows both sides to come together while keeps the true identity of the parties confidential. InnoCentive’s web-based community includes over 20,000 scientists and researchers from 125 countries, plus an unspecified number of companies (Inouye, 2004).

Online knowledge communities can be used not only across corporate, institutional, and organizational borders, but also within single corporations, institutions, and organizations. One case is the example of IBM, a global player that utilized the power of forum-
based approaches within its corporate borders by conducting so called Jams – the forum-based verbal equivalent of an improvisational jam session among jazz musicians. In July 2003 IBM held such a three-day, forum-based discussion about the company’s values. During this time, around 50,000 of IBM’s employees checked out the discussion, posting nearly 10,000 comments about the proposed values (Hemp & Stewart, 2004; Schütt, 2005). Several other forum-based discussions, called ValueJam followed this.

On an institutional level, many universities also utilize forum-based systems to support knowledge communities. The project database of the web portal of the German Federal Government’s action program “New Media in Education” (“Neue Medien in der Bildung”), of the German Federal Ministry of Education and Research (PT-NMB+F, 2004) includes more than 10 projects that apply online forum systems (e.g., “eCampus Duisburg” and “UbiCampus Notebook University Hannover”).

The IUB online forums, which are the basis of the empirical study of this thesis, are also a university-based forum, targeted towards its own community of students and alumni, faculty and staff. Most of the forums are course-related, dedicated to a particular course in a particular term and year of study; the IUB forums are heavily used for the purpose of teaching undergraduate and graduate students. The IUB forums were implemented in September 2001. At the time the empirical study was conducted in Autumn 2004, the IUB forums had over 1,900 members and more than 33,000 messages.
6 KEY RESEARCH TOPICS AND KEY TERMS

The theme of the research in this thesis is Online Knowledge Communities (OKCs) – online communities utilizing collaborative systems with the main purpose of initiating or supporting knowledge processes, thus representing a means for online-based knowledge management. The phrase “Forum-based Online Knowledge Communities” – part of the title of this thesis – provides a clue to the four key fields of research of the project as depicted in Figure 6-1: Collaborative System, Knowledge Management, and Knowledge and Online Communities research.

Like online forums, collaborative systems form the technical foundation of online communities and serve a community of members sharing ideas and opinions. In 1993, Harasim (1993) defined as collaborative systems such diverse systems as email, chat, discussion forums, and other groupware systems. Online (or virtual) communities are the human organizations that actually make use of the technical infrastructure of collaborative systems. As such, the key field of research of online communities draws on collaborative systems research. The key field of research of knowledge communities, however, draws on knowledge management research, informing research in knowledge communities such as Communities of Interest (CoIs; Rheingold, 1993), Communities of Practice (CoPs; Lave & Wenger, 1991) and Communities of Learning (CoLs; Bielaczyc & Collins, 1999).

As argued by Beinhauer (2000), Beinhauer et al. (1999), Radding (1998), de Vries and Koomers (2004), and Waltert (2002), online communities, based on a collaborative system, can be used for knowledge management in the form of Online Knowledge Communities (OKCs) – online-based communities supporting collaborative learning and/or collaborative knowledge work. Thus, together, all four fields of research inform the research field of Online Knowledge Communities (OKC) research.
This chapter provides a brief outline of each of these four areas of research and integrates aspects of each in the specific context of the research of this thesis – Forum-based Online Knowledge Communities (Section 6.5). Given the breadth of the individual fields, these sections are not to be understood as a comprehensive review, but as a means to introduce and describe the terminology of the areas of research involved.

![Figure 6-1: Key Research Topics of Online Knowledge Community Research](image)

### 6.1 Collaborative Systems

As mentioned in the introduction to this chapter, collaborative systems form the technical foundation of online communities. The term collaborative system embraces such diverse systems as email, chat, discussion forums, and other groupware systems (Harasim, 1993).

The increased availability of computer networks and the trend towards teamwork increased the research on computer support for teamwork. Activities in that domain are known by the term Computer-Supported Cooperative Work (CSCW). CSCW refers to the study of tools and techniques of groupware as well as their psychological, social and organizational effects and by the notions of collaborative systems or groupware, with
these terms referring to the actual computer-based systems that people use to work together (Brinck & Gomez, 1992).

The term collaborative systems – also known by the synonym groupware or as computer-supported cooperative work applications – has been described earlier than the notion of CSCW. A popular definition by Ellis et al. (1991) defines collaborative systems as:

“[…] computer-based systems that support groups of people engaged in a common task (or goal) and that provide an interface to a shared environment.” (Ellis et al., 1991, p. 40).

Another popular definition by Preece et al. (1994) defines collaborative systems as:

“[…] software designed to be used by more than one person, for instance, networking and electronic mail software.” (Preece et al., 1994, p. 711).

Collaborative systems are an extension of or an enhancement tool for the collaborative process and refer to web-based or software tools and programs that help people work together collectively while being located remotely from each other.

Group activities supported by collaborative systems are: communication, collaboration, and coordination. Examples of collaborative systems are: groupware applications for co-authorship, distributed project management, group decision support and shared database access; and systems such as conferencing tools and collaborative management tools like electronic bulletin boards and shared calendars (Grudin, 1990; Shneiderman, 1998).

While some systems, such as project support systems like electronic meeting rooms and workflow automation systems are useful only for groups of 6 or more users, others, like desktop conferencing and collaborative writing applications, are useful only for small groups of up to 3 or 4 users.

Collaborative systems are commonly categorized along the time / space matrix (de Sanctis & Gallupe, 1984; Ellis et al., 1991; Preece et al., 1994; Shneiderman, 1998), depicted in Table 6-1.
Table 6-1: Time / Space Classification of Collaborative Systems

<table>
<thead>
<tr>
<th>Space</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Same</strong></td>
<td><strong>Different but predictable</strong></td>
</tr>
<tr>
<td><strong>Face-to-face</strong></td>
<td>Classroom / meeting facilitation, electronic whiteboards, electronic meeting rooms</td>
</tr>
<tr>
<td><strong>Asynchronous interaction</strong></td>
<td>Work shifts, desktop computers</td>
</tr>
<tr>
<td><strong>Different but predictable</strong></td>
<td>Blackboards, Team rooms</td>
</tr>
<tr>
<td><strong>Different but unpredictable</strong></td>
<td>Tele-, video-, and desktop conferencing</td>
</tr>
<tr>
<td><strong>Synchronous distributed</strong></td>
<td>Email, fax, voice mail</td>
</tr>
<tr>
<td><strong>Asynchronous distributed</strong></td>
<td>Collaborative writing</td>
</tr>
<tr>
<td><strong>Different but unpredictable</strong></td>
<td>Interactive multicast seminars</td>
</tr>
<tr>
<td><strong>Online forums, computer bulletin boards</strong></td>
<td>Workflow automation</td>
</tr>
</tbody>
</table>

(Adapted: Grudin, 1994; Johansen, 1988; Preece et al., 1994. Online forums and their respective field of assignment to the time/space matrix [Asynchronous distributed] are marked in bold.)

The time / space matrix distinguishes between synchronous and asynchronous interaction (participants working at the same time or not) and co-located and remote spaces (participants working at the same place or not). The distinctions between these four situations in which groups may work together was made first by de Sanctis and Gallupe (1984). Table 6-1 provides an extension of the classical time / space matrix, based on Grudin’s (1994) groupware typology, with its extension of the standard classification of asynchronous interaction and remote places in predictable and unpredictable time / space, itemizing representative application examples for each category. Grudin (1994) acknowledges that most real work does not match one or another of these categories completely, and notes that assignments are somehow arbitrary (thus electronic mail, where one expects the receiver to read a message within a day or so, is allocated to the column “different but predictable time”).

Within the time / space matrix, online forums, as the system being studied in the empirical part of this thesis, are referred to by the synonym “Computer bulletin boards,” representing asynchronous, distributed interaction systems designed for different, but predictable time settings, under different, but unpredictable conditions of place, that is,
participants are generally expected to read messages within a “predictable” time, but they can access the forum from any location. (In their original meaning, Bulletin Board Systems [BBSs] refer to computer systems that allow participants to dial up to the system using a terminal program in order to download files, read and/or exchange messages, etc. In current usage, BBSs refer to any online forum or message board system.)

Online forum systems are not the only type of collaborative system. According to Ross et al. (2004), four main categories of collaborative systems can be distinguished that can be used to support online communities: asynchronous communication systems (e.g., email, mailing lists, online forums, news groups), synchronous communication systems (e.g., chat rooms and internet relay chat - IRC), peer-to-peer network systems (e.g., Napster and Kazaa, which can be used to add distributed resources to communication channels), and virtual world systems (e.g., multi-user domains - MUDs). However, as Augar et al. (2005) could show, Wikis – fully editable websites that enables users to read, re-organize and update the structure and content of the Wiki just in time; first developed by Ward Cunningham in 1994 (Augar et al., 2005) – can also be used to support online communities – and make up a new category of “collaboration via content.”

**Online Forum Software Systems**

Because an online forum-based collaborative system forms the basis of the empirical study of this thesis, key terminology and properties of online forum systems are briefly outlined below. Online forums, or just “forums,” are also known as electronic communication forums, electronic forums, discussion boards, discussion forums, bulletin boards, and message boards. As has been pointed out, online forums serve a community of members sharing ideas and opinions within moderated or unmoderated discussion areas asynchronously over time.

The two key terms of online forums are “thread” and “post.” The term “thread” refers to the topic that is listed on the forum main page, meaning a post that is created in order to start a conversation about a given topic. The term “threaded” means that the content of a forum is organized according to discussion topics. The term “post” refers to any thread and replies to that thread.
A common phenomenon within online forums is so-called “lurking.” The jargon term refers to the activity of reading forum postings regularly without posting own messages (Takahashi, Masakazu, & Yamasaki, 2003). Barab et al. (2004, p. 4) note that it is common for many people “to visit and leave without posting messages, for many others to stay and only read public messages.” Even though the term is not meant as a pejorative (i.e., does not express disapproval of this behavior), the term “lurker” has come to have negative connotations (Halverson, Erickson, & Sussman, 2003); e.g., Kollock and Smith (1996) compare lurkers to free-riders. However, Halverson et al. (2003) note that Nonnecke and Preece (2000) argue along Barab et al.’s line, extending it by an argument towards the potential value of lurking for the community: “lurking is normal, and should be seen as a valid form of participation that can, in some cases, add value to the group” (Halverson et al., 2003, p. 185). Takahashi et al. (2003) empirically tested and proved their hypothesized categories of two further subcategories of posters and lurkers. They suggested differentiating active lurkers into “active lurkers as propagators” (propagating information or knowledge gained from an online community to others outside it) and “active lurkers as practitioners” (using such information or knowledge in their own or organizational activities), and passive lurkers into “active lurker candidates” and the “persistent lurkers” (depending on whether the online community affects the lurker’s thought).

Further research on the “value added” for each lurker-category has yet to be carried out. Just as the answer to the question of which status is most beneficial to the community depends on such research, that is, the same applies to the issue of how to encourage users to switch their status to one more beneficial to the community.

Lurkers are just one of the many challenges facing collaborative system design, implementation, and finally, the operation of collaborative systems. As early as 1990, when Grudin (1990) recognized that the interface is moving into the social and work setting, Grudin stressed the complexity of developing groupware or workgroup systems, which would not only have to consider the research of single-user applications, but would also have to incorporate social, motivational, economic, and political factors. For example, Grudin emphasized that collaborative systems should be implemented so that people who are required to do additional work are also the ones who benefit from the adoption of the
system, and such that users are not demotivated by the violation of social taboos and threats to the political culture (Grudin, 1990). Besides Grudin (1990), Baecker et al. (1993), Bentley et al. (1997), Berlin et al. (1993), Borenstein (1992), Kidd (1994), and Palfreyman and Rodden (1996) identified specific challenges that collaborative systems should account for, and problems that should be addressed.

Many online forum systems exist. Woolley (2005) lists 140 online forum systems that are available as of the time of research in 2005. Of the 140 online forum systems, 65 are commercial packets, licensed under proprietary license terms, and 75 are freeware, most of them licensed under the GNU (a recursive acronym for “GNU’s Not Unix”) General Public License, one of the most popular licenses for free software.

6.2 Knowledge Management

In addition to collaborative systems and online and knowledge communities, Knowledge Management (KM) was quoted as one of four key research topics in the context of online knowledge communities, the research topic of this thesis.

Following an introductory fundamental definition of “knowledge” (Section 6.2.1), aspects of knowledge management with particular relevance to the given research and its people-centered perspective, are discussed (Section 6.2.2).

6.2.1 Knowledge – The JTB-conception

The conception of knowledge as “justified true belief,” commonly referred to as the JTB-conception, represents the predominant definition of knowledge in Western philosophy, according to Nonaka and Takeuchi (1995). This predominance applies both to the field of epistemology – the branch of philosophy that deals with the nature, origin, and scope of knowledge, where the conception of knowledge as justified true belief still represents the broadest common denominator of several refined definitions of knowledge (Evolution Education Encyclopedia, 2005; Stanford Encyclopedia of Philosophy, 2005) – but also to the definition of knowledge within the field of business administration that covers knowledge management research (Kakabadse, Kakabadse, & Kouzmin, 2003).
The JTB-account with its definition of knowledge as justified true belief dates back to Plato’s “Theaetetus,” written in 360 B.C.E. (Plato, translated by Waterfield, 1987). The discussion within “Theaetetus” centers around the question of what knowledge is, exploring several options such as knowledge as perception, knowledge as true belief, and finally knowledge as true belief plus an account (i.e., a justified true belief). Here, belief is used in the sense of asserting the truth (or untruth) of some proposition or statement, leading to the following definition of knowledge as justified true belief:

“If A believes that x is true, and x is in fact true, then A holds a true belief. If, in addition to being true, this belief has a justification, it counts a knowledge.” (Evolution Education Encyclopedia, 2005; Stanford Encyclopedia of Philosophy, 2005).

The problem with the so-called JTB account is the proper definition of what represents a suitable justification of a true belief. Gettier (1963) provided many counterexamples to the definition of knowledge as justified true belief, showing that all interpretations of justification are inadequate, thus proving that the three conditions of the JTB account – truth, belief, and justification – are not sufficient for knowledge.

However, due to (1) the intuitiveness of the JTB-account, (2) its predominance as a definition of knowledge, (3) the lack of commonly agreed on, intuitive alternatives, and (4) the very specific nature of the epistemology research that provides alternative definitions of knowledge (or rather extensions of the JTB-account), for the purpose of this research the definition of knowledge as justified true belief is deemed appropriate, and attempts to solve the constructed “Gettier problems” are left to the epistemological branch of philosophy.

As far as the empirical research (i.e., the survey) of this thesis is concerned, a fundamental definition of knowledge must in any case be based on pragmatic considerations for what conception of knowledge can be made explicit in a survey and questionnaire under given restrictions of time and attention. Here lies the key advantage of the JTB-account: its intuitiveness, which allows an exemption of detailed definitions and the foundation on common perceptions of what “knowledge” is.
From a theoretical point of view, knowledge can be distinguished in several forms, one of which is to differentiate knowledge into explicit and tacit forms. This concept was originally invented by the scientist and philosopher Polanyi (1966), one of whose famous aphorisms is “We can know more than we can tell” (Polanyi, 1966, p. 16, as cited in Kakabadse et al., 2003). A popular model in this context is Reinhardt and Stattkus’s (2002) “Iceberg Model,” which distinguishes explicit and tacit knowledge. While the prior (codified knowledge stored in documents and IT-systems) represents the “top of the iceberg,” the latter (ranging from directly communicable, potentially explicable knowledge to non-communicable, heuristic knowledge) represents the (much larger) “under-the-water-line-part of the iceberg.” In their famous book “The Knowledge-Creating Company,” Nonaka and Takeuchi (1995) extend Polany’s concept of tacit knowledge and its ineliminable subjective dimension to a knowledge management perspective, with explicit knowledge encompassing codified knowledge sources such as electronic documents, email, GroupWare databases, data warehouses, paper files and scanned images, and tacit knowledge sources comprising subject matter experts, specialist skills, expertise, senses, skills and intuition.

Besides a distinction in explicit and tacit knowledge, knowledge can also be perceived from several other perspectives. Kimble et al. (2001) outline other views of knowledge discussed in the recent knowledge management literature, such as the perspective of knowledge as a pair of opposites of tacit / focal (Sveiby, 1997), know-what / know-how (Brown & Duguid, 1991), cognitivist / constructionist (von Krogh, 1998) and work-in-practice and domain-knowledge (Sachs, 1995).

6.2.2 Knowledge Management – The People-Centered Perspective

Basically, two perspectives on knowledge management can be distinguished: a technology- and a people-centered perspective, often referred to as codification strategy and personalization strategy, respectively (de Souza, Jayaraman, & Evaristo, 2002; Hansen, Nohria, & Tierney, 1999). At the center of the technology-centered perspective is the understanding of knowledge management as a process of the management of (knowledge) objects with the help of information technology and computer science, and its main focus is on easily encodable (explicit) knowledge. Contrary to this, the people-centered
perspective interprets knowledge management as a process, focused on knowledge that is difficult to encode (tacit), with the support of HCI, group dynamics, organizational behavior, and psychology.

Von Krogh (2003) and von Krogh et al. (2000) represent the personalization-based definition of knowledge, arguing that knowledge cannot be “managed” since knowledge relies on creativity, relationships, and context, and management implies control, which can suppress knowledge creation. According to his view, knowledge can only be shared. (Information, however, can be managed.) Von Krogh (von Krogh, 2003, p. 387) defines knowledge management as a “metaphor for activities aimed at reaching a community’s or an organization’s goals through the activities of capturing, transferring, and creating knowledge.”

Recently, it has been recognized that knowledge management processes need to consider the tacit dimension of knowledge and acknowledge that tacit knowledge is mainly shared through person-to-person contacts (de Souza et al., 2002). Most importantly however, it has been recognized that the two perspectives of codification strategy and personalization strategy need to be integrated, since knowledge management is “a people-centered philosophy that necessarily involves and will promote the use of information technologies” (Silver & Shashuki, 2002, p. 255), or, as Davenport (1998) put it, to “construct hybrid knowledge management environments in which we use both humans and machines in complimentary ways” (Davenport, 1998, para.10).

The major differences between the two perspectives of codification strategy and personalization strategy are very well presented by Hahn’s (2000) framework model for knowledge management support. Hahn (2000) argues that so far, knowledge management research focused mainly on document repositories and data warehouses, collaborative filtering, or Intranets and search engines as the focal point of knowledge; only recently expertise profiles and electronic discussion forums become a more relevant research issue, with the individual and system user as the focal point of knowledge. Table 6-2 represents the framework, with examples of currently used knowledge management systems representing each category.
Focal Point of Knowledge

<table>
<thead>
<tr>
<th>Level of A Priori Structure</th>
<th>Artifact</th>
<th>Individual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structured</td>
<td>Document repository / Data warehousing</td>
<td>Yellow Pages of experts / expertise profiles and databases</td>
</tr>
<tr>
<td>Unstructured</td>
<td>Collaborative filtering / Intranets and search engines</td>
<td>Electronic discussion forums</td>
</tr>
</tbody>
</table>

(Adapted: Hahn & Subramani, 2000)

**Table 6-2: Framework for Knowledge Management Support**

Reflecting the difference of the two perspectives of codification strategy and personalization strategy, a wide variety of practices and processes are used in knowledge management. Some of the more common ones are shown in Table 6-3. Skyrme’s (2003) original table is replenished by the entry of Communities of Practice (CoPs) as a practice and process to support knowledge creation and discovery (in addition to its support for the knowledge process of sharing and learning, as suggested by Skyrme). Skyrme’s original term Learning Networks (as a practice and process to support knowledge sharing and learning) has been replaced by the more common term of Communities of Learning (CoLs), which also serves the purpose of referring to their close relation to communities of practice. These adaptations were made on the basis of the review of the respective literature of both Communities of Practice and Communities of Learning, outlined in Section 6.4.

<table>
<thead>
<tr>
<th>Knowledge Process / Practices and Processes</th>
<th>Creating and Discovering</th>
<th>Sharing and Learning</th>
<th>Organizing and Managing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business simulation</td>
<td>After-action reviews</td>
<td></td>
<td>Expertise profiling</td>
</tr>
<tr>
<td>Communities of practice</td>
<td>Communities of learning</td>
<td></td>
<td>Information audits</td>
</tr>
<tr>
<td>Content analysis</td>
<td>Communities of practice</td>
<td></td>
<td>IRM (Information Re-</td>
</tr>
<tr>
<td>Creativity techniques</td>
<td>Cross functional teams</td>
<td></td>
<td>sources Management)</td>
</tr>
<tr>
<td>Data mining</td>
<td>Decision diaries</td>
<td></td>
<td>Knowledge centers</td>
</tr>
<tr>
<td>Environmental scanning</td>
<td>Share fairs</td>
<td></td>
<td>Knowledge mapping</td>
</tr>
<tr>
<td>Knowledge elicitation</td>
<td>Sharing best practice</td>
<td></td>
<td>Measuring intellect. capital</td>
</tr>
<tr>
<td>Text mining</td>
<td>Structured dialogue</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Adapted: Skyrme, 2003)

**Table 6-3: Practices and Processes used in Knowledge Management**
6.3 Online Communities

As mentioned in the introduction to this chapter, the key field of research of online communities draws on collaborative systems research. Online communities draw their name from communities that are commonly defined as a group of persons deriving their nature from a common location, shared cultural / ethnic background, interest, profession, or a common existential awareness (Kovatcheva & Kommers, 2004). Online communities are commonly referred to by the synonym “web-based communities” or “virtual communities.”

The annex term “online” specifies online communities as online-based (web-based or virtual) human organizations that actually make use of the technical infrastructure of collaborative systems, described in the previous section. In this context, Vasconcelos and de Souza (2002) emphasize an important aspect:

"In the communities of the Web, the focus is usually in the tools, such as, chat, discussion forum and email. It is important not to confuse these tools with the community itself. Online communities are more than merely a collection of tools. They are organizations similar in everything to the associations of the real world; just existing and developing in a digital way." (Vasconcelos & de Souza, 2002, p. 2)

The rapid evolution of information technology has led to new potential for communication and collaboration between people within and across corporations, institutions, and organizations. As early as 1990, Grudin, in his classic paper “The computer reaches out: the historical continuity of interface design,” argues that the computer will reach beyond individual users to support groups and organizations, marking the shift to “the interface at the work setting” as the “level of interface focus” of this century (Grudin, 1990, p. 265).

Rheingold (1993) coined the term “online communities,” and defined them as social aggregations that emerge when people engage in online discourses long enough and with sufficient social engagement to form online-based personal relationships.
Wellman (1998) observes that online communities organized by shared interests represent a long-term shift to communities that are founded on their shared location, for example, a neighborhood or a village.

A formal specification for defining characteristics of online forums is provided by Kovatcheva and Kommers (2004, p. 48), who identified four components that fundamentally define online communities: people (“people and how they communicate”), purpose (“people’s needs and their purpose for communicating”), policies (“people’s behavior and established policies to guide such behavior”), and software (“to support the interaction and influences of people’s behavior”).

A more specific description of the defining characteristics of online forums was developed at a workshop on the “Theory and Practice of Physical and Network Communities.” The workshop, summarized by Steve Whittaker from ATT Labs-Research, Ellen Isaacs from Electronic Communities, and Vicki O’Day from Xerox PARC, agreed on five fundamental defining characteristics of online communities. First, members need to have “some shared goal, interest, need, or activity that provides the primary reason for belonging to the community” (Whittaker, Issacs, & O’Day, 1997, p. 137). Next, it was concluded that participants need to participate actively, often leading to “intense interactions, strong emotional ties, and shared activities occurring between participants” (Whittaker et al., 1997, p. 137). Like Kovatcheva and Kommers (2004), the workshop participants required policies, in particular policies determining access to shared resources. Finally, among members of an online community, reciprocity of information, support, and services should be given, and a shared context should be constructed (Whittaker et al., 1997). All of these five characteristics of online communities are met by the IUB online forums, underlying the empirical study of the thesis outlined in the following parts of the thesis.

### 6.4 Knowledge Communities

Knowledge community research draws, as outlined in the introduction, on knowledge management research. Be they co-located or online, knowledge communities can be differentiated in different types of communities, but the transition between the different types of communities is a fluid one.
Members of the most basic knowledge communities, *Communities of Interest (CoIs)*, are simply bound together by a shared common interest (Rheingold, 1993). Members of *Communities of Practice (CoPs)* share not only an interest in a particular theme, but also have an interest in achieving a particular process while at the same time pursuing different goals (Lave & Wenger, 1991). Finally, *Communities of Learning (CoLs)* focus on aspects of collaborative learning (Bielaczyc & Collins, 1999).

The following two paragraphs provide a brief summary of the two aforementioned types of knowledge communities, which present the two representations of knowledge communities mostly discussed in recent literature: communities of practice and communities of learning.

Lave and Wenger (1991) defined communities of practice as a set of relations over time among persons, activities, and the world, and the process of social learning that occurs when people in organizations, who have a common interest in some subject or problem, collaborate to share ideas, find solutions, and build innovations. Communities of practice are focused on a specific domain of knowledge and over time accumulate expertise in this domain by interacting around problems, solutions, and insights (Wenger, 1999). One important indicator of communities of practice is the fact that participants are generally not a formal team, but an informal network with a shared agenda and shared interests, as observed by Merali and Davies (2001), who define communities of practice as “peers in the execution of real work” (p. 93). In comparison to a team, the number of members of a community of practice is generally larger and the degree of interaction lower. In addition, contrary to teams that are generally oriented towards a common goal, communities of practice are generally oriented along a common interest. As Millen et al. (2002) observe, communities of practice increasingly collaborate and “interact in online environments, shared web spaces, email lists, discussion forums, and synchronous chats” (Millen et al., 2002, p. 68/69).

While the focus of communities of practice is on the execution of real work (Wenger, 1999), communities of learning, also referred to as learning networks, educational virtual communities, or learning communities, focus on aspects of collaborative learning. Some authors see learning communities as distinct from communities of practice; others see them as communities of practice “focused on learning” (de Rezende, da Silva, de Souza,
& Ramirez, 2005, p. 87). In the given context, the definition should be more specific, and, based on Hiltz (2005), communities of learning are defined as communities of learners who collaborate to create and transfer knowledge through collaborative systems. Bielaczyc and Collins (1999) list the characteristics that communities of learning must have: diversity of expertise among members, a shared objective of continually advancing the collective knowledge and skills, an emphasis on learning how to learn, and finally, mechanisms for sharing what is learned.

The categorization of knowledge communities along communities of practice and communities of learning is the most common in recent literature. The categorization of knowledge communities along the type of knowledge process sought to be supported represents an alternative to this approach.

According to Reinmann-Rothmeier (2000), two basic extremes of (virtual) knowledge communities can be distinguished: those with a focus on knowledge creation and innovation and those with a focus on knowledge sharing and communication. Between these two extremes, a continuum of mixtures of both types can evolve. Reinmann-Rothmeier acknowledges that neither extreme will be represented in its pure form, as all communication incorporates potential for innovation (and knowledge creation), and as innovation is required to function in communities, communication (and knowledge sharing).

6.5 Online Knowledge Communities

Initially, knowledge communities, like communities of practice and communities of learning, did not refer to online communities, but to communities tied to a particular place. This changed at the beginning of this decade. In an article published in 2000, Erickson and Kellogg, both from the renowned IBM Watson Research Center, defined collaborative systems that support activities of knowledge communities as “conversationally-based systems that support the creation, management and reuse of knowledge in a social context” (Erickson & Kellogg, 2000, p. 59).

Erickson and Kellogg’s (2000) definition of collaborative systems that support knowledge communities provides an excellent account of collaborative systems for the support
of knowledge communities and a vision of their potential (plus an implicit definition of online knowledge communities):

"Imagine a knowledge management system that was designed from a social perspective, a system predicated on the assumption that knowledge is distributed throughout a network of people, and that only a small proportion of it is captured in concrete form. As the above vignettes suggest, such a system would, along with its data and documents, also provide a rich set of connections back to the social network of people who produced the information. But, if we think in terms of making socially significant activity visible, considerably more possibilities suggest themselves. Imagine that the knowledge management system provided access not only to authors, but to people who were accessing and using the knowledge. [...] Such a system would not be just a database from which workers retrieved knowledge, it would be a knowledge community, a place within which people would discover, use, and manipulate knowledge, and could encounter and interact with others who are doing likewise." (Erickson & Kellogg, 2000, p. 66/67)

This definition emphasizes the online-attributes of knowledge communities, and also points towards the risk of confusing the collaborative system with the online community itself, as outlined in Section 6.3. To make the distinction clear, within this thesis it is explicitly referred to as either the forum community (i.e., the online community) or the online forum (i.e., the collaborative forum system).

Following Erickson and Kellogg’s (2000) implicit definition, this section will formally integrate the sub-concepts and individual fields of research in Collaborative Systems, Knowledge Management, and Online and Knowledge Communities outlined in the previous Sections 6.1 to 6.4, among the term of Online Knowledge Communities (OKCs). Based on the previous definitions, online knowledge communities are defined as follows:
Online Knowledge Communities (OKCs) are communities which utilize collaborative systems with the main purpose of initiating or supporting knowledge processes.

Online knowledge communities are thus defined as a generic term for communities composed of individuals with a common interest in their educational and/or professional development that are supported by collaborative systems with the means to support knowledge processes among the members of the community. The given definition thus covers the entire spectrum of both communities of practice, with their focus on continuous professional development as defined by Lave and Wenger (1991), and communities of learning, representing learning networks as defined by Bielaczyc and Collins (1999). As far as the collaborative systems are concerned that support online communities’ knowledge processes, Erickson and Kellogg’s (2000) definition of collaborative systems is built upon.

The given definition of online knowledge communities extends that of de Vries and Kommers (2004, p. 116), who view online knowledge communities as “a social network of professionals aiming at the development and exploitation of a particular knowledge domain, that is, to a certain extent, online”, a definition restricting online knowledge communities to the previously mentioned online-based communities of practice, while excluding aspects of collaborative learning.

**Forum-based Online Knowledge Communities**

Because an online forum-based collaborative system forms the basis of the empirical study, particular aspects and properties of forum-based online knowledge communities are briefly outlined in the following.

More and more often, electronic communication forums are used as a means of knowledge management (Kuhlen, 2001), and a huge potential is relegated to forums as a means of managing knowledge (Waltert, 2002).

Electronic forums can be used to generate continuous and digitally stored knowledge bases that are independent of time and location, open to all members of the forum, and
represent a powerful tool for knowledge management in increasingly networked and distributed corporations, institutions, and organizations.

The communication and question-based knowledge management approach underlying forum-based online knowledge communities helps to integrate participants and thus supports the creation of a sustainable knowledge community. The communication and question-based approach also helps to generate a clear structure of the forum's content, providing a narrative that aids in “reconstruction, retrospection, prediction, and memory as well as motivation” (Plowman, 1996, as cited in Plowman, 1998, para.13), thus helping to overcome the paradox of how one can learn something one knows nothing about (Laurillard, 1996; Laurillard & Taylor, 1994).

As outlined in Section 6.2, knowledge resources can be distinguished in both explicit and tacit knowledge resources. Through the communication within forums, the narrative thus formed, and the knowledge processes thus stimulated, forums are a way of communicating the more implicit aspects of knowledge, allowing subject matter experts and key knowledge holders to convey implicitly what they cannot explicitly communicate and describe. With particular emphasis on tacit knowledge, Radding (1998) argues that knowledge that is otherwise difficult to structure lends itself particularly well to extraction, storage, and management through online communities. Waltert (2002) could empirically establish proof of the usability of online communities for knowledge management in the context of cooperative banks.

Forums are thus ideal for dynamic contexts such as research environments, in which “the pressures to act appropriately in a given time and space are high, so that the right context-specific information is very valuable, but the shelf-life of context-specific knowledge is low (because the context is dynamic)” (Merali & Davies, 2001, p. 97).

The forums of International University Bremen (IUB), which form the basis for the empirical study of this research, represent such a forum-based online knowledge community, mainly consisting of forums for information exchange and discussion.

It must be emphasized that in the given research, the term (online) forum refers only to forums as used by forum-based online knowledge communities (i.e., forums used by knowledge communities with a focus on supporting knowledge processes, as outlined in
Section 6.4), in contrast to Kuhlen (1998, p. 34-39), who uses the term (online) forum as a generic term for forums with a broad range of content, subsuming information forums (“Informationsforen”), fun forums (“Fun-Foren”), transaction forums (“Transaktionsforen”), and communication / discussion forums (“Diskussionsforen”); that is, forums that do not necessarily support knowledge processes, but a community’s desire for entertainment as well.

As will become clear in Section 13.2, Part III, the five forum categories of the IUB forums identified in the context of the empirical study represent the whole spectrum of the two distinct types of communities referred to in Section 6.4, communities of practice and communities of learning. While members of the IUB course forums can be considered members of a community of learning, members of the IUB general forums, with their many teams, association and special interest group forums, can more readily be considered members of a community of practice.
7 RESEARCH APPROACH, RESEARCH FRAMEWORK, 
AND PROPOSED MODEL

In its first section this chapter presents the thesis’ overall research approach – including 
the authors epistemological stance in approaching the research problem at hand, as well 
as the actual type of research and the specifics of the research methodology taken.

The second section of this chapter provides an overview of knowledge management 
research frameworks, while the last section of this chapter argues for the selection of one 
of these frameworks in the given context of the study and presents an outline of the 
proposed model on the basis of this framework.

7.1 Research Approach - Epistemology, Type of Research, Methodology,…

Based on Straub, Gefen, and Boudreau (2004; 2005) and Myers (1997a; 1997b), this 
section presents the thesis’ overall research approach with respect to its individual dimen-
sions, as shown in the following table, Table 7-1: the author’s epistemological stance, the 
type of research (with respect to its two dimensions), the research methodology, data 
collection techniques, and data analysis techniques.

This thesis takes a Quantitative, Positivist Research (QPR) approach that is commonly 
applied in the social sciences in general and the field of Information Systems research in 
particular. The QPR research approach adopted in this research is based on the assump-
tion that the scientific theories identified throughout the course of the research can be 
falsified (i.e., a positivist approach). Further, empirically derived numbers and the statis-
tical tests applied to them, lie at the core of the scientific methodology of this research 
(i.e., a quantitative approach).

Instead of the chosen positivist approach and its underlying philosophical perspective, 
an interpretive or critical research approach could have been adopted as the underlying
epistemology. Both Myers (1997a; 1997b) and Straub et al. (2004; 2005) present an overview of these fundamental philosophical perspectives.

<table>
<thead>
<tr>
<th>Underlying Epistemology</th>
<th>Type of Research I/II</th>
<th>Research Methodology</th>
<th>Data Collection Technique</th>
<th>Data Analysis Technique</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positivist</td>
<td>1st Dimension:</td>
<td>Quantitative, Positivist Research (QPR)-Methods:</td>
<td>Surveys/Questionnaires via div. media (online, print or telephone) Interviews Objective measures Transcript analysis Etc.</td>
<td>Qualitative: Hermeneutics Semiotics Narrative &amp; metaphor Etc.</td>
</tr>
<tr>
<td>Interpretive</td>
<td>Quantitative</td>
<td>Archival Research Field Study Experiments Etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical</td>
<td>Qualitative</td>
<td>Non-QPR-Methods:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Action Research Case Study Ethnography Participative Research Etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2nd Dimension:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Descriptive Exploratory (or Explanation-building)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Explanatory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(or Confirmatory / Pattern-matching)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Based on: Straub et al., 2004; Straub et al., 2005)

**Table 7-1: Research Approach – This Thesis’ Specifications Underlined**

To some extent, the epistemological assumption of positivism, upon which this thesis is based, determines the type of research with respect to its first distinct property: qualitative versus quantitative research approaches. While an interpretive or critical philosophical perspective could be applied to both qualitative and quantitative research approaches, in case of positivism only a quantitative research approach is meaningful (Straub et al., 2004, 2005).

The second distinct property of the type of research is the distinction in exploratory versus confirmatory research approaches – a distinction suggested by Straub et al. (2005). Quoting Hair et al. (1995), Straub et al. (2005) define confirmatory studies as those
“seeking to test (confirm) a pre-specified relationship” and exploratory studies as those which “define possible relationships in only the most general form and then allow multivariate techniques to estimate a relationship(s)” (online). A comparable distinction is being made by Myers (1997a; 1997b), who differentiates between pattern-matching research approaches, which test a preliminary model derived from theory and logic and try to improve it; and explanation-building research approaches, which use data to derive hypotheses as the method of data analysis. The most distinct differentiation is being made by Yin (2003), who differentiates among descriptive research approaches (illustrative, with a means to add information to the body of examples); exploratory research approaches (descriptive, aimed at generating hypotheses for future research); and explanatory research approaches (descriptive, usable for causal investigations and confirmation of hypotheses based on a previously developed theory).

As outlined previously, the given thesis is based on an explanatory (i.e., confirmatory or pattern-matching) study that tests a preliminary model (and the individual hypotheses derived in the following Chapters 9 and 10) derived on theory and logic, using pattern-matching procedures as the method of data analysis.

Besides the type of research the underlying epistemology indirectly determines the actual research methodologies through that a research problem is actually approached. QPR research methodologies commonly applied in the social sciences include: field studies, survey methods, field experiments, laboratory experiments, experimental simulations, opinion research, and archival research; Non-QPR methods include: action research, case study research, ethnography, group feedback and participative research, as well as philosophical research (Myers, 1997a, 1997b; Straub et al., 2004, 2005). As quoted in Boudreau, Gefen, and Straub (2001), Stone (1979) also quote sample surveys as another research methodology. However, the author, in line with Boudreau et al. (2001), prefers to conceptualize sample surveys as a technique for data collection rather than a research methodology, that is, a means to “systematically collect data from individuals in a sample” (p. 7/8).

With a focus on Information Science (IS) research Boudreau et al. (2001) – referring to Stone (1978, 1979) – define field studies as “non-experimental inquiries occurring in
natural systems. Researchers using field studies cannot manipulate independent variables or control the influence of confounding variables” (p. 6).

With a focus on Human-Computer Interaction (HCI) research, Preece et al. (1994) define a field study along the same line: as “a study that is done in a natural setting as opposed to a controlled laboratory setting” (p. 713) – a definition that is also shared by Bortz and Döring (2002) and Bortz (2005) with respect to the social sciences.

In this sense, this thesis represents an in-depth single field study of the attitudes and behavior of online forum users in everyday working situations, with the International University Bremen’s (IUB) online forum selected as a case to address the research question.

This in-depth single field study approach was chosen for two reasons. First, evaluations of collaborative technology are best done through field- or case studies, because field- or case studies can be used to assess social, psychological and anthropological effects of the technology, among other things (Grudin, 1988). Second, one possible alternative to field- or case studies, running a “controlled” experiment, is typically not a valid option in information science research, mainly due to the impossibility of obtaining enough participants for a long enough time to control for the hugely different backgrounds and skill levels of the participants (Lethbridge, 1994).

As will be outlined in detail in Chapter 13 of Part III, the data collection techniques applied in the given thesis are online surveys or online questionnaires. Alternative data collection techniques are: surveys/questionnaires via other media (print or telephone), interviews, objective measures, or transcript analysis.

Finally, the data analysis techniques – or the “modes of analysis” as Myers calls data analysis techniques with respect to qualitative research approaches (1997a; 1997b) – is strongly determined by the previous decisions with regards to the epistemological stance, the type of research (with respect to its two dimensions), the research methodology, and the data collection techniques.

Many modes of analysis are available for qualitative types of research: hermeneutics, semiotics, or narrative and metaphor. Even more data analysis techniques exist for
quantitative types of research: ANOVA, ANCOVA, cluster analysis, factor analysis, MANOVA, multidimensional scaling, regression, Structural Equation Modeling (SEM), among others. As mentioned earlier, and as outlined in detail in Part IV of the thesis, in the given thesis, two data analysis techniques are applied: an ANOVA-based calculation of type of content-based knowledge process values and a SEM-based hypotheses test of individual factors of impact on an individual’s knowledge process contribution.

### 7.2 Research Framework

Referring to research by Shaw, Gardner, and Thomas (1997), Snow and Thomas (1994), and Thomas and Dewitt (1996), Gallupe (2001) observes that research frameworks have been used in a number of fields not only to guide research, but also with the main benefits of a framework “to establish boundaries around the phenomena being studied” (Gallupe, 2001, p. 65). The argument of research models guiding the research applies to the reason for selecting a framework model for the given research.


The main purpose of the model was to narrow down methodological approaches to the research question. For this purpose, the “General Systems Framework for Knowledge Management Systems” as outlined in Gallupe’s (2001) famous survey of the knowledge management systems landscape, published in the International Journal of Management Reviews in 2001, was selected because it also offered the opportunity to be applied as an abstract causal path model.

While Figure 7-1 represents Gallupe’s model with its three levels, Figure 7-2 represents the Gallupe’s model applied to the context of the given research. The input level represents the input factors (predictors / antecedents) measured by the questionnaire, through log-file data, and the derived constructs; the second level represents the action / process-level with the direct process relevance of the individual user’s action; the
third level represents the knowledge effect (output) level with the indirectly derived knowledge process relevance of the individual user’s action.

![Figure 7-1: Gallupe’s (2001) General Systems Framework](image1)

7.3 Outline of the Proposed Model

For didactic purposes, at this point, the proposed measurement and structural model is presented as a brief outline of the proposed model, followed by a summary of comparable theoretical and empirical models and approaches in Chapter 8. The individual factors and the respective hypothesis of the proposed model outlined in this section are presented in Chapter 9 and Chapter 10. As noted earlier, these chapters are organized to mirror the proposed conceptual framework.
The proposed measurement and structural model presented in Figure 7-3 depicts the central element of the research project. The measurement and structural model builds on the three levels of Gallupe’s (2001) previously outlined General Systems Framework for Knowledge Management Systems. The first level – the input level – represents the expected input factors (predictors or antecedents) as constructs that are measured by data from questionnaires and / or log-files. The second level – the action / process-level – represents the direct process relevance of the individual user’s action (i.e., the frequency of contribution and the type of message contributed). Finally, the third level – the knowledge effect (output) level – represents the indirectly derived knowledge process relevance (i.e., knowledge transfer and / or knowledge creation contributions) of the individual user’s action.
Figure 7-3: Measurement and Structural Model
8 SUMMARY OF COMPARABLE MODEL APPROACHES

As pointed out in Chapter 5, a huge potential is relegated to online knowledge communities as a means of managing knowledge within collaborative, distributed, and networked environments such as universities, research institutions or other knowledge based corporations, institutions, and organizations (Waltert, 2002). However, as Waltert (2002) points out, few empirical studies exist that scientifically test the assumed advantages of suitable systems, such as forum-based systems. Thus, there is a particular need for empirical studies to enhance the data basis and to compare the results across different contexts (Waltert, 2002).

So far, no integrated empirical research has been conducted that focuses on the identification / prediction of factors stimulating actors to contribute to processes of knowledge transfer and knowledge creation in the context of forum-based online knowledge communities. Since online forums are becoming common tools for means of online community-based knowledge management, this research project is meant to close this gap of knowledge.

To date, there exists very little empirical and theoretical research on knowledge processes in collaborative systems comparable to the given research. Existing empirical or theoretical research generally focuses on a specific context and is restricted to knowledge transfer processes. Much more research, however, has been published on the potential influence of specific factors on key knowledge processes.

Following the outline of the research framework and the proposed measurement and structural model of the given research in Chapter 7, this chapter (Chapter 8) is meant to provide an overview of existing empirical and theoretical research comparable to the given research, before outlining the specifics of the given research in the final chapters of this part of the thesis. The phrase “empirical and theoretical research comparable to the given research” refers to empirical or theoretical research identifying / predicting factors
stimulating actors to contribute to key knowledge processes in the context of knowledge communities.

In total, five empirical and theoretical studies could be identified: three empirical studies, by Faraj and McLure Wasko (2001), Wang and Fesenmaier (2003), and Wathne et al. (1996); and two theoretical studies, by von Krogh (2003), and Sharratt and Usoro (2003).

All of the five identified studies except Wang and Fesenmaier (2003) focus on knowledge transfer processes, each in a different collaborative context. Wang and Fesenmaier’s (2003) study focuses on the involvement in and contribution to online communities. As such, no comparable empirical or theoretical studies on the identification / prediction of factors stimulating actors to contribute to knowledge creation processes have been conducted so far, let alone studies focusing on both knowledge processes, knowledge transfer and knowledge creation, at the same time.

Studies focusing on only one particular aspect of potential influence (e.g., the sense of community among members) are not outlined in this chapter: they are referred to in the appropriate section in Chapter 9 and Chapter 10. Nevertheless, as will become clear in these chapters, this project was strongly informed by these research publications which addressed only one particular aspect of potential influence. Research addressing selected aspects in the context of either knowledge transfer or knowledge creation processes includes, among others, von Krogh (1998), von Krogh et al. (2000), and Nonaka and Takeuchi (1995), all of whom focus on the relevance of “care” for knowledge creation processes; and Hansen (1999), who focuses on the relevance of “weak ties” for knowledge transfer processes.

Table 8-1 provides an overview and summary of: the key properties of these five empirical and theoretical studies, expanding on the type of study (including the key research methodology in the case of empirical studies) and each study’s general focus; the sample and data collection methodology in the case of empirical studies; and the identified / predicted factors stimulating actors to contribute to which type of key knowledge process under study.
<table>
<thead>
<tr>
<th>Author / Title</th>
<th>Type of Study and General Focus</th>
<th>Sample / Data Collection</th>
<th>Items</th>
<th>Impact on</th>
</tr>
</thead>
<tbody>
<tr>
<td>von Krogh (2003): “Knowledge Sharing and the Communal Resource”</td>
<td>Theoretical study with regard to knowledge communities</td>
<td>— Communal resource – Opportunity structure – Care – Authenticity</td>
<td>Knowledge sharing</td>
<td></td>
</tr>
<tr>
<td>Wang and Fesenmaier (2003): “Assessing Motivation of Contribution in Online Communities”</td>
<td>Amos-based empirical study on involvement in and contribution to an online community</td>
<td>322 online survey responses from a virtual tourism community with 150,000 members</td>
<td>– Ease of communication – Instrumental – Efficacy – Quality control – Status – Expectation – Personality</td>
<td>Involvement in and contribution to online community</td>
</tr>
<tr>
<td>Wathne et al. (1996): “Towards a Theory of Knowledge Transfer in a Cooperative Context”</td>
<td>Lisrel-based empirical study on knowledge transfer within a cooperative context</td>
<td>62 structured phone-interviews with representatives involved in project-oriented cooperative arrangements in 45 companies</td>
<td>– Prior experience – Degree of openness – Richness of interaction – Degree of trust</td>
<td>Effectiveness of knowledge transfer</td>
</tr>
</tbody>
</table>

Table 8-1: Overview of Comparable Empirical & Theoretical Model Approaches
9 OUTPUT / KNOWLEDGE PROCESS FACTORS AND HYPOTHESIS

The definition of knowledge processes that ought to be studied is a key aspect of the examination of the relationship of potential antecedent factors in knowledge process contribution within an online forum context.

This chapter (Chapter 9) provides an overview of fourteen concepts of key knowledge processes and proposes Knowledge Creation, Knowledge Capture, Knowledge Transfer, and Knowledge Utilization as the underlying conceptual knowledge cycle of all models. Finally, with regard to the empirical study at hand, the focus on the two key knowledge processes knowledge transfer and knowledge creation is proposed and argued for. The output / knowledge process section is particularly based on the field of research of Knowledge Management (KM).

9.1 Concepts of Key Knowledge Processes – Overview

Following the selection of the abstract causal path model, knowledge processes as discussed in the literature are summarized in this section.


Table 9-1 integrates the compilations of models of knowledge processes by Liebowitz (2001), Weber and Kaplan (2003), and Ortiz Laverde et al. (2003), and adds one further model of knowledge processes, proposed by von Krogh et al. (2000) and von Krogh (2001) to the table, as well as Weber and Kaplan’s (2003) own model. Furthermore, Ruggles’ 1996 model is actualized by his 1997 model. Finally, the conceptual knowledge cycle, identified as outlined below, is included, and assigned to all 14 models.

As can be seen from the table, the 14 models of knowledge processes differ to some extent, depending on their particular focus and/or the context of application the author(s) had in mind. Nevertheless, among all the models listed in the table, certain knowledge processes can be identified as common to all models.

<table>
<thead>
<tr>
<th>Knowledge Processes</th>
<th>Literature (alphabetical order)</th>
<th>Assignment to identified conceptual cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Create</td>
<td>Heisig (2001)</td>
<td>Creation</td>
</tr>
<tr>
<td>(2) Store</td>
<td></td>
<td>Capture</td>
</tr>
<tr>
<td>(3) Distribute</td>
<td></td>
<td>Transfer</td>
</tr>
<tr>
<td>(4) Apply</td>
<td></td>
<td>Utilization</td>
</tr>
<tr>
<td>(1) Capturing and locating</td>
<td>Von Krogh et al. (2000); von Krogh (2001)</td>
<td>Capture</td>
</tr>
<tr>
<td>(2) Transferring and sharing</td>
<td></td>
<td>Transfer</td>
</tr>
<tr>
<td>(3) Enabling and creating</td>
<td></td>
<td>Creation</td>
</tr>
<tr>
<td>[Specifics: (a) From content- towards process-focus; (b) from focus on existing knowledge towards focus on new knowledge.]</td>
<td></td>
<td>N/A</td>
</tr>
<tr>
<td>(1) Transform information to knowledge</td>
<td>Liebowitz (2001)</td>
<td>Capture</td>
</tr>
<tr>
<td>(2) Identify and verify knowledge</td>
<td></td>
<td>Capture</td>
</tr>
<tr>
<td>(3) Capture and secure knowledge</td>
<td></td>
<td>Capture</td>
</tr>
<tr>
<td>(4) Organize knowledge</td>
<td></td>
<td>Utilization</td>
</tr>
<tr>
<td>(5) Retrieve and apply knowledge</td>
<td></td>
<td>Creation</td>
</tr>
<tr>
<td>(6) Combine knowledge</td>
<td></td>
<td>Creation</td>
</tr>
<tr>
<td>(7) Create knowledge</td>
<td></td>
<td>Utilization</td>
</tr>
<tr>
<td>(8) Distribute / sell knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1) Knowledge production – individual and group learning, information acquisition</td>
<td>McElroy (2002)</td>
<td>Creation</td>
</tr>
<tr>
<td>(2) Knowledge integration – broadcasting, searching, teaching, sharing</td>
<td></td>
<td>Transfer</td>
</tr>
<tr>
<td>[Specifics: (a) demand-side knowledge management (1) versus supply-side knowledge management (2); (b) knowledge life cycle as integrator of both.]</td>
<td></td>
<td>N/A</td>
</tr>
</tbody>
</table>

[continued]
(1) Socialization – transfers tacit knowledge from one person to tacit knowledge in another person
(2) Externalization – making tacit knowledge explicit
(3) Combination – knowl. transfer once knowl. is explicit
(4) Internalization – understanding and absorbing explicit knowledge into tacit knowledge held by the individual

<table>
<thead>
<tr>
<th>(1) Identification</th>
<th>(2) Acquisition</th>
<th>(3) Development</th>
<th>(4) Distribution</th>
<th>(5) Utilization</th>
<th>(6) Preservation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identification</td>
<td>Capture</td>
<td>Capture</td>
<td>Capture</td>
<td>Capture</td>
<td>Capture</td>
</tr>
<tr>
<td>Acquisition</td>
<td>Capture</td>
<td>Capture</td>
<td>Capture</td>
<td>Capture</td>
<td>Capture</td>
</tr>
<tr>
<td>Development</td>
<td>Capture</td>
<td>Capture</td>
<td>Capture</td>
<td>Capture</td>
<td>Capture</td>
</tr>
<tr>
<td>Distribution</td>
<td>Capture</td>
<td>Capture</td>
<td>Capture</td>
<td>Capture</td>
<td>Capture</td>
</tr>
<tr>
<td>Utilization</td>
<td>Capture</td>
<td>Capture</td>
<td>Capture</td>
<td>Capture</td>
<td>Capture</td>
</tr>
<tr>
<td>Preservation</td>
<td>Capture</td>
<td>Capture</td>
<td>Capture</td>
<td>Capture</td>
<td>Capture</td>
</tr>
</tbody>
</table>

[Specifics: (a) Inner circle (processes listed above); (b) Outer circle (Knowledge goals and Knowledge assessment) – provides direction to the whole KM-cycle.]

<table>
<thead>
<tr>
<th>(1) Knowledge creation or acquisition</th>
<th>(2) Knowledge codification and storage</th>
<th>(3) Knowledge transfer or dissemination</th>
<th>(4) Knowledge Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ruggles (1996); Ruggles (1997)</td>
<td>Capture</td>
<td>Capture</td>
<td>Creation</td>
</tr>
<tr>
<td></td>
<td>Capture</td>
<td>Capture</td>
<td>Transfer</td>
</tr>
<tr>
<td></td>
<td>Capture</td>
<td>Capture</td>
<td>Utilization</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(1) Developing new knowledge</th>
<th>(2) Securing new and existing knowledge</th>
<th>(3) Distributing knowledge</th>
<th>(4) Combining available knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Van der Spek &amp; Spijkervet (1997)</td>
<td>Capture</td>
<td>Capture</td>
<td>Transfer</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Utilization</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(1) Creation and import</th>
<th>(2) Capture</th>
<th>(3) Retrieve / access</th>
<th>(4) Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staab et al. (2001)</td>
<td>Capture</td>
<td>Capture</td>
<td>Transfer Utilization</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(1) Knowledge sharing</th>
<th>(2) Knowledge accessibility – extent to which people have access to the information they need to make decisions, solve problems, perform job tasks, etc.</th>
<th>(3) Knowledge assimilation – extent to which people learn/assimilate the knowledge they need to perform well</th>
<th>(4) Knowledge application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tannenbaum &amp; Alliger (2000)</td>
<td>Transfer</td>
<td>N/A</td>
<td>Utilization</td>
</tr>
</tbody>
</table>
(1) Collect 韦伯 & 阿哈 (2003) \textit{Capture}
(2) Verify 韦伯 & 阿哈 (2003) \textit{Capture}
(3) Store 韦伯 & 阿哈 (2003) \textit{Capture}
(4) Disseminate 韦伯 & 阿哈 (2003) \textit{Transfer}
(5) Reuse 韦伯 & 阿哈 (2003) \textit{Utilization}

(1) Create – focuses on how knowledge comes into existance in processes of organizations and individuals
(2) Understand – comprises verification, representation, synthesis, adaptation, storage and organization of the new knowl. with knowl. existing within the organization
(3) Distribute – embodies active and passive dissemination methods
(4) Reuse – applying knowl. to an organizational process

Table 9-1: Knowledge Processes in the Literature and Proposed Framework

\begin{tabular}{|l|l|}
\hline
(1) Creation and sourcing & Wiig (1993) \textit{Creation} \\
(2) Compilation and transformation & Wiig (1993) \textit{Capture} \\
(3) Dissemination & Wiig (1993) \textit{Transfer} \\
(4) Application and value realization & Wiig (1993) \textit{Utilization} \\
\hline
\end{tabular}

(Based on: Liebowitz, 2001; Ortiz Laverde et al., 2003; Weber & Kaplan, 2003)

Underlying Conceptual Knowledge Cycle

Based on the knowledge processes of the 14 models enlisted in Table 9-1, the underlying conceptual knowledge cycle of all models can now be identified.

Starting point is the conceptual knowledge cycle as identified by Weber and Kaplan (2003). Among the six models contained in their original compilation, Weber and Kaplan identified the four knowledge processes \textit{Create}, \textit{Understand}, \textit{Distribute}, and \textit{Reuse} as the underlying conceptual cycle of their models.

While three of these core knowledge processes – create, distribute, and reuse – are explicitly or implicitly identified as one key knowledge process of each of the six models, this does not apply to the knowledge process “understand.” Neither Ruggles’ (1997; 1996) knowledge process of “knowledge codification and storage,” nor van der Spek and Spijkervet’s (1997) knowledge process of “securing new and existing knowledge,” nor Staab et al.’s (2001) knowledge process “capture,” nor Weber and Aha’s (2003) knowledge processes of “disseminate” and “reuse,” nor Wiig’s (1993) knowledge process of
“application and value realization” suggest themselves intuitively as representations of Weber and Kaplan’s knowledge process “understand.”

As the knowledge processes just mentioned suggest, the knowledge process actually referred to by the models quoted is a process of knowledge capture. While the terms “create,” “distribute,” and “reuse” are fairly self-explanatory, the term “understand” is not very intuitive. Weber and Kaplan suggest that this generic term comprises such diverse processes as “verification, representation, synthesis, adaptation, storage and organization of the new knowledge with knowledge existing within the organization” (Weber & Kaplan, 2003, p. 154).

With a focus on intuitive and self-explanatory terminology, the underlying conceptual knowledge cycle of all models of the extended compilation of 14 models of knowledge processes, as presented in Table 9-1, is thus proposed as the knowledge processes Knowledge Creation, Knowledge Capture, Knowledge Transfer, and Knowledge Utilization. These four knowledge processes form the basis for further investigations.

For an outline of synonyms and analogies of the four individual knowledge processes, specifically the synonyms and analogies of the two knowledge processes “Knowledge Creation” and “Knowledge Transfer” outlined in Section 9.2.5, the four identified conceptual knowledge processes common to all models are assigned along the original processes in the above table.

Ruggles (1997) “Knowledge Life Cycle Framework” actually resembles the four identified key knowledge processes, with Ruggles’ original term of “knowledge creation or acquisition” representing knowledge creation, “knowledge codification and storage” representing knowledge capture, “knowledge transfer or dissemination” representing knowledge transfer, and “knowledge use” representing knowledge utilization.

### 9.2 Knowledge Creation, Capture, Transfer, and Utilization

As outlined in the previous section, the knowledge processes Knowledge Creation, Knowledge Capture, Knowledge Transfer, and Knowledge Utilization can generally be identified as the processes common to all models of knowledge processes. The models,
obviously differ to some extent, depending on their particular focus and/or the context of application the author(s) had in mind. With a focus towards the proposed empirical study of online community-based knowledge processes, the processes just mentioned have the advantage of being easily differentiated.

9.2.1 Knowledge Capture

As far as forum-based online communities are concerned, Knowledge Capture is an inherent element in the collaborative forum system upon which the community builds; typically, all messages are saved and accessible at a later time. The knowledge process of knowledge capture is thus not a process that can be influenced by – or have an impact on – individual users; instead, it is a process that depends on the underlying software and its respective settings. As such, Knowledge Capture takes place indirectly by using the online forum system to communicate. Given this feature, the support of online forums for Knowledge Capture differs from, for example, telephone-meetings, group meetings, or even particular chat-systems, none of which explicitly capture the knowledge generated in the context of the communicative process. Given the inherent realization of the knowledge process demands for Knowledge Capture in the context of online forums, there is no need to focus on this process in the context of the given research.

9.2.2 Knowledge Utilization

As opposed to knowledge capture, the knowledge process of Knowledge Utilization is triggered through the participation in a forum and the communicative exchanges within it (i.e., the knowledge gained through the process of participation). Knowledge utilization is thus based on both the system-based process of knowledge capture and the community-based processes knowledge creation and knowledge transfer. Contrary to these system- or community-based knowledge processes, the process of knowledge utilization is both independent of the system and the community – and only bound to the person that individually utilizes the content of the system (i.e., the knowledge gained through participation). The individual-based process of knowledge utilization thus depends on the context of the user and her/his ability to apply cooperative content directly or indirectly within this personal context. Optimally, new knowledge generated through the process of
utilization “flows back” into the forum community through the community-based process of knowledge creation (Knowledge Life Cycle; Ruggles, 1997). Because it is an individual-based process, taking place “outside” of the collaborative-based forum context, the process of knowledge utilization is not considered in the given study. In any case, the degree of knowledge utilization would obviously be hard to measure consistently, as the degree to which knowledge is being utilized strongly depends on the individual user’s ability to apply (i.e., utilize) collaborative content in his personal context.

9.2.3 Knowledge Creation and Knowledge Transfer

This leaves the two community-based processes Knowledge Creation and Knowledge Transfer as processes of relevance for the given research. As outlined in Chapter 8, so far very few theoretical and empirical studies exist that predict the factors that would stimulate actors to contribute to either of these knowledge processes. As pointed out previously, no integrated empirical research focusing on both of these knowledge processes in the context of online forums has been conducted so far.

9.2.4 Focus on Community-based Knowledge Processes

Table 9-2 summarizes the core properties of the four identified key knowledge processes of knowledge creation, knowledge capture, knowledge transfer, and knowledge utilization, and visualizes them on the basis of Ruggles’ (1997) Knowledge Life Cycle.

As pointed out, the given research focuses on the two community-based knowledge processes knowledge creation and knowledge transfer. From now on, the phrase “knowledge processes” is meant to refer to these two community-based knowledge processes knowledge creation and knowledge transfer addressed in the empirical part of the research.

The following section provides a definition of these two community-based knowledge processes on the basis of synonyms and analogies that are used interchangeably with their terms. These synonyms and analogies were identified on the basis of the previously outlined compilation of fourteen knowledge processes.
<table>
<thead>
<tr>
<th>Community-based knowledge process</th>
<th>System-based knowledge process</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Knowledge Creation</strong></td>
<td><strong>Knowledge Capture</strong></td>
</tr>
<tr>
<td>(Ruggles: Knowledge Creation or Acquisition)</td>
<td>(Ruggles: Knowledge Codification and Storage)</td>
</tr>
<tr>
<td><strong>Knowledge Transfer</strong></td>
<td><strong>Knowledge Utilization</strong></td>
</tr>
<tr>
<td>(Ruggles: Knowledge Transfer or Dissemination)</td>
<td>(Ruggles: Knowledge Use)</td>
</tr>
</tbody>
</table>

(Based on: Ruggles, 1997)

**Table 9-2: Identified Conceptual Knowledge Cycle**

### 9.2.5 Definitions (and Synonyms) of Knowledge Transfer & Creation

Several synonyms are used interchangeably with the terms knowledge transfer and knowledge creation. Most commonly, the term knowledge transfer is used synonymously and interchangeably with the term knowledge sharing. However, the term knowledge transfer is preferred to the term knowledge sharing, as the latter suggests impressions of knowledge as a “good.” Contrary to the term knowledge sharing, the term knowledge transfer makes clear that no reduction of knowledge as an entity takes place when it is being “shared.”

The following two tables, Table 9-3 and Table 9-4, provides an overview of synonyms and analogies of knowledge transfer and knowledge creation as used by the authors summarized in the compilation of the fourteen knowledge processes outlined in Section 9.1.

Definitions of knowledge creation are more diverse than definitions of knowledge transfer, where a much higher degree of agreement appears to exist.

Knowledge creation is most intuitively defined as individual and group learning (McElroy, 2002). More abstract definitions define knowledge creation as the process of enabling existing knowledge (von Krogh, 2001; von Krogh et al., 2000), the combination of existing knowledge into new knowledge (Liebowitz, 2001), and the acquisition of new knowledge (McElroy, 2002; Ruggles, 1997, 1996).
Knowledge transfer is predominantly defined as the process of sharing knowledge (McElroy, 2002; Rastogi, 2000; Tannenbaum & Alliger, 2000; von Krogh, 2001; von Krogh et al., 2000), and the process of distributing existing knowledge (Heisig, 2001; Probst et al., 2002; van der Spek & Spijkervet, 1997; Weber & Kaplan, 2003). Knowledge transfer is also defined as the dissemination of knowledge (Ruggles, 1997, 1996; Weber & Aha, 2003; Wiig, 1993). The most intuitive definition defines knowledge transfer as a process of knowledge integration and teaching (McElroy, 2002).

The identified synonyms and analogies were used within the questionnaire, in order to make the meaning of the two key knowledge processes clear to all participants of the online-survey.

<table>
<thead>
<tr>
<th>Knowledge Creation</th>
<th>Literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge enabling</td>
<td>von Krogh et al. (2000); von Krogh (2001)</td>
</tr>
<tr>
<td>Knowledge combination</td>
<td>Liebowitz (2001)</td>
</tr>
<tr>
<td>Individual and group learning</td>
<td>McElroy (2002)</td>
</tr>
<tr>
<td>Knowledge development</td>
<td>Probst et al. (2002)</td>
</tr>
<tr>
<td>Knowledge acquisition</td>
<td>McElroy (2002); Ruggles (1996); Ruggles (1997)</td>
</tr>
</tbody>
</table>

**Table 9-3: Synonyms and Analogies of Knowledge Creation**

<table>
<thead>
<tr>
<th>Knowledge Transfer</th>
<th>Literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge distributing</td>
<td>Heisig (2001); Probst et al. (2002); van der Spek &amp; Spijkervet (1997); Weber &amp; Kaplan (2003)</td>
</tr>
<tr>
<td>Knowledge sharing</td>
<td>von Krogh et al. (2000); von Krogh (2001); McElroy (2002); Rastogi (2000); Tannenbaum &amp; Alliger (2000)</td>
</tr>
<tr>
<td>Knowledge integration; Knowledge teaching</td>
<td>McElroy (2002)</td>
</tr>
<tr>
<td>Knowledge dissemination</td>
<td>Ruggles (1996); Ruggles (1997); Weber &amp; Aha (2003); Wiig (1993)</td>
</tr>
</tbody>
</table>

**Table 9-4: Synonyms and Analogies of Knowledge Transfer**
9.3 **Indirect Measurement of Knowledge Process Contribution**

The two key knowledge processes identified – knowledge creation and knowledge transfer – represent highly complex concepts and can thus only be approximated by any scale and measure. In the given research, individual actors’ knowledge process contributions must be derived through an indirect method due to the apparent risk of assessment skews on the side of survey participants in the case of direct attempts to gauge individual actors’ knowledge process contributions (e.g., by posing questions such as “How would you rate your contributions in terms of their knowledge creation impact?”).

The derivation of an indirect method for measuring individual actors’ knowledge process contributions constitutes a prerequisite for the final analysis of the suggested factors within the structural and measurement model – and for the outline of the hypothesis for the input factors, as outlined in the following section. Due to the relevance of the indirect measurement method, for didactic purposes this section thus has to anticipate results from the methodological section relating to the indirect measurement of knowledge process contribution (for the same reason, Chapter 15 of the following Part III anticipates results from the analysis section, relating to the indirect measurement of knowledge process contribution).

The following subsections outline the indirect knowledge process derivation procedure. As the two knowledge process constructs are the ultimate variable of interest, the outlined procedure describes a key aspect of the empirical methodology and analyses.

The theoretical aspects of the methodology for the indirect measurement of knowledge processes were outlined in Schmitz-Justen and Wilhelm (2005a).

**9.3.1 Type of Content as Knowledge Process Indicator**

The indirect measurement of knowledge process contribution proposes to derive a participant’s knowledge process contribution by the type of content the participant mostly contributes and the average frequency of the participant’s contribution.

Bullinger et al. (2001) and Waltert (2002) suggested that the content of online forums (i.e., the individual posts) can be grouped in categories with distinct features with regard
to their relevance for knowledge transfer and knowledge creation processes. In this respect, Bullinger et al. (2001) and Waltert (2002) proposed three types of content: statement / declaration entries, question-answer entries, and discussion entries.

In the given study, the participants were expected to select both the type of existing content, and the type of content of their own contributions from a pre-determined list of types of content. Accordingly, the pre-determined list of content types from which to select had to cover the entire spectrum of possible types of content, not only those relevant with respect to knowledge processes. Thus, the items of Bullinger et al. (2001) and Waltert (2002) were extended by the two further indicators – chat entries and information entries.

The following Table 9-5 lists the items identified by Bullinger et al. (2001) and Waltert (2002), and supplements them with synonyms and a detailed description that were also used within the questionnaire in / for the empirical part of this research.

As can be seen in the table, chat entries refer to posts directed mainly at socializing based on talk and informal conversation. Chat entries only communicate information as a secondary purpose. Statement / declaration entries refer to the proposal of one’s view, opinion, or position on an issue, as well as comments, remarks, explanations, statements, announcements, descriptions, and portrayals. Contrary to statement / declaration entries, information entries focus on notifications and contributions with data-related distribution of information. Question / answer entries refer to posts and replies to a thread with self-contained (“closed”) questions and related answers. Contrary to question / answer entries, discussion entries refer to replies to a thread initiated by statements or open questions.
<table>
<thead>
<tr>
<th>Reference / Type of Content</th>
<th>Synonyms</th>
<th>Description in questionnaire</th>
<th>Indicator for…</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chat entry</td>
<td>Talk, informal conversation</td>
<td>Posts mainly directed at socializing based on talk and informal conversation.</td>
<td>Socializing</td>
</tr>
<tr>
<td>Discussion entry</td>
<td>Communal exchange based on open questions</td>
<td>Posts as part of a discussion initiated by statements or open questions.</td>
<td>Knowledge Creation</td>
</tr>
<tr>
<td>Information entry</td>
<td>Supply of data, provision of information</td>
<td>Posts with the primary purpose of supplying data or providing information.</td>
<td>Knowledge Transfer</td>
</tr>
<tr>
<td>Question-answer entry</td>
<td>Entry to self-contained (&quot;closed&quot;) questions and related answers</td>
<td>Posts like self-contained questions and related answers to these “closed” questions.</td>
<td>Knowledge Transfer and Knowledge Creation</td>
</tr>
<tr>
<td>Statement / declaration entry</td>
<td>Description, announcement</td>
<td>Posts with the primary purpose of distributing statements, declarations, or announcements.</td>
<td>Knowledge Transfer</td>
</tr>
</tbody>
</table>

(Based on: Bullinger et al., 2001, p. 259; Waltert, 2002, p. 117. The original indicators “Statement/declaration,” “Question-answer,” and “Discussion” were extended by the two categories “Chat”- and “Information” entries.)

Table 9-5: Type of Content Indicators for Knowledge Distribution

9.3.2 Indirect Derivation Methodology

Based on the definition of distinct Type of Content (ToC)-categories, the following method is applied to derive a participant’s knowledge process contribution. The following Figure 9-1 represents the individual steps outlined below.

The proposed indirect model derives the process / output correlation by first asking survey participants about the type of content they most often contribute (1), and frequency of contribution (2). Next, survey participants are asked to evaluate the type of content of existing forum content (3) and to assess relevance of both knowledge transfer (4a) and knowledge creation (4b) relevance of existing forum content. Combining the information 3, 4a, and 4b, the processes knowledge transfer and knowledge creation are associated with certain types of content (5).
This *perceived* type of content / knowledge process association can be used to measure individual actor’s knowledge transfer and knowledge creation, based on information from 1 (and possibly 2), resulting in the individual’s relative (or absolute) knowledge process contribution: Associating information from 5 with the prior information about the individual actor’s most frequently contributed type of content (1), the individual actor’s contribution (RKPC) of relative knowledge transfer (7a), and knowledge creation (7c) is obtained (6, 7a, 7c); alternatively, by also including the individual actor’s general frequency of contribution (2), the individual actor’s absolute contribution (AKPC) of knowledge transfer (7b), and knowledge creation (7d) is obtained (6, 7b, 7d).

**Figure 9-1: Indirect derivation of individual actors’ KP-contributions**

A more accurate approximation could be achieved by asking participants the average frequency with which they contribute *each* of the defined types of content, resulting in a type of content / frequency matrix. With hindsight to the planned division of the forum in categories of comparable content and size, however, this version was deemed inappropriate with regard to the empirical study, as the resulting type of content / frequency matrix would be required for each forum category. Thus, the indirect derivation methodology outlined above provides a pragmatic concession towards the planned survey with its restrictions on time and complexity.
9.3.3 Research Question and Hypothesis

As outlined, it is hypothesized that the type of content contributed to a forum can be used as an approximation of a participant’s contribution to the two key knowledge processes of knowledge transfer and knowledge creation.

The hypothesis suggested by the literature review and the derived model is the following:

\[ H_{TOC,KP1}: \text{Knowledge Process-Effects express themselves in Types of Content.} \]
10 INPUT FACTORS AND HYPOTHESES

This chapter (Chapter 10) outlines the constructs that could be identified as potential input factors with a hypothesized direct or indirect impact on the two key knowledge processes knowledge transfer and knowledge creation.

The individual sections of the chapter are organized to mirror the proposed conceptual framework, outlined in Chapter 7.

Following a general theory review with a focus on an individual factor’s impact on knowledge process contributions in general, the specific hypotheses are formulated for each factor.

The individual hypotheses also mirror the proposed conceptual framework, by explicitly (directly and/or indirectly) referring to either or both of the two core influences on an individual’s knowledge process contribution – relative knowledge process contribution (RKPC) and frequency of contribution (FoC), as outlined in Chapter 9.

For the given forum-based online knowledge community context, little empirical precedent was available to guide the development of measures in the context of the empirical part of this research. Where possible, this chapter expands on existing options for the generation of the initial constructs and the a priori assignment of items to measure those constructs, which will be evaluated in Chapter 16, Part III.

The individual potential input factors were grouped in clusters of their common underlying aspects, System Aspects, Content Aspects, Social Aspects, and Actor Aspects, as a result of a publication by a publication by North et al. (2000). This publication suggests the theoretical connection amongst the aspects person, interaction, and knowledge transformation and organizational anchoring as dimensions of knowledge communities, and, as such, stimulated the clustering of input factors in the mentioned clusters deemed relevant for the given research.
The research that most inspired the construction of input factors was Wathne et al.’s (1996) Lisrel-based study “Towards a Theory of Knowledge Transfer,” outlined in Chapter 8 with its summary of comparable model approaches. The authors’ study examines the impact of several factors on the effectiveness of knowledge transfer processes in the context of face-to-face and telephone interactions in cooperative environments. The authors identified prior experience, richness of interaction, degree of trust, and degree of openness as the main factors. The given research depicts a comparable study in the context of forum-based online knowledge community research, without restricting the analysis to knowledge transfer, as does the study by Wathne et al. (1996). Instead, the given research focuses on both knowledge creation and knowledge transfer. Wathne et al.’s (1996) study encouraged the inclusion of two user aspects input factors (experience and motivation), the inclusion of one content aspect input factor (perceived quality of content), and the inclusion of two social aspects input factors (sense of community and trust).

Further stimulus for the given research was obtained from von Krogh’s (2003) theoretical analysis “Knowledge Sharing and the Communal Resource,” a theoretical study focusing on impact factors of knowledge sharing processes, also outlined in Chapter 8. – On a theoretical level, von Krogh identified the factors communal resource, opportunity structure, care, and authenticity as main factors of influence. Von Krogh emphasizes in particular the impact of the last three factors, when the interests of the population under study are diverse and distributed. Von Krogh’s study encouraged the inclusion of one social aspect input factor (cooperation).

For the individual input factors and hypotheses outlined in the following sections of this chapter see Schmitz-Justen and Wilhelm (in press).

### 10.1 System Aspects

The first cluster covers the System Aspects. The first cluster is based specifically on the field of research of Human Computer Interaction (HCI). One latent construct, Perceived Service Quality, was identified as a potential input factor.
Perceived Service Quality

Research in Human Computer Interaction (HCI) points to the general importance of usability and learnability (subsumed under the term Perceived Service Quality in the given research) of interactive systems of all kinds, with the direct implication of a decreased frequency of usage in the case of ill-designed systems (e.g., Choi, Lee, Lee, & Subramani, 2004; Lin, Choong, & Salvendy, 1997; Nielsen, 1993).

In their theoretical study “Understanding Knowledge-Sharing in Online Communities of Practice,” outlined in Chapter 8, Sharratt and Usoro (2003) discuss potential antecedents of knowledge sharing in online communities of practice. They identify organizational structure, information system, trust, and recognition as potential factors, and draw comparable conclusions with regard to the participation in knowledge sharing processes, hypothesizing that an easier use of the knowledge sharing system increases the use of the system, and that a greater perceived usefulness of the knowledge sharing system increases the user’s participation in knowledge sharing.

In addition to the mentioned direct influence on the frequency of usage, perceived service quality can be expected to affect the perceived quality of content, as the perceived service quality is being “transferred” onto the perceived quality of content by the user of the interactive system. In the Lisrel-based study “Effects of Web Retail Service Quality and Product Categories on Consumer Behavior” by Choi et al. (2004), the authors explore the impact of the web retail service quality on consumers’ perceptions of value and willingness to buy. This intuitive “transmission” mechanism of functional- and technical web service quality on perceived product quality has been empirically confirmed. It seems appropriate to expect that usability and learnability have the same impact on the perceived quality of content of a forum, in which the content represents the “product.” Thus, perceived service quality can be expected to indirectly affect knowledge processes, as outlined in the context of the content aspects input factor perceived quality of content.

Without expanding on the mechanism, the mechanism of a potential effect of the degree of perceived service quality on knowledge processes is also considered by Ardito et al. (2004). The authors argue that “Forcing students to spend longer time understanding poorly usable interfaces than understanding learning content disturbs accommodation of
new concepts and overall retention of what is being learnt” (p. 80), suggesting that knowledge processes will be inhibited by ill-designed systems.

The input factor called perceived service quality is intended to capture both key dimensions of usability (in the broader sense of the term); first, the degree to which a forum is effective and efficient and provides a high degree of satisfaction with which a user can achieve tasks (i.e., usability); and second, the degree to which a forum is usable without documentation and provides task-oriented help (i.e., learnability).

Many validated instruments exist to assess the service quality aspects of usability and learnability, e.g., Chin et al.’s “Questionnaire for User Interface Satisfaction” (1988); Nielsen’s “Attributes of Usability” and “Heuristic Evaluation” (1993); and Lin et al.’s “Purdue Usability Testing Questionnaire” (1997). The questions for the manifest variables upon which the latent construct was finally measured, were derived from Lin et al.’s “Purdue Usability Testing Questionnaire” (1997).

The hypotheses suggested by the literature review are the following:

\[ H_{Freq} : \text{The higher the degree of Perceived Service Quality, the higher the frequency of contribution.} \]

\[ H_{indirect KP} : \text{The higher the degree of Perceived Service Quality, the higher the degree of Perceived Quality of Content.} \]

10.2 Content Aspects

The second cluster covers the Content Aspects. This cluster is based specifically on the field of research of Human Computer Interaction (HCI) – in particular, Social Navigation (SN) and Computer Mediated Communication – and Computer Supported Collaborative Work (CSCW).

10.2.1 Perceived Quality of Content

Perceived quality of content is intended to capture the degree to which a forum is perceived to contain content of high quality.
Contrary to the other hypotheses, the hypotheses for this proposed input factor are exploratory in nature, as no specific literature exists on this proposed input factor and its direct or indirect impact on knowledge process contributions. It is proposed that the perceived quality of content is positively related to both knowledge processes and the frequency of contribution.

The first hypothesis – that perceived quality of content is positively related to knowledge processes – is deemed appropriate for the following reason: Content that is perceived to be of high quality is intuitively likely to stimulate knowledge-relevant responses and/or contributions (i.e., knowledge processes) at a comparably high level of “knowledge quality.” Content that is perceived to be of low quality is intuitively likely to stimulate responses and/or contributions of a comparably low level of “knowledge quality.” This “leveling” of new contributions with existing content is fundamentally based on the assumption that users adapt to the given “culture” of a forum, including its existing content. It can thus be expected that participants adapt their style of contribution to the given style of exchange and communication, and adapt the quality of their own contributions to the perceived quality of content.

The second hypothesis – that perceived quality of content is positively related to frequency of contribution – is deemed appropriate for the following reason: Even though exceptions in the form of users participating for the sake of participation certainly exist, it is expected that most users participate in forums for the “sake of the content.” It seems likely that users are stimulated to contribute at a higher level of frequency to forums with a higher perceived quality of content from which they will expect to gain more for their own benefit, e.g., learning about the particular subject of a forum. Increased active participation will presumably maximize the “knowledge demands” of the user as, typically, gaining more for their own benefit generally requires participation in discussions and asking questions to solve open issues.

The given study focuses on active users. However, even passive participants who do not actively contribute content – generally referred to as “lurkers” as outlined in Section 6.1 – might be stimulated by the perceived quality of content, as being stimulated by content of high quality might transform into exterior actions, e.g., changing the participants’ behavior (Takahashi et al., 2003).
Perceived quality of content is expected to be influenced by the perceived service quality, as argued in the description of the system aspects input factors in Section 10.1.

The hypotheses suggested by the literature review are the following:

\[ H_{Freq2} \]: The higher the degree of Perceived Quality of Content, the higher the frequency of contribution.

\[ H_{KP1} \]: The higher the degree of Perceived Quality of Content, the higher the relative share of knowledge process-relevant contributions.

### 10.2.2 Social Navigation

Social navigation is a term that refers to both a design approach and the aspects implemented through this design approach. Its methods and purpose as a design approach can be defined as “either visualizing traces of other users’ activities or on direct or indirect communication between users, with the goal to facilitate locating and evaluating information” (Dieberger, Höök, Svensson, & Lönnqvist, 2001, p.107).

Social navigation functionality, where information is visible at an aggregated and non-concurrent level, can be distinguished from social navigation functionality where the presence and activities of participants are perceived by other participants without delay (Dieberger et al., 2001; Wexelblat & Maes, 1997).

Dieberger et al. (2000) argue that in a system with social navigation abilities, information about what other participants are doing will guide and inform, but not control participants’ decisions, and that history-enriched environments support users in finding the most relevant information.

In online forums, social navigation indicators include, forum- and / or thread-based “posts per month” and “views per month,” and user based “number of posts,” among others. These social navigation indicators are commonly supported by forum software systems. The vBulletin (Jelsoft Enterprises Limited, 2000-2005) forum software system, which forms the basis of the online forum under study, provides several non-concurrent social navigation indicators on an aggregated level: on a forum basis the number of posts and threads within a particular forum, on a thread basis the number of replies to and
views of a particular thread, and on a user basis the number of posts of a particular user. As social navigation indicators in a concurrent manner, the usernames of users browsing a particular forum are provided by the vBulletin software.

Indicators of high social navigation are expected to impact on the frequency of participants’ contribution. It is expected that higher social navigation indicators increase the participants’ commitment towards particular content, indirectly increasing the participants’ degree of participation: Higher social navigation indicators are expected to stimulate the participant into selecting a particular forum/thread as a priority and into reading the chosen content more attentively (i.e., increasing their commitment towards this specific content). This increased commitment towards specific content is expected to increase the overall frequency of contribution.

These hypothesized effects of social navigation indicators are independent of the change of user interests and preferences; as social navigation indicators are slow to adapt to such changes, creating the effect that the “popularity” suggested by the indicator stays higher than it should actually be, reinforcing the problem (Dieberger et al., 2001).

In the given forum context, the two indicators forum posts per month and forum views per month are proposed as a social navigation construct.

The hypothesis suggested by the literature review is the following:

\[ H_{Freq}^3: \text{The higher the degree of Social Navigation, the higher the frequency of contribution.} \]

### 10.3 Social Aspects

The third cluster covers the Social Aspects. The third cluster is particularly based on the fields of research in Knowledge Management (KM), Collaborative Systems, and Communities of Practice (CoP).
10.3.1 Cooperation

As pointed out in Chapter 5, the trend of individual knowledge-based work moving towards knowledge-based cooperative work can be expected to continue, as the complexity of the work environment expands.

Cooperation lies at the heart of any cooperative system such as forum messaging systems. One of the most influential cooperative systems is Lotus Notes® by Lotus Corporation; its PC-version dates back to as early as 1984 (IBM Technical Library, 2003). As the first common organization-wide commercial collaborative-IT software package, it was particularly designed to increase cooperation (more specifically, communication, collaboration, and coordination) through the open sharing of ideas (Karsten, 1998). Just as with Lotus Notes®, any forum messaging system’s key purpose is to exchange messages and to communicate and cooperate through the system for the benefit of the user community.

In the context of corporations, Loebbecke et al. (1998), referring to Lorange (1996), argue that “cooperation, in the form of inter-organizational knowledge sharing, has the potential to increase each partner’s knowledge” (Loebbecke et al., 1998, p. 216). It seems plausible to expect that this knowledge process effect of cooperation in a supposedly more competitive, corporate environment can be expanded towards less competitive environments, such as universities and comparable non-corporate environments (i.e., that cooperation contributes to knowledge processes in general).

De Michelis (1996) supports this line, arguing that knowledge generated by cooperative processes is both a principal component of cooperation and the value of the cooperation. De Michelis further argues that the communicative relations within a cooperative process give rise to the cooperative process itself. In a forum context, communicative relations can thus be expected to support cooperative relations among the members (i.e., communicative relations can be expected to support cooperative relations, which in turn lead to cooperative processes – and an increased frequency of contribution. Just as important, however, is the value generated by the cooperative process (i.e., the knowledge processes initiated). De Michelis (1996) argues that knowledge processes are “performed” within the cooperative process, or formulated in a less abstract way: that knowledge proc-
esses are embedded into the conversations among participants, who are themselves supported by the cooperative relations among the members. This provides a further argument for the previously mentioned argument that cooperation contributes to knowledge processes.

De Michelis further refers to the fact that through their cooperation, participants in fact share a space. De Michelis’ mentioning of “shared space” leads us to the notion of “shared social space,” and to a publication by Rauterberg et al. (1995). Rauterberg et al. could show that, in a gaming context, conditions of shared social space lead to a significantly increased number of coalitions between players. It seems plausible to argue that conditions of shared social space that surely evolve within the co-located learning and working environments of a comparatively small university (in autumn 2004, International University Bremen has 804 undergraduate, graduate, and professional degree students, in addition to 320 faculty and staff members; IUB, 2004), lead to an increased degree of cooperation among forum participants of the university community. Obviously, this hypothesis is not based only on a broader perception of Rauterberg et al.’s definition of shared social space, but also applied to a broader context than the gaming context of their study.

Further support for the relevance of the construct cooperation is inferred from the Lisrel-based study “Towards a Theory of Knowledge Transfer” by Wathne et al. (1996), outlined in Chapter 8. Wathne et al. (1996) included a measure of cooperation (“the degree to which the partner representatives were working together on a common task;” p. 74) in their study, which together with two other variables made up the construct “degree of openness.” They could show that this measure had a large impact on the effectiveness of knowledge transfers.

As will be outlined in the further sections of the social aspects input factors, cooperation is expected to be influenced by both trust and care.
The hypotheses suggested by the literature review are the following:

\[ H_{Freq}4: \text{The higher the degree of Cooperation, the higher the frequency of contribution.} \]

\[ H_{KP2}: \text{The higher the degree of Cooperation, the higher the relative share of knowledge process-relevant contributions.} \]

10.3.2 Sense of Community

Several authors emphasize the importance of Sense of Community in the context of online-environments, among them Faraj and McLure Wasko (2001), von Krogh (2003), North et al. (2000), Papargyris and Poulymenakou (2003), and Sharratt and Usoro (2003).

Just as with the other social aspects, such as cooperation, trust, and care, the concept of sense of community is somehow fuzzy. The following list of synonyms used by the authors mentioned are meant to provide an impression of what the terminus refers to: a sense of community (Sharratt & Usoro, 2003); a sense of identity and commitment (Papargyris & Poulymenakou, 2003); an identification and sense of affiliation (Faraj & McLure Wasko, 2001); and an atmosphere, identity, and sense of belonging (“Atmosphäre, Identität, Zugehörigkeit”) (North et al., 2000).

In their paper on knowledge communities, North et al. (2000) point out the importance of four basic conditions for successful knowledge communities. First, the organization in which the knowledge communities are domiciled should emphasize the values of trust, openness, personal responsibility, and authenticity. Next, the enterprise must strike a balance between short-, medium-, and long-term goals, and a balance between transfer and experiment must be maintained. Third, a sense of belonging should be established. Finally, a sense of community should be established. The final aspect is addressed in this section as a further construct.

Focusing on Communities of Practice, Papargyris and Poulymenakou (2003) identified “motivation and willingness to share knowledge” and “sense of identity and commitment” as the most relevant non-technical challenges in knowledge management domains after, thus emphasizing North et al.’s argumentation for the importance of Sense of Community. Referring to Nonaka and Takeuchi (1995) and Bate and Robert (2002),
Papargyris and Poulymenakou argue that “knowledge is embedded and constructed from and through social relationships and interactions” (Papargyris & Poulymenakou, 2003, p. 4), which provide community members with a sense of collective identity and value.

In their empirical study of extra-organizational networks of practice outlined in Chapter 8, Faraj and McLure Wasko (2001) argue for the importance of sense of community (sense of identification). The authors point out that a sense of identification (together with understanding the norms of exchange) increases the degree of participation and the degree of knowledge exchange. The authors could show that identification has a significant impact on knowledge contribution, and they conclude that participants with a strong sense of community are “less prone to free-riding and knowledge hoarding behaviors” (Faraj & McLure Wasko, 2001, p. 32). Transferred to the given forum context, it can be hypothesized that Sense of Community increases the degree of participation (i.e., the frequency of contribution) and the degree of knowledge exchange (i.e., the knowledge process contribution).

In the previously mentioned theoretical study of potential antecedents of knowledge sharing in online communities, Sharratt and Usoro (2003), referring to Yoo et al. (2002), define sense of community as “The degree to which a member feels a sense of belonging in a community” (Sharratt & Usoro, 2003, p. 193). Sharratt and Usoro argue that sense of community has a positive impact on knowledge transfer, as it would create a perception of knowledge as a public good, creating a “moral obligation that results in a deeper sense of satisfaction than when motivated by extrinsic factors” and “lead to a greater degree of importance being placed on recognition of knowledge sharing” (2003, p. 192).

In summary, sense of community is intended to capture the degree to which participants of a forum feel they are members of a community within that particular forum, and their perception of the degree of social harmony within this forum, as well as the relative share of members of the forum community they know personally.

Besides the prerequisite of the users’ underlying interest in the topics discussed in the forum, the amount of knowledge process-relevant contributions as well as the degree of active or passive participation in a forum are expected to be based on the sense of
community (i.e., the feeling of membership towards the community represented by the forum members).

In case of online-only communities, as in the case where online forums only represent a replenishment rather than a self-sustained medium, the following distinction applies. While established members of a particular forum community have already established a certain feeling of sense of community, new members have to traverse through this process. In the case of the new user, the sense of community is based on the user’s expectations towards the forum community, until the expectations regarding the forum community have been confirmed or adjusted to the actual sense of community.

Just as in the case of trust, outlined in Section 10.3.3, the establishment of a feeling of sense of community can be actively supported, e.g. by encouraging early communication in newly established forum communities. Obviously, more means to establish a feeling of sense of community exist in cases where forums represent a replenishment rather than a self-sustained medium, such as in the given study, where the sense of community is established through virtual contacts in forums, as well as personal contacts on campuses, in classes, and colloquiums.

The hypotheses suggested by the literature review are the following:

\[ H_{\text{Freq}}: \text{The higher the degree of Sense of Community, the higher the frequency of contribution.} \]

\[ H_{\text{KPR}}: \text{The higher the degree of Sense of Community, the higher the relative share of knowledge process-relevant contributions.} \]

10.3.3 Trust

Initiated by Handy’s (1995) seminal paper “Trust and the Virtual Organization” published in the Harvard Business Review, in which the author argues for the importance of trust in virtual organizations and society at large, trust was identified as a key construct with particular reference to knowledge transfer processes, based on the following research.
Just as in the case of the construct of perceived service quality, the inclusion of the construct trust was motivated by the previously mentioned theoretical study of online communities by Sharratt and Usoro (2003), among others. Referring to Nahapiet and Ghoshal (1998), the authors argue that trust is a key aspect of knowledge transfer and creation. Furthermore, referring to Fukuyama (1996), Sharratt and Usoro (2003) also point out the importance of trust for transactions and collaboration, that is, cooperative processes.

The conception of a positive impact of trust on knowledge transfer processes was empirically tested in 1996 by Wathne et al.’s previously mentioned Lisrel-based study. The study, focusing on the effectiveness of knowledge transfer in cooperative contexts in general, could indeed show trust to have a large impact on the effectiveness of knowledge transfer.

In the previously mentioned empirical study of extra-organizational networks of practice, Faraj and McLure Wasko (2001) point out that trust has been identified by several authors as a key enabler for interpersonal exchange and cooperation in organizations. They argue that “Trust is especially important in online environments, since social and interactional cues are filtered out” (Faraj & McLure Wasko, 2001, p. 18). However, contrary to Wathne et al. (1996), in their empirical study of three technical newsgroups, Faraj and McLure Wasko could not prove that trust has a significant relationship to knowledge contribution. However, the authors acknowledge that this might be due to their chosen measure of trust (adapted from McAllister, 1995) and, for future studies, suggest measures of trust that are more “contextualized to the environment and made contingent to the task” (Faraj & McLure Wasko, 2001, p. 33).

Faraj and McLure Wasko’s key argument for trust as being positively related to knowledge transfer is emphasized in a paper by Carayannis (1999), who argues that collaborative systems will be either ignored, underused, or subverted, unless participants trust and respect each other. With other words, without trust, no communicative relations will develop to give rise to cooperative processes upon which knowledge can be generated.

Quintana-García and Benavides-Velasco (2004) argue along the same line extending the focus from knowledge transfer to knowledge processes in general. The authors claim
that trust is necessary to achieve common aims in situations of collaboration. The authors further suggest that the cooperative processes thus stimulated contribute to knowledge development and utilization.

Contrary to the argument for care and trust as two individual constructs, von Krogh et al. (2000) argue for trust as being one dimension of care. Independent of the question of whether to combine the two highly abstract concepts of trust and care in one construct or to keep them separate, von Krogh et al.’s argument supports the view that higher levels of trust lead to higher levels of care.

In summary, it can be said that there is a common agreement on the importance of trust in online environments. In the literature, trust is largely viewed as history-based (Scott & Gavrieli, 2004). The most common conception of trust in this respect is the one by Rempel et al. (1985), who argue that trust progresses in three stages over time from predictability, to dependability, to faith.

Interesting insights with particular relevance to virtual teams were inspired by a keynote lecture on “swift trust” by Hiltz (2005) at the International Conference on Web Based Communities 2005. The concept of swift trust was originally developed by Meyerson et al. (1996, as cited in Hiltz, 2005), and relates to “temporary teams whose existence is formed around a clear purpose and common task with a finite life span” (Hiltz, 2005, p. 13). With particular respect to virtual teams, Coppola et al. (2004) argue for swift trust as an alternative to the history-based view of trust.

Key elements of swift trust are: “the belief (hope) that others will care for what is being entrusted with good will,” “a willingness to suspend doubt in order to execute the task performance,” “a willingness to take risks,” and “a positive expectation of benefits of temporary group activity” (Coppola et al., 2004, p. 95). Coppola et al. (2004) and Hiltz (2005) outline several strategies to establish swift trust in virtual teams. They recommend establishing early communication and emphasize the need to develop a positive social atmosphere. With specific reference to online learning environments the authors point out that team members should perceive the instructor’s presence right as participants enter the course and suggest to assign tasks to begin working together at that early stage of group formation (Coppola et al., 2004; Hiltz, 2005). A key aspect of swift trust in virtual teams
is the argument that levels of trust, once established, are sustained if participants are engaged in continuous and frequent interaction (Coppola et al., 2004).

With respect to the given research, traditional indicators of trust are more applicable than indicators of swift trust. This is due to the fact that criteria of swift trust are developed with reference to online-only learning networks rather than communities with blended online / offline properties, as in the given case of the study. Because online forum participants in the given study environment meet on campuses, in classes, colloquiums, and discussions, online forums represent a replenishment rather than a self-sustained medium. Even though properties of swift trust are clearly worthy of further research in online-only communities, traditional criteria appear more applicable in the given study.

As noted in the previous section about the social aspects input factor “cooperation,” it is expected that cooperation will be / is influenced by both trust and care. Besides the previously mentioned study by Sharratt and Usoro (2003), this conception is based on a study by Schrader (1990) and Soekijad and Andriessen (2003). Schrader argues that cooperation requires an appropriate level of trust between the actors. Focusing on affective trust, Soekijad and Andriessen (2003) argue along the same line, stating that “cooperation can be accomplished when people have social activities together, and when it includes affective trust” (p. 583). It thus seems plausible to suggest that trust is a prerequisite for cooperation. Particularly among people who hardly know each other before they become engaged in an online forum, trust can be expected to be a prerequisite for cooperative processes, and thus also for the knowledge transfer and knowledge creation processes that take place through these cooperative processes.

As in the case of the system aspect of perceived service quality, many validated instruments exist to assess trust.

Sharratt and Usoro’s (2003) conceptualization of trust is based on Mayer et al. (1995), who suggest a conceptualization of trust based on integrity, benevolence, and competence. Here, integrity-based trust is defined as the “perception that another party is honest and reliable;” benevolence-based trust relates to the “perception that another party would keep the best interests of the trustor at heart;” and competence-based trust is rooted in the
“perception that another party is knowledgeable or possesses a certain level of competence” (Sharratt & Usoro, 2003, p. 190).

Wathne et al.’s conceptualization of trust is based on the previously referred to 3-stage conceptualization (predictability, to dependability, to faith) by Rempel et al. (1985). Here, predictability is defined as the “belief that the partner’s behavior is consistent;” dependability as the “belief that the partner can be counted on to be honest, reliable, and benevolent;” and faith as “a person’s motivation to be responsive and caring towards another individual” (Wieselquist, Rusbult, Foster, & Agnew, 1999).

To a large extent, the conceptualizations are equal (Mayer et al.’s integrity-based trust vs. Rempel et al.’s dependability-dimension of trust; Mayer et al.’s benevolence-based trust vs. Rempel et al.’s faith-dimension of trust), only differing in Mayer et al.’s competence-based trust vs. Rempel et al.’s predictability-dimension of trust. However, Rempel et al.’s conception of trust appears to be the most commonly accepted (Chopra & Wallace, 2003; Feng, Lazar, & Preece, 2004; Wieselquist et al., 1999).

In an empirical study, Jian et al. (1998) could show that rating patterns of trust are similar across the three conditions of trust under study, general trust, human-human trust, and human-machine trust. Thus, the authors argue that results from studies of human-human trust may indeed have applicability to situations of trust between humans and automated systems. This provides an important insight with regard to the question of which type of trust is actually measured in the given online forum context, suggesting that the measure of trust would be similar for each dimension.

The decision was made to base the scale upon which the latent construct trust should be measured on Rempel et al. (1985). Due to the appealing intuitiveness of the wording, the actual questions were adapted from Wathne et al. (1996), who measured trust as a predictor of the effectiveness of knowledge transfer in their Lisrel-based study upon Rempel et al.’s components.
The hypotheses suggested by the literature review are the following:

\[ H_{Freq6}: \text{The higher the degree of Trust, the higher frequency of contribution.} \]

\[ H_{KP4}: \text{The higher the degree of Trust, the higher the relative share of knowledge process-relevant contributions.} \]

\[ H_{indirect KP2}: \text{The higher the degree of Trust, the higher the degree of Care.} \]

\[ H_{indirect KP3}: \text{The higher the degree of Trust, the higher the degree of Cooperation.} \]

### 10.3.4 Care

With specific reference to knowledge creation processes, care could be identified as a key construct based on research by van den Brink (2001); von Krogh (1998); von Krogh et al. (2000); and Scharmer (1999), among others.

In their classic book “Enabling Knowledge Creation,” von Krogh et al. (2000) argue that under conditions of high care “Individuals create knowledge through a process of bestowing their insights, and groups will create social knowledge through what we call indwelling” (p. 54) that is, conditions of “helping by sharing insights” and “living with a concept together,” respectively (p. 55). Von Krogh et al. (2000) differentiate five core dimensions of care: moral trust, active empathy, access to help, lenience in judgment, and courage.

As mentioned in the previous section about trust, and as becomes clear in the five core dimensions of care just mentioned, von Krogh et al. (2000) argue for trust as one dimension of care. In an interview with Scharmer (1999), von Krogh outlines his respective point of view, arguing that while trust is purely exchange-based and relevant for explicit knowledge processes, care is voluntary cooperation and voluntary giving, and relevant for tacit knowledge processes. Von Krogh concludes that “Care includes but extends far beyond trust” (Scharmer, 1999, p. 3). However, the fuzziness of the concept becomes clear when von Krogh compares care to love, stating that care is “very fundamental, and
perhaps it cannot be decomposed – or if you look at the heart of it, care is even the source of love, because it’s what drives attention” (Scharmer, 1999, p. 4). In his famous paper “Care in Knowledge Creation,” von Krogh (1998) himself points out that some researchers believe that care cannot be broken down into sub-dimensions, while others argue that it can be.

Even though the terminus “care” generally initiates a perception of understanding, the fuzziness of a more explicit definition of the concept of care poses a problem for its application in an empirical study. It was decided to capture both concepts, trust and care, individually, and to leave open the possibility of merging the concepts in case their distinctness could not be determined.

Van den Brink (2001) describes a model to quantify knowledge transfer enabling conditions in organizations. By ranking social, organizational, and technological conditions, van den Brink argues that conditions that effect motivation have most influence on knowledge transfer processes. Van den Brink concludes that conditions of appraisal, care, and competence leverage will be the most important stimulators of knowledge transfer, followed by cultural conditions of empowerment, trust, collaboration, and others. Although referring to von Krogh et al. (2000) with respect to the concept of care, van den Brink also opted to keep both concepts as individual entities, as is also planned in the given project.

Questions regarding the construct of care were finally formulated based on von Krogh (1998) and von Krogh et al. (2000), with the intention to capture the degree to which a forum participant judges the communication within this forum as characterized by an attitude of seizing and bestowing.

The hypotheses suggested by the literature review are the following:

\[ H_{KP5}: \text{The higher the degree of Care, the higher the relative share of knowledge process-relevant contributions.} \]

\[ H_{KP4}: \text{The higher the degree of Care, the higher the degree of Cooperation.} \]
10.4 User Aspects

The fourth and final cluster covers the User Aspects. As with the third cluster, the fourth cluster is based specifically on the fields of research in Knowledge Management (KM), Collaborative Systems, and Communities of Practice (CoP).

10.4.1 Experience

The better a person knows a particular software or online tool, the more likely that person can be expected to use it, and to put it to a constructive use (Newman & Lamming, 1995; Preece et al., 1994). This expectation seems intuitive, and users can be predicted to unconsciously tradeoff the expected “expenditure” to learn the use of an online forum system with the potential gain of participation in the forum community.

In the given context of an online forum system, it seems obvious that experience with software systems comparable to the online forum system at hand increases the ease of use for the participant, and thus lowers the threshold for participation in the forum.

Here, the term “experience” is meant as the degree of the user’s experience with online forums and comparably complex websites such as auction websites, shopping websites, or Internet newsgroups websites, and hence is not to be confused with experience with the topics discussed in a given forum and/or thread (as used by North et al., 2000; von Krogh & Roos, 1996; Wathne et al., 1996).

The item experience is an exploratory item in the context of online-based knowledge communities, as its influence has not been tested in prior studies. As outlined, it is expected that the degree of experience will lead to a higher frequency of contribution. Indirectly, and potentially with only a subtle effect, the degree of experience will also lead to a higher relative share of knowledge process-relevant contributions, as the user can focus all her/his mental capacity on the content of her/his contribution (and the discourse within the forum), rather than on the process of contribution.
The hypotheses suggested by the literature review are the following:

\[H_{\text{Freq.7}}: \text{The higher the degree of Experience, the higher the frequency of contribution.}\]

\[H_{\text{KPR6}}: \text{The higher the degree of Experience, the higher the relative share of knowledge process-relevant contributions.}\]

10.4.2 Motivation

Motivation has generally been defined as that disposition of an individual that activates, guides, and maintains behavior over time (Eccles, 2002; Heckhausen, 1991).

In their empirical study “Assessing Motivation of Contribution in Online Communities,” outlined in Chapter 8, Wang and Fesenmaier (2003) could show that efficacy motivation, instrumental motivation, and expectancy motivation have positive effects on the (quantitative) level of contribution in online communities.

The importance of motivation for knowledge processes is pointed out by Faraj and McLure Wasko (2001), Papargyris and Poulomenakou (2003), and Wenger and Snyder (2000).

Contrary to Sharratt and Usoro (2003), who call on Hall (2001) to argue that two aspects of systems use are related to the motivation to act (actions must not be difficult to undertake and the outcome of the action must be perceived to be useful), in the given study motivational aspects due to system usability and learnability are separated from the motivation to act, which is more consequent and thus deemed more appropriate.

A paper by Hummel et al. (2005) inspired further research into the influence of motivation in the given online forum context, and increased awareness of the different dimensions and aspects of motivation. In Hummel et al.’s study on “Critical Facilities for Active Participation in Learning Networks,” the authors emphasize the importance of motivation in addition to usability and issues of sociability. They also emphasize that extrinsic motivation must be distinguished from intrinsic motivation. Summarizing research on intrinsic motivation (e.g., Hardre & Reeve, 2003; Levesque, Zuehlke, Stanek, & Ryan, 2004), Hummel et al. argue that intrinsic motivation improves understanding, leads to
curiosity and exploratory behavior, and increases cooperation and exchange; contrary to that, by increasing memorizing (instead of understanding), extrinsic motivation does not create such positive characteristics of learning and understanding. First results from the authors’ ongoing study in the context of learning networks reveal that motivation raised through a reward system (i.e., earning points for making contributions and by others replying to or rating the originator’s contribution) has a strong impact on the degree of active contribution. Reward-based systems, as implemented in the authors’ study, are most likely to stimulate extrinsic motivation, as this refers to direct or indirect compensation and/or recognition by others (Elenberg & Ryan, 2005) as opposed to intrinsic motivation, which refers to the desire to feel competent and self-determined (ibid.). Even though Hummel et al. conclude that reward systems are able to stimulate active participation, the results must be interpreted with care: Issues of quality of content are not addressed, which is an important aspect not only in the given context of knowledge communities, but also in the context of learning networks, underlying Hummel et al.’s study.

In a theoretical outline of a planned study on participants’ motivations for contributing to Music Virtual Communities (MVCs), Elenberg and Ryan (2005) outline potential motivational aspects that contribute to the motivation to provide resources, such as files (i.e., music), time, and effort, to the community. Like Hummel et al. (2005), the authors distinguish between intrinsic- and extrinsic motivation. Elenberg and Ryan further differentiate both aspects: They propose two components of intrinsic motivation (altruism and community identification) and three components of extrinsic motivation (personal needs, peer recognition, and sense of efficacy). The authors’ research model proposes that the amount of contribution to the MVCs will be positively driven by increases in either type of motivation. Given the type of exchange in MVCs, contrary to Hummel et al.’s (2005) study (and the given research project), issues of quality of content need not be, and are not addressed, again making the study only partially informative for the given context of online knowledge communities. In any case, in the given context of the study it seems more consequent and appropriate to treat community identification as an aspect of the previously discussed factor “sense of community” (rather than an aspect of intrinsic motivation). The reason for this is that community identification is a social aspect, in the sense that it is influenced by the community, and not predisposed by the individual. The
intention of the factor motivation, however, is to capture aspects of personal motivation, independent of the community, and only depending on the individual. The same applies to the measures of peer recognition and sense of efficacy, neither of which measures aspects of personal motivation independent of the community.

The empirical study “The web of knowledge: an investigation of knowledge exchange in networks of practice” by Faraj and McLure Wasko (2001), however, fulfills the requirement to measure only aspects of personal motivation. Faraj and McLure Wasko distinguish between two leitmotifs of motivation: social affiliation and professional affiliation. They represent two separate dimensions of individual motivation. While the social affiliation leitmotiv is intended to measure the degree to which forum participants are using forums to meet new and different people, and to gain a feeling of belonging, the professional affiliation leitmotiv is intended to measure the degree to which forum participants are using forums to exchange advice and solutions for their professional use (studies, research, or work), and the degree to which they wish to keep abreast of new ideas and innovations in the context of their professional situation. Faraj and McLure Wasko could show that the motivation for professional affiliation had a positive and significant relationship on both knowledge acquisition and knowledge contribution, while the motivation for social affiliation had a much weaker effect on knowledge acquisition and could not be shown to contribute to knowledge (2001). Referring to Brown and Duguid (1991), Orr (1996), and Wenger (1998), the authors point out that these findings correspond to theoretical publications in the field of Community of Practice (CoP) research.

Faraj and McLure Wasko’s findings are also supported by Albers et al.’s (1999) and Waltiert’s (2002) research in the field of online forums, attributing forum-interactions to the individual’s wish to fulfill four basic needs: interest, conversation, communication, and transaction – four dimensions that can be assigned to Faraj and McLure Wasko’s two-item measures, with exchanges driven by social affiliation motivation being motivated by an individual’s conversation and communication needs, and exchanges driven by professional affiliation motivation being motivated by an individual’s information or transaction needs.
Building on Faraj and McLure Wasko’s results in the context of Communities of Practice, the hypotheses were formulated. Faraj and McLure Wasko observed that people who participated due to social affiliation motivation were not associated with contributing knowledge, and were significantly less likely to acquire knowledge from their participation in the network.

In the online forum context under study in the given research, the negative impact of the degree of motivation of social affiliation on knowledge process contribution is expected to be much higher than what could be measured in the context of Communities of Practice, because members of Communities of Practice are professionals with typically a common professional experience, while in the case of the online forums under study such common professional experience cannot generally be expected. Thus, contrary to Communities of Practice, exchanges driven by motivation of social affiliation are not expected to contribute to knowledge processes “along the way.”

As in the case of the previously derived input factors, the impact of motivation on knowledge process contribution is expected to impact on both the frequency of contribution and the relative share of knowledge process-relevant contributions.

As can be seen from the previously quoted papers, several dozen conceptions, classifications, and components of the construct motivation are defined in the literature. Here, Wang and Fesenmaier (2003), focusing on motivation as a factor of potential influence on contributions in online communities, offer the broadest definition, suggesting such diverse components of motivation as: instrumental motivation, efficacy motivation, quality assurance motivation, status motivation, and expectancy motivation. Obviously, such a wide range of dimensions of motivation would not be suitable for the planned research, as the focus of research goes beyond motivation alone to a much broader range of factors of potential influence. Thus the number of questions (and thus the range of dimensions captured) must be limited for each parameter for practical reasons in order to limit the length of the final questionnaire.

For the given context, Faraj and McLure Wasko’s (2001) two aspects of personal motivation (social affiliation and professional affiliation) were deemed most appropriate, in particular as they were already applied and shown to be useful in the authors’ empirical
study, and not least because their compressed representations in only two motivational dimensions made them comparatively easy to capture in the planned survey, as fewer questions were needed. The questions for the manifest variables upon which these two latent constructs of motivation were finally measured were thus derived from Faraj and McLure Wasko. In the case of the social affiliation leitmotiv, measures were originally derived from Beard and Ragheb (1983); in the case of the professional affiliation measures, from Thomsen (1996).

It should be emphasized that the aspect of motivation of social and professional affiliation is not to be confused with the aspect of intrinsically and extrinsically driven motivation. While both affiliation types of motivation may be intrinsically driven, extrinsically driven motivation may also build on explicit rewards, such as monetary compensation (Deci & Ryan, 1985; Osterloh & Frey, 2000). Even though it is expected that exchanges driven by motivation of social affiliation (i.e., conversations of “chat”-style types of content) are expected to be particular candidates for intrinsic motivation, in the sense that both types of exchange take place for their own sake, exchanges driven by motivation of professional affiliation (i.e., communications of “discussion,” “question-and-answer-” and “information”-style types of content) are still driven by intrinsically driven motivation, even though not for their own sake, but motivated by professional needs for information and knowledge. In the environment under study, no explicit rewards in the sense of extrinsically driven motivation were given.

The hypotheses suggested by the literature review are the following:

\[ H_{Freq.8}: \text{The higher the degree of Motivation, the higher the frequency of contribution.} \]

\[ H_{KP7}: \text{The higher the degree of Social Affiliation Leitmotiv Motivation, the lower the relative share of knowledge process-relevant contributions.} \]

\[ H_{KP8}: \text{The higher the degree of Professional Affiliation Leitmotiv Motivation, the higher the relative share of knowledge process-relevant contributions.} \]
11 SUMMARY AND OVERVIEW

In total, nine factors were identified as factors potentially having an impact on the contribution of knowledge process-relevant content in forum-based Online Knowledge Communities. These factors were grouped in four underlying clusters. Within the first cluster (system aspects) one latent construct (perceived service quality) was identified as a potential input factor. The first cluster is based on research in the field of Human Computer Interaction (HCI). Within the second cluster, content aspects, two latent constructs – perceived quality of content and social navigation – were identified as potential input factors. Cluster two is based on the field of research of Human Computer Interaction (HCI) and Computer Supported Collaborative Work (CSCW). Within the third cluster, social aspects, four latent constructs – cooperation, sense of community, trust, and care – were identified as potential input factors. Within the fourth cluster, user aspects, two latent constructs – experience and motivation – were identified as potential input factors. Clusters three and four are based on the fields of research in Knowledge Management (KM), Collaborative Systems, and Communities of Practice (CoP).

Table 11-1 outlines the hypothesis and key sources for the indirect measurement of knowledge process contribution.

<table>
<thead>
<tr>
<th>Impact of...</th>
<th>... on perceived Knowledge Process-relevance of contributions</th>
<th>References of Key Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Content - Knowledge Effect Link</td>
<td>Bullinger et al. (2001); Schmitz-Justen &amp; Wilhelm (2005a); Waltert (2002)</td>
<td></td>
</tr>
<tr>
<td>Type of Content</td>
<td>+ (H_{TOC,KP1})</td>
<td></td>
</tr>
</tbody>
</table>

Table 11-1: Knowledge Process Factors: Summary of Hypothesized Relationships

Table 11-2 outlines the proposed input factors, together with the hypothesized relationships, and the key sources the constructs / factors are inferred from or based on.
<table>
<thead>
<tr>
<th>Impact of...</th>
<th>... on Freq. of Contrib.</th>
<th>... on direct RKPC effects (^{(1)})</th>
<th>... on indirect RKPC effects (^{(2)})</th>
<th>References of Key Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived service quality</td>
<td>+ (H(_{\text{Freq.1}}))</td>
<td>+ (H(_{\text{indirect KP1}}))</td>
<td>Ardito et al. (2004); Chin et al. (1988); Choi et al. (2004); Lin et al. (1997); Nielsen (1993); Sharratt &amp; Usoro (2003)</td>
<td></td>
</tr>
<tr>
<td>Perceived quality of content</td>
<td>+ (H(_{\text{Freq.2}}))</td>
<td>+ (H(_{\text{KP1}}))</td>
<td>Takahashi et al. (2003)</td>
<td></td>
</tr>
<tr>
<td>Social navigation</td>
<td>+ (H(_{\text{freq.3}}))</td>
<td></td>
<td>Dieberger et al. (2000); Dieberger et al. (2001); Wexelblat &amp; Maes (1997)</td>
<td></td>
</tr>
<tr>
<td>Cooperation</td>
<td>+ (H(_{\text{Freq.4}}))</td>
<td>+ (H(_{\text{KP2}}))</td>
<td>de Michalis (1996); IBM Technical Library (2003); Karsten (1998); Loebbecke et al. (1998); Rauterberg et al. (1995); Wathne et al. (1996)</td>
<td></td>
</tr>
<tr>
<td>Sense of community</td>
<td>+ (H(_{\text{freq.5}}))</td>
<td>+ (H(_{\text{KP3}}))</td>
<td>Faraj &amp; McLure Wasko (2001); North et al. (2000); Papargyris &amp; Poulymenakou (2003); Sharratt &amp; Usoro (2003); von Krogh (2003)</td>
<td></td>
</tr>
<tr>
<td>Trust</td>
<td>+ (H(_{\text{Freq.6}}))</td>
<td>+ (H(_{\text{KP4}}))</td>
<td>+ (H(<em>{\text{indirect KP2}})) + (H(</em>{\text{indirect KP3}}))</td>
<td>Carayannis (1999); Chopra &amp; Wallace (2003); Coppola et al. (2004); Faraj &amp; McLure Wasko (2001); Feng et al. (2004); Handy (1995); Hiltz (2005); Jian et al. (1998); Mayer et al. (1995); Quintana-García &amp; Benavides-Velasco (2004); Rempel et al. (1985); Schrader (1990); Scott &amp; Gavrieli (2004); Sharratt &amp; Usoro (2003); Soekijad &amp; Andriessen (2003); von Krogh et al. (2000); Wathne et al. (1996); Wieselquist et al. (1999)</td>
</tr>
<tr>
<td>Care</td>
<td>+ (H(_{\text{KP5}}))</td>
<td>+ (H(_{\text{indirect KP4}}))</td>
<td>Van den Brink (2001); Scharmer (1999); von Krogh (1998); von Krogh et al. (2000)</td>
<td></td>
</tr>
</tbody>
</table>

[continued]
Cluster 4: User Aspects

<table>
<thead>
<tr>
<th>Experience</th>
<th>+ (HFreq.7)</th>
<th>+ (HKP6)</th>
<th>Newman &amp; Lamming (1995); North et al. (2000); Preece et al. (1994); von Krogh &amp; Roos (1996); Wathne et al. (1996)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivation of social affiliation</td>
<td>+ (HFreq.8)</td>
<td>- (HKP7)</td>
<td>Albers et al. (1999); Beard &amp; Ragheb (1983); Deci &amp; Ryan (1985); Eccles (2002); Elenberg &amp; Ryan (2005); Faraj &amp; McLure Wasko (2001); Heckhausen (1991); Hummel et al. (2005); Osterloh &amp; Frey (2000); Papargyris &amp; Poulymenakou (2003); Sharratt &amp; Usoro (2003); Thomsen (1996); Waltter (2002); Wang &amp; Fesenmaier (2003); Wenger &amp; Snyder (2000)</td>
</tr>
<tr>
<td>Motivation of professional affiliation</td>
<td>+ (HKP8)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(1) Direct effects on the relative share of knowledge process-relevant contributions.
(2) Indirect effects on the relative share of knowledge process-relevant contributions:

$[\text{H}_{\text{indirect KP}1}: \text{Perceived Service Quality } \rightarrow \text{Perceived Quality of Content}]$

$[\text{H}_{\text{indirect KP}2}: \text{Trust } \rightarrow \text{Care}]$

$[\text{H}_{\text{indirect KP}3}: \text{Trust } \rightarrow \text{Cooperation}]$

$[\text{H}_{\text{indirect KP}4}: \text{Care } \rightarrow \text{Cooperation}]$

Table 11-2: Input Factors: Summary of Constructs, Hypotheses, and Key Sources
III. RESEARCH METHODOLOGY
12 INTRODUCTION

Based on the literature review and hypotheses development of Part II, Part III presents the empirical study in general and the research methodology of the given research in particular.

First, Chapter 13 expands on the sample and data collection procedures and methodologies, and outlines the research focus of the empirical study in the following Chapter 14.

Due to the relevance of the indirect measurement method, for didactic purposes Chapter 15 presents and discusses results relating to the indirect measurement of knowledge process contribution (and thus anticipates part of Part IV).

Chapter 16 presents the development of scales and measures on the basis of the theoretical work presented in the previous part of the thesis.

While Chapter 17 presents an overview of the measures deducted in the previous chapter, Chapter 18 provides a general summary and overview of this part of the thesis.

SPSS® (Statistical Package for Social Sciences), Release 12.0 (SPSS Inc., 1989-2003) and the public-domain software G*Power, Release 2.0 (Faul & Erdfelder, 1992) were used for all calculations.
13 SAMPLE AND DATA COLLECTION

The empirical part of the research project is based on an online survey of the users of International University Bremen’s (IUB) online forum. For the given study the sample consists of anonymous, self-selected participants of all account holders of the IUB online forum. The online questionnaire was designed using Globalpark GmbH’s Internet-based panel-software OPST® (Online Panel Site Tool), Release 3.4 (Globalpark GmbH, 2004).

The IUB online forum corresponds to a traditional online forum in which a community of members shares ideas and opinions within moderated or unmoderated discussion areas. Individual forum content can be accessed by browsing the forum category threads or through keyword searches. Members can edit their user profiles to provide additional information to other members, and use edit options to specify settings such as notification, use of cookies, thread view options and so on. Additionally, members can designate specific members by adding them to their ‘buddy’ or ‘ignore’ lists.

With about 2,000 users, 6,387 threads (the number of groups of posts on a certain subject) and 33,367 posts (the individual messages posted by any user) in a university and research setting, the 751 individual IUB forums provide an excellent environment for the research in terms of the number of participants and the focus on knowledge-relevant content. (All numbers are based on a log-file analysis of the IUB forum data, as of Sept. 2004, 3 years after initiation of the IUB forum in Sept. 2001.) Further analysis of the log-file data revealed that 1,975 of 2,108 total accounts can be attributed to 1,082 active “posters” with posts and 893 passive “lurkers” without posts, with 133 accounts belonging to non-users (i.e., users whose accounts were never used to log on to the forum). The exclusion of invalid email addresses and email-address-doubles led to 1,904 actual account holders, who were invited to participate in the survey. Using log-file usergroup- and access-right-data, these 1,904 accounts were subdivided into 788 guest account holders, 866 students and alumni account holders, 125 staff and faculty account holders,
and 125 account holders with an unassignable usergroup status. A detailed review of descriptive log-file data is presented in Chapter 20 of the following Part IV.

Given the online nature of the forums, an online survey was deemed the natural methodology, not least because it presented the only chance to reach those forum users belonging to the large group of guest account holders (41.38%), and those account holders with an unknown usergroup status (6.56%), since for these two groups the forum-system names and email addresses were the only available data. Also, the large number of alumni included in the usergroup of students/alumni was expected to present a problem in terms of contacting them, had the questionnaire not been conducted online, given the largely international community of IUB. Although the largest overall response rate would potentially have been obtained by a mixed-mode approach, such as handing out paper versions on campus in addition to conducting an online survey (thus offering students and staff/faculty the choice of the medium they are most comfortable with), this approach was dismissed because it posed its own risk of leading to non-comparable results, because sampling error, measurement error, and non-response error are not equal across modes (Gray, 2003). (Besides, due to the need for anonymity, a mixed-mode approach would make it impossible to control for/track back participation in both mediums that might potentially occur due to the potential risk of individual participants’ wishes to increase the chance of winning in the advertised raffle.)

In summary, and in view of the requirement for large data sets for the planned structural equation modeling analysis, the number of obtained surveys was expected to be the largest by conducting the survey as an online survey. As initially mentioned, this was also considered the most natural mode of conduct, given the online nature of the subject under study.

13.1 Online Questionnaire – Details

Online surveys can either be personalized or anonymous, depending on whether the sample is known or unknown. In personalized online surveys, potential participants are invited to participate in the survey, while in anonymous online surveys the online survey is simply communicated to a target population.
In the case of personalized online surveys, the survey is only accessible to people who are included in the sample of the survey and thus personally invited to participate. Personalized online surveys require the participant to log in to the survey.

In the given case the login procedure was automated through sending out invitation emails with a coded link, including the login-ID and password to access the questionnaire, thus decreasing the inhibition to participate by lowering the access hurdle.

In order to motivate participants and to increase response rates, three vouchers, each with a value of 25 Euro (sponsored by a local bookshop), were raffled among participants. To ensure data privacy, the used Internet-based panel-software OPST® (Globalpark GmbH, 2004) automatically separates user data and survey data. In the given research the questionnaire was also programmed to ensure the separate storage of questionnaire data / written comments and the email address, which was requested if participants asked to participate in the raffle of vouchers among the participants. For this purpose, the personalized questionnaire was programmed so that at the end of the survey participants were diverted from the personalized survey to a second, anonymous survey before being asked for their written comments and their email address in case they would like to participate in the raffle; that way, both data sets were being made independent of each other.

The main advantage of online-based surveys is the multitude of facilities available to control and direct users through the questionnaire: it can be ensured that participants are only shown pages (or questions or items) relevant for the usergroup they chose to belong to on an earlier question of the questionnaire; and / or that they are only presented pages (or questions or items) based on a particular answer to a question on an earlier page of the questionnaire. Proper application of these options obviously vastly increases data quality.

In order to obtain only complete data sets, in the given questionnaire responses to questions were “forced” (as opposed to being left optional); that is, participants could only move on to the next page of the questionnaire if all questions on the current page had been answered.

Pages were also randomly ordered to ensure that effects of the sequence of appearance of items were ruled out.
Andrews et al. (2003) laid down the following design guidelines for online surveys: (1) support for different browser and computer systems, (2) prevention of multiple submissions, (3) provision to present questions in logical or adaptive manner, if necessary, (4) option to save work in long questionnaires, (5) advice to obtain both quantitative data and qualitative (i.e., narrative) data, and (6) presentation of final feedback page. Andrews et al.’s design guidelines were followed in the design of the online questionnaire, with items (1, 2, and 4) being inherent features of Globalpark GmbH’s Internet-based panel-software OPST® (Globalpark GmbH, 2004).

The questionnaire was designed in an appropriately structured manner according to item (3) – and as a requirement for the utilization of filters as previously outlined.

Finally, items (5, 6) were both adhered to with the second final page asking “Please feel free to submit any comments and improvement suggestions you might have regarding the IUB forums and/or any questions and or comments you might have with regard to this survey/questionnaire,” followed by the chance to submit the email address to participate in the raffle. The final page provided contact data and thanked the participants for her/his participation.

The questionnaire is provided in Appendix A. Online Questionnaire, supplemented by an overview of the structure of the questionnaire (with marked filter pages/blocks and randomly ordered pages/blocks) in Appendix B. Questionnaire – Overview of Structure & Abortion-Ratio by Page.

### 13.2 Control Variable Forum Categories

With the ultimate target of controlling for particular forum content, the 751 individual forums were clustered in five categories (College, Student, Course, Public, and General) and one remaining forum category (Others) covering unclassifiable individual forums that were not considered in the analyses. The subdivision was based on an iterative log-file-analysis and targeted at the distinctness of particular forum content, comprising the following three aspects.
First, with regard to the likelihood of participants having used a particular forum category and thus obtaining a data set for that particular forum category through the survey, the forum categories were designed to create an approximately comparable size per forum category as measured by the number of messages.

Next, with regard to the usability of the questionnaire and thus the chance to increase response rates, the forum categories were clustered in such a way that the resulting summarizing “labels” allow participants to intuitively assign individual forums to each particular forum category.

Finally, with regard to ensuring equal access rights to all individual forums of each category (with the purpose to rule out effects of different judgments of usergroups due to different access-rights within certain forum categories), forum categories were set up so that equal access rights of a particular usergroup were ensured to all individual forums within each forum category. One effect of different access rights across the forum categories themselves remained: guest account holders have their access restricted to the public forums.

Table 13-1 presents the forum categories resulting from the iterative analysis. The forum categories were described in detail at the beginning of the questionnaire (see Appendix A. Online Questionnaire). The same detailed description could be retrieved throughout the survey by selecting the “help” button, which was also introduced at the beginning of the questionnaire, triggering the display of a popup page containing the same detailed description along with a detailed description of the types of content (see Appendix A. Online Questionnaire).

Throughout the questionnaire and following the definition of the categories, participants were asked to indicate which forum categories they had used. Subsequently, questions were asked only for this / these forum category / categories.
### Table 13-1: Categorization of IUB-Forums in Forum Categories

<table>
<thead>
<tr>
<th>Forum Category</th>
<th>Description of Forum Categories in the Online Questionnaire and Follow-up Description in its Popup-Help Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td>College Forums (e.g., IUB Colleges, Apartment 0-815, College Office Forum)</td>
</tr>
<tr>
<td>Course Forums</td>
<td>Course Forums (e.g., Current Course Forums, Course Forum Archive)</td>
</tr>
<tr>
<td>General Forums</td>
<td>General Forums (e.g., IUB General, IUB Teams and Associations, Campusnet Forum, Buy &amp; Sell, Academic Affairs Forums)</td>
</tr>
<tr>
<td>Public Forums</td>
<td>Public Forums (e.g., Incoming Students, Country Forum, The IUB Blackboard)</td>
</tr>
<tr>
<td>Student Forums</td>
<td>Student Forums (e.g., Student Affairs / Government / Court, Graduate Forum; Internal-/Academic Affairs, 1st/2nd/3rd year SES &amp; SHSS students)</td>
</tr>
<tr>
<td>Other Forums</td>
<td>[This forum category was excluded from the survey, as indicated by the comment within the questionnaire: “Forums not fitting this categorization are excluded from the survey.”]</td>
</tr>
</tbody>
</table>

#### 13.3 Data Collection Procedure and Sequence of Events

Prior to the planned one-week period of the online survey, selected faculty members of all schools of IUB were asked to announce the survey in their lectures / classes themselves, or to let the author announce the survey in their lectures and / or classes himself. This announcement period was from 17.09.2004 until 28.09.2004. On September 24th, an announcement of the upcoming online survey was posted in the announcement section of the IUB forum, the “IUB Blackboard Forum.” Four days later, on September 29th 2004, the system generated personal invitation emails with the individual, coded links to the online survey were emailed to all 1.904 selected forum account holders (including staff and faculty, current or previous students, and registered guests, and excluding accounts with invalid email addresses and email-address-doubles). Users were addressed personally, and invited to participate in the survey with one of four texts, adapted to four user-group categories: staff and faculty; students and alumni; registered guests; and users of unknown status.

The actual survey period lasted for one week, from 29th September until 6th October 2004. Two days after the personal invitation emails were sent out, non-respondents were reminded of the survey with a post on the internal IUB mailing-list on 1st October 2004. Following the drawing of the raffle for the three vouchers, all participants were thanked.
for their participation with a post in the announcement section of the IUB forum, the “IUB Blackboard Forum” on 26th October 2004; within the same post, the winners of the raffle were announced. Table 13-2 summarizes the sequence of events.

<table>
<thead>
<tr>
<th>Date / Period</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.09.2004 – 28.09.2004</td>
<td>Announcement of survey in graduate and undergraduate classes by selected faculty members and / or the author.</td>
</tr>
<tr>
<td>24.09.2004</td>
<td>Posting of announcement of upcoming online survey in the public “IUB Blackboard forum.”</td>
</tr>
<tr>
<td>29.09.2004</td>
<td>Mailing of personalized invitation emails to all 1.940 participants.</td>
</tr>
<tr>
<td>01.10.2004</td>
<td>Posting of survey-reminder in IUB-internal “IUB-Talk” mailing-list.</td>
</tr>
<tr>
<td>26.10.2004</td>
<td>Posting of expression of thanks, together with the names of the raffle-winners in the public “IUB Blackboard Forum.”</td>
</tr>
</tbody>
</table>

Table 13-2: Survey Period and General Sequence of Events

Throughout the survey period, 424 participants logged in to the questionnaire by selecting the coded link in the invitation email. In total, 330 participants continued the survey through the final page and submitted a completed questionnaire (i.e., 94 did not finish the questionnaire). Typically for online surveys, most participants did not complete answering on the first page, with the abortion ratio steadily decreasing to about zero to two participants per page throughout the questionnaire. Appendix B. Questionnaire – Overview of Structure & Abortion-Ratio by Page provides an overview of the dropout rates along the structure of the questionnaire. Of those 330 participants finishing the questionnaire, the average time spent answering the questionnaire was 12 minutes and 39 seconds.

Just as the drop-out ratio per page decreased along the progress of the questionnaire, the number of participants accessing and finishing the questionnaire per day decreased following the send-out of the invitation emails, with a slight increase following the survey-reminder. While 242 participants submitted a complete questionnaire on the day the email-invitation was sent out, this figure declined to 27 and 31 on the following two days, with a big decrease to between two and 10 submissions in the final days of the one-week survey period.
13.4 Response Rates by Usergroup

As outlined, a total of 330 people submitted a completed questionnaire, which corresponds to an average response rate (i.e., the ratio of the number of submitted surveys to the number of units in the sample) of 17.33%.

All account holders with a valid email address were invited, from a user-base generated over a period of 3 years beginning with the initiation of the IUB forums in September 2001. Obviously, many email addresses had become invalid in this time, and were thus returned with an “Undelivered”-receipt. The number of “Undelivered”-receipts was 137, equivalent to 7.19% of all initially invited account holders.

Considering these invalidated accounts, the average “cleaned” response rate (i.e., the ratio of the number of submitted surveys to the number of units in the sample after consideration of Undelivered”-receipts) corresponds to 18.68%.

Table 13-3 shows the response rates per usergroup (guest account holders, students / alumni, staff / faculty, and users of unknown status).

The data are based on accumulated, anonymous response data per usergroup as derived from the panel software, which tracks the overall status of the questionnaires (e.g., “in process,” “finalized,” “finalized after interruption,” etc.) based on the usergroups of the panel (themselves based on the forum log-file analysis, and set up to allow for the usage of group-specific invitation emails). As will be discussed in Section 21.1, which presents descriptive statistics and correlations of the questionnaire data within the analysis and results part of the thesis – Part IV – this led to some minor inconsistencies, as questionnaire participants apparently assigned themselves to usergroups other than those they were assigned to based on the forum log-file data – a difference apparently due to the three-year accumulation of accounts, without, apparently, keeping track of changes of user-status, from, most likely, guest account holders to actual students of the IUB.

The highest “cleaned” response rate was obtained among the staff and faculty usergroup, with a response rate of 28.23% and a total number of 35 participants completing the online survey. The second highest “cleaned” response rate was obtained among the students and alumni usergroup, with a “cleaned” response rate of 26.87% and a total of
230 participants submitting the online survey. A much lower “cleaned” response rate of only 8,92% was obtained among the guest account holders usergroup, however due to the large number (684) of invited usergroup members, yielding a total of 61 completed online surveys. Finally, a negligible response rate of only 3,88% was obtained among the 103 invited members of the unknown user status usergroup, yielding 4 completed online surveys.

<table>
<thead>
<tr>
<th>Usergroup based on Forum Log-file Data</th>
<th>Invited</th>
<th>Undelivered</th>
<th>“Cleaned” Invited</th>
<th>Questionnaire Completed</th>
<th>Response Rate % of Invited</th>
<th>Response Rate % of “Cleaned” Invited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students / Alumni</td>
<td>866</td>
<td>10</td>
<td>856</td>
<td>230</td>
<td>26,56%</td>
<td>26,87%</td>
</tr>
<tr>
<td>Staff / Faculty</td>
<td>125</td>
<td>1</td>
<td>124</td>
<td>35</td>
<td>28,00%</td>
<td>28,23%</td>
</tr>
<tr>
<td>Guest Account</td>
<td>788</td>
<td>104</td>
<td>684</td>
<td>61</td>
<td>7,74%</td>
<td>8,92%</td>
</tr>
<tr>
<td>Unknown Status</td>
<td>125</td>
<td>22</td>
<td>103</td>
<td>4</td>
<td>3,20%</td>
<td>3,88%</td>
</tr>
<tr>
<td>Total</td>
<td>1904</td>
<td>137</td>
<td>1767</td>
<td>330</td>
<td>17,33%</td>
<td>18,68%</td>
</tr>
</tbody>
</table>

Table 13-3: Response Rates by Usergroup – OPST® Panel Statistic

When low response rates occur, a non-response bias may exist, that is, a systematic difference between those participants and non-participants of the survey (Knapton & Myers, 2005). If and when non-response bias exists, results can be false or misleading, and results cannot be generalized to the entire population being studied (Knapton & Myers, 2005).

In the given case, however, the low response rates of guest account holders and users of unknown status can more logically be attributed to their lower level of commitment to the IUB forum community and their correspondingly low level of involvement. Because such low levels of involvement would have led to the neglect of potentially submitted forum category data sets (due to the minimum frequency-requirement of active or passive participation above the last category of frequency of “Seldom, once or twice a year” – as outlined in the following section), it is argued that differing response rates pose no risk as non-response errors.
13.5 Sample and Random Sub-Samples (I.) – 827 vs. 297 vs. 192 Data Sets

The 330 participants who submitted a complete questionnaire were assigned either “viewer” or “poster” status, depending on whether they viewed or posted and viewed (in) any of the forums they ever used with a frequency above the last category of “Seldom, once or twice a year” (e.g., if a participant had so far viewed three of the forum categories with a high frequency, while actively and frequently posting in one of these forum categories, she/he would have been assigned an overall “poster”-status).

In the case of participants with either “viewer” or “poster” status, all forum category data sets that had the last frequency-category (“Seldom, once or twice a year”) selected were neglected. In the case of participants with “viewer” status this referred to the question “Please select the frequency with which you have viewed (i.e., read) messages in this forum category.” In the case of participants with “poster” status this referred to the two questions “Please select the frequency with which you have viewed (i.e., read) messages in this forum category;” “Please select the frequency with which you have actively posted messages to this forum category.”

These two measures were applied to filter out forum category data sets of “convenience” forum participants: those who post very few messages in a particular forum category (mostly announcements and spam posts), over a long period, and who, due to their low level of engagement, cannot be seen as “true” members of the knowledge community of that respective forum category (and whose survey replies for that respective forum category were thus expected to skew replies of “true” knowledge community members of that respective forum category).

Of the total of 330 participants, 297 submitted at least one complete forum category data set that did not trigger the frequency rules previously mentioned. This implies that questionnaires from 33 participants were neglected since either the first or the second rule applied to any forum category set(s) submitted by the respective participants.

Of these 297 participants, 827 (active and passive) complete forum category data sets with view/post-frequencies above the lowest category were obtained representing the definite sample, and averaging 2.78 forum category data sets per user.
In order to reduce random error correlations, for each of the two main analyses, one forum category data set per participant was selected randomly from the total of 827 complete forum category data sets of the 297 participants.

In the case of the ANOVA analysis of the knowledge process derivation calculation (outlined in Chapter 15), one data set meeting the minimum-frequency requirement of each of these participants was randomly drawn, leading to a sub-sample with 297 data sets for the ANOVA analysis.

Given that in the case of the Structural Equation Modeling analysis (SEM; outlined in Chapter 22 of the following Part IV) only active sets were relevant for the calculation, from each participant one set of the active, completed sets meeting the minimum-frequency requirement was randomly drawn, leading to a sub-sample with 192 data sets for the SEM analysis.

Detailed analyses of usergroups und forum categories for each of the respective sub-samples are provided in Chapter 21 of the following Part IV.
14 FOCUS OF THE MODEL – RKPC INSTEAD OF AKPC

An individual’s knowledge process contribution can best be measured over time, replicating the knowledge processes the individual contributes to a particular forum-based Online Knowledge Community.

As outlined in Section 9.3.2, Part II, which outlines the indirect type of content-based knowledge process derivation methodology, an individual’s absolute knowledge process contribution (AKPC) is approximated by a linear combination of that individual’s average relative knowledge process contribution (RKPC) of the individual’s most frequently contributed type of content with the individual’s respective frequency of contribution (FoC) of that particular type of content.

As outlined in the same chapter, a more accurate approximation could be achieved by asking participants the frequency with which they, on average, contribute each of the defined types of content to each forum category, resulting in a type of content / frequency matrix for each. Though included in early draft versions of the questionnaire, this approach was later simplified in an attempt to reduce the overall complexity of the questionnaire and the time it takes to answer all its questions.

Devising a Structural Equation Model (SEM) focusing on an integrated AKPC-measure would obviously not make sense in this early stage of research, because such a model would not provide information about which underlying factor (RKPC or FoC) the resulting AKPC results are related to (which would not allow drawing conclusions with regard to either factor). Accordingly, the individual hypotheses of Chapter 10 of the literature review and hypotheses development part of the thesis – Part II – were formulated to specifically refer to either RKPC or FoC.

Obviously, both measures – RKPC and FoC – are relevant to the study, as both represent a “vehicle” for calculating a valid, though abstract, measure of an individuals knowl-
edge process contribution over a given period of time – the AKPC. A perfect model would thus incorporate both of these key aspects.

Due to the high complexity of a Structural Equation Model (SEM) incorporating both key factors that determine the frequency-weighted knowledge process contribution, this study focuses on the obvious key aspect, the type of content-derived RKPC.

A structural equation model incorporating both aspects would be too complex given the restrictions of the expected limited number of participants. An extension of the number of the participants in itself was also deemed inappropriate considering the status of the study in a field without much prior research. It was thus decided to focus on the key aspect, and to build on these results in follow-up studies, which should incorporate both key aspects to control for distinct effects.

Accordingly, the structural equation model was designed to cover only paths that are relevant for the covered RKPC aspect, as visualized in the bottom left side of Figure 7-3, presented in Chapter 7, Part II.

Paths, variables, and latent constructs relevant only for the frequency of contribution aspect were excluded from the model. As outlined in Section 10.2.2, Part II, Social Navigation indicators are only expected to influence the frequency of contribution, and accordingly these indicators and their latent construct were also excluded from the model. The same applies to one direct path, from service quality to frequency of contribution, as outlined in Section 10.1, Part II; however, the hypothesized indirect path from service quality to perceived quality of content obviously remained. All other variables and latent constructs hypothesized to impact on both relative knowledge process contribution and frequency of contribution had their hypothesized FoC-paths removed.

Along the way, the decision to focus the model on RKPC provided a solution to the risk of the overall response rate being to low. It was initially planned to derive two social navigation-indicators – forum posts per month and forum views per month – through log-file data. This would, along with a corresponding notice in the invitation email, (1) have required personalizing the submitted questionnaire data, as opposed to capturing questionnaire data on an anonymous basis as in the given survey, and (2) – potentially most off-putting to would-be participants – would have required participants to explicitly
consent to linking their log file data to their personalized questionnaire data. With would-be participants probably being worried about the use of their personalized data, both measures would obviously have posed a risk to the overall response rate, along with the risk of potential bias in the answers of participants, because they would not feel as free to express their true opinion as they would in an anonymous survey.

The alternative – capturing social navigation-indicators through the questionnaire, just as with the other data – was dismissed, as the large number of individual forums would only allow capturing data on a forum category basis, as with the other data. However, if they would be measured over only five forum categories, these two indicators of social navigation would become meaningless: what would be measured would be the average number of posts per thread per month per forum category and the average number of views per thread per month per forum category, respectively. Recognizing the distinct nature of social navigation indicators along individual forums of each particular forum category, it was decided that these indicators would be too aggregated. The decision to focus the model on RKPC, as outlined above, along the way provided a solution to the risk that obtaining appropriate social navigation indicators would pose to the overall response rate.

**Refined Research Question**

Based on the decision to focus on the degree of relative knowledge process contribution (RKPC) within forum-based Online Knowledge Communities, as opposed to the absolute knowledge process contribution (AKPC), the research question from Chapter 4, Part II, is refined as follows:

> Which factors influence and support the knowledge-relevant usage of online forums and increase the relative contribution of “Knowledge Transfer” and “Knowledge Creation” relevant content?
15 INDIRECT MEASUREMENT OF KNOWLEDGE PROCESS CONTRIBUTION

The Univariate Analysis of Variance (ANOVA) methodology was used to analyze whether the means of forums’ perceived knowledge transfer / knowledge creation contributions differed along the forums’ perceived types of content to test whether types of content could be used as an approximation for a participant’s contribution to knowledge transfer and knowledge creation, the two key knowledge processes. Within the SPSS® software package (version 12.1), the GLM Univariate procedure was used for the calculation.

Following an outline of initial descriptive data regarding the indirect measurement of knowledge processes, published in Schmitz-Justen and Wilhelm (2005c), this chapter outlines the detailed statistical analysis, presented by Schmitz-Justen and Wilhelm (2005b).

As mentioned in Section 9.3, Part II, due to the relevance of the indirect measurement method, for didactic purposes this section has to anticipate results from the analysis section relating to the indirect measurement of knowledge process contribution.

15.1 Research Question and Hypothesis

The research question regarding the indirect measurement of knowledge process contributions is defined as follows:

*Can the Type of Content contributed to a forum be used as an approximation for a participant’s contribution to the two key knowledge processes of knowledge transfer and knowledge creation?*
The hypothesis is that knowledge-process effects express themselves in types of content. The derived, empirically testable hypotheses are:

\[ H_0: \text{Average Knowledge Transfer / Knowledge Creation scores are equal across Types of Content.} \]

\[ H_1: \text{Average Knowledge Transfer / Knowledge Creation scores are not equal across Types of Content.} \]

### 15.2 Descriptive Statistics

First results suggest that the outlined type of content-based valuation is a viable approach to capture individual and group learning processes (knowledge creation) and knowledge teaching and sharing processes (knowledge transfer) within online forums. Based on a 5-point scale \((-1; -0.5; 0; +0.5; +1)\), participants on average associated all submitted 827 forum category data sets with a Knowledge Transfer Factor (KTF) of 0,31 and a Knowledge Creation Factor (KCF) of 0,19. With a factor nearly twice as high in both cases, participants associate information entries with the highest contribution to both knowledge processes (0,59 knowledge transfer factor; 0,38 knowledge creation factor), as can be seen in Table 15-1. Chat entries were associated with the lowest knowledge process factors in both cases (0,08 knowledge transfer factor; 0,03 knowledge creation factor).

<table>
<thead>
<tr>
<th>Main Type of Content</th>
<th>( \Sigma ) Sets</th>
<th>( \Sigma ) KTFs*</th>
<th>Avg. KTF*</th>
<th>( \Sigma ) KCFs**</th>
<th>Avg. KCF**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chat</td>
<td>229</td>
<td>19,00</td>
<td>0,08</td>
<td>6,50</td>
<td>0,03</td>
</tr>
<tr>
<td>Statement / declaration</td>
<td>58</td>
<td>16,00</td>
<td>0,28</td>
<td>8,00</td>
<td>0,14</td>
</tr>
<tr>
<td>Information</td>
<td>280</td>
<td>164,50</td>
<td>0,59</td>
<td>105,50</td>
<td>0,38</td>
</tr>
<tr>
<td>Discussion</td>
<td>166</td>
<td>25,50</td>
<td>0,15</td>
<td>21,00</td>
<td>0,13</td>
</tr>
<tr>
<td>Question &amp; answer</td>
<td>94</td>
<td>33,00</td>
<td>0,35</td>
<td>19,50</td>
<td>0,21</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>827</strong></td>
<td><strong>258,00</strong></td>
<td><strong>0,31</strong></td>
<td><strong>160,50</strong></td>
<td><strong>0,19</strong></td>
</tr>
</tbody>
</table>

* KTF: Knowledge Transfer Factor  
** KCF: Knowledge Creation Factor  

Table 15-1: Perceived Knowledge Transfer / Creation Factor per Type of Content
Splitting the completed sets in forum category sets of actors that actively used (i.e., posted within) that forum category (active forum category data sets) and those who passively used (i.e., only viewed within) that forum category (passive forum category data sets), reveal major differences. For example, the 166 forum category data sets perceived to contain mainly discussion entries can be distinguished in 52 active forum category data sets – with a knowledge transfer factor of 0.22 (and a knowledge creation factor of 0.20) – and 114 passive forum category data sets – with a knowledge transfer factor of only 0.12 (and a knowledge creation factor of 0.08).

### 15.3 Assumptions

For the purpose of testing hypotheses concerning parameter estimates, ANOVA assumes, besides (1) fundamental data assumptions, that (2) the values of errors are independent of each other and the variables in the model, (3) normality of distributions of the dependent variables, and (4) homogeneity of variance among the groups being compared (i.e., homoscedasticity). The latter can be particularly important when there are unequal cell sizes; that is, different numbers of observations across factor-level combinations as in the given case. In addition to these four requirements, Random and Mixed model ANOVA designs assume (5) sphericity. The following paragraphs provide a brief summary of the fulfillment of each of these conditions with respect to the indirect measurement of knowledge processes outlined in this chapter.

**Fundamental data assumptions** refer to the measurement of the dependent variable as a quantitative, and the factors as categorical variables. In the given case, the condition of fundamental data assumptions is considered to be met due to Labovitz’s (1970) argumentation to treat Likert scale variables of five points and higher as quantitative variables, a common research practice as observed by Bryman and Cramer (2001). Labovitz argues that almost all ordinal variables can and should be treated as interval variables, because the minimal amount of error is compensated with the advantages of being able to apply a much wider and technically enhanced range of statistical methodologies. Thus, all analyses in this research project treat multiple-item measures, such as the five-item Likert scales used, as though they were interval scales. As far as the ANOVA analysis of the
given chapter is concerned, the dependent variables knowledge transfer and knowledge creation are thus treated as quantitative variables.

In order to adhere to the second requirement of independence, as outlined in Section 13.5, a random selection of one forum category data set per participant was drawn from those 223 participants who submitted more than one complete forum category data set. This led to a total of 297 complete forum category data sets for the ANOVA analysis (including 74 complete forum category data sets from 74 participants who submitted only one complete forum category data set and for which there was thus no need for inclusion in the random selection procedure). A detailed review of descriptive questionnaire data for the main sample and the two sub-samples is presented in Chapter 21, Part IV, the following analysis and results part of the thesis.

The third assumption requires normality of distributions of the dependent variables. ANOVA is known to be robust even to moderate departures from normality (Jackson & Brashers, 1994). In the given case, descriptive statistics do not indicate any strong deviations from the assumptions of normality.

The fourth assumption requires homoscedasticity, that is, the homogeneity of group variances, most frequently assessed by Bartlett’s test and Levene’s test. ANOVA is robust with respect to this assumption when the groups are of equal or near equal size; however, in the given case of unequal variances and unequal sample sizes, the standard F statistic lacks power and is prone to give incorrect results. Such a situation of unequal sample sizes and variances can be handled by adjusting the degrees of freedom for finding the critical value of F. Alternatively, the Welch or Brown-Forsythe statistics can be applied as so-called Robust Tests of Equality of Means. Of the two models tested, the homoscedasticity assumption is violated in one case, in which the Welch’s variance-weighted ANOVA is used as an alternative.

Finally, sphericity, also called circularity, is an additional assumption for random and mixed-effect ANOVA designs. In the given case, sphericity, which is given when the variance of the difference between the estimated means for any pair of groups is the same as for any other pair, is thus relevant for one of the two tested models, the (mixed) model 2 with its random factor. However, because this model only has two levels, only one covari-
ance exists and thus the homogeneity of variances of differences is not relevant in the given case.

In summary, all assumptions were reasonably met to justify the application of ANOVA, which is known to be robust against violations of its assumptions (Jackson & Brashers, 1994).

### 15.4 Model 1 – Type of Content as Fixed Factor

Following the random selection of sets, first an ANOVA was conducted with knowledge transfer / knowledge creation as the dependent variable and type of content as the independent variable (fixed factor). The statistical model was proposed as:

\[
\text{KP} = \text{ToC} + \text{Error}
\]

\[
\text{Knowledge Process} = \text{Type of Content} + \text{Error}
\]

Testing for the key assumption of homoscedasticity, the Levene’s test for knowledge transfer was significant below 0,05 (0,027), suggesting that the equal variances assumption is violated. Therefore, Welch’s variance-weighted ANOVA was applied as a so-called Robust Test of Equality of Means. Welch’s statistic was not significant (p<0,001), providing an indication of the correctness of the F statistic despite the formally violated assumption of homoscedasticity. In the case of knowledge creation, the Levene’s test scored above 0,10, meeting the homoscedasticity assumption.

The ANOVA revealed that both knowledge transfer and knowledge creation values were significantly different along types of content (knowledge transfer: p<0,001; F[4, 292]=23,133; effect size, partial Eta-square = 0,241 and knowledge creation: p<0,001; F[4, 292]=10,567; effect size, partial Eta-square = 0,126).

The standardized effect size measure \( f \) for global ANOVA F-tests equals (Bucher, Erdfelder, & Faul, 1997): \( f^2 = \eta^2 / (1-\eta^2) \). Thus, for knowledge transfer (\( \eta^2=0,241 \)) \( f \) equals 0,563; for knowledge creation (\( \eta^2=0,126 \)) \( f \) equals 0,380. Based on Cohen’s popular interpretation of effect sizes (Cohen, 1988), defining \( f=0,10 \) as small effects, \( f=0,25 \) as medium effects, and \( f=0,40 \) as large effects, these \( f \)-values correspond to a large
effect in case of knowledge transfer and a marginally large effect in case of knowledge creation.

**15.5 Model 2 – Forum Category as Random Factor**

Selecting the forum category variable as a random-effects factor, efforts were made to improve the model.

In the case of a random factor, one is not really interested in the specific differences in means from one level of the factor to another. Instead, one is interested in the extent to which the random factor accounts for variance in the dependent variable, and to control for this. Rather than being interested in the individual means across the levels of the fixed factor, one is therefore interested in the variance of means across the levels of a random factor.

The factor forum category was chosen as a random effect for two reasons. First, the author wants to generalize findings to the type of content, independent of the forum a particular message is posted in: the interest lies in generalizing to a population of forums, of which the given categories are just regarded as a random subset or sample. Second, if the random factor would be treated as a fixed factor, it could be argued that the findings pertain only to the arbitrary cases studied – and, without stating forum category as a random factor, inferences might be quite different if alternative compositions of individual forums to forum categories had been selected.

The second ANOVA was thus conducted as a mixed model, with knowledge transfer / knowledge creation as the dependent variables, type of content as the fixed factor, and forum category as the random-effect variable. The statistical model was proposed as:

\[
KP = ToC + FC(R) + ToC \times FC(R) + Error
\]

with (R) indicating a random effect.

Knowledge Process = Type of Content + Forum Category (Random) + Interaction Type of Content \times Forum Category (Random) + Error

For both knowledge transfer and knowledge creation the Levene’s Test of Equality of Error Variances was greater than 0.10. Therefore, there is no reason to believe that the equal variances assumption is violated.
In the proposed mixed design (or Model III as it is called in ANOVA terminology), hypothesis testing only makes sense for fixed effect factors (even though, contrary to SAS/STAT® (2005a), SPSS® (1989-2003) outputs F-ratios and p-values for the random effect and any interaction with a random effect).

The hypothesis test for the type of content factor again revealed that both knowledge transfer and knowledge creation values were significantly different along types of content (knowledge transfer: p=0.003; F[4, 273]=5.496; effect size, partial \( \eta^2 = 0.469 \) and knowledge creation: p=0.028; F[4, 273]=3.227; effect size, partial \( \eta^2 = 0.334 \)).

Computing the standardized effect size measure \( f \) for model 2, in case of knowledge transfer, \( f \) equaled 0.940 (\( \eta^2 = 0.469 \)). In case of knowledge creation, \( f \) equaled 0.708 (\( \eta^2 = 0.334 \)). Based on Cohen’s popular interpretation of effect sizes, these \( f \)-values correspond to large effects for both knowledge transfer and knowledge creation.

Instead of hypothesis tests the random factors forum category (FC) and the interaction type of content with forum category (ToCxFC) (interactions, including a random factor, can generally be assumed to be a random factor as well; Schwarz, 1993) were subject to estimates on how variable the results would be when a combination of random levels were chosen. For this purpose partial Eta-square was used (it must be considered that partial Eta-square overestimates variability, as the individual items in an analysis add up to more than 1).

The effect size of the random factor forum category equals partial \( \eta^2 = 0.503 \) for knowledge transfer and partial \( \eta^2 = 0.227 \) for knowledge creation. About 50% (knowledge transfer) / 27% (knowledge creation) of the total variability can thus be attributed to the random factor forum category, suggesting – as expected – that types of content are consistently higher / lower along certain forum categories. (As previously outlined, hypothesis testing only makes sense for fixed effect factors. For the sake of completeness, the SPSS® output is nevertheless provided: the random factor forum category (FC) was calculated as being significant for knowledge transfer, but not for knowledge creation, with knowledge transfer: p<0.001; F[4, 273]=7.414; effect size, partial \( \eta^2 = 0.503 \) and knowledge creation: p=0.087; F[4, 273]=2.250; effect size, partial \( \eta^2 = 0.227 \).)
The effect size of the interaction term type of content with forum category (ToC x FC) equals partial $\eta^2=0.063$ for knowledge transfer and partial $\eta^2=0.058$ for knowledge creation. The variability of the interaction term is thus very small: less than 6% (knowledge transfer) / 5% (knowledge creation) of the total variability can be attributed to the interaction, implying that the effect of the types of content along different forum categories is consistent, that is, a particular type of content does not have a different knowledge process contribution within certain forum categories compared to other forum categories. (Again, for the sake of completeness, the SPSS® output is provided. The interaction term type of content with forum category (ToC x FC) was output as not being significant for both knowledge transfer and knowledge creation, with knowledge transfer: $p=0.260; F[15, 273]=1.215$; effect size, partial $\eta^2=0.063$ and knowledge creation: $p=0.336; F[15, 273]=1.122$; effect size, partial $\eta^2=0.058$.)

Comparing model 2 against model 1, it appeared that the addition of forum category as a random effects variable not only reduced the overall unexplained variability (which is marked as Error in the SPSS® ANOVA tables) from 52,684 to 44,455 and from 58,581 to 52,947, for knowledge transfer and knowledge creation, respectively. Most importantly, the proportional reduction in the variation explained by the main effect type of content was not as great as the reduction in the unexplained variation. Thus, the partial Eta-square has increased for the model effect type of content in both knowledge transfer and knowledge creation of model 2: from partial $\eta^2=0.241$ to partial $\eta^2=0.469$ for knowledge transfer and from partial $\eta^2=0.126$ to partial $\eta^2=0.334$ for knowledge creation.

By adding forum category as a random effect, the amount of unexplained variation has thus been reduced, increasing the accuracy of the estimates of the type of content model term.

### 15.6 Retrospective Power Analysis

Without details of effect size and power as a quantitative method to evaluate the sensitivity of a study (Muller & Benignus, 1992), statistical significance, on its own, is inadequate as a way of judging research (Clark-Charter, 2003).
Achieving statistical significance could be due to two situations: either the alternative hypothesis is true, or the study is subject to such a high degree of statistical power that even a trivial result is shown to be statistically significant. Such overpowered samples may not only be oversensitive to trivial or irrelevant “significant” findings (Clark-Charter, 2003), they can also be wasteful in terms of unnecessary effort, time, and resources spent (Mone, Mueller, & Mauland, 1996). In contrast, not achieving statistical significance could be due to another two situations: either the null hypothesis is true, or the study is subject to such a low degree of statistical power that even an existing difference is shown not to be statistically significant. As will be outlined in the following, the first of these four cases, that is the only situation that supports the alternative hypothesis to be true, applies to the given research.

Retrospective power analysis can be conducted to inform potential follow-up studies about appropriate sample sizes and to support the interpretation of results. While in case of significant results – as in the given research – power levels can be calculated to control whether potentially obtained significant findings might have occurred because an overpowered sample exists, in case of non-significant results power levels can be calculated to bolster the claim that substantial differences do in fact not exist.

Retrospective power analysis can be useful to either (1) calculate power for a specified effect size (or range of effect sizes) thought to be the minimum for scientific significance, or (2) calculate an detectable effect size (or range of effect sizes) for a specified minimum desired level of power (Thomas & Krebs, 1997).

As pointed out by Thomas and Krebs (1997), Hoenig and Heisey (2001), and Lenth (2001), the common procedure to use “Observed Power” (an output provided by SPSS® and other software packages) for interpretation does not add any information to the interpretation beyond the p-value, as the observed power is a 1:1 function of the p-value.

Instead – just as the “[d]efensible interpretation of [non-significant results] depends on an appreciation of the distinction between statistical significance and scientific importance” (Muller & Benignus, 1992, p. 215) – one must distinguish between statistical power and scientific power. Using the first does provide the same information as a p-
value; using the latter can help interpretation of significant and non-significant results, as outlined above.

Muller and Benignus (1992) suggest five criteria that should be considered for selecting an appropriate level of scientific power: opportunity costs, ethical trade-offs, the size of the effect considered important, the uncertainty of parameter estimates, and the analyst’s preference for amount of power.

Given the importance of the analysis for the given research project – due to the planned utilization of results of the indirect measurement of the knowledge process contribution in the structural equation modeling analysis – power levels were calculated for a medium effect size, which the author required to be the minimum for scientific significance.

As outlined before, Cohen’s (1988) popular convention for medium effects is an effect size of \( f = 0.25 \). For medium effect sizes, the convention for the minimum level of power is 0.80 (Clark-Charter, 2003; Cohen, 1988). Muller and Benignus (1992) point out that with regard to robustness of calculations to small changes in effect size, effort variance, or sample size, power should be at least 0.84.

Calculations of power levels were performed with the public-domain software G*Power (Faul & Erdfelder, 1992), and based on Koele (1982). Using the specified medium effect size as input, power levels were calculated for both knowledge creation and knowledge transfer, and based on the average group size.

For model 1, power levels could be calculated using the standard G*Power procedure “F-test (ANOVA),” and power was calculated as: \( P(F>2.4026 \mid \alpha=0.05; df1=4; df2=292; \lambda=18.5625) = 0.9464 \) with \( \lambda \) being calculated as \( N \times f^2 = 297 \times 0.0625 = 18.5625 \).

For the calculation of power levels for model 2, the mixed model, Koele’s (1982) formula was used. The power of the fixed factor type of content is the average effect of type of content across the arbitrarily-selected categories of the random effect factor forum category. Power levels were only calculated for the fixed factor of the model, considering that power levels for fixed factors in mixed designs can only be approximated (Koele, 1982). Following Koele’s (1982) suggestion, the calculation of the power for the interac-
tion was not carried out. The power of the random factor forum category is of no theoretical interest, because its levels are arbitrary particular cases. For calculation, G*Power’s “Other F-tests” procedure was used, based on the effect size measure $f^2$, corresponding (for the required medium effect, $f=0.25$) to $f^2=0.0625$. The degrees of freedom were calculated based on Koele (1982) as: $df1=5-1=4$; $df2=(5-1)\times(5-1)=16$. The power level for the fixed factor of model 2 was calculated as: $P(F>3.0069 \mid df1=4; df2=16; \lambda=18.5625)=0.8614$, again with lambda being calculated as $\lambda=N\times f^2=297\times0.0625=18.5625$.

Thus, both model 1 and model 2 meet the commonly recommended minimum level of power of 0.80 (e.g., Clark-Charter, 2003; Cohen, 1988) and even the stricter level of 0.84 suggested by Muller and Benignus (1992), without being so large as to suggest that the significance of the results might be due to the sample being overpowered (Clark-Charter, 2003).

The significant results obtained in the given research thus arguably not occur because an overpowered sample exists, suggesting that the type of content provides a viable approximation of individual actor’s knowledge transfer and knowledge creation contributions.

15.7 Type of Content-based Knowledge Process Measures

This section summarizes the results of the indirect content-based knowledge process derivation methodology aimed at approximating individual actors’ knowledge process contribution.

The result shows that the indirect methodology can be applied as an alternative to a direct question to gauge an individual actor’s knowledge process contributions, thus overcoming the associated risk of assessment skews on the side of survey participants.

Of the two models tested, model 2 (including the fixed factor type of content, the random factor forum category, and their interaction) is statistically more viable than model 1.
Table 15-2 presents the model 2-based Estimated Marginal Means. These Estimated Marginal Means are, in the following, used as an approximation for each participant’s knowledge process contributions by applying them to individual actor’s most frequently contributed type of content, as outlined in Section 9.3.2, Part II.

<table>
<thead>
<tr>
<th>Knowledge Process</th>
<th>Knowledge Transfer</th>
<th>Knowledge Creation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std. Error</td>
</tr>
<tr>
<td>Chat</td>
<td>0.102</td>
<td>0.054</td>
</tr>
<tr>
<td>Statement / declaration</td>
<td>0.321</td>
<td>0.095</td>
</tr>
<tr>
<td>Information</td>
<td>0.565</td>
<td>0.080</td>
</tr>
<tr>
<td>Discussion</td>
<td>0.226</td>
<td>0.058</td>
</tr>
<tr>
<td>Question &amp; answer</td>
<td>0.442(^{(1)})</td>
<td>0.116</td>
</tr>
</tbody>
</table>

\(^{(1)}\) Based on modified population marginal mean.

**Table 15-2: Model 2-based Estimated Marginal Means**
16 SCALE DEVELOPMENT AND MEASURES

As mentioned in the introduction to this part of the thesis, for didactic purposes the previous chapter, Chapter 15, presented and discussed results relating to the indirect measurement of knowledge process contribution, to some extent anticipating Part IV.

As outlined in Chapter 15, the model 2-based Estimated Marginal Means are used as an approximation for each participant’s knowledge process contributions by applying them to individual actor’s most frequently contributed type of content. As such, the results of the previous chapter are used in this chapter, which presents the development of scales and measures on the basis of the theoretical work of the thesis, outlined in Part II.

While the literature review outlined in Part II informed the creation of the initial constructs and the a priori assignment of items to measure those constructs, this chapter outlines the development and adjustment of scales used to finally measure these latent factors. As outlined in Chapter 10, Part II, for the given forum-based online knowledge community context little empirical precedent was available to guide the development of measures.

As summarized in Chapter 11, Part II, the theoretically extracted constructs to be identified and confirmed are: perceived service quality, social navigation indicators, perceived quality of content, cooperation, sense of community, trust, care, experience, motivation, and relative knowledge process contribution.

Due to the focus on relative knowledge process contribution, of these constructs, social navigation indicators were not realized in the empirical part of the given research project, as outlined in Chapter 14.

Based on calculations and arguments outlined in this chapter, two sets of two constructs that were deemed closely related (cooperation and sense of community; trust and
care), were combined following Bivariate Correlations, which indeed confirmed a close relationship between the respective variables.

Because single-item measures are limited as compared to multi-item measures, constructs are commonly composed of multiple-items, also referred to as a scale. Where applicable and/or possible, scales of multi-item measures were thus developed and validated. In order to assess whether multiple-item measures are acceptable, each construct’s convergent validity must be assessed (Gerbing & Anderson, 1988). This was done through calculation of unidimensionality and reliability for each individual construct. While unidimensionality measures whether the individual items that make up the construct are measuring the same construct, reliability is a measure of internal consistency.

As Gerbing and Anderson (1988) and Yu (2001) observe, both concepts of convergent validity (unidimensionality and reliability) and their sequence of calculation are often confused. Scale development in the given project follows Gerbing and Anderson’s recommendation to first assure unidimensionality through Exploratory and Confirmatory Factor Analysis, followed by calculation of construct reliability, because the calculation of the reliability score is based on the assumption that the items actually form a unidimensional set and have equal reliabilities.

All items are measured through the online questionnaire, with all measures being obtained per forum category and the knowledge process contribution being derived indirectly. Most variables were measured on a 5-point Likert scale anchored between “strongly disagree” and “strongly agree” (scale: $-1; -0.5; 0; +0.5; +1$). Experience (measured by a 5-point “frequency;” scale: 1; 2; 3; 4; 5), knowledge creation (measured on and scaled according to the indirectly-derived KC-scale; scaled from 0 to 1), and knowledge transfer (measured on and scaled according to the indirectly derived KT-scale; scaled from 0 to 1) were measured on different scales.

Again, as argued in Section 15.3, all analyses treat multiple-item measures, such as the used five-item Likert-scales, as though they were interval scales.

This chapter expands on two papers by Schmitz-Justen and Wilhelm, currently under review (accepted; under review).
Table 16-1 summarizes the steps of scale development and the respective types of analysis.

<table>
<thead>
<tr>
<th>Step of Modeling</th>
<th>Type of Analysis</th>
<th>Purpose of Analysis</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scale Development</td>
<td>Exploratory Factor Analysis</td>
<td>Assessment of unidimensionality</td>
<td>Section 16.1 Unidimensionality – Exploratory Factor Analysis</td>
</tr>
<tr>
<td></td>
<td>Confirmatory Factor Analysis</td>
<td>Assessment of unidimensionality</td>
<td>Section 16.2 Unidimensionality – Confirmatory Factor Analysis</td>
</tr>
<tr>
<td></td>
<td>Reliability Analysis</td>
<td>Assessment of reliability</td>
<td>Section 16.3 Construct Reliability – Reliability Analysis</td>
</tr>
</tbody>
</table>

Table 16-1: Steps & Types of Analysis of Scale Development

16.1 Unidimensionality – Exploratory Factor Analysis

Exploratory Factor Analysis (EFA) is primarily used for data reduction or structure detection. It is thus also a helpful technique for scale development (Gerbing & Anderson, 1988) through its support of the examination of the underlying (or latent) relationships between variables. Its ultimate purpose is used to make sure that individual variables assumed to be good indicators of a latent factor do indeed measure this factor (and, e.g., do not load on other factors).

Principal component analysis with Varimax rotation was used to identify constructs. Two criteria were set for item selection of the predetermined items of any scale. First, following Ford, MacCallum and Tait (1986), only items with factor loadings larger than 0.4 were considered meaningful. Second, only items with unambiguous loadings onto the extracted factors were included.

Following the selection of variables based on these criteria, unidimensionality of the final scales was met. For two sets of two constructs that were deemed closely related on a theoretical basis (cooperation and sense of community; trust and care), bivariate correlations were calculated to control whether the variables of the respective constructs should be combined in a common construct. In both cases, strong correlation of each of the two
constructs led to a rerun of the exploratory factor analysis for the combined constructs, revealing one common factor in both cases. In both cases the variables for each combined construct meeting the previously outlined criteria for unidimensionality were included.

Table 16-2 displays the constructs extracted through the exploratory factor analysis. For means of the overall view, Cronbach’s alpha coefficients as measures of reliability, and calculated following confirmatory factor analysis, are included.

All constructs meet the common thresholds of variance explained of 0.5 to 0.6 deemed appropriate for exploratory models.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Number of Items</th>
<th>Factors Extracted</th>
<th>Eigenvalue</th>
<th>Explained Variance</th>
<th>Item Loadings</th>
<th>Alpha coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Quality</td>
<td>2</td>
<td>1</td>
<td>1,364</td>
<td>68.22%</td>
<td>All exceed 0.826</td>
<td>0.527</td>
</tr>
<tr>
<td>Perceived Quality of Content</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cooperation &amp; Sense of Community</td>
<td>4</td>
<td>1</td>
<td>1,981</td>
<td>49.52%</td>
<td>All exceed 0.659</td>
<td>0.649</td>
</tr>
<tr>
<td>Trust &amp; Care</td>
<td>3</td>
<td>1</td>
<td>1,746</td>
<td>58.20%</td>
<td>All exceed 0.679</td>
<td>0.639</td>
</tr>
<tr>
<td>Experience</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Social Affiliation Motivation</td>
<td>2</td>
<td>1</td>
<td>1,476</td>
<td>73.80%</td>
<td>All exceed 0.859</td>
<td>0.645</td>
</tr>
<tr>
<td>Professional Affiliation Motivation</td>
<td>2</td>
<td>1</td>
<td>1,559</td>
<td>77.95%</td>
<td>All exceed 0.883</td>
<td>0.717</td>
</tr>
<tr>
<td>Relative KP- Contribution</td>
<td>2</td>
<td>1</td>
<td>1,891</td>
<td>94.53%</td>
<td>All exceed 0.972</td>
<td>0.902</td>
</tr>
</tbody>
</table>

(1) Due to strong theoretical support and given that the Variance Explained value was within 0.0048 (0.5–4952) of the minimum required Variance Explained of 0.5, the combined construct Cooperation and Sense of Community remained in the analysis.

Table 16-2: Final Constructs and their Statistical Determinants
Bivariate Correlations of Closely Related Concepts

As mentioned in the introduction to this chapter, bivariate correlations were calculated for two sets of two constructs that were deemed closely related. For both sets, the two concepts are theoretically closely related and it was assumed that – for the given context of the study – they might as well be combined in a common construct. In both cases, the variables for each construct that met the previously-outlined criteria for unidimensionality were combined, as shown in Table 16-2.

The first set containing two constructs assumed to be related were cooperation and sense of community. In the case of the construct cooperation, the two variables homogeneity and cooperation met the criteria for the Exploratory Factor Analysis. In the case of the construct sense of community, the two variables feeling as a member and social harmony met the criteria for the Exploratory Factor Analysis.

Table 16-3 presents the bivariate correlations between these four variables of the two constructs. From a total of six correlations, all are significant and five have a high correlation of more than 0.25 ranging from 0.264 to 0.450. All of those five correlations are highly significant (p<0.01), and three of these five highly significant correlations refer to correlations of variables between the two constructs.

Based on the results of the bivariate correlation, the decision was made to rerun the Exploratory Factor Analysis for the two combined constructs, revealing one common factor for all four variables. Thus, a combined cluster of four variables was formed, explaining 49.52% of variance and resulting in a reliability factor of Cronbach’s alpha of 0.649, as shown in Table 16-2.
### Table 16-3: Cooperation & Sense of Community – Bivariate Correlations

The second set of two constructs that were assumed to be related were trust and care. In the case of trust, the three variables predictability, dependability, and faith met the criteria for the Exploratory Factor Analysis. In the case of care, the two variables seizing and bestowing met the criteria for the Exploratory Factor Analysis.

Table 16-4 presents the bivariate correlations between these five variables of the trust and care construct. Of a total of ten correlations, four are (highly) significant and correlate highly with values ranging between 0.224 and 0.480. Two of the four highly significant correlations refer to correlations between the two constructs. The two variables of the construct care did not correlate to a high degree and were not significant.

Based on these results, the decision was made to rerun the Exploratory Factor Analysis for a combination of the two clusters, leading to an output of two factors with a combination of trust and care variables as the first factor. Based on the previously outlined criteria for unidimensionality, the final common construct was thus accepted as comprising the two trust variables dependability and faith, and the single care variable bestowing, altogether explaining 58.20% of variance and resulting in a reliability factor of Cronbach’s alpha of 0.639, as shown in Table 16-2.

<table>
<thead>
<tr>
<th>Item</th>
<th>Cooperation – Homogeneity</th>
<th>Cooperation – Co-operation</th>
<th>Sense of Community – Feeling As Member</th>
<th>Sense of Community – Social Harmony</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooperation – Homogeneity</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperation – Cooperation</td>
<td>0.450**</td>
<td>0.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sense of Community – Feeling As Member</td>
<td>0.172*</td>
<td>0.286**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Sense of Community – Social Harmony</td>
<td>0.265**</td>
<td>0.336**</td>
<td>0.444**</td>
<td>1</td>
</tr>
</tbody>
</table>

N=192

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).
<table>
<thead>
<tr>
<th>Item (Pearson Correlation, Sig. (2-tailed))</th>
<th>Trust – Predictability</th>
<th>Trust – Dependability</th>
<th>Trust – Faith</th>
<th>Care – Seizing (reversely recoded)</th>
<th>Care – Bestowing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trust – Predictability</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trust – Dependability</td>
<td>0.224**</td>
<td>0.002</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trust – Faith</td>
<td>0.124</td>
<td>0.480**</td>
<td>0.000</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Care – Seizing (reversely recoded)</td>
<td>–0.060</td>
<td>0.053</td>
<td>0.108</td>
<td>0.135</td>
<td>1</td>
</tr>
<tr>
<td>Care – Bestowing</td>
<td>0.130</td>
<td>0.262**</td>
<td>0.366**</td>
<td>0.138</td>
<td>0.056</td>
</tr>
</tbody>
</table>

N=192
** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Table 16-4: Trust & Care – Bivariate Correlations

16.2 Unidimensionality – Confirmatory Factor Analysis

Table 16-5 presents the results of the Confirmatory Factor Analysis. The correlation matrix was calculated based on construct Factor Analysis Scores (FAC) scores with all variables being z-standardized. Intercorrelations among individual model variables are presented in Table 21-10 of the following analysis and results part of the thesis – Part IV.

Confirmatory factor analysis suggests that no multicollinearity exists between constructs. Of the total of 28 correlations, 12 are non-significant. Of those that are significant, 9 have a correlation below 0.30, and 6 have a correlation between 0.30 and 0.42. Confirmatory Factor Analysis suggests that only one significant and high correlation exists (0.55 between cooperation / sense of community and trust / care); all others are either non-significant or have a low correlation.
<table>
<thead>
<tr>
<th>Item (Pearson Correlation, Sig. (2-tailed))</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Quality (2 Vars.) [A]</td>
<td>(0.527)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Content Quality (1 Var.) [B]</td>
<td>0.25**</td>
<td>(1.00)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coop. &amp; S. o. C (4 Vars.) [C]</td>
<td>0.21**</td>
<td>0.39**</td>
<td>(0.649)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trust &amp; Care (3 Vars.) [D]</td>
<td>0.25**</td>
<td>0.40**</td>
<td>0.55**</td>
<td>(0.639)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experience (1 Var.) [E]</td>
<td>0.03</td>
<td>−0.07</td>
<td>0.04</td>
<td>−0.04</td>
<td>(1.00)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PA Motivation (2 Vars.) [F]</td>
<td>0.07</td>
<td>0.35</td>
<td>0.26**</td>
<td>0.20*</td>
<td>−0.07</td>
<td>(0.645)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA Motivation (2 Vars.) [G]</td>
<td>0.26**</td>
<td>0.31**</td>
<td>0.42**</td>
<td>0.35**</td>
<td>−0.04</td>
<td>0.14*</td>
<td>(0.717)</td>
<td></td>
</tr>
<tr>
<td>RKPC (2 Vars.) [H]</td>
<td>0.06</td>
<td>0.26**</td>
<td>0.03</td>
<td>0.05</td>
<td>0.03</td>
<td>−0.34**</td>
<td>0.17*</td>
<td>(0.902)</td>
</tr>
</tbody>
</table>

N = 192.

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).
Construct FAC-Scores – Bivariate Correlations.
Cronbach’s alpha reliabilities appear on the diagonal for multiple-item measures.

### 16.3 Construct Reliability – Reliability Analysis

Once unidimensionality has been established through Exploratory and Confirmatory Factor Analysis, the reliability of the preliminary scales can be analyzed. As Gerbing and Anderson (Gerbing & Anderson, 1988, p. 191) note: “Even a perfectly unidimensional scale will not be useful in practice if the resultant scale score has unacceptably low reliability.”

Reliability can be distinguished in three types: stability, equivalence, and consistency (also referred to as stability and equivalence). Of these, only the coefficient of equivalence can be estimated at any one time (Gerbing & Anderson, 1988) and is thus the only one applicable to this study. Cronbach’s Alpha coefficient (Cronbach, 1951), which is based on the average inter-item correlation of the items, is applied in the following, as it
is widely accepted and the most commonly applied coefficient of equivalence. Alternatively, equivalence could be measured by the Kuder Richardson (KR) Formula or the Split-half Reliability coefficient (Yu, 2001).

The acceptable lower boundary of Cronbach’s Alpha that determines the reliability of a factor is commonly agreed to be 0,50 to 0,70. As Yu (2001) observes, there is no commonly agreed cut-off. Nunnally (1978, as quoted in Yu, 2001) suggests an alpha coefficient of 0,70 or higher as an acceptable level of internal consistency. A level of 0,60 is considered acceptable by Shields and Young (1993) and Black and Porter (1996, as quoted in Antony & Fergusson, 2004). Nunnally (1967, as quoted in Kwong & Lee, 2002) argues that in the early stages of research within a new field, Cronbach’s Alpha reliabilities of 0,50 to 0,60 are sufficient.

As can be seen in Table 16-2, all constructs meet the requirement of Alpha loadings of 0,50 to 0,70.

It is common practice to use reliability analysis to exclude items from scales if they bear a negative influence on the Alpha value of that scale. However, in the given study, the reliability analysis did not suggest changes to the scales as derived through the unidimensionality analysis discussed previously.

As far as the items with the Alpha-scores at the lower bound of the minimal recommended range are concerned, it must be considered that Cronbach’s Alpha statistic is dependent on the number of items in a measure (Yu, 2001). Therefore, the lower internal consistency that was observed for some items (with Alpha scores of about 0,50) are not necessarily due to low homogeneity of variances among items and thus poor reliability, but may be due to the small number of items in their scales. Second, Nunnally’s (1967, as quoted in Kwong & Lee, 2002) argument regarding lower bounds of Alpha in the early stages of research within a new field should be considered.
17 MEASURES – OVERVIEW

The literature review presented in Part II provided information about potential scales and measures used in the literature. These scales and measures derived from the literature informed the generation of the initial constructs and the a priori assignment of items to measure those constructs, which were then slightly adjusted through the scale development procedure that is outlined in Chapter 16.

The two tables presented in this chapter – Table 17-1 and Table 17-2 – provide an overview of the latent and manifest variables, and the item wording within the questionnaire of the items and scales that were selected to measure the constructs derived. Detailed descriptive data are presented in Chapter 21, Part IV, of the following analysis and results part of the thesis.
Relative Knowledge Process Contribution (Chapter 15)

<table>
<thead>
<tr>
<th>Construct (Latent Variable) with Cronbach’s Alpha and Items (Manifest Variables)</th>
<th>Item Wording</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Processes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relative Knowledge Process Contribution (0.902)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cluster 1: System Aspects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service Quality (0.527)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Usability</td>
<td>The IUB forums in general have a high degree of usability (i.e., are effective and efficient, and provide a high degree of satisfaction with which a user can achieve tasks).</td>
<td>0.3620</td>
<td>0.4466</td>
</tr>
<tr>
<td>Learnability</td>
<td>The IUB forums in general have a high degree of learnability (i.e., are usable without documentation, provide task-oriented help).</td>
<td>0.4870</td>
<td>0.3669</td>
</tr>
</tbody>
</table>

N=192. Knowledge Creation and Knowledge Transfer were measured on and scaled according to the indirectly derived Knowledge Creation / Knowledge Transfer scales, anchored between –1 and +1.

Table 17-1: Constructs and Items for Relative Knowledge Process Contribution
### Cluster 2: Content Aspects

<table>
<thead>
<tr>
<th>Perceived Quality of Content (–)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Quality of Content</td>
<td>This forum category provides content of high quality.</td>
</tr>
</tbody>
</table>

### Cluster 3: Social Aspects

<table>
<thead>
<tr>
<th>Cooperation &amp; Sense of Community (0.649)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Feeling as Member</td>
<td>Within this forum category I feel as a member of a community (i.e., as a member of a group).</td>
</tr>
<tr>
<td>Social Harmony</td>
<td>The degree of social harmony within this forum category is high.</td>
</tr>
<tr>
<td>Homogeneity</td>
<td>The interests of the participants of this forum category are homogeneous.</td>
</tr>
<tr>
<td>Cooperation</td>
<td>The degree of cooperation between the members of this forum category is very high.</td>
</tr>
</tbody>
</table>

#### Trust & Care (0.639)

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bestowing</td>
<td>The communication within this forum category is characterized by an attitude of bestowing (i.e., an attitude of helping others by sharing insights).</td>
</tr>
<tr>
<td>Dependability</td>
<td>The members of this forum category are dependable (i.e., they can be relied on when it counts; they are honest, reliable, and benevolent).</td>
</tr>
<tr>
<td>Faith</td>
<td>The members of this forum category are willing to maintain a good relationship (i.e., they are responsive and care towards another; you feel secure that they will continue to be responsive and caring).</td>
</tr>
</tbody>
</table>

### Cluster 4: User Aspects

<table>
<thead>
<tr>
<th>Experience (–)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Experience</td>
<td>Please select the frequency with which you are using complex websites like auction websites, shopping websites, complex websites.</td>
</tr>
</tbody>
</table>

[continued]
Social Affiliation Motivation (0.645)

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Description</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>New People</td>
<td>One of my reasons for participation in this forum category is to meet new and different people.</td>
<td>−0.2656 0.6008</td>
</tr>
<tr>
<td>Belonging</td>
<td>One of my reasons for participation in this forum category is to gain a feeling of belonging.</td>
<td>−0.3125 0.5593</td>
</tr>
</tbody>
</table>

Professional Affiliation Motivation (0.717)

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Description</th>
<th>Correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exchange</td>
<td>One of my reasons for participation in this forum category is to exchange advice and solutions for my studies / research / work with knowledgeable members of the forum community.</td>
<td>0.2083 0.5974</td>
</tr>
<tr>
<td>Abreast</td>
<td>One of my reasons for participation in this forum category is to keep abreast of new ideas and innovations for my studies / research / work.</td>
<td>−0.0078 0.5889</td>
</tr>
</tbody>
</table>

N=192.

All input factors, except Experience (which was measured on a 1-5 frequency scale anchored between “Seldom, once or twice a year” to “Frequently, daily”), were measured on a 5-point Likert scale (−1; −0.5; 0; +0.5; +1) anchored between “strongly disagree” to “strongly agree.”

Table 17-2: Constructs and Items for Input Factors
18 SUMMARY AND OVERVIEW

Based on the literature review and hypotheses development of Part II, this part presented the empirical study in general and the research methodology of the given research in particular. It presented the sample and data collection procedures and methodologies and expanded on the research design of the empirical study.

Due to the relevance of the indirect measurement method, for didactic purposes Chapter 15 presented and discussed (and thus anticipated from the following analysis and results part of the thesis, Part IV) results relating to the indirect measurement of knowledge process contribution.

The final chapters of this part expanded on the identification of indicators on the basis of the theoretical work presented in the previous Part II of the thesis.

Before moving on to the analysis and results, Part IV, this part will end with Table 18-1 as a brief reminder and summary of the hypothesized relationships among latent variables outlined in detail in Table 11-1 and Table 11-2, Part II.

As can be seen from the table, in comparison to Table 11-2, Part II, only the construct Social Navigation is no longer included, as social navigation only covers hypotheses relating to the frequency of contribution. All other constructs are still included as they address either an hypothesized direct or indirect RKPC effect. As in Table 11-2, Part II, the only construct with a negatively directed hypothesis is the construct Social Affiliation Motivation.
### Table 18-1: Input Factors: Hypothesized Relationships Among Latent Variables

<table>
<thead>
<tr>
<th>Construct</th>
<th>Hypothesis</th>
</tr>
</thead>
<tbody>
<tr>
<td>KP-Contributions (Type of Content - Knowledge Effect Link)</td>
<td>+ (HTOC-KP1)</td>
</tr>
<tr>
<td>Perceived Service Quality</td>
<td>+ (Hindirect KP1)</td>
</tr>
<tr>
<td>Perceived Quality of Content</td>
<td>+ (HKP1)</td>
</tr>
<tr>
<td>Cooperation &amp; Sense of Community</td>
<td>+ (HKP2)</td>
</tr>
<tr>
<td></td>
<td>+ (HKP3)</td>
</tr>
<tr>
<td>Trust &amp; Care</td>
<td>+ (HKP4)</td>
</tr>
<tr>
<td></td>
<td>+ (HKP5)</td>
</tr>
<tr>
<td></td>
<td>+ (Hindirect KP3)</td>
</tr>
<tr>
<td></td>
<td>+ (Hindirect KP4)</td>
</tr>
<tr>
<td>Experience with Complex Websites</td>
<td>+ (HKP6)</td>
</tr>
<tr>
<td>Social Affiliation Motivation</td>
<td>- (HKP7)</td>
</tr>
<tr>
<td>Professional Affiliation Motivation</td>
<td>+ (HKP8)</td>
</tr>
</tbody>
</table>

1. **ToC-KP**: Hypothesis on Type-of-Content-based knowledge process derivation.
2. **KP**: Hypothesis on direct RKPC effects.
3. **indirect KP**: Hypothesis on indirect RKPC effects:
   - \( H_{\text{indirect KP}1} \): Perceived Service Quality \( \rightarrow \) Perceived Quality of Content
   - \( H_{\text{indirect KP}3} \): Trust \( \rightarrow \) Cooperation
   - \( H_{\text{indirect KP}4} \): Care \( \rightarrow \) Cooperation
4. The second hypothesized indirect effect \( H_{\text{indirect KP}2} \): Trust \( \rightarrow \) Care, predicting higher degrees of care for higher degrees of trust, cannot be tested since trust and care have been combined in a common construct.
IV. ANALYSIS AND RESULTS
19 INTRODUCTION

This part of the thesis presents the results of the descriptive data analysis and the Structural Equation Modeling (SEM) analysis. As outlined in the introduction and background part of the thesis – Part I – the SEM analysis represents the second major empirical component of the research in addition to the test of the indirect method for measuring individual actor’s knowledge process contributions, outlined in Chapter 15, Part III.

The first chapter of this part – Chapter 20 – presents descriptive statistics and analysis of the forum log-file data. This is followed by an outline of correlations and descriptive statistics of the questionnaire data in Chapter 21. Finally, the structural equation modeling analysis is presented in Chapter 22.

Descriptive data analyses, outlined in Chapter 20 and Chapter 21, were conducted using SPSS® (Statistical Package for Social Sciences), Release 12.0 (SPSS Inc., 1989-2003) and EXCEL®, Release 2000 (Microsoft Corp., 1985-1999). Frequencies, descriptive statistics, and distributions were examined for all variables, both at the aggregate level and separated into usergroups, forum categories, and types of content.

AMOS® (Analysis of MOment Structures), Release 5.0 (Arbuckle, 1994-2003) was used for the structural equation modeling analysis, outlined in Chapter 22.
Prior to carrying out the survey, the log-file data of the IUB online forum were analyzed to gain an understanding of the IUB forum community and its underlying communication structure. The log-file analysis also presents the foundation of the forum category control variable, as outlined in Section 13.2, Part III.

Initially, log-file data were also planned to complement questionnaire data and to be incorporated into the final Structural Equation Modeling (SEM) analysis. However, as argued in Chapter 14, Part III, contrary to these initial considerations, all variables were finally measured through the questionnaire.

In addition to depicting the foundation of the forum category control variable, the log-file data analysis complements the data of the online survey through descriptive statistics, summarized in this chapter (Chapter 20), with the purpose of providing an overview of user properties and content structure of the IUB online forum.

The IUB forums are based on the vBulletin software (Jelsoft Enterprises Limited, 2000-2005), a scaleable, customizable, and database-driven bulletin board system, written in PHP, an open-source scripting language, and driven by MySQL, an open-source database server. The log-file data were analyzed using EXCEL®, Release 2000 (Microsoft Corp., 1985-1999).

The IUB forums were implemented on 18th September 2001. The log-file analysis is based on the log-files from 22nd September 2004, 3 years after the initiation of the IUB online forums. Table 20-1 presents the total number of posts for each month of this 3-year period. The figures clearly show the drop in the number of postings during the summer and winter breaks, around June and January, respectively.
### Table 20-1: Total Posts per Month ‘09/2001 – ‘09/2004

As can be seen in Table 20-1, the total number of posts has steadily increased since the initiation of the forum. In each year, the total number of posts per month drops during the term breaks, that is, in June/July and January of each year. A number that stands out in the table is the 2,962 messages posted in July 2004. These can be broken down along the forum categories, with 2,152 posts posted to the Public Forum and 810 posted to the other forum categories (College Forums, Student Forums, Course Forums, and General Forums; including 19 posts from the Excluded Forums). Some further data mining reveals the individual forums behind the large number of posts. In the given case, 1,199 posts of the 2,152 messages were posted to the “Incoming Students” forum, 513 to the “Country Forum” and 440 to the “IUB Blackboard” forum. The largest individual thread within the “Incoming Students” forum was the thread “Pics of Incoming Students”, which alone attracted 366 posts of the total of 2,962 messages posted in July 2004.

#### 20.1 Analysis of Usergroup / Account Status Data

As of 22nd September 2005, 2,108 accounts have been set up within the IUB online forum. The owners of these 2,108 accounts can be distinguished among 1,082 active account holders, 893 passive account holders, and 133 non-users (i.e., accounts that were...
never used to log on to the forum). Thus, the total number of active and passive account holders is 1,975.

In addition to subdividing these data along the various usergroups, Table 20-2 provides an overview of the average length of membership in month, which is quite different between groups of active and passive users. While the average length of membership for active users is 17,07 month, the average length of membership of passive users is 10,48 month, about the same as the average length of membership of non-users, whose average length of membership is 10,89 month.

<table>
<thead>
<tr>
<th>Usergroup (as applied in Questionnaire)</th>
<th>Staff &amp; Faculty</th>
<th>Students &amp; Alumni</th>
<th>Registered Guests</th>
<th>Excluded Users</th>
<th>Total (Avg.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Number of Posts (and Share of Active &amp; Passive Users) [and avg. Number of Month of Membership]</td>
<td>Account Holders</td>
<td>208</td>
<td>975</td>
<td>763</td>
<td>162</td>
</tr>
<tr>
<td></td>
<td>Active &amp; Passive Users</td>
<td>193</td>
<td>950</td>
<td>707</td>
<td>125</td>
</tr>
<tr>
<td></td>
<td>Active Users</td>
<td>111</td>
<td>(57,51%)</td>
<td>628</td>
<td>(66,11%)</td>
</tr>
<tr>
<td></td>
<td>[21,20 Mt.]</td>
<td>[18,58 Mt.]</td>
<td>[12,61 Mt.]</td>
<td>[27,63 Mt.]</td>
<td>[17,07 Mt.]</td>
</tr>
<tr>
<td></td>
<td>Passive Users</td>
<td>82</td>
<td>(42,49%)</td>
<td>322</td>
<td>(33,89%)</td>
</tr>
<tr>
<td></td>
<td>[19,91 Mt.]</td>
<td>[5,42 Mt.]</td>
<td>[12,23 Mt.]</td>
<td>[12,21 Mt.]</td>
<td>[10,48 Mt.]</td>
</tr>
<tr>
<td></td>
<td>Non-Users</td>
<td>15</td>
<td>-</td>
<td>25</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>[12,20 Mt.]</td>
<td>[12,00 Mt.]</td>
<td>[11,39 Mt.]</td>
<td>[8,84 Mt.]</td>
<td>[10,89 Mt.]</td>
</tr>
</tbody>
</table>

Table 20-2: Matrix Usergroup / Account Status – Descriptive Data

Table 20-3 presents a more detailed analysis of the number of month of membership (i.e., the number of months between the join-date and the log-file analysis). While 93,39% of those account holders with a membership of more than 36 months are active users, only 30,19% of those account holders with a membership of 1 month are active users. As can be seen from the table, the degree of activity increases steadily with the length of membership.
Table 20-3: Length of Membership – Overall Distribution

Another interesting phenomenon can be observed when measuring the number of active users who fall within a specified range of the average number of postings per month per account holder. As can be seen in Table 20-4, the number of users who fall within a specified range of the average number of postings per month per account holder steadily decreases from 425 active users posting on average up to 0.5 postings per month; over 152 active users posting on average between 1.0 and 1.5 postings per month; to 44 active users posting on average between 3.0 and 3.5 postings per month. Interestingly, the number of users posting on average more than 4.0 postings per month increases to 143, suggesting that a relatively large core group of strong posters exists among the IUB forum community.

Table 20-4: Number of Postings per Month per Account Holder
20.2 Posts and Views by Forum Categories

Within the three years of its existence, 751 individual forums were set up in the IUB online forum. These individual forums contain 6,387 threads, with an average age of 12.28 months each. In total, 33,367 posts (i.e., thread-initiating messages and replies to them) were posted in the IUB online forum. Of these, 33,244 posts are attributable to existing user accounts, while the log-files contain 123 un-attributable posts (i.e., posts with a dummy user-ID.) On average, each post was viewed 46.24 times.

Besides these data, Table 20-5 presents an overview of posts, threads, forums, the average age of threads in month, and the number of views per post. All of these data are provided individually for each forum category, indicating the distinct structure of the forum categories. While the Public Forums category covers more (9,675) messages than the Course Forums category (8,214), within the prior these messages are distributed along 3 forums and 451 threads, as opposed to 682 forums and 4,349 threads in case of the latter.

As these figures indicate, in terms of their distribution along forums and threads the Course Forums category clearly stands out, as the five remaining forum categories have a much more equal ratio of message, forums, and threads. One reason for the Course Forums category having so many forums is that each course taught at IUB has, at the beginning of each term, an individual course forum set up automatically, independent of whether this forum is actually needed for the course or not.

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of Posts</th>
<th>Number of Threads</th>
<th>Number of Forums</th>
<th>Avg. Age of Threads in Month</th>
<th>Number of Views per Post</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td>5,809</td>
<td>353</td>
<td>5</td>
<td>28.9</td>
<td>32.1</td>
</tr>
<tr>
<td>Student Forums</td>
<td>5,433</td>
<td>422</td>
<td>17</td>
<td>15.0</td>
<td>37.7</td>
</tr>
<tr>
<td>Course Forums</td>
<td>8,214</td>
<td>4,349</td>
<td>682</td>
<td>9.7</td>
<td>52.2</td>
</tr>
<tr>
<td>Public Forums</td>
<td>9,675</td>
<td>451</td>
<td>3</td>
<td>9.0</td>
<td>39.3</td>
</tr>
<tr>
<td>General Forums</td>
<td>2,930</td>
<td>457</td>
<td>14</td>
<td>15.7</td>
<td>33.1</td>
</tr>
<tr>
<td>Other [Excluded]</td>
<td>1,306</td>
<td>355</td>
<td>30</td>
<td>23.3</td>
<td>23.3</td>
</tr>
<tr>
<td><strong>Total (Average)</strong></td>
<td><strong>33,367</strong></td>
<td><strong>6,387</strong></td>
<td><strong>751</strong></td>
<td>(12,28)</td>
<td>(46,24)</td>
</tr>
</tbody>
</table>

Table 20-5: Posts and Views by Forum Categories
20.3 Distribution of Active Forum Category Sets

As previously mentioned, there are 1,082 active account holders. Each of these users has actively contributed to at least one forum category. Table 20-6 presents the distribution of active members along the number of active forum category sets, with a surprising result. While the number of account holders with three to six active forum category sets is relatively constant (with an average of 73 users per category along these four categories), the number of account holders with two active forum category sets is about twice as large, covering 127 account holders in total. The number of account holders with only one active forum category set is even nine times as large, covering 662 account holders in total.

This suggests that a large group of one-time users exists, whose members post few messages and restrict their activity to only a few individual forums covering a specific context (i.e., a forum category). This interpretation is consistent with and supported by the number of postings per month per account holder presented in Table 20-4: specifically the large group of 425 of the 1,082 active account holders (39.28%) posting between 0–0.5 posts per user per month of membership.

<table>
<thead>
<tr>
<th>Number of Active Forum Category Sets (i.e., ≥ Posts per Forum Category)</th>
<th>Number of Users with the Specified Number of Active Forum Category Sets</th>
<th>in % of Active Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>User with 1 active FC-Set</td>
<td>662</td>
<td>61.18%</td>
</tr>
<tr>
<td>User with 2 active FC-Sets</td>
<td>127</td>
<td>11.74%</td>
</tr>
<tr>
<td>User with 3 active FC-Sets</td>
<td>94</td>
<td>8.69%</td>
</tr>
<tr>
<td>User with 4 active FC-Sets</td>
<td>(Average along these four groups: 73.25) 59</td>
<td>(Average along these four groups: 6.77%) 7.58%</td>
</tr>
<tr>
<td>User with 5 active FC-Sets</td>
<td>82</td>
<td>7.58%</td>
</tr>
<tr>
<td>User with 6 active FC-Sets (i.e., including excluded “Other” FC-Sets)</td>
<td>58</td>
<td>5.36%</td>
</tr>
</tbody>
</table>

**Total Number of Users with active Sets**  
1,082  
100.00%

Table 20-6: Number of Users with Active Forum Category Sets
20.4 Matrix Data – Usergroup / Forum Categories

Table 20-7 presents the total number of posts per forum category as posted by individual usergroups, along with the average number of posts per active user per month of membership. Overall, the students / alumni usergroup contributed 25,860 of the total 33,367 messages (77.50%). The second largest contributing group, staff and faculty, posted 4,044 messages (12.11%). As can be seen in the table, the distribution of posts along individual forum categories between groups is quite different, even though their access rights along the forum categories are the same. While staff and faculty group members post 3,265 of their 4,044 messages in the course forum category (80.73%), students and alumni group members post about equally to each forum category (excluding the “Other” forum category). In total, registered guests posted 3,303 messages (9.89%), of which 3,277 (9.82%) were posted to the public forum, as access rights restrict most registered guests to this forum category.

The average number of posts per active user per month of membership is 2.03 posts per month, with a standard deviation of 4.27. The average number of posts per active user per month of membership is relatively constant along usergroups, ranging from 1.75 for registered guests to 2.20 for students and alumni (excluding the usergroup of excluded users). Interestingly, however, the standard deviation of staff and faculty group members is much lower (2.71) than the standard deviation of students and alumni group members (4.74) and registered guests (3.78), suggesting that staff and faculty group members contribute to the forum much more constantly per month of membership than do these two groups.
### Table 20-7: Matrix Data – Usergroup / Forum Categories

<table>
<thead>
<tr>
<th>Usergroup (as applied in Questionnaire)</th>
<th>Staff &amp; Faculty</th>
<th>Students &amp; Alumni</th>
<th>Registered Guests</th>
<th>Excluded Users</th>
<th>Total / Avg.</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td>107 (0,32%)</td>
<td>5.641 (16,90%)</td>
<td>0</td>
<td>61 (0,18%)</td>
<td>5.809 (17,40%)</td>
</tr>
<tr>
<td>Student Forums</td>
<td>28 (0,08%)</td>
<td>5.404 (16,19%)</td>
<td>0</td>
<td>1 (0,00%)</td>
<td>5.433 (16,28%)</td>
</tr>
<tr>
<td>Course Forums</td>
<td>3.265 (9,78%)</td>
<td>4.945 (14,82%)</td>
<td>4</td>
<td>0 (0%)</td>
<td>8.214 (24,61%)</td>
</tr>
<tr>
<td>Public Forums</td>
<td>87 (0,26%)</td>
<td>6.234 (18,68%)</td>
<td>3.277</td>
<td>77 (0,23%)</td>
<td>9.675 (28,99%)</td>
</tr>
<tr>
<td>General Forums</td>
<td>245 (0,73%)</td>
<td>2.654 (7,95%)</td>
<td>21</td>
<td>10 (0,02%)</td>
<td>2.930 (8,78%)</td>
</tr>
<tr>
<td>Other [Excluded]</td>
<td>312 (0,93%)</td>
<td>982 (2,94%)</td>
<td>1</td>
<td>11 (0,03%)</td>
<td>1.306 (3,91%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4.044 (12,11%)</strong></td>
<td><strong>25.860 (77,50%)</strong></td>
<td><strong>3.303 (9,89%)</strong></td>
<td><strong>160 (0,47%)</strong></td>
<td><strong>33.367 (100%)</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Average Number of Posts per User per Month of Membership</th>
<th>College Forums</th>
<th>Student Forums</th>
<th>Course Forums</th>
<th>Public Forums</th>
<th>General Forums</th>
<th>Other [Excluded]</th>
<th>Total (Std. Dev.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0,03</td>
<td>0,33</td>
<td>0,00</td>
<td>0,20</td>
<td>0,00</td>
<td>0,04</td>
<td><strong>2,04 (2,71)</strong></td>
</tr>
<tr>
<td></td>
<td>0,01</td>
<td>0,41</td>
<td>0,00</td>
<td>0,00</td>
<td>0,00</td>
<td>0,04</td>
<td><strong>2,20 (4,74)</strong></td>
</tr>
<tr>
<td></td>
<td>1,84</td>
<td>0,73</td>
<td>0,01</td>
<td>0,00</td>
<td>0,35</td>
<td>0,19</td>
<td><strong>1,75 (3,78)</strong></td>
</tr>
<tr>
<td></td>
<td>0,02</td>
<td>0,50</td>
<td>1,73</td>
<td>0,35</td>
<td>0,03</td>
<td>0,04</td>
<td><strong>0,62 (1,03)</strong></td>
</tr>
<tr>
<td></td>
<td>0,06</td>
<td>0,19</td>
<td>0,00</td>
<td>0,04</td>
<td>0,03</td>
<td>0,04</td>
<td><strong>0,03 (4,27)</strong></td>
</tr>
</tbody>
</table>

Table 20-7: Matrix Data – Usergroup / Forum Categories
21 DESCRIPTIVE STATISTICS AND CORRELATIONS – QUESTIONNAIRE DATA

After the survey had been carried out, and following the drawing of the random samples as outlined in Section 13.5, Part III, descriptive data from the survey were analyzed to gain an understanding of the various groups of participants, the responses with regard to selected model variables, and those variables making up the final scales and measures as outlined in Chapter 16, Part III.

This chapter (Chapter 21) first outlines the demographics of all 330 participants of the online survey, including the participants’ usergroup-structure and their age and gender structure.

Next, the two random sub-samples of 297 active and passive data sets and 192 active data sets are compared to the main sample of 827 complete forum category data sets adhering to the minimum frequency requirement (as outlined in Chapter 13, Part III), with respect to the variables usergroup, forum category, and type of content.

The two final sections of this chapter focus on the 192 active data sets and the variables identified in Chapter 16, Part III, with respect to further processing in the SEM analysis. Following an outline of the descriptive statistics of all model variables of interest, the correlations of all model variables of interest are presented.

21.1 Respondents Demographics – 330 Participants

This section provides an overview of respondent demographics, including the distribution along usergroups, the age and gender structure among participants, all focused on the total number of participants and thus without consideration for the minimum frequency requirement of the data sets submitted by the participants, as outlined in Chapter 13, Part III.
As can be seen in Table 21-1, 257 of the total 330 participants who submitted a complete questionnaire (78%) classified themselves as belonging to the students and alumni usergroup. The staff and faculty usergroup represents the second largest group of participants, with 41 participants (12.42%) classifying themselves as belonging to this usergroup. The remaining 32 participants (9.70%) classified themselves as belonging to the guest status usergroup.

As mentioned in Section 13.4, Part III, at this point some minor inconsistencies come to light, when comparing participants’ own classification of their user status in the questionnaire to the log-file-based usergroup assignment (used for the group-specific invitation emails) tracked by the panel-software.

Prior to sending out the invitation emails, three usergroups were specified on the basis of the log-file data to allow for the usage of group-specific invitation emails. The panel-software tracks the overall status of the questionnaires on an accumulated and anonymous basis. According to the accumulated, anonymous response data per usergroup as derived by the panel software, 230 students / alumni usergroup members, 35 staff / faculty members, 61 guest account holders, and 4 unknown status account holders completed the questionnaire. However, the self-assessment of their usergroup status by the participants revealed the previously mentioned 257 students / alumni usergroup members (plus 27 participants, or 12%), 41 staff / faculty members (plus 6 participants, or 17%), and 32 guest account holders (minus 29 participants, or 48%).

It is argued that this difference is due largely to the three-year-long period of accumulation of accounts. Obviously the large number of accounts does not allow the status of individual accounts to be tracked individually. Thus, when a guest-account holder “transfers” to a new status by becoming a student of IUB (the most likely “status transfer” to occur) and still uses her / his previous email address to access the forum, this change of status does not show up in the statistics of the log-file data (unless the user explicitly asks for a status-change for her / his previous email address). This would explain the apparent and comparatively large “shift” in the number of guest account-status holders (61 log-file / panel-software-based accounts vs. 32 self-classification-based accounts; i.e., minus 29 accounts) to the number of student / alumni status holders (230 log-file / panel-software-based accounts vs. 257 self-classification-based accounts; i.e., plus 27 accounts).
Table 21-1: Usergroup-Structure of Participants

As can be seen in Table 21-2, corresponding to the large students and alumni user-group, the age structure of the participants is strongest in the range from 20 to 25 years, representing 171 of the 330 participants (51.82%), with the age range of up to 30 years representing an accumulated 291 of the 330 participants (88.18%).

Table 21-2: Age-Structure of Participants

The gender-structure of the 330 participants is balanced, with 163 female participants (49.39%) and 167 male participants (50.60%). However, compared to the current gender ratio of International University Bremen, with 42.30% female students to 57.70% male students (as of Sept. 2005), relatively more female students participated in the survey.

21.2 Sample and Random Sub-Samples – 827 vs. 297 vs. 192 Data Sets

As outlined in Section 13.5, Part III, to adhere to requirements of independence, two random sub-samples of forum category data sets were drawn from the total of 827 complete forum category data sets adhering to the minimum frequency-requirement.

While for the ANOVA analysis of the knowledge process derivation calculation (outlined in Chapter 15, Part III) one data set meeting the minimum-frequency requirement
was randomly drawn per participant, leading to 297 data sets for the ANOVA analysis, for the Structural Equation Modeling analysis (outlined in Chapter 22) one set of the active, completed sets meeting the minimum-frequency requirement was randomly drawn per participant, leading to 192 data sets for the SEM analysis.

This section compares the main sample of 827 data sets to the two random sub-samples of 297 and 192 data sets. It focuses on the three variables of usergroup, forum category, and types of content, to provide an impression of the underlying structure of these variables. The data are mainly provided for descriptive purposes: For both the ANOVA and the SEM analysis (1) the usergroups are not considered in either analysis and (2) the forum categories are either considered only as a random factor (in case of the ANOVA analysis) or neglected (in case of the SEM analysis); more importantly (3) the types of content are used as an indirect derivation methodology through the ANOVA analysis to obtain knowledge process contribution values for each individual type of content for further processing in the SEM analysis, as outlined in Chapter 15, Part III.

Individual differences among the three sets of data (827 vs. 297 vs. 192 data sets) are not discussed. However, at this point it should be pointed out that the likelihood is comparatively high for students and alumni usergroup/course forum combinations to be drawn for the random sub-samples, since many students must use the course forum for their coursework. Thus, if a particular member of the students/alumni usergroup is participating (either actively or passively) in one forum category only, this is most likely to be the course forum category. Accordingly, this course forum data set would automatically be drawn for the ANOVA random sub-sample, and also – if it is an active set – for the SEM random sub-sample.

21.2.1 Distribution of Usergroups along Forum Categories

In total, of the 827 complete forum category data sets with view/post-frequencies above the lowest frequency category, 74 participants (24.9%) submitted one complete set; 68 participants (22.9%) submitted two; 60 participants (20.2%) submitted three; 38 participants (12.8%) submitted four; and 57 participants (19.2%) submitted the maximum of five complete forum category data sets. This added up to a total of 297 participants who submitted at least one data set with view/post-frequencies above the lowest frequency category.
The following three tables, Table 21-3 to Table 21-5, provide a detailed overview of the number of data sets submitted by the respective usergroups to the five forum categories. The numbers in the cells of each table represent the number of data sets submitted to a particular forum category by participants who assess themselves as belonging to a particular usergroup. Table 21-3 to Table 21-5 refer to the sample of 827 data sets and its two random sub-samples of 297 and 192 data sets, respectively.

<table>
<thead>
<tr>
<th>Data Sets</th>
<th>Students &amp; Alumni</th>
<th>Staff &amp; Faculty</th>
<th>Registered Guest</th>
<th>All Usergroups</th>
</tr>
</thead>
<tbody>
<tr>
<td>College</td>
<td>101</td>
<td>2</td>
<td>4</td>
<td>107</td>
</tr>
<tr>
<td></td>
<td>12,21%</td>
<td>0,24%</td>
<td>0,48%</td>
<td>12,94%</td>
</tr>
<tr>
<td>Student</td>
<td>128</td>
<td>5</td>
<td>5</td>
<td>138</td>
</tr>
<tr>
<td></td>
<td>15,48%</td>
<td>0,60%</td>
<td>0,60%</td>
<td>16,69%</td>
</tr>
<tr>
<td>Course</td>
<td>237</td>
<td>22</td>
<td>6</td>
<td>265</td>
</tr>
<tr>
<td></td>
<td>28,66%</td>
<td>2,66%</td>
<td>0,73%</td>
<td>32,04%</td>
</tr>
<tr>
<td>Public</td>
<td>148</td>
<td>22</td>
<td>17</td>
<td>175</td>
</tr>
<tr>
<td></td>
<td>17,90%</td>
<td>1,21%</td>
<td>2,06%</td>
<td>21,16%</td>
</tr>
<tr>
<td>General</td>
<td>128</td>
<td>11</td>
<td>3</td>
<td>142</td>
</tr>
<tr>
<td></td>
<td>15,48%</td>
<td>1,33%</td>
<td>0,36%</td>
<td>17,17%</td>
</tr>
<tr>
<td>Total</td>
<td>742</td>
<td>50</td>
<td>4</td>
<td>827</td>
</tr>
<tr>
<td></td>
<td>89,72%</td>
<td>6,05%</td>
<td>4,23%</td>
<td>100%</td>
</tr>
</tbody>
</table>

N=827: All complete 827 (active and passive) sets. The different number of forum category data sets submitted by individual participants is not considered in this table. Percent values: percent of total.

Table 21-3: Usergroup / Forum Category Crosstabulation – 827 Data Sets

<table>
<thead>
<tr>
<th>Data Sets</th>
<th>Students &amp; Alumni</th>
<th>Staff &amp; Faculty</th>
<th>Reg. Guest</th>
<th>All Usergroups</th>
</tr>
</thead>
<tbody>
<tr>
<td>College</td>
<td>27</td>
<td>1</td>
<td>1</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>9,09%</td>
<td>0,34%</td>
<td>0,34%</td>
<td>9,76%</td>
</tr>
<tr>
<td>Student</td>
<td>49</td>
<td>2</td>
<td>4</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>16,50%</td>
<td>0,67%</td>
<td>1,35%</td>
<td>18,52%</td>
</tr>
<tr>
<td>Course</td>
<td>89</td>
<td>18</td>
<td>4</td>
<td>111</td>
</tr>
<tr>
<td></td>
<td>29,97%</td>
<td>6,06%</td>
<td>1,35%</td>
<td>37,37%</td>
</tr>
<tr>
<td>Public</td>
<td>49</td>
<td>4</td>
<td>14</td>
<td>67</td>
</tr>
<tr>
<td></td>
<td>16,50%</td>
<td>1,35%</td>
<td>4,71%</td>
<td>22,56%</td>
</tr>
<tr>
<td>General</td>
<td>33</td>
<td>2</td>
<td>0</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>11,11%</td>
<td>0,67%</td>
<td>0,00%</td>
<td>11,78%</td>
</tr>
<tr>
<td>Total</td>
<td>247</td>
<td>27</td>
<td>23</td>
<td>297</td>
</tr>
<tr>
<td></td>
<td>83,16%</td>
<td>9,09%</td>
<td>7,74%</td>
<td>100%</td>
</tr>
</tbody>
</table>

N=297: One randomly selected complete (active or passive) set per participant. Percent values: percent of total.

Table 21-4: Usergroup / Forum Category Crosstabulation – 297 Data Sets

<table>
<thead>
<tr>
<th>Data Sets</th>
<th>Students &amp; Alumni</th>
<th>Staff &amp; Faculty</th>
<th>Registered Guest</th>
<th>All Usergroups</th>
</tr>
</thead>
<tbody>
<tr>
<td>College</td>
<td>11</td>
<td>1</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>5,73%</td>
<td>0,52%</td>
<td>0,00%</td>
<td>6,25%</td>
</tr>
<tr>
<td>Student</td>
<td>30</td>
<td>0</td>
<td>2</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>15,63%</td>
<td>0,00%</td>
<td>1,04%</td>
<td>16,67%</td>
</tr>
<tr>
<td>Course</td>
<td>71</td>
<td>20</td>
<td>5</td>
<td>96</td>
</tr>
<tr>
<td></td>
<td>36,98%</td>
<td>10,42%</td>
<td>2,60%</td>
<td>50,00%</td>
</tr>
<tr>
<td>Public</td>
<td>29</td>
<td>0</td>
<td>8</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>15,10%</td>
<td>0,00%</td>
<td>4,17%</td>
<td>19,27%</td>
</tr>
<tr>
<td>General</td>
<td>13</td>
<td>1</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>6,77%</td>
<td>0,52%</td>
<td>0,52%</td>
<td>7,81%</td>
</tr>
<tr>
<td>Total</td>
<td>154</td>
<td>22</td>
<td>16</td>
<td>192</td>
</tr>
<tr>
<td></td>
<td>80,21%</td>
<td>11,46%</td>
<td>8,33%</td>
<td>100%</td>
</tr>
</tbody>
</table>

N=192: One randomly selected complete, active set per participant. Percent values: percent of total.

Table 21-5: Usergroup / Forum Category Crosstabulation – 192 Data Sets
For each of the three (sub-)samples, the last column of the respective table provides a summary of the overall number of data sets submitted to each forum category by all user-groups.

As has already been pointed out, among the two sub-samples course forums are likely to be represented to a much higher degree compared to the main sample, since many students must use the course forum for their coursework. Accordingly, the likelihood of students and alumni usergroup / course forum combinations being drawn for the random sub-samples is comparatively high among participants who only actively or passively participated in one (or a few) forum category (categories). With the students and alumni group representing the largest usergroup, the likelihood is comparatively high of a course forum data set being drawn for the two random sub-samples; this explains the large increase in the course forum representation from 32% among the main sample to 37% and 50% among the two random sub-samples.

### 21.2.2 Perception of Types of Content along Forum Categories

This section provides an overview of the distribution of the perception of types of content along forum categories, that is, the total number of participants who attribute a data set referring to a particular forum category as mainly containing a particular type of content. Table 21-6 to Table 21-8 refer to the sample of 827 data sets and its two random sub-samples of 297 and 192 data sets, respectively.

<table>
<thead>
<tr>
<th>Data Sets</th>
<th>Chat entries</th>
<th>Statement / declaration entries</th>
<th>Information entries</th>
<th>Discussion entries</th>
<th>Question &amp; answer entries</th>
<th>All Types of Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>College</td>
<td>54</td>
<td>50%</td>
<td>10</td>
<td>9%</td>
<td>17</td>
<td>16%</td>
</tr>
<tr>
<td>Student</td>
<td>63</td>
<td>46%</td>
<td>15</td>
<td>11%</td>
<td>12</td>
<td>9%</td>
</tr>
<tr>
<td>Course</td>
<td>8</td>
<td>3%</td>
<td>11</td>
<td>4%</td>
<td>205</td>
<td>77%</td>
</tr>
<tr>
<td>Public</td>
<td>66</td>
<td>38%</td>
<td>9</td>
<td>5%</td>
<td>14</td>
<td>8%</td>
</tr>
<tr>
<td>General</td>
<td>38</td>
<td>27%</td>
<td>13</td>
<td>9%</td>
<td>32</td>
<td>23%</td>
</tr>
<tr>
<td>Total</td>
<td>229</td>
<td>28%</td>
<td>58</td>
<td>7%</td>
<td>280</td>
<td>34%</td>
</tr>
</tbody>
</table>

N=827: All complete 827 (active and passive) sets. The different number of forum category data sets submitted by individual participants is not considered in this table. Percent values: percent per Forum Category.

**Table 21-6: Types of Content / Forum Category Crosstabulation – 827 Sets**
Table 21-7: Types of Content / Forum Category Crosstabulation – 297 Sets

<table>
<thead>
<tr>
<th>Data Sets</th>
<th>Chat entries</th>
<th>Statement / declaration entries</th>
<th>Information entries</th>
<th>Discussion entries</th>
<th>Question &amp; answer entries</th>
<th>All Types of Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>College</td>
<td>17 59%</td>
<td>4 14%</td>
<td>3 10%</td>
<td>5 17%</td>
<td>0 0%</td>
<td>29</td>
</tr>
<tr>
<td>Student</td>
<td>28 51%</td>
<td>7 13%</td>
<td>3 5%</td>
<td>16 29%</td>
<td>1 2%</td>
<td>55</td>
</tr>
<tr>
<td>Course</td>
<td>6 5%</td>
<td>4 4%</td>
<td>82 74%</td>
<td>9 8%</td>
<td>10 9%</td>
<td>111</td>
</tr>
<tr>
<td>Public</td>
<td>22 33%</td>
<td>2 3%</td>
<td>7 10%</td>
<td>18 27%</td>
<td>18 27%</td>
<td>67</td>
</tr>
<tr>
<td>General</td>
<td>7 20%</td>
<td>4 11%</td>
<td>6 17%</td>
<td>17 49%</td>
<td>17 49%</td>
<td>35</td>
</tr>
<tr>
<td>Total</td>
<td>80 27%</td>
<td>21 7%</td>
<td>101 34%</td>
<td>60 20%</td>
<td>35 12%</td>
<td>297</td>
</tr>
</tbody>
</table>

N=297: One randomly selected complete (active or passive) set per participant. Percent values: percent per Forum Category.

Table 21-8: Types of Content / Forum Category Crosstabulation – 192 Sets

<table>
<thead>
<tr>
<th>Data Sets</th>
<th>Chat entries</th>
<th>Statement / declaration entries</th>
<th>Information entries</th>
<th>Discussion entries</th>
<th>Question &amp; answer entries</th>
<th>All Types of Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>College</td>
<td>8 67%</td>
<td>1 8%</td>
<td>2 17%</td>
<td>1 8%</td>
<td>0 0%</td>
<td>12</td>
</tr>
<tr>
<td>Student</td>
<td>14 44%</td>
<td>2 6%</td>
<td>4 13%</td>
<td>10 31%</td>
<td>2 6%</td>
<td>32</td>
</tr>
<tr>
<td>Course</td>
<td>3 3%</td>
<td>7 7%</td>
<td>70 73%</td>
<td>6 6%</td>
<td>10 10%</td>
<td>96</td>
</tr>
<tr>
<td>Public</td>
<td>11 30%</td>
<td>1 3%</td>
<td>3 8%</td>
<td>14 38%</td>
<td>8 22%</td>
<td>37</td>
</tr>
<tr>
<td>General</td>
<td>6 40%</td>
<td>0 0%</td>
<td>3 20%</td>
<td>4 27%</td>
<td>2 13%</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>42 22%</td>
<td>11 6%</td>
<td>82 43%</td>
<td>35 18%</td>
<td>22 11%</td>
<td>192</td>
</tr>
</tbody>
</table>

N=192: One randomly selected complete, active set per participant. Percent values: percent per Forum Category.

As expected, the distribution along the three (sub-)samples outlined in Table 21-6 to Table 21-8 are fairly consistent. This is due to the fact that the perception of the type of content along individual forum categories should be independent of the status of the participant as an active or active / passive participant, that is, independent of the participants assignment to either of the three (sub-)samples.

21.3 Descriptive Statistics – 192 Data Sets / SEM Model Variables

The final two sections of this chapter focus on the 192 active data sets and the variables identified in Chapter 16, Part III, for further processing in the SEM analysis. The following table, Table 21-9, provides descriptive statistics (mean, standard deviation, variance, skewness, and kurtosis values) for each variable identified as a potential input factor in
Part II and confirmed as an input factor variable for the structural equation model in Chapter 16, Part III.

<table>
<thead>
<tr>
<th>Variable*</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Variance</th>
<th>Skewness Statistic</th>
<th>Std. Error</th>
<th>Kurtosis Statistic</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usability</td>
<td>0.3620</td>
<td>0.4466</td>
<td>0.1994</td>
<td>-0.7186</td>
<td>0.1754</td>
<td>0.0200</td>
<td>0.3491</td>
</tr>
<tr>
<td>Learnability</td>
<td>0.4870</td>
<td>0.3669</td>
<td>0.1346</td>
<td>-0.4412</td>
<td>0.1754</td>
<td>0.1400</td>
<td>0.3491</td>
</tr>
<tr>
<td>P.Q. of Content</td>
<td>0.2917</td>
<td>0.4411</td>
<td>0.1946</td>
<td>-0.3720</td>
<td>0.1754</td>
<td>-0.1505</td>
<td>0.3491</td>
</tr>
<tr>
<td>Homogeneity</td>
<td>0.1042</td>
<td>0.5362</td>
<td>0.2875</td>
<td>0.0385</td>
<td>0.1754</td>
<td>-0.9116</td>
<td>0.3491</td>
</tr>
<tr>
<td>Cooperation</td>
<td>0.2292</td>
<td>0.4543</td>
<td>0.2064</td>
<td>-0.2348</td>
<td>0.1754</td>
<td>-0.2583</td>
<td>0.3491</td>
</tr>
<tr>
<td>Feel. as Member</td>
<td>0.2474</td>
<td>0.5292</td>
<td>0.2801</td>
<td>-0.4814</td>
<td>0.1754</td>
<td>-0.0835</td>
<td>0.3491</td>
</tr>
<tr>
<td>Social Harmony</td>
<td>0.1615</td>
<td>0.4250</td>
<td>0.1806</td>
<td>-0.0011</td>
<td>0.1754</td>
<td>-0.2136</td>
<td>0.3491</td>
</tr>
<tr>
<td>Dependability</td>
<td>0.2578</td>
<td>0.3544</td>
<td>0.1256</td>
<td>0.0335</td>
<td>0.1754</td>
<td>-0.2280</td>
<td>0.3491</td>
</tr>
<tr>
<td>Faith</td>
<td>0.2552</td>
<td>0.3963</td>
<td>0.1570</td>
<td>-0.2896</td>
<td>0.1754</td>
<td>-0.0758</td>
<td>0.3491</td>
</tr>
<tr>
<td>Bestowing</td>
<td>0.3724</td>
<td>0.3698</td>
<td>0.1368</td>
<td>-0.7296</td>
<td>0.1754</td>
<td>1.3996</td>
<td>0.3491</td>
</tr>
<tr>
<td>Experience*</td>
<td>3.1719</td>
<td>1.3943</td>
<td>1.9441</td>
<td>-0.1472</td>
<td>0.1754</td>
<td>-1.2597</td>
<td>0.3491</td>
</tr>
<tr>
<td>New People</td>
<td>-0.2656</td>
<td>0.6008</td>
<td>0.3610</td>
<td>0.5499</td>
<td>0.1754</td>
<td>-0.6772</td>
<td>0.3491</td>
</tr>
<tr>
<td>Belonging</td>
<td>-0.3125</td>
<td>0.5593</td>
<td>0.3128</td>
<td>0.3515</td>
<td>0.1754</td>
<td>-0.9186</td>
<td>0.3491</td>
</tr>
<tr>
<td>Exchange</td>
<td>0.2083</td>
<td>0.5974</td>
<td>0.3569</td>
<td>-0.4613</td>
<td>0.1754</td>
<td>-0.6616</td>
<td>0.3491</td>
</tr>
<tr>
<td>Abreast</td>
<td>-0.0078</td>
<td>0.5889</td>
<td>0.3468</td>
<td>-0.1249</td>
<td>0.1754</td>
<td>-0.8291</td>
<td>0.3491</td>
</tr>
<tr>
<td>KT-Contrib.*</td>
<td>0.3840</td>
<td>0.1753</td>
<td>0.0307</td>
<td>-0.3472</td>
<td>0.1754</td>
<td>-1.3598</td>
<td>0.3491</td>
</tr>
<tr>
<td>KC-Contrib.*</td>
<td>0.2628</td>
<td>0.1169</td>
<td>0.0137</td>
<td>-1.3633</td>
<td>0.1754</td>
<td>0.5142</td>
<td>0.3491</td>
</tr>
</tbody>
</table>

* Experience was measured on a 1-5 frequency scale anchored between “Seldom, once or twice a year” to “Frequently, daily.”
Knowledge Creation and Knowledge Transfer were measured on the indirectly derived Knowledge Creation / Knowledge Transfer scales, anchored between −1 and +1.
All other input factors were measured on a 5-point Likert scale anchored between “strongly disagree” to “strongly agree” (−1; −0.5; 0; +0.5; +1).

Table 21-9: Mean, Std. Dev., Variance, Skewness- & Kurtosis Values (N=192)
As can be seen in Table 21-9, of all variables, only the two social affiliation motivation variables New People and Belonging, and the professional affiliation motivation variable Abreast have a negative mean, with all three variables being measured on a 5-point Likert scale anchored between “strongly disagree” to “strongly agree” (−1; −0,5; 0; +0,5; +1).

While eight of 17 variables are not skewed, some are characterized by a distortion in the symmetry of their distribution, as measured by the rough guide that a skewness value of more than twice its standard error indicates such distortion in the symmetry. While the five variables Learnability, Perceived Quality of Content, Feeling as a Member, Belonging, and Exchange are characterized by a small asymmetry of distribution (up to 2,74 times its standard error), the three variables Usability, Bestowing and New People are characterized by a slightly stronger asymmetry of distribution (up to 4,16 times its standard error), with the variable KC-Contribution having the strongest skewness with a departure by 7,77 times its standard error. Except for the two variables New People and Belonging, all distributions with a significant skewness are characterized by a significant negative skewness, that is, a distribution with a long left tail.

21.4 Correlation – 192 Data Sets / SEM Model Variables

As in the previous section, this final section focuses on the 192 active data sets and the variables identified in Chapter 16, Part III, for further processing in the SEM analysis.

The following table, Table 21-10, presents the intercorrelations among individual model variables for the 192 SEM sub-sample data sets. The correlations of a construct Factor Analysis Scores (FAC-score)-based correlation matrix have been presented and discussed in Table 16-5 and Section 16.2, Part III, respectively.
Table 21-10: Intercorrelations Among Individual Model Variables (N=192)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Usability</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learnability</td>
<td>0.26**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P.O. of Content</td>
<td>0.23**</td>
<td>0.18**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feeling as M.</td>
<td>0.18**</td>
<td>0.06</td>
<td>0.13</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social H.</td>
<td>0.01</td>
<td>0.38</td>
<td>0.06</td>
<td>0.44**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Homogeneity</td>
<td>0.16*</td>
<td>0.09</td>
<td>0.27**</td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperation</td>
<td>0.02</td>
<td>0.18</td>
<td>0.00</td>
<td>0.17*</td>
<td>0.26**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bestow-</td>
<td>0.09</td>
<td>0.07</td>
<td>0.28**</td>
<td>0.25**</td>
<td>0.24**</td>
<td>0.20**</td>
<td>0.40**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depend-</td>
<td>0.21</td>
<td>0.30</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Faith</td>
<td>0.16*</td>
<td>0.09</td>
<td>0.35**</td>
<td>0.15*</td>
<td>0.24**</td>
<td>0.27**</td>
<td>0.30**</td>
<td>0.26**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experience</td>
<td>0.07</td>
<td>0.05</td>
<td>0.03</td>
<td>0.03</td>
<td>0.12</td>
<td>0.03</td>
<td>0.03</td>
<td>0.03</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>New People</td>
<td>0.96</td>
<td>0.49</td>
<td>0.00</td>
<td>0.60</td>
<td>0.92</td>
<td>0.92</td>
<td>0.07</td>
<td>0.64</td>
<td>0.96</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Belonging</td>
<td>0.02</td>
<td>0.02</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.02</td>
<td>0.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exchange</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abreast</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KT-C.</td>
<td>0.24**</td>
<td>0.20**</td>
<td>0.28**</td>
<td>0.28**</td>
<td>0.29**</td>
<td>0.27**</td>
<td>0.24**</td>
<td>0.27**</td>
<td>0.17**</td>
<td>0.20**</td>
<td>0.20**</td>
<td>0.10</td>
<td>0.05</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KC-C.</td>
<td>0.21**</td>
<td>0.01</td>
<td>0.26**</td>
<td>0.24**</td>
<td>0.23**</td>
<td>0.20**</td>
<td>0.30**</td>
<td>0.20**</td>
<td>0.17*</td>
<td>0.20**</td>
<td>0.20**</td>
<td>0.20**</td>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

N=192 / ** Correlation is significant at the 0.01 level (2-tailed). / * Correlation is significant at the 0.05 level (2-tailed).
STRUCTURAL MODEL ANALYSIS

This chapter (Chapter 22) presents the Structural Equation Modeling (SEM) analysis, which, as outlined in Part I, is the second major empirical component of the research, in addition to the test of the ANOVA-based indirect measurement of individual actor’s knowledge process contributions, outlined in Chapter 15, Part III. The chapter expands on two papers by Schmitz-Justen and Wilhelm, currently under review (accepted; under review).

Structural equation modeling is a general statistical technique, that is widely used in the social sciences and management sciences. Structural equation modeling can be viewed as a combination of exploratory factor analysis and confirmatory factor analysis (or regression or path analysis), with the SEM model implying a structure for the covariance between the identified latent factors, thus giving rise to its alternative name of covariance structure modeling (Hox & Bechger, 1998; Long, 1983a, 1983b).

Throughout this thesis, structural equation modeling analysis is used in the sense of Hox and Bechger (1998) and Kline (2005) to refer to the entire SEM analysis, covering both the structural equation model and the measurement model.

As outlined in Chapter 13, Part III, the structural equation modeling analysis is based on a sub-sample with 192 data sets consisting of one randomly drawn set per participant and all their active, completed sets meeting the minimum-frequency requirement.

As mentioned in Chapter 16, Part III, not all variables have the same scale. While most variables were measured on a 5-point Likert scale anchored between “strongly disagree” to “strongly agree” (scale: −1; −0.5; 0; +0.5; +1), the variables Experience (measured by a 5-point “frequency;” scale: 1; 2; 3; 4; 5), knowledge creation (measured on and scaled according to the indirectly derived KC-scale; scaled from 0 to 1), and knowledge transfer (measured on and scaled according to the indirectly derived KT-scale; scaled from 0 to 1)
were measured on different scales. Accordingly, with variables being measured on different scales, all variables of the 192 data sets were z-standardized. Next, as correlations are easier to interpret than covariances, a correlation matrix was calculated for all relevant variables as identified in Chapter 16, Part III. All analyses of this chapter are based on the correlation matrix of these z-standardized variables. Alternatively, as pointed out by Bortz (2005), a covariance matrix of the z-standardized variables could have been calculated, leading to the same results.

Of the different Structural Equation Modeling (SEM) approaches, it is generally argued that for theory testing and development, the maximum likelihood (ML) or generalized least squares (GLS) approach has several relative strengths, while for application and prediction, a partial least squares (PLS) approach has several relative strengths (Wathne et al., 1996). Because the main purpose of the given research is the empirical testing of the theoretical model, an ML- (or GLS)-based estimation technique is appropriate and was applied to the data for the theory-driven empirical measurement of input factors.

Following Gerbing and Anderson’s (1988) and Kline’s (2005) suggestion, the structural equation modeling analysis outlined in this chapter is founded on a two-step modeling approach. First, the pure measurement model is being tested. Next – and supposed that the fit of the model is acceptable – the structural model is calculated. As Wilson et al. (2004, p. 575) put it: “It does not make sense to infer the statistical significance of the hypothesized paths without first asking whether the model itself is reasonable.”

Table 22-1 summarizes the steps of development of the structural model and the respective types of the analysis.

<table>
<thead>
<tr>
<th>Step of Modeling</th>
<th>Type of Analysis</th>
<th>Purpose of Analysis</th>
<th>Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fitting of the Structural</td>
<td>Measurement Model Valida-</td>
<td>Validation of the measurement model</td>
<td>Section 22.1 Validation of the Measurement Model</td>
</tr>
<tr>
<td>Model Validation</td>
<td>tion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Structural Model Analysis</td>
<td>Hypothesis testing</td>
<td></td>
<td>Section 22.2 Results of the Structural Model and Goodness of Fit Measures</td>
</tr>
</tbody>
</table>

Table 22-1: Steps & Types of Analysis of Structural Equation Modeling
AMOS® (Analysis of MOment Structures), Release 5.0 (Arbuckle, 1994-2003) was used for all calculations.

It is generally recommended that multiple indicators be applied for each latent variable in order to obtain a more reliable representation than can be achieved by a single indicator (Raykov & Marcoulides, 2000). In SEM analysis, measurement errors cannot generally be identified with single indicators: due to identification difficulties, whenever a single indicator alone exists for a latent variable, one must decide to either solve the loading of the variable, or its variance (Pugesek, Tomer, & Eye, 2003). Within the given research, for the two one-item measures Perceived Quality of Content and Experience, an assumed error variance was set: instead of the standard setting of an error variance of “0” for 1-item-measures, the error variances were set to “0,1” and the paths from the latent measure to the one-item variable were set to (1−0,1)²=0,81, accordingly. Even though these assumed error variances are somehow arbitrary, this adjustment is deemed more appropriate than staying with an unadjusted error variance (i.e., an error variance of zero) for the one-item measures.

22.1 Validation of the Measurement Model

Compared to a structural model, the measurement model has unmeasured covariances between each possible pair of latent variables and no direct effects connecting the latent variables. The measurement model is evaluated such as any other structural equation model (SEM), using goodness of fit measures.

Model evaluation is a hotly disputed topic within the research field of structural modeling. Chi-square and p-values are the most commonly reported measures, without, however, much meaning in terms of judging a model’s fit. Chi-square is a “badness of fit” measure, with significant Chi-square values indicating lack of satisfactory model fit. If the proposed model has a good fit, the Chi-square value should not be significant (i.e., p should be larger than 0,05, or even better, larger than 0,10 or 0,20).

Three important objections can be raised against the use of Chi-square values for judging SEM models. First, due to the large sample sizes commonly used in SEM analysis, even weak effects may be found to be significant, even for models which, when judged
by other measures, do not appear to conform to the data very well. Second, applying structural equation modeling, the researcher’s focus is on the *fit of the entire model* with the data. Significance is thus less important, as significance tests can only test single effects, while SEM analysis focuses on the entire model. Third, Chi-square values might lead to Type I type errors – and thus to the rejection of a model which should not be rejected – if data do not meet assumptions of normality. Based on simulation studies, Kline (2005) could show that even under conditions of severe non-normality of data, SEM parameter estimates are fairly accurate, but significance coefficients such as Chi-square values are overestimated. Accordingly, SEM fit indices, focusing on the entire model, are more appropriate measures of relevance of a tested model than the single paths, significance-based Chi-square measure – or, as Kline (2005, p. 16) put it: “[T]here is some sense in SEM that the view of the entire landscape (the whole model) has precedence over that of specific details (individual effects).”

Limitations of the Chi-square statistic have also been noted by Wang and Fesenmaier (2003, citing Bentler, 1990, and Fornell and Larker, 1981).

Given the unsuitability of the Chi-square measure, many alternative measures of fit were developed in recent years. AMOS® offers macros for the calculation of 26 alternative measures of fit. Of these, GFI (Goodness of Fit Index; Jöreskog & Sörbom, 2001) is one of the most commonly used measures. AGFI (adjusted goodness of fit index) takes into account the degrees of freedom available for testing the model. Other common measures to compare models to an absolute standard (as opposed to comparing different models to each other) are CFI (Comparative Fit Index; Bentler, 1990) and IFI (Incremental Fit Index; Bollen, 1989). RMSEA (Root Mean Square Error of Approximation, also referred to as RMS) is another popular measure, penalizing for model complexity.

RMSEA / RMS values close to 0 indicate good fit, with values below 0,05 or 0,08 generally deemed acceptable (Browne & Cudeck, 1993). GFI, AGFI, CFI, and IFI are less than or equal to 1, with values of 1 indicating a perfect fit. Values of 0,90 are generally accepted as a good fit. For the normed Chi-square value, values in the range of 2 to 1 or 3 to 1 indicate a good fit between model and sample data (Carmines & McIver, 1981).
Bollen (1989) observes that these cut-offs are arbitrary. A more salient criterion may be simply to compare the fit of one’s model to the fit of other, prior models of the same phenomenon. For example, a CFI of 0.85 may represent progress in a field where the best prior model had a fit of 0.70. However, in the given field of research there are no existing models with which to compare the proposed model.

With high to acceptable fit measures (151.72 \{93df\}; \p<0.01; Normed Chi-square 1.63; GFI 0.92; AGFI 0.86; CFI 0.93; IFI 0.94; RMSEA 0.06), the measurement model was found to be acceptable. As can be seen in Section 21.3, in the given case some variables in fact do not meet reasonable assumptions of normality, potentially explaining the increased Chi-square value, without necessarily posing a risk to the appropriateness of the parameter estimates, just as Kline’s (2005) study suggests. However, recalculation with a restricted sample size indicated that the inflated Chi-square was most likely caused by a large sample size rather than the distribution of the data or inadequacy of the measurement model: with the sample size reduced to half the original size (N=96, instead of N=192), Chi-square halves to 75.46 (93 df) and the associated p-value (p=0.91) rises above the significance threshold of 0.05 (and even above the preferred values of 0.10 or 0.20).

### 22.2 Results of the Structural Model and Goodness of Fit Measures

Following the validation of the measurement model, the structural model was evaluated based on the same fit measures.

For the structural model, the error variance of the error term affiliated with the Social Affiliation Motivation variable “New People” was restricted to “0” to avoid its becoming negative (−0.028) in an unrestricted calculation, a procedure that is permissible because the restricted value lies within the confidence interval of the negative value.

Like the measurement model, the proposed structural model is compared to the alternative null model by means of fit measures that measure the extent to which the covariances predicted by the model correspond to the observed covariances in the data. Like the measurement model, the structural model exhibited good to acceptable fit with the data (Chi-square 265 [114df]; \p<0.01; Normed Chi-square 2.32; GFI 0.86; AGFI 0.81; CFI 0.83;
IFI 0.84; RMSEA 0.08), in particular since the model was built without prior models in the specific area of research of forum-based online knowledge communities. As in the case of the measurement model, the significant Chi-square indicates lack of satisfactory model fit. However, again recalculations with a restricted sample size indicated that the inflated Chi-square was caused by a large sample size rather than inadequacy of the model. With the sample size reduced to half the original size (N=96, instead of N=192), the Chi-square value halves to 131.81 (114 df) and the associated p-value (p=0.12) rises above the significance threshold of 0.05 (and even above the preferred value of 0.10).

Table 22-2 provides an overview of the fit measures mentioned for both the measurement and the structural model.

<table>
<thead>
<tr>
<th>Fit Measure</th>
<th>Measurement Model</th>
<th>Structural Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-square (df)</td>
<td>151.72 (93df)</td>
<td>265 (114 df)</td>
</tr>
<tr>
<td>Normed Chi-square</td>
<td>1.63</td>
<td>2.32</td>
</tr>
<tr>
<td>P</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>GFI</td>
<td>0.92</td>
<td>0.86</td>
</tr>
<tr>
<td>AGFI</td>
<td>0.86</td>
<td>0.81</td>
</tr>
<tr>
<td>CFI</td>
<td>0.93</td>
<td>0.83</td>
</tr>
<tr>
<td>IFI</td>
<td>0.94</td>
<td>0.84</td>
</tr>
<tr>
<td>RMSEA</td>
<td>0.06</td>
<td>0.08</td>
</tr>
</tbody>
</table>

Table 22-2: Measures of Fit for Measurement and Structural Model

22.3 Model Optimization Using Modification Indexes

AMOS® provides “Modification Indexes,” described by Jöreskog and Sörbom (2001), which can be used to improve model fit. As outlined in the AMOS® program documentation (Arbuckle, 1994-2003), AMOS® minimizes discrepancy functions in the form outlined by Browne (1982, 1984). The modification index for a particular parameter
estimates the amount by which the discrepancy function would decrease if the analysis were repeated with the constraints on that parameter removed.

However, in the given case, the modification indexes did not suggest sensible modifications, with respect to the theory outlined in Part II. None of the regression weights or covariances suggested by the modification indexes and presented in Table 22-3 were thus applied to the a priori model to deduce what Marsh (1991, as cited in Lietz, 1996) termed a posteriori models.

<table>
<thead>
<tr>
<th>Type of Modification</th>
<th>Construct A</th>
<th>Direction</th>
<th>Construct B</th>
<th>Modification Index*</th>
<th>Parameter Change**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression Weight</td>
<td>P.Q. of Content</td>
<td>←</td>
<td>Cooperation &amp; S. o. C.</td>
<td>27,411</td>
<td>0,785</td>
</tr>
<tr>
<td>Regression Weight</td>
<td>P.Q. of Content</td>
<td>←</td>
<td>Trust &amp; Care</td>
<td>25,359</td>
<td>0,641</td>
</tr>
<tr>
<td>Covariance</td>
<td>Trust &amp; Care</td>
<td>←</td>
<td>Prof. Affil. Motivation</td>
<td>21,503</td>
<td>0,297</td>
</tr>
<tr>
<td>Covariance</td>
<td>Trust &amp; Care</td>
<td>←</td>
<td>Service Quality</td>
<td>19,882</td>
<td>0,202</td>
</tr>
<tr>
<td>Covariance</td>
<td>Service Quality</td>
<td>←</td>
<td>Prof. Affil. Motivation</td>
<td>19,512</td>
<td>0,225</td>
</tr>
<tr>
<td>Regression Weight</td>
<td>Cooperation &amp; S. o. C.</td>
<td>←</td>
<td>Prof. Affil. Motivation</td>
<td>14,718</td>
<td>0,190</td>
</tr>
<tr>
<td>Regression Weight</td>
<td>P.Q. of Content</td>
<td>←</td>
<td>Prof. Affil. Motivation</td>
<td>10,066</td>
<td>0,285</td>
</tr>
</tbody>
</table>

* Modification index (M.I.) for regression weight: if the analysis is repeated treating the regression weight for using Construct B to predict Construct A as a free parameter, the discrepancy will fall by at least the specified Modification Index.

Modification index (M.I.) for covariance: if the analysis is repeated treating the covariance between Construct A and Construct B as a free parameter, the discrepancy will fall by at least the specified Modification Index.

** Estimated parameter change for regression weight: if the analysis is repeated treating the regression weight for using Construct B to predict Construct A as a free parameter, its estimate will become smaller than it is in the present analysis by approximately the specified Parameter Change.

Estimated parameter change for covariance: if the analysis is repeated treating the covariance between Construct B and Construct A as a free parameter, its estimate will become smaller than it is in the present analysis by approximately the specified Parameter Change.

Table 22-3: AMOS® Modification Indices (sorted by M.I.)

22.4 Results – Direct, Indirect, and Total Effects on RKPC

The differences between perfect fit and the obtained measures of fit have three sources: model misspecification, parsimony error, and sampling error. As argued by Cheung and
Rensvold (2001, p. 248), “[o]f the three, misspecification has the greatest theoretical importance.”

Cheung and Rensvold (2001) argue that misspecification (specification error) occurs when relevant relationships, such as factor loadings or error term correlations, are omitted from the model. Contrary to that, parsimony error refers to errors due to omitted secondary relationships, such as secondary factor loadings and small, irrelevant error term correlations, which are unavoidable for all but saturated models.

As far as the sampling error is concerned, SEM models assume simple random samples, which are not given. Instead, a self-selected sample exists. As in the case of most social sciences research, interpretations can only be drawn on a substantial rather than a statistical basis. Despite the drawbacks with regard to the validity of results that are related to the application of a self-selected sample to a SEM analysis, the approach was chosen to kick-start empirical research on forum-based online knowledge communities. It seems that the huge potential of SEM analysis, combined with a substantial rather than a statistical interpretation, justifies this approach. Limitations of this approach are discussed in Chapter 27 of the following Part V.

Lietz (1996), who conducted a study of changes in reading comprehension across cultures and over time using linear structural relations analysis, item response modeling, and three-level hierarchical linear modeling of data, faced the same obstacle in her research, and she argued along the same line: in the absence of better theories the results obtained through the analyses allow for the assessment of their relative appropriateness.

The path coefficients (the standardized path coefficients, which are equivalent to standardized partial regression coefficients) should hence be interpreted as relative rather than absolute. The relative strength of individual paths (discussed in Chapter 25 of the following Part V) and the fit of the model (as outlined in Section 22.2 of this chapter) provide a pointer, and suggest that the model might be valid.

The author is less interested in the absolute path results than in the relative strength, which together provide an indication of the relative appropriateness of the proposed hypotheses and also for future research.
Figure 22-1 presents the path diagram with the standardized estimates for the direct effects. Numbers in squared brackets in the following paragraph represent these (standardized) path values of the path diagram for the factors without indirect effects; for the factors with indirect effects, the numbers in squared brackets represent the (standardized) total effects as shown in Table 25-1 of the following discussion and conclusion part of the thesis – Part V.

In relative terms, the following effects can be distinguished: very strong total negative effects (social affiliation motivation \([ -0.410 ]\)); strong total negative effects (cooperation / sense of community \([ -0.185 ]\)); no total effects (trust / care \([ -0.012 ]\), as can be seen in Table 25-1 of the following Part V); weak total positive effects (experience \([ 0.050 ]\) and service quality \([ 0.085 ]\)); and strong total positive effects (professional affiliation motivation \([ 0.187 ]\) and perceived quality of content \([ 0.235 ]\)). A detailed discussion of the results is provided in the following final part of the thesis, Part V.
Figure 22-1: Standardized Estimates of Path Model
23 SUMMARY AND OVERVIEW

Based on the previous Part III of the thesis, particularly its development of scales and measures for the input factors derived in the preceding Part II, and following an outline of descriptive statistics of log-file data and questionnaire data, this part of the thesis presented the second major empirical component of the research (in addition to the test of the indirect method for measuring individual actors’ knowledge process contributions) – the Structural Equation Modeling (SEM) analysis.

Along with the validation of the measurement model and the validation of the structural model, Chapter 22 considered the optimization of the suggested model using modification indices, and finally presented and discussed the results of the structural equation model with regard to statistical aspects.

The following part of the thesis will expand on the results of this part by discussing in detail the individual paths of the structural equation model with respect to the conceptual framework and the specific hypotheses outlined in the literature review and hypotheses development part of the thesis – Part II.
V. DISCUSSION AND CONCLUSION
24 INTRODUCTION

Starting with a summary of the results of the empirical study, this final part of the thesis discusses in depth the results of the empirical study and with reference to the theoretical propositions outlined in Part II of the thesis. Further, it outlines its practical implications, followed by a discussion of the contributions, significance, and limitations of the research, and propositions for future research.

Specifically, the first chapter of this part, Chapter 25, discusses the results of the research and outlines the practical implications of the research results with respect to aspects of collaborative knowledge management. This is followed by Chapter 26, which discusses contributions of the given research and its significance; and Chapter 27, which outlines the limitations of the given research. The second to the last chapter, Chapter 28, provides an outlook on future research. The thesis ends with a summary of the research findings and a conclusion of the thesis in Chapter 29.


25 DISCUSSION AND IMPLICATIONS

This chapter presents the discussion and the implications of the research of this thesis, which accumulates in the SEM analysis presented in Chapter 22 of the previous Part IV. Selected aspects of this chapter are under review for publication (Schmitz-Justen & Wilhelm, accepted, under review).

Presumably, forum-based online knowledge communities in corporations, institutions, and organizations are set up to maximize knowledge process-relevant contributions in absolute terms (i.e., AKPCs), in order to support value creation. The results of each factor of the path diagram, presented in Figure 22-1, Part IV, are discussed with particular reference to newly established forum-based online knowledge communities set up for that particular purpose, as this offers the opportunity to make influences particularly clear. Unless explicitly mentioned, the arguments apply to established forum-based OKCs as well.

Given that the study is restricted to the relative share of knowledge process-relevant contributions (i.e., RKPCs; as opposed to the absolute or frequency-weighted relative share of knowledge process-relevant contributions, AKPCs), the discussion is restricted to arguments about an individual’s relative share of knowledge process-relevant contributions.

As outlined in Chapter 22, Part IV, the author is less interested in the absolute path results than in the relative path results, which provide an indication for the relative appropriateness of the proposed hypotheses and for future research. Accordingly, the discussion always refers to the relative strength of the individual factors.

Altogether, the identified factors explain more than one fourth of the variation (0.272) of an individual’s relative share of knowledge process-relevant contributions. This is a large portion, given that no comparable studies on the identification / prediction of factors stimulating actors to contribute to knowledge creation processes have been conducted so
far, let alone studies focusing on both knowledge processes, knowledge transfer and knowledge creation, at the same time, as outlined in Chapter 8, Section II. Furthermore, the large variation in individual aspects which can be expected to influence an individual’s RKPCs should be considered: it also suggests the amount of variation explained by the identified factors to be large.

In the following discussion, the numbers in brackets represent the (standardized) direct, indirect, or total effects as shown in Table 25-1, which presents a detailed view of the individual paths of the SEM diagram presented in Figure 22-1 of Chapter 22, Part IV. The discussion addresses each of the hypothesized effects outlined in Chapter 11 of the literature review and hypotheses development part of the thesis – Part II – and summarized in Table 18-1, Part III.

<table>
<thead>
<tr>
<th>Effect of...</th>
<th>Direct effects on...</th>
<th>Indirect effects on...</th>
<th>Total effects on...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Quality</td>
<td>0</td>
<td>0,360</td>
<td>0</td>
</tr>
<tr>
<td>Perceived Q. o. C.</td>
<td>0</td>
<td>0</td>
<td>0,235</td>
</tr>
<tr>
<td>Coop. &amp; S. o. C.</td>
<td>0</td>
<td>0</td>
<td>-0,185</td>
</tr>
<tr>
<td>Trust &amp; Care</td>
<td>0,826</td>
<td>0</td>
<td>0,141</td>
</tr>
<tr>
<td>Experience</td>
<td>0</td>
<td>0</td>
<td>0,050</td>
</tr>
<tr>
<td>Social Affil. M.</td>
<td>0</td>
<td>0</td>
<td>-0,410</td>
</tr>
<tr>
<td>Prof. Affil. M.</td>
<td>0</td>
<td>0</td>
<td>0,187</td>
</tr>
<tr>
<td>KP-Contrib.</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 25-1: Direct, Indirect, and Total Effects on RKPC

The table headers “Direct effects on...” and “Indirect effects on...” of Table 25-1 must not be confused with the hypothesized direct and indirect effects summarized in Chapter 11, Part II, and Table 18-1, Part III: The three hypothesized indirect effects...
(\(H_{\text{indirect } KP1}\), \(H_{\text{indirect } KP3}\), \(H_{\text{indirect } KP4}\)) refer to the \textit{direct} effect of one factor on another factor, and their \textit{implied indirect} effect on an individual’s RKPC via the other factors and their associated hypotheses. Table 25-1, however, explicitly differentiates these “indirect” effects in direct effects on either an individual’s RKPC or another factor, in indirect effects on an individual’s RKPC, and in total effects on an individual’s RKPC or another factor.

Focusing on the hypothesized \textit{direct} effects (\(H_{KP1}\) to \(H_{KP8}\)), perceived quality of content (0.235; excluding the indirect effect of service quality), trust and care (0.141; excluding the indirect effect of cooperation and sense of community), experience (0.050), and professional affiliation motivation (0.187) can all – as predicted – be found to have a positive impact on an individual’s relative share of knowledge process-relevant contributions (RKPCs). The predicted negative effect of social affiliation motivation (\(-0.410\)) can also be found in the SEM path diagram and the SEM effects table. Contrary to the hypothesis, the factor cooperation and sense of community does not have the hypothesized positive effect, but has a negative effect (\(-0.185\)) on an individual’s RKPCs.

As far as the hypothesized \textit{direct} effects are concerned, two paths come as a surprise. First, experience (experience with complex websites, such as electronic forum websites themselves, auction websites, shopping websites, Internet newsgroup websites, and comparably complex websites) has a comparatively small impact (0.050) on an individual’s RKPCs – just one-third of the second smallest direct effect factor loading (0.141) and only one-eighths of the largest direct effect factor loading (\(-0.410\)) in absolute terms. Second, the factor cooperation and sense of community does not have the anticipated positive effect, but has a comparatively large negative direct effect (\(-0.185\)) on an individual’s RKPCs.

Focusing on the first hypothesized \textit{indirect} effect (\(H_{\text{indirect } KP1}\)), the \textit{indirect} positive effect of perceived service quality on perceived quality of content can – as predicted – be found (direct / total effect of service quality on perceived quality of content: 0.360). As this effect has the same direction as the correctly hypothesized \textit{direct} effect of perceived quality of content on an individual’s RKPC (\(H_{KP1}\)), service quality also has a positive total effect on an individual’s RKPC (total effect of service quality on an individual’s RKPC via perceived quality of content: \(0.360 \times 0.235 = 0.085\)); in this case, the indirect
effect of service quality on an individual’s RKPC is identical to the total effect of service quality on an individual’s RKPC, as service quality has no direct effect on an individual’s RKPC).

The second hypothesized indirect effect ($H_{\text{indirect KP2}}$), predicting higher degrees of care for higher degrees of trust, cannot be tested since trust and care have been combined in a common construct.

Just as the first hypothesized indirect effect, the third and fourth hypothesized indirect effect predicting a positive effect of trust and care on cooperation and sense of community ($H_{\text{indirect KP3}}, H_{\text{indirect KP4}}$) can be found (direct / total effect of trust and care on cooperation and sense of community: 0.826). However, contrary to service quality – which does not have a direct effect on an individual’s RKPC – the factor trust and care has a hypothesized direct effect on an individual’s RKPC ($H_{KP4}; H_{KP5}$). Thus, the total effect of trust and care on an individual’s RKPC is obviously influenced by the aforementioned negative path result of cooperation and sense of community ($H_{KP2}; H_{KP3}$), because the factor trust and care has both a (positive) direct and a (negative) indirect effect (through cooperation and sense of community) on an individual’s RKPCs. Assuming the hypothesized positive direct effect of the factor cooperation and sense of community on an individual’s RKPC would apply ($H_{KP2}; H_{KP3}$), the hypothesis concerning the positive total path result of the factor trust and care ($H_{KP4}; H_{KP5}$) would be correct. However, the surprising negative path result of the factor cooperation and sense of community has important implications for the total effect of the factor trust and care on an individual’s RKPCs. As can be seen in Table 25-1, the previously mentioned large positive direct effect of trust and care (0.141) is completely offset by the large negative indirect effect of trust and care via cooperation and sense of community (0.826$\times$[−0.185]= −0.153), leading to a total effect of trust and care of about zero (−0.012).

The following sections present the detailed discussion and the implications of the results of the SEM analysis. They are organized to mirror the conceptual framework as maintained throughout the thesis: the outline of potential input factors and their individual hypotheses in Chapter 10, Part II, and their summary in Chapter 11, Part II; the development of the scales to measure those constructs in Chapter 16, Part III; the SEM-analysis in Chapter 22, Part IV.
25.1 System Aspects

The first of the four aspects distinguished throughout the course of the thesis covers the System Aspects. On the basis of theoretical research, particularly in the field of Human Computer Interaction (HCI), the latent construct (Perceived) Service Quality was identified as a potential input factor and confirmed by the scale development in the context of the empirical study.

Service Quality

In the course of establishing a forum in which to maximize knowledge process-relevant contributions to support value creation, aspects of Service Quality (usability and learnability of the forum software) should not be neglected, even though service quality has a small total effect (0.085) on an individual’s relative share of knowledge process-relevant contributions. However, this small total effect materializes despite the fact that service quality has no direct effect on an individual’s RKPC. Instead, it impacts on an individual’s RKPC via perceived quality of content, which acts as a mediator for service quality and of which more than one eighth (0.130) of the total variation is explained by the factor service quality. The direct effect of service quality on perceived quality of content is much larger, representing the third largest direct effect in total terms (0.360). Together, the direct effect of service quality on perceived quality of content and the direct effect of perceived quality of content on an individual’s RKPC (0.235) make up for the mentioned indirect / total effect of service quality on an individual’s RKPC (0.360×0.235= 0.085).

Even though it is acknowledged that quantity does not guarantee quality, given the choice of about 140 online forum systems that are publicly available as of the time of research (Woolley, 2005), it is expected that knowledge process potential bound to service quality can easily be realized: Due to the large number of packages available and the corresponding large competition among the developers, it can be expected that system aspects and issues of human computer interaction are taken into consideration appropriately within several packages. Of the 140 online forum systems publicly available at the time this research was carried out, 65 are commercial packets licensed under proprietary license terms, and 75 are freeware, most of them licensed under the GNU general public license, one of the most popular licenses for free software (Woolley, 2005).
The relatively weak total effect of service quality on relative knowledge contribution makes sense intuitively, as aspects of service quality (as well as experience, as argued in Section 25.4.1) are expected to affect the frequency of contribution rather than the relative knowledge process contribution. Accordingly, the relatively weak total effect of service quality on relative knowledge contribution is due to the factor having only an indirect, and thus “diluted”, effect on the relative knowledge process contribution, while having a direct effect on the frequency of contribution.

25.2 Content Aspects

The second of the four aspects distinguished throughout the course of the thesis covers the Content Aspects. On the basis of theoretical research in the field of Human Computer Interaction (HCI) – specifically, the areas of Social Navigation (SN) and Computer Mediated Communication – and Computer Supported Collaborative Work (CSCW), the latent constructs (Perceived) Quality of Content and Social Navigation were identified as potential input factors. While the first item was confirmed by the scale development in the context of the empirical study, the latter is not considered in the given research due to the focus of the research on relative knowledge process contribution.

Perceived Quality of Content

In summary, it can be said that Perceived Quality of Content is of great importance for the “knowledge direction” a forum-based online knowledge community will take. Intuitively, this can be expected to apply in particular to initial content posted during the initiation phase of new OKCs. As can be seen in Figure 22-1 of Chapter 22, Part IV, and in Table 25-1, participant’s relative share of knowledge process-relevant contribution is largely (0.235) informed by the perceived quality of content already existent in the forum; it represents the second strongest (direct) effect on relative knowledge process contribution within the path diagram (in absolute terms). Thus, initial content must be carefully drafted in order not to spoil the chance to easily increase participants’ relative share of knowledge process-relevant contributions. Changing the perception of existing content at a later stage obviously becomes harder when more content exists, since the impression of carefully drafted (new) content with a high relative share of knowledge process-relevant
value is presumably being “averaged” with the perception of the relative share of knowledge process-relevance of existing content.

25.3 Social Aspects

The third of the four aspects distinguished throughout the course of the thesis covers the Social Aspects. On the basis of theoretical research in the fields of Knowledge Management (KM), Collaborative Systems, and Communities of Practice (CoP), the four latent constructs Cooperation, Sense of Community, Trust, and Care were identified as potential input factors. Throughout the scale development in the context of the empirical study, it was decided to combine the two sets of two constructs that were deemed closely related in the combined constructs Cooperation / Sense of Community and Trust / Care.

25.3.1 Cooperation and Sense of Community

In summary, with a strong negative direct effect (−0.185), the empirical results suggest that investments in good Cooperation between and a strong Sense of Community among the members of an online knowledge community are counterproductive with respect to the members’ relative knowledge process contribution. Three arguments are presented below that might explain this surprising result.

First, the high correlation between the two factors (mentioned in Section 16.2, Part III) might have affected that particular path result. The high correlation between cooperation / sense of community and trust / care might potentially make it harder to differentiate and distinguish effects within the SEM analysis, and thus make it more difficult to assign individual effects as belonging to either factor. However, this would not explain the overall effect of both factors, since only the “allocation” of variance to either factor would be affected, as opposed to affecting both factors’ total effect on relative knowledge process contribution. This argument being true, the problem of the negative path result would thus only be shifted to the factor of trust and care, and thus pose no solution to the problem – as opposed to the following two arguments.

Second, the underlying structure of the sample might have affected that path result. It could be argued that among students, undergraduate students in particular, most of whom
are away from home for the first time and from foreign countries, the relative knowledge process contribution suffers from a high level of cooperation and sense of community, while it might benefit from a high level of cooperation and sense of community in the case of professional knowledge communities, such as Community of Practice-like web-based communities drawing their members from industry. The argument is being supported by the high ratio of students / alumni among the 192 data sets randomly drawn for the SEM-analysis: among the 192 data sets, 154 (80.21%) belong to students / alumni, 22 belong to staff / faculty (11.46%), and 16 (8.33%) belong to registered guests. In the given case, the high level of cooperation / sense of community might strongly increase the number of chat-type entries with their associated low level of knowledge process contribution, thus leading to a strong decrease in the relative knowledge process contribution. It is hypothesized that the given community structure, with the properties just outlined, increases the frequency of contribution of chat-type entries (with their associated low relative degree of knowledge process contribution) without affecting the frequency of contribution of knowledge process-relevant contributions. While increasing the overall frequency of contribution, this community structure-effect would thus dilute – or, as in the given case, completely offset – the relative share of knowledge process contribution, explaining the negative path result obtained in the given study.

The third argument expands on the second one. Interpreting the given surprising path result, it should be considered that the given study addresses only one key aspect of an individual’s absolute knowledge process contribution. While aspects regarding the relative share of knowledge process-relevant contributions are being addressed, the frequency of contribution of these knowledge process-relevant contributions is not being considered. As quoted earlier, Brown et al. (1989) note that knowledge arises and evolves only in its social context, and it appears unlikely that a “no emotions network” would prosper over a longer period of time. It could thus be argued that the social communication within strong social contexts might potentially be associated with a higher relative share of types of content with an associated comparatively low degree of relative knowledge process contribution, such as chat entries, whose overall effect on the absolute knowledge process contribution, however, is under certain conditions being more than out-weighed by the increased overall frequency of contribution in such social contexts, that is, leading to an overall increased absolute knowledge process contribution. It is hypothesized that a
certain level of cooperation and sense of community is required to uphold an optimal level of frequency of contribution within an OKC to maximize the absolute knowledge process contribution. However, given the focus of the study on relative knowledge process contribution, nothing can be said about the effect of the factor cooperation / sense of community on the absolute knowledge process contribution.

Section 27.1 provides a theoretical example of the paradoxical effect outlined in the third argument, that is, the possibility of a decrease in an individual’s relative share of knowledge process-relevant contributions, which might (depending on the specifics of the ratio of types of content contributed and the overall frequency of contribution) be offset by an increase in the individual’s frequency of contribution, leading to an overall increase in the individual’s absolute share of knowledge process-relevant contributions.

**25.3.2 Trust and Care**

Any discussion of the aspects of Trust and Care must consider the arguments raised regarding cooperation and sense of community. Focusing on the direct positive effect of trust and care on an individual’s RKPC, it appears that, as predicted by the theory, an individual’s relative share of knowledge process-relevant contributions is to a certain degree (0.141; the second smallest direct effect factor loading in absolute terms) influenced by the degree of trust and care among members of the community. This suggests that, to a certain degree, investments in the degree of trust and care of members towards each other are an effective measure to increase individual participants’ relative knowledge process contribution.

As predicted by theory, the much larger direct positive effect of trust and care on cooperation and sense of community (0.826) is also an effective measure to strongly increase the degree of cooperation between and the sense of community among the members of the online knowledge community, with trust and care explaining more than two-thirds (0.683) of the total variation of cooperation and sense of community.

However, given the comparatively large direct negative effect of cooperation and sense of community on an individual’s RKPC (−0.185), trust and care do not appear to affect an individual’s relative share of knowledge process-relevant contributions overall, as any
increase in an individual’s relative share of knowledge process-relevant contributions on the basis of the direct positive effect of trust and care (0.141) would be completely offset by the indirect negative effect of trust and care on such contributions via cooperation and sense of community (0.826×[−0.185] = −0.153).

As trust and care increase, the stronger cooperation between and the stronger sense of community among the members of the community would thus lead to a total effect of about zero (−0.153 + 0.141 = −0.012) on an individual’s relative share of knowledge process-relevant contributions. However, as mentioned, to explain the paradoxical total effect of trust and care, the arguments raised in the previous section regarding cooperation and sense of community, and the theoretical example of the paradoxical effect described in the third argument outlined in that section (outlined in Section 27.1) must be considered.

25.4 User Aspects

The fourth and final aspect distinguished throughout the course of the thesis covers the User Aspects. On the basis of theoretical research, particularly in the fields of Knowledge Management (KM), Collaborative Systems, and Communities of Practice (CoP), the latent constructs Experience and Motivation were identified as potential input factors and confirmed by the scale development in the context of the empirical study, with Motivation being specified into Social Affiliation Motivation and Professional Affiliation Motivation.

25.4.1 Experience

As far as Experience is concerned, it can be summarized that investments in an increase in the experience with online forums or comparably complex websites appear not to have a large impact on an individual’s relative share of knowledge process-relevant contributions. Overall, the degree of software usage skills of participants with online forums or comparably complex websites such as shopping websites, auction websites, etc., has a small positive direct effect (0.050) on an individual’s relative share of knowledge process-relevant contributions. Trainings and further education with forum software
in particular and/or complex web-based software in general, does thus not appear to be an effective measure to increase the relative knowledge process contribution of individuals. As mentioned under aspects of service quality, this comparatively small effect makes sense intuitively, since experience (as well as service quality) is more likely to affect the frequency of contribution rather than the relative knowledge process contribution. The degree of experience can only be expected to affect the relative knowledge process contribution to a small extent: through the participants’ mental capacity not being diluted by also having to learn the software, a process that would inevitably shift the mental focus from the contribution of knowledge-relevant content.

25.4.2 Social- and Professional Affiliation Motivation

The last two factors under consideration are Social- and Professional Affiliation Motivation. As can be seen in Figure 22-1 of Chapter 22, Part IV, and in the previously depicted Table 25-1, which presents the detailed standardized estimates of the individual paths, these factors represent the largest and third largest direct effect (in absolute terms) on an individual’s relative share of knowledge process-relevant contributions, respectively – a large positive direct effect (0.187) and a very strong negative direct effect (−0.410). As expected, if one wants to increase those participants’ RKPC, it appears strongly counterproductive to address participants’ needs and desires driven by aspects of social affiliation motivation. Targeted in the right direction, however, would be measures addressing participants’ needs and desires driven by aspects of professional affiliation motivation.

Emphasizing aspects of professional affiliation (i.e., participation to keep abreast of new ideas and innovations; participation to exchange advice and solutions with knowledgeable members of the forum community) would potentially appeal to participants with the corresponding professional affiliation motivation, while potentially putting off participants who are largely motivated by aspects of social affiliation (i.e., participation to meet new and different people; participation to gain a feeling of belonging). An effective way to address both factors would thus be to clearly communicate the purpose of the forum to all members, and to communicate an official policy governing the use of
the forum, pointing out the professional purpose of the forum, together with the plea to refrain from misuse of the forum for private communication.

### 25.5 Practical Implications

In summary, it can be said that in addition to the careful selection of a forum-platform (service quality) and the careful drafting of initial content in the case of newly established online knowledge communities (perceived quality of content), the best strategy to stimulate participants to contribute a larger share of knowledge-process-relevant content appears to be the emphasis of the online forum as an online knowledge community, with a focus on professional as opposed to social content (social vs. professional affiliation motivation).

These four factors could not only presumably be positively influenced, but also represent the three largest factors of influence (in absolute terms) plus the fifth largest factor of influence on participants’ relative share of knowledge process-relevant contributions.

As far as “investments” in the degree of trust and care among members of the community and the degree of cooperation and sense of community are concerned, it is being referred to the arguments risen in the previous sections – and to Chapter 27, addressing potential limitations of the research and the need for further research.
CONTRIBUTIONS AND SIGNIFICANCE

This research is unique in its interdisciplinary perspective on aspects of knowledge transfer and knowledge creation within online communities. Specifically, it is unique in its complex conceptualization of the influence of system, content, social, and user aspects on processes of knowledge creation and transfer in the cooperative context of forum-based online knowledge communities.

The major methodological contribution of this research is the use of structural equation modeling in the outlined context, allowing – in addition to analysis of the hypothesized direct effects – the analysis of the hypothesized mediating effects of service quality on perceived quality of content, and of trust and care on cooperation and sense of community.

The research thesis in information science draws its inspirations from an interdisciplinary body of research, particularly from the fields of research in computer science and management science. The research is specifically inspired by the sub-fields of research in knowledge management, communities of practice, human-computer interaction, and collaborative systems.

As the first comprehensive study covering both the key knowledge processes knowledge creation and knowledge transfer and the entire range of input factors that could impact these processes, the thesis represents the first major integrated and empirical research in the area of forum-based collaborative knowledge management.

As a pioneering attempt at an integrated perspective on forum-community-based online knowledge management, there is, nevertheless, a limitation in this research in the focus on one of the two aspects identified as proxies for an individual’s knowledge process contributions: type of content and frequency of contribution. Focusing on the aspect of
the types of content contributed and their associated knowledge processes, the second aspect of frequency of contribution is not considered in the given research.

Besides its contribution to progress in research in information science, specifically the field of community-based knowledge management, the thesis research and its propositions on how to maximize knowledge processes in an online community context is targeted at contributing to the decision process of knowledge managers who are designing and planning effective and efficient community-based knowledge management tools.
27 LIMITATIONS OF THE RESEARCH

Despite the strengths of the research outlined in the previous chapter, which summarized the contributions and significance of the given research, limitations obviously exist due to the theoretical approach taken to measure individual’s knowledge process contributions, and the sample taken to validate the model.

To circumvent the greatest pitfall of single-shot field- or case studies – prematurity (i.e., reporting on seemingly convincing results as if they had the strength of a larger study) – the reader is thus explicitly pointed towards the fact of this research being based on an exemplary case, and that further research – outlined in the following chapter – is required to confirm the results and generalizability of this study.

27.1 Focus on Relative Knowledge Process Contribution (RKPC)

Limited by the high complexity of a model incorporating both key aspects of absolute knowledge process contribution (AKPC) – the frequency of contribution (FoC) weighted relative share of knowledge process-relevant contributions (RKPC) – this study focuses on the obvious key aspect, that is, the type of content-derived relative knowledge process contribution, as outlined in Chapter 14, Part III.

A model incorporating both aspects would be too complex given the restrictions of a limited number of participants – as in the given case – while on the other hand, an extension of the number of participants was deemed inappropriate given the status of the study in a field without much prior research. It was thus decided to focus on the aspect of RKPC, and to build on the results of the given research in a follow-up study, planned to incorporate both key aspects to control for distinct effects. Hypotheses concerning the aspect of frequency of contribution are already outlined and discussed in Chapter 10 and Chapter 11, Part II.
Obviously, the disadvantage of this research decision is that stimulating factors on the basis of results of the given research (with its focus on RKPC) might, in the worst case, lead to paradoxical results, e.g., an increase in an individual’s relative share of knowledge process-relevant contributions, which might (depending on the specifics of the ratio of types of content contributed and the overall frequency of contribution) potentially be offset by a decrease in the individual’s frequency of contribution, leading to a decrease in the individual’s absolute share of knowledge process-relevant contributions. The following hypothetical example of two online knowledge communities will make this paradoxical effect clear.

There are two online knowledge communities, OKC 1 and OKC 2. The difference between these hypothetical OKCs is a much stronger degree of cooperation between and a much stronger sense of community among the members of OKC 2 as compared to those members of OKC 1.

Table 27-1 presents OKC 1, where all types of content are being posted at an equal rate (Individuals’ ToC-Weight). The overall frequency of contribution shall be 1 per unit of time (Individuals’ FoC). Table 27-2 presents OKC 2, where chat types of content make up half of all postings to the OKC, with the remaining half of all postings to the OKC consisting equally of the other four types of content. The overall frequency of contribution shall be 3 per unit of time.

<table>
<thead>
<tr>
<th>ToC</th>
<th>KT*</th>
<th>KC*</th>
<th>Avg. KP*</th>
<th>Individuals’ ToC-Weight</th>
<th>Individuals’ RKPC</th>
<th>Individuals’ AKPC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chat</td>
<td>0.10</td>
<td>0.01</td>
<td>0.055</td>
<td>0.2</td>
<td>0.011</td>
<td>1 0.011</td>
</tr>
<tr>
<td>Statement / D.</td>
<td>0.32</td>
<td>0.25</td>
<td>0.286</td>
<td>0.2</td>
<td>0.057</td>
<td>1 0.057</td>
</tr>
<tr>
<td>Information</td>
<td>0.57</td>
<td>0.34</td>
<td>0.454</td>
<td>0.2</td>
<td>0.091</td>
<td>1 0.091</td>
</tr>
<tr>
<td>Discussion</td>
<td>0.23</td>
<td>0.23</td>
<td>0.228</td>
<td>0.2</td>
<td>0.046</td>
<td>1 0.046</td>
</tr>
<tr>
<td>Question &amp; A.</td>
<td>0.44</td>
<td>0.35</td>
<td>0.394</td>
<td>0.2</td>
<td>0.079</td>
<td>1 0.079</td>
</tr>
<tr>
<td>Avg. KP</td>
<td></td>
<td></td>
<td>0.283</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total RKPC</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total AKPC</td>
<td></td>
<td></td>
<td>0.283</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Average KP as weighted average of the KT and KC values as outlined in Section 15.7, Part III.

Table 27-1: Hypothetical RKPC and AKPC of an OKC – Example 1
Table 27-2: Hypothetical RKPC and AKPC of an OKC – Example 2

As can be seen in the two tables, the weighted average of the KT and KC values as outlined in Section 15.7, Part III, \((\text{Avg. KP})\) combined by the weight with which specific types of content are being contributed, is 0,283 for OKC 1 and a much lower 0,197 for OKC 2 (\(\text{Individuals' [Total] RKPC}\)). This happens as expected, due to OKC 2’s large relative proportion of chat entries – which have the lowest average knowledge process contribution value. However, when considering the frequency-weighted RKPC (i.e., \(\text{Individuals' AKPC}\)), the picture changes. While the AKPC of OKC 1 remains identical with the RKPC at 0,283, the AKPC of OKC 2 increases to 0,592, thus being higher not only than OKC 2’s RKPC value, but also than OKC 1’s RKPC- and AKPC value – representing the previously mentioned paradoxical effect.

Considering the hypothesis that good cooperation and a strong sense of community among the members of the online knowledge community will increase the overall AKPC, while potentially decreasing the RKPC – as in the given research – the example presented confirms that such a setting is potentially possible. The paradoxical effect just outlined might thus explain the surprising result of the strong negative direct effect of Cooperation / Sense of Community on RKPC, elaborated in Section 25.3.1. As argued in Section 28.1 of the following chapter, future research is needed on this issue.
27.2 Sample – Aspects of Generalizability

As far as the sample for the given empirical study is concerned, two aspects need to be addressed: first, the application of a *self-selected sample* to a SEM analysis; second, the *population* itself, from which the participants for the self-selected sample were drawn.

With respect to the first aspect – the application of a self-selected sample to the SEM analysis – it must be noted that, as outlined in Section 22.4, Part IV, SEM models assume simple random samples, which are not given in this research. Instead, a self-selected sample exists. In the same section, it is argued that, as in the case of most social sciences research, interpretations can thus only be drawn on a substantial, rather than a statistical basis. The approach to choosing a self-selected sample was selected despite the drawbacks with regard to the validity of results that are connected with the application of a self-selected sample to a SEM analysis; it appeared that the huge potential of SEM analysis combined with a substantial, rather than a statistical interpretation justified this approach. Accordingly, path results were not interpreted in an absolute form, but interpreted with respect to their relative strength. The results of the given research provide an indication for the relative appropriateness of the proposed hypotheses and for future research. As outlined in Section 22.4 of the analysis and results part of the thesis – Part IV – the approach and argumentation occurs in consideration of Lietz (1996).

With respect to the second aspect – the population from which the participants for the self-selected sample were drawn – the following three sub-issues can be distinguished: (1) generalizability; (2) adolescents; (3) spill-over effects.

It can be expected that the population of online forum users comprises international Internet users who, in their work and/or leisure time use online forums to (a) enhance their knowledge on specific topics and/or to convey their own knowledge to the forum community (knowledge transfer); (b) generate new knowledge through the exchange with the forum community (knowledge creation); and (c) communicate/chat with members of the forum community (no associated knowledge process). Compared to the entire population, an age structure of 20-50 years can be expected, as well as a higher level of Internet usage in general, a higher level of education, and higher levels of computer literacy.
With respect to the first sub-issue, generalizability, it could be asked how distinct particular forum contexts and/or communities are (e.g., industrial workplace forums, vs. forums set up in an education context, vs. leisure forums), giving rise to the question how far the largely student-based sample of the IUB online knowledge community is representative for the outlined population, and thus how far results can be transferred from a university to an industrial workplace context and/or generalized to the average population of online forum participants with the outlined population characteristics.

With respect to the second sub-issue, adolescents, it is worth pondering whether adolescents – which, in the given research are represented in the age group of “up to 25 years” with an accumulated share of 81.52% – might be too young for such an analysis due to their less stable cognitive capabilities.

Finally, with respect to the third sub-issue, spill-over effects, it should be considered that, potentially, spillover effects might hinder individual participants to correctly assess and distinguish forum-based criteria from other types of impact, such as other types of media (e.g., emails, mailing-lists) and personal communication on campus, in colleges, and classes. In this research project, spillover effects from competing communication channels such as other types of media and from personal communication were not taken into consideration, and thus might “blur” the results of the impact factors. It is being acknowledged that, within IUB’s campus setting, these effects might be much stronger than in a distributed web-based community, whose members potentially do not communicate personally at all, and probably only to a lesser degree via other media channels.
28 FUTURE RESEARCH DIRECTIONS

While the previous chapter outlined the limitations of the given research, this chapter points out future research directions and proposes improvements for future research.

28.1 Incorporation of Frequency of Contribution

As outlined in Chapter 14, Part III, an individual’s absolute knowledge process contribution (AKPC) is approximated by a linear combination of that individual’s average relative knowledge process contribution (RKPC) of the individual’s most frequently contributed type of content with the individual’s respective frequency of contribution (FoC) of that particular type of content. As outlined in the same chapter, the given research focuses on RKPC as the key variable of interest.

Even though it is being argued that this is an acceptable approach in the face of (1) the study’s status as an explanatory study in a field without much prior research, and (2) the number of participants required to test a much more complex model incorporating both RKPC and FoC to determine the overall AKPC, this obviously constitutes a limitation of the given research, as outlined in Section 27.1.

Expanding on the results of the given research, future empirical research should thus build upon the theory review and the hypotheses outlined in Part II, which already takes into consideration both RKPC and FoC to determine the overall AKPC-level, and expand the focus of the empirical study towards the inclusion of the frequency of contribution.

The inclusion of frequency of contribution would lead to the inclusion of paths, variables, and latent constructs relevant only for the frequency of contribution aspect, which could not to be considered in the RKPC-focused model, as outlined in Chapter 14, Part III. This concerns social navigation indicators in particular. Future research covering social navigation indicators should be personalized and ask participants explicitly to
consent to link their log file data with their questionnaire data. Thus it would be possible to control if and how an individual’s frequency of contribution within a thread (posts per unit of time) and frequency of viewing within a thread (views per unit of time) links to the cohorts’ frequency of contribution / viewing within a thread. Obviously, under such conditions, the right to initiate threads within an individual forum – differing among individual users and / or usergroups – must be taken into account, as otherwise results might be distorted.

### 28.2 Cross-Validation and Screening-out of Sample-Effects

As outlined in Section 27.2, two aspects need to be addressed, as far as the sample for the given empirical study is concerned: (1) the application of a self-selected sample to a SEM analysis, and (2) the population from which the participants for the self-selected sample itself were drawn.

With respect to the first aspect, the application of a self-selected sample to the SEM analysis, a follow-up study building on the results of the given research should be conducted, using a simple random sample. Following this route care must be taken to obtain enough cases to conduct the suggested SEM-analysis.

With respect to the second aspect, the population from which the participants for the self-selected sample were drawn, the following three sub-issues should be considered: generalizability; adolescents; and spill-over effects, as outlined in Section 27.2. With respect to direction for future research discussed in this chapter, the first two sub-issues are of particular interest.

The second sub-issue, adolescents, suggests a review of research considering this aspect, and its appropriate consideration in any follow-up studies conducted. A follow-up study in a comparable context could help to determine the stability of the results obtained in the given research, suggesting the stability of the participants’ replies in case of comparable results – besides cross-validating the results of the given research in general. Should the results differ, either the generalizability of the results must be questioned or differences could be due to the instability of the adolescent participants’ replies, hence requiring further investigation.
As far as the first sub-issue, *generalizability*, is concerned, a follow-up study conducted in a different context, e.g., a forum with the same degree of co-location of its members in a corporate context or a distributed web-based forum, would prove helpful to cross-validate the results of the given study. Should the results be the same, this would suggest the generalizability of the results of the given study; otherwise the generalizability of the results must be questioned, and – depending on the chosen forum context – answers for sub-issue three, *spill-over effects*, would have been obtained.

### 28.3 Improvement and Extension Potential for Future Research

In addition to the two major aspects outlined in the previous two sections, five further aspects were identified for the improvement and extension of the given research in future studies, and are outlined in this final section. As far as the first sub-issue – *improvement potential* for future research – is concerned, two aspects were identified throughout the conduct of the given research: (1) cross-validation of ToC-based knowledge process derivation figures, and (2) specification of certain questionnaire questions. As far as the second sub-issue – *enhancement potential* for future research – is concerned, three aspects were identified throughout the conduct of the given research: (3) the separate measurement of factors impacting on processes of knowledge creation and knowledge transfer, (4) the consideration of extrinsically rewarding mechanisms, and (5) the conduct of a content and text analysis of forum content.

The first of the five aspects for the improvement and extension of the given research concerns the realization of *improvement potential* of the given research by means of the *cross-validation of ToC-based knowledge process derivation figures*. In the given research, individual actors’ knowledge process contributions are derived indirectly, due to the apparent risk of assessment skews on the side of survey participants in case of direct attempts to gauge individual actors’ knowledge process contributions. However, the indirect type of content-based knowledge process derivation can only be seen as an approximation for participants’ knowledge process contributions, and the results of the derived individual knowledge process contribution measure could have profited from cross-validation with direct self-assessment questions (e.g., “How would you rate your contributions in terms of their knowledge creation impact?”). Even though these direct
self-assessment questions would presumably have overestimated the degree of knowledge process contribution, the replies to such a question would have proven helpful to cross-validate the chosen indirect methodology of measuring an individual’s knowledge process contribution.

The second of the five aspects for the improvement and extension of the given research concerns the realization of improvement potential of the given research by means of the specification of certain questionnaire questions. Comments from participants in the online survey suggest that some of the questions in the questionnaire were too abstractly formulated. For example, the statement “This forum category contributes to the creation of knowledge (i.e., individual and group learning; the acquisition and production of knowledge),” to which participants were asked to state their degree of approval, could be replaced by the rephrased and specified statement “This forum category helps me to learn, to acquire and produce knowledge.” Another improvement to the understanding of the questionnaire – and thus the resulting data quality – could be achieved by reformulating questionnaire questions that were formulated in too unspecific a manner. For example, questions such as “Please select the frequency with which you have viewed (i.e., read) messages in this forum category” could be rephrased to include a reference time frame, for example, “Please select the frequency with which you have viewed (i.e., read) messages in this forum category within the last quarter.”

The third of the five aspects for the improvement and extension of the given research concerns the realization of extension potential of the given research by means of the separate measurement of knowledge process factors. In the given research, both knowledge processes are measured separately in the context of the ANOVA-based indirect measurement of individual actor’s knowledge process contributions to capture both processes as accurately as possible. For the SEM analysis, the measures were combined in a common knowledge process scale, because – as outlined in Chapter 22, Part IV – multiple indicators for each latent variable are to be preferred to single indicators, in order to obtain a more reliable representation (Raykov & Marcoulides, 2000). A potential enhancement for future research could thus be the separate measurement of factors affecting the two key knowledge processes knowledge creation and knowledge transfer through a common SEM model to evaluate the individual effects of the identified input factors on
each of the two key knowledge processes. Prior to such an evaluation of the individual
effects of the identified input factors through a common SEM model, this separate meas-
urement would require research on multiple indicators for each of the two knowledge
processes.

The fourth of the five aspects for the improvement and extension of the given research
concerns the realization of *extension potential* of the given research by means of the
*consideration of extrinsically rewarding mechanisms*. The “cost” of participation in an
online forum is not considered in the given study, and could be included in an extended
version of the research. Focusing on knowledge sharing, a study by Hansen (1999) shows
that such costs range from the potential risk of losing power to the perception of sharing
as a time-consuming routine work. This aspect is closely linked to the issue of extrinsi-
cally driven motivation (as opposed to intrinsically driven motivation), which is thought
to “crowd out” intrinsic driven motivations, and hence undermines the efforts forthcoming
on a voluntary basis, thus posing a “hidden cost” of the extrinsic rewards (Lepper &
Greene, 1978). It would thus be interesting to rerun the study in an environment with
extrinsic reward mechanisms (e.g., monetary rewards or token rewards) for knowledge
process contributions to the forum.

Finally, the last of the five aspects for the improvement and extension of the given
research concerns the realization of *extension potential* of the given research by means of
the performance of a *content and text analysis* of the forum content. As outlined in “*Text
Analysis as a Tool for Analyzing Conversation in Online Support Groups*” (Kramer,
Fussell, & Setlock, 2004), software such as LIWC (Pennebaker, Francis, & Booth,
2001b), WordStat (Péladeau, 2005), or SAS® Text-Miner (SAS Inc., 2005b) could be
used to analyze forum content by counting words representing certain psychological proc-
cesses. Cognitive processes, when indicated by words standing for cognitive mechanisms
(e.g., cause, know, ought); causation (e.g., because, effect, hence); insight (e.g., think,
know, consider); discrepancy (e.g., should, would, could); inhibition (e.g., block,
constrain); tentative (e.g., maybe, perhaps, guess); or certainty (example words drawn
from Pennebaker, Francis, & Booth, 2001a), could thus be marked of from the use of
affective or emotional processes, sensory and perceptual processes and social processes.
28.4 Alternative Research Approaches

As outlined in Chapter 7.1 of Part II, this thesis takes a Quantitative, Positivist Research (QPR) approach that is commonly applied in the social sciences in general and the field of Information Systems research in particular.

The adopted QPR research approach is based on a positivist epistemology and, interconnected to this decision, a quantitative research approach: In case of a QPR approach, the underlying philosophical perspective of positivism goes hand in hand with a decision for a quantitative research approach, as in case of positivism only a quantitative research approach is meaningful – as opposed to interpretive or critical underlying philosophical perspectives, for which both qualitative and quantitative research approaches are meaningful (Straub et al., 2004, 2005).

The previous sections of this chapter focused on suggestions for extensions and improvements of the chosen QPR research approach. Future research could, however, be based on a fundamentally different research approach as the one adopted in this thesis: Instead of extending and improving the chosen quantitative research approach and its underlying positivist perspective, future research could adopt an interpretive or critical epistemology in conjunction with a qualitative research approach.

As outlined in Chapter 7.1, Part II, such a qualitative research approach would indirectly determine the actual research methodologies through that the given research problem would then be approached. Instead of the chosen quantitative single-shot study, a non-QPR method such as a qualitative case study would then be conducted – as applied by Voelpel and Han (2005) / Voelpel, Dous and Davenport (2005) in the context of research on Siemens’ ShareNet on creating a global knowledge-sharing system. Alternative non-QPR methods include action research, ethnography, group feedback and participative research, or philosophical research (Myers, 1997a, 1997b; Straub et al., 2004, 2005).

As far as the data analysis techniques of the chosen QPR research approach is concerned – Structural Equation Modeling (SEM) –, this would then be replaced by a mode of analysis applicable to such a qualitative research approach: e.g. hermeneutics, semiotics, or narrative and metaphor, as suggested by Myers (1997a; 1997b).
The key aspect of such a consideration is that such an alternative research approach would approach the research question from a fundamentally different angle – potentially leading to different insights that might complement the results obtained from the quantitative research approach chosen in the given thesis. Accordingly, approaching the chosen field of research – and the specific research question – with a fundamentally different research approach as the one adopted in this thesis might form a constructive replenishment to the results obtained throughout the research of this thesis.
29 SUMMARY OF RESEARCH FINDINGS AND CONCLUSION

The research outlined in this thesis theoretically deduced and empirically validated individual factors of influence on the two key knowledge processes knowledge creation and transfer in what this research defined as forums-based Online Knowledge Communities (OKCs). The research question investigated in the thesis was defined as the following: Which factors influence and support the knowledge-relevant usage of online forums and thus indirectly stimulate the two key knowledge processes “Knowledge Transfer” and “Knowledge Creation” within forum-based OKCs?

The starting point of the research was the argumentation that future learning and knowledge work will be ever more influenced by inter- and transdisciplinary conditions under both remote and co-located combinations of lifelong learning and knowledge work. This argument was followed by a literature review and an outline of individual hypotheses based on an interdisciplinary body of research, particularly from the fields of research in computer science and management science; specifically knowledge management literature, community of practice literature, human-computer interaction literature, and collaborative systems literature.

The empirical part of the research was based on an in-depth single study, with the users of the electronic communication forums at International University Bremen (IUB) chosen as an example. Based on a log-file analysis, an online questionnaire survey, and direct observation, the empirical part of the research outlined in this thesis consisted of two main parts: First, an ANOVA-based calculation of type of content-based knowledge process values; second, a SEM-based hypotheses testing of individual factors of impact on an individual’s knowledge process contribution.
As far as the ANOVA-based analysis is concerned, the ultimate purpose of this aspect of the research was to create an indirect measure of individuals’ knowledge process contribution as an alternative to a direct question to gauge an individual actor’s knowledge process contributions with its apparent risk of assessment skews on the side of survey participants. The distinct values resulting from the given research suggest that this goal was achieved, and that the type of content provides a viable approximation for individuals’ knowledge transfer and knowledge creation.

As far as the SEM-based analysis is concerned, the hypotheses outlined in the first part of the thesis could largely be shown to be correct, with most paths of the structural model pointing in the hypothesized direction.

It can be summarized that besides the careful selection of a forum-platform (factor service quality) and besides carefully drafting of initial content in case of newly established online knowledge communities (factor perceived quality of content), the best strategy to stimulate participants to contribute a larger share of knowledge-process-relevant content appears to be the emphasis of the online forum as an online knowledge community, with a focus on professional as opposed to social content (factors social vs. professional affiliation motivation). These four factors could presumably not only be positively influenced, but also represent the three largest factors of influence (in absolute terms) plus the fifth largest factor of influence on a participant’s relative share of knowledge process-relevant contributions. As far as “investments” in the degree of trust and care among members of the community and the degree of cooperation and sense of community are concerned, further research is required.

As one of the first comprehensive studies covering both key knowledge processes (knowledge creation and knowledge transfer) and covering the entire range of potential input factors that might potentially impact on these processes (system, content, social, and user aspects), the thesis integrated existing, fragmented research with a limited focus on a restricted number of input aspects and / or knowledge processes into an integrated model of forum-based collaborative knowledge management.

As a pioneering attempts at forum-community-based online knowledge management there are, nevertheless, certain limitations in this research in the form of the thesis’s
empirical focus on participants’ relative knowledge process contribution, leaving the empirical aspect of frequency of contribution – as a second factor hypothesized to be influenced by the proposed input factors and contributing to participants’ absolute knowledge process contribution – for future research. With the respective hypotheses already being outlined in the first, theoretical part of the research, future research should extend the focus of the given research to aspects contributing to participants’ absolute knowledge process contribution.
REFERENCES
REFERENCES


References


the German Classification Society, Gesellschaft für Klassifikation, GfKl 2005, Magdeburg, Germany.


References


Tannenbaum, S.I., & Alliger, G.M. (2000). *Knowledge Management: Clarifying the Key Issues*. Chicago, IL, USA: IHRIM.


APPENDICES
A. ONLINE QUESTIONNAIRE

The three screenshots on this and the following page present the first three web pages of the online questionnaire as presented to the survey participants. The twelve pages thereafter present a printout of all questionnaire web pages. Due to filter questions, individual paths through the questionnaire are taken by participants. Accordingly, several web pages appear more than once in this linear printout.

Whereas the printed questionnaire version on the following pages is meant to provide an overview of the content of the pages displayed to the participants, the HTML and PDF versions of this printout on the respective files of Appendix C. CD-ROM also include the filters and plausibility checks implemented to maximize data quality, and thus make clear to the reader which paths individual participants take under which conditions.
Please select the IUB forum category/categories of which you have ever viewed (i.e. read) any messages. (Please leave blank if you did not view messages on other forum category.)

For the purpose of the survey and the readability of the questionnaire, the IUB forums have been categorized in the categories. Examples of the forums which are referred to by the different categories are listed in brackets following the summary term. Forums not listed in this categorization are excluded from the survey.

Registered guests generally only have access to the 'Public Forums' category. From now on the individual forums will only be referred to by the summary term; for a reminder of the summary term, please click on the heading.

- College Forums (e.g. IUB College, Apartment 0-015, College Office Forum, ...)
- Student Forums (e.g. Student Affairs - Government - Court, Graduate Forum, ...)
- Course Forums (e.g. Current Course Forum, Course Forum Archive, ...)
- Public Forums (e.g. Incoming Students, County Forum, The IUB Blackboard, ...)
- General Forums (e.g. IUB General, IUB Teams and Associations, Company Forum, ...)

Since when have you viewed (i.e. read) content of the IUB forums in general?

- Less than 3 months
- Between 3 months and 1 year
- Between 1 year and 3 years
- Between 3 years and 5 years
- Between 5 years and 10 years
- More than 10 years

Next
Introduction

Thank you for agreeing to complete this questionnaire!

The questionnaire should take about 10 minutes to complete.

The information that you provide will be kept strictly confidential and will be used in a summarized format only. It will not be used in any way that could identify you personally. All information will be treated with the strictest of confidence and will be used for research purposes only.

If you are interested, a summary of the questionnaire results can be provided in appreciation for your time and information. Please check the appropriate box at the end of the questionnaire if you wish to receive such information. Contact details are provided at the end of the questionnaire.

As a gesture towards your participation and in appreciation of your time and information, you can also take part in a raffle of three 'Missing Link' vouchers of EUR 25 each, sponsored by IUB's officially authorized textbook wholesaler 'Missing Link'. Details are provided at the end of the questionnaire.

Instructions: Please check boxes as appropriate to indicate your chosen responses. There is no right or wrong answer. I am interested in your opinion on the issues. If you are unsure about how to reply to any question, please give the best answer you can and write your comments in the comments/thoughts text box at the end of the questionnaire.

Thank you very much for your assistance!

Please select the IUB forum category/categories of which you have ever VIEWED (i.e. read) any messages.

(Please leave blank if you did not view messages on either forum category.)

For the purpose of the survey and the readability of the questionnaire, the IUB forums have been categorized in five categories. Examples of the forums which are referred to by the different categories are listed in brackets following the summary term; forums not fitting this categorization are excluded from the survey.

Registered guests generally only have access to the 'Public Forums' category. From now on the individual forums will only be referred to by the summary term; for a reminder of the summary terms, please click on the help-icon.

- College Forums (e.g. IUB Colleges, Apartment 6-815, College Office Forum, ...)
- Student Forums (e.g. Student Affairs/-Government/-Court, Graduate Forum, ...)
- Course Forums (e.g. Current Course Forums, Course Forum Archive, ...)
- Public Forums (e.g. Incoming Students, Country Forum, The IUB Blackboard, ...)
- General Forums (e.g. IUB General, IUB Teams and Associations, Campusnet Forum, ...)
4.1.1 Since When

Since when have you **VIEWED** (i.e. read) content of the IUB forums in general?
- Less than ¼ year
- Between ¼ and ½ year
- Between ½ and 1 year
- Between 1 and 1½ years
- Between 1½ and 2 years
- More than 2 years

4.1.2 Viewing - Frequency

Please select the **frequency** with which you have **VIEWED** (i.e. read) messages in this forum category.

<table>
<thead>
<tr>
<th></th>
<th>Frequently, daily</th>
<th>Often, several times a week</th>
<th>Sometimes, about once a week</th>
<th>Occasionally, about once a month</th>
<th>Seldom, once or twice a year</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Student Forums</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Course Forums</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Public Forums</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>General Forums</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>

4.1.3.1 Viewing - Type of Content

Please select the **type of content** which you have mostly **VIEWED** (i.e. read) within this forum category.

For the purpose of the survey all posts have been categorized in five categories as follows:
- **Statements/Declarations**: posts with the primary purpose of distributing statements, declarations, or announcements.
- **Information**: posts with the primary purpose of supplying data or providing information.
- **Question-Answer Scenarios**: posts as part of a discussion initiated by statements or open questions.
- **Discussions**: posts like self-contained questions and related answers to these 'closed' questions.

From now on the types-of-content will only be referred to by the summary term; for a reminder of the summary terms, please click on the help-icon.

<table>
<thead>
<tr>
<th></th>
<th>Chat entries</th>
<th>Statement/ declaration entries</th>
<th>Information entries</th>
<th>Discussion entries</th>
<th>Question &amp; answer entries</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Student Forums</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Course Forums</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Public Forums</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>General Forums</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
ACTOR POSTING (=> FILTER)

Please select the forums in which you have ever (actively) POSTED any messages. (Please leave blank if you did not use either forum category actively.)

- College Forums
- Student Forums
- Course Forums
- Public Forums
- General Forums

6.1.1 Since When

Since when have you (actively) been POSTING messages to the IUB forums in general?

- Less than ½ year
- Between ½ and ½ year
- Between ½ and 1 year
- Between 1 and 1½ years
- Between 1½ and 2 years
- More than 2 years

6.1.2 Posting - Frequency

Please select the frequency with which you have actively POSTED messages to this forum category.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Frequently, daily</th>
<th>Often, several times a week</th>
<th>Sometimes, about once a week</th>
<th>Occasionally, about once a month</th>
<th>Seldom, once or twice a year</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Student Forums</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Course Forums</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Public Forums</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>General Forums</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

6.1.3.1 Posting - Type of Content

Please select the type of content which you have mostly POSTED within this forum category.

<table>
<thead>
<tr>
<th>Content Type</th>
<th>Chat entries</th>
<th>Statement/ declaration entries</th>
<th>Information entries</th>
<th>Discussion entries</th>
<th>Question &amp; answer entries</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Student Forums</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Course Forums</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Public Forums</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>General Forums</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
6.1 Reasons For Not Using

Please check the box most appropriate to your reasons for not using the IUB forums.

- I do not use the forums, because I have no time.
- I do not use the forums, because the content is not relevant for me.
- I do not use the forums, because I so far had no awareness of them.
- I do not use the forums, because...

7.1 Age

How old are you?

- Below 20
- 20-25
- 26-30
- 31-35
- 36-40
- 41-45
- 46-50
- 51-55
- Above 55

7.2 Gender

Please indicate your gender.

- Female
- Male

7.3 Highest Educ. Qualification

Please indicate your highest educational qualification so far.

- Secondary School; Grammar School; High School
- Bachelor
- Master
- PhD

7.4 Forum User Status

Please indicate your user status within the IUB forums.

- IUB Alumni
- IUB Student
- IUB Administrative Staff
- IUB Research Staff
- IUB Faculty
- Registered Guest
### 7.6.1 IUB-School SES/HSS/J/CLL

**Which school / research centre of IUB do (did) you study, research and/or work at?**
- School of Humanities and Social Sciences
- School of Engineering and Science
- Jacobs Center for Lifelong Learning and Institutional Development

### 7.6 Web-Experience

**Please select the frequency with which you are using complex websites like auction websites, shopping websites, electronic forum websites, Internet newsgroups websites and comparably complex websites.**

<table>
<thead>
<tr>
<th>Complex Websites</th>
<th>Frequently, daily</th>
<th>Often, several times a week</th>
<th>Sometimes, about once a week</th>
<th>Occasionally, about once a month</th>
<th>Seldom, once or twice a year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 7.7 Experience With Forums

**Did you passively (i.e. reading) and/or actively (i.e. posting) participate in other electronic forums or Internet newsgroups before using the IUB forums?**
- Yes
- No

### 0.1 Forums - Type of Content

**In your opinion, which type of content does this IUB forum category mainly contain?**

<table>
<thead>
<tr>
<th></th>
<th>Chat entries</th>
<th>Statement/declaration entries</th>
<th>Information entries</th>
<th>Discussion entries</th>
<th>Question &amp; answer entries</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student Forums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Course Forums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Forums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Forums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### 0.2 Identity - Personal Acquaintance

**How many percent of the community of this IUB forum category do you approximately know personally (e.g. from living together in the same college or from attending the same courses)?**

<table>
<thead>
<tr>
<th></th>
<th>0-20%</th>
<th>21-40%</th>
<th>41-60%</th>
<th>61-80%</th>
<th>81-100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student Forums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Course Forums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Forums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Forums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 8.3.1 Motivation - Voluntariness

Please indicate if your usage of this forum category is voluntary or involuntary (e.g. because your course instructor or college master told you to attend the forum or because you are the forum’s moderator).

<table>
<thead>
<tr>
<th></th>
<th>Voluntary</th>
<th>Involuntary</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Student Forums</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Course Forums</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Public Forums</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>General Forums</td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>

### 8.4 Please indicate information

On the next pages, you are asked to indicate the extent to which you agree or disagree with the prevailing statement. Please select the answer that best represents your opinion - again there is no right or wrong answer.

### 8.4.1 Forums - Knowledge Transfer

This forum category contributes to the **transfer of knowledge** (i.e. the teaching, sharing and integration of knowledge).

```
<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Student Forums</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Course Forums</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Public Forums</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>General Forums</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>
```

### 8.4.2 Forums - Knowledge Creation

This forum category contributes to the **creation of knowledge** (i.e. individual and group learning; the acquisition and production of knowledge).

```
<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Student Forums</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Course Forums</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Public Forums</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>General Forums</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>
```
### System Aspects - Usability

The IUB forums in general have a high degree of usability (i.e. are effective and efficient, and provide a high degree of satisfaction with which a user can achieve tasks).

<table>
<thead>
<tr>
<th>Forum usability</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### System Aspects - Learnability

The IUB forums in general have a high degree of learnability (i.e. are usable without documentation, provide task-oriented help).

<table>
<thead>
<tr>
<th>Forum learnability</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Content - Quality of Content

This forum category provides content of high quality.

<table>
<thead>
<tr>
<th>College Forums</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Forums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Course Forums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Forums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Forums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Identity - Feeling as Member

Within this forum category I feel as a member of a community (i.e. as a member of a group).

<table>
<thead>
<tr>
<th>College Forums</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Forums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Course Forums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Forums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Forums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Identity - Social Harmony

The degree of social harmony within this forum category is high.

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td>c</td>
<td>c</td>
<td></td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Student Forums</td>
<td>c</td>
<td>c</td>
<td></td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Course Forums</td>
<td>c</td>
<td>c</td>
<td></td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Public Forums</td>
<td>c</td>
<td>c</td>
<td></td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>General Forums</td>
<td>c</td>
<td>c</td>
<td></td>
<td>c</td>
<td>c</td>
</tr>
</tbody>
</table>

### Seizing

The communication within this forum category is characterized by an attitude of seizing (i.e. an attitude of 'everyone out for him/herself').

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td>c</td>
<td>c</td>
<td></td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Student Forums</td>
<td>c</td>
<td>c</td>
<td></td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Course Forums</td>
<td>c</td>
<td>c</td>
<td></td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Public Forums</td>
<td>c</td>
<td>c</td>
<td></td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>General Forums</td>
<td>c</td>
<td>c</td>
<td></td>
<td>c</td>
<td>c</td>
</tr>
</tbody>
</table>

### Bestowing

The communication within this forum category is characterized by an attitude of bestowing (i.e. an attitude of helping others by sharing insights).

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td>c</td>
<td>c</td>
<td></td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Student Forums</td>
<td>c</td>
<td>c</td>
<td></td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Course Forums</td>
<td>c</td>
<td>c</td>
<td></td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Public Forums</td>
<td>c</td>
<td>c</td>
<td></td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>General Forums</td>
<td>c</td>
<td>c</td>
<td></td>
<td>c</td>
<td>c</td>
</tr>
</tbody>
</table>

### Trust - Predictability

The actions of the members of this forum category are predictable (i.e. their behavior conforms to your expectations; they act consistently).

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td>c</td>
<td>c</td>
<td></td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Student Forums</td>
<td>c</td>
<td>c</td>
<td></td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Course Forums</td>
<td>c</td>
<td>c</td>
<td></td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Public Forums</td>
<td>c</td>
<td>c</td>
<td></td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>General Forums</td>
<td>c</td>
<td>c</td>
<td></td>
<td>c</td>
<td>c</td>
</tr>
</tbody>
</table>
### 0.5.7.2 Trust - Dependability

The members of this forum category are dependable (i.e., they can be relied on when it counts; they are honest, reliable, and benevolent).

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Student Forums</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Course Forums</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Public Forums</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>General Forums</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

### 0.5.7.3 Trust - Faith

The members of this forum category are willing to maintain a good relationship (i.e., they are responsive and care towards another; you feel secure that they will continue to be responsive and caring).

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Student Forums</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Course Forums</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Public Forums</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>General Forums</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

### 0.5.8.1 Competition - Homogenity

The interests of the participants of this forum category are homogeneous.

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Student Forums</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Course Forums</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Public Forums</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>General Forums</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

### 0.5.8.2 Competition - Cooperation

The degree of cooperation between the members of this forum category is very high.

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Student Forums</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Course Forums</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Public Forums</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>General Forums</td>
<td>○</td>
<td>○</td>
<td></td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
### Coetration - Competition

The degree of competition between the members of this forum category is very high.

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Student Forums</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Course Forums</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Public Forums</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>General Forums</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
</tbody>
</table>

### Social Affiliation Indicator - 1

One of my reasons for participation in this forum category is to meet new and different people.

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Student Forums</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Course Forums</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Public Forums</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>General Forums</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
</tbody>
</table>

### Social Affiliation Indicator - 2

One of my reasons for participation in this forum category is to gain a feeling of belonging.

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Student Forums</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Course Forums</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Public Forums</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>General Forums</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
</tbody>
</table>

### Professional Affl. Indicator - 1

One of my reasons for participation in this forum category is to exchange advice and solutions for my studies/ research/ work with knowledgeable members of the forum community.

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Student Forums</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Course Forums</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>Public Forums</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
<tr>
<td>General Forums</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
<td>c</td>
</tr>
</tbody>
</table>
Professional Affl. Indicator - 2

One of my reasons for participation in this forum category is to keep abreast of new ideas and innovations for my studies/research/work.

<table>
<thead>
<tr>
<th></th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither agree nor disagree</th>
<th>Disagree</th>
<th>Strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>College Forums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Student Forums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Course Forums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Forums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Forums</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comments, Raffle, Study: Yes/No

Do you want to comment on this study and/or the forums and/or do you want to participate in the raffle and/or do you want to be informed about the results of the study?

☐ Yes
☐ No

Neither of all = Endpage

Thank you for your participation!

Contact details:
Felix Schmitz-Justen, M.Sc.
Research Associate to Prof. Adalbert Wilhelm
International University Bremen
School of Humanities and Social Sciences
Research IV.88a, Campus Ring 1, D-28759 Bremen
Mailing Address: P.O. Box 750, 561, D-28172 Bremen

Phone: [int. +49] (0)421 200-3498
Mobile: [int. +49] (0)173 434 1104
Fax: [int. +49] (0)421 308-3363
Email: f.schmitz-justen@u-bremen.de
URL: http://www.u-bremen.de/directory/faculty/34137/

Thank you for your participation so far!

On the final two pages of the questionnaire you can submit your comments regarding the survey and/or the forums and/or submit your email address in order to participate in the raffle and/or submit your email address in order to be informed about the results of the study.

In order to keep your survey data separate from your comment and/or your email address and ensure data protection, please click the 'next' button to be diverted to the separate storage of your comment and/or email address.

Next
Comments + Email-Addresses

Please feel free to submit any comments and improvement suggestions you might have regarding the IUB forums and/or any questions and or comments you might have with regard to this survey/questionnaire.

In gesticulatory appreciation of your time and information, three 'Missing-Link' vouchers, each worth 25 EUR, will be raffled among participants who want to participate in the raffle. In order to participate in the raffle, just enter your email address in the following text box.

Many thanks to IUB's officially authorized textbook wholesalers 'Missing Link', who sponsors this research project with the three vouchers. The lots will be drawn end of October. The winners will be informed by email and announced on 'The IUB Blackboard' forum on the same day.

@iub-bremen.de

If you are interested I can provide you with a summary of the results in appreciation for your time and information. In order to receive a summary of the results, just enter your email address in the following text box.

@iub-bremen.de

Thank You, Contact Details

Thank you for your participation!

Contact details:
Felix Schmitz-Justen, M.Sc.
Research Associate to Prof. Andreas Wilhelm
International University Bremen
School of Humanities and Social Sciences
Research IV.6.0, Campus Ring 1, D-28759 Bremen
Mailing Address: P.O. Box 750561, D-28775 Bremen

Phone [Int. +49] (0)421 230-3403
Mobile [Int. +49] [0]173.240.41 04
Fax: [Int. +49] (0)421 280-3303
Email: f.schmitz-justen@iub-bremen.de
URL: http://www.iub-bremen.de/directory/faculty/54137
## B. QUESTIONNAIRE – OVERVIEW OF STRUCTURE & ABORTION-RATIO BY PAGE

<table>
<thead>
<tr>
<th>Page</th>
<th>Aborted until Page...</th>
<th>Continued to Page...</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction</strong></td>
<td>23 5,42%</td>
<td>424 100,00%</td>
</tr>
<tr>
<td><strong>ACTOR VIEWING (=&gt; FILTER!)</strong></td>
<td>22 5,19%</td>
<td>401 94,58%</td>
</tr>
<tr>
<td>Filter Actor Viewing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Since When</td>
<td>4 0,94%</td>
<td>379 89,39%</td>
</tr>
<tr>
<td>Viewing – Frequency</td>
<td>1 0,24%</td>
<td>375 88,44%</td>
</tr>
<tr>
<td>Filter Viewing Frequency Filter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Viewing – Type of Content</td>
<td>8 1,89%</td>
<td>374 88,21%</td>
</tr>
<tr>
<td><strong>ACTOR POSTING (=&gt; FILTER!)</strong></td>
<td>5 1,18%</td>
<td>366 86,32%</td>
</tr>
<tr>
<td>Filter Actor Posting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Since When</td>
<td>2 0,47%</td>
<td>361 85,14%</td>
</tr>
<tr>
<td>Posting – Frequency</td>
<td>2 0,47%</td>
<td>359 84,67%</td>
</tr>
<tr>
<td>Filter Posting Frequency Filter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Posting – Type of Content</td>
<td>2 0,47%</td>
<td>357 84,20%</td>
</tr>
<tr>
<td><strong>Filter FORUMS NEVER USED</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reasons For Not Using</td>
<td>2 0,47%</td>
<td>355 83,73%</td>
</tr>
<tr>
<td><strong>[Grouping Page] Personal Data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>1 0,24%</td>
<td>353 83,25%</td>
</tr>
<tr>
<td>Gender</td>
<td>0 0,00%</td>
<td>352 83,02%</td>
</tr>
<tr>
<td>Highest Education Qualification</td>
<td>0 0,00%</td>
<td>352 83,02%</td>
</tr>
<tr>
<td>Forum User Status</td>
<td>0 0,00%</td>
<td>352 83,02%</td>
</tr>
<tr>
<td><strong>Filter SES/SHSS/JCLL</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IUB-School SES/SHSS/JCLL</td>
<td>1 0,24%</td>
<td>352 83,02%</td>
</tr>
<tr>
<td>Web-Experience</td>
<td>0 0,00%</td>
<td>351 82,78%</td>
</tr>
<tr>
<td>Experience With Forums</td>
<td>0 0,00%</td>
<td>351 82,78%</td>
</tr>
<tr>
<td><strong>Filter FORUMS USED (REF. COMMUNITY)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forums – Type of Content</td>
<td>0 0,00%</td>
<td>351 82,78%</td>
</tr>
<tr>
<td>Identity – Personal Acquaintance</td>
<td>2 0,47%</td>
<td>351 82,78%</td>
</tr>
<tr>
<td><strong>[Grouping-Page] 4B MOTIVATION</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motivation – Voluntary</td>
<td>0 0,00%</td>
<td>349 82,31%</td>
</tr>
<tr>
<td>Please-Indicate Information</td>
<td>0 0,00%</td>
<td>349 82,31%</td>
</tr>
</tbody>
</table>

[continued]
Random (Rotation) Indicate ROTATION 1-4A

<table>
<thead>
<tr>
<th>Forumin Knowledge Transfer</th>
<th>2</th>
<th>0,47%</th>
<th>349</th>
<th>82,31%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forumin Knowledge Creation</td>
<td>2</td>
<td>0,47%</td>
<td>347</td>
<td>81,84%</td>
</tr>
</tbody>
</table>

**[Grouping-Page 1] SERVICE QUAL.**

<table>
<thead>
<tr>
<th>System Aspects – Usability</th>
<th>0</th>
<th>0,00%</th>
<th>345</th>
<th>81,37%</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Aspects – Learnability</td>
<td>0</td>
<td>0,00%</td>
<td>345</td>
<td>81,37%</td>
</tr>
</tbody>
</table>

**[Grouping-Page 2] CONTENT QUAL.**

| Content – Quality of Content | 1 | 0,24% | 345 | 81,37% |

**[Grouping-Page 3A] SENSE OF COMMUN.**

| Identity – Feeling as Member | 1 | 0,24% | 344 | 81,13% |
| Identity – Social Harmony | 0 | 0,00% | 343 | 80,90% |

**[Grouping-Page 3B] CARE**

| Seizing | 1 | 0,24% | 343 | 80,90% |
| Bestowing | 0 | 0,00% | 342 | 80,66% |

**[Grouping-Page 3C] TRUST**

| Trust – Predictability | 2 | 0,47% | 342 | 80,66% |
| Trust – Dependability | 0 | 0,00% | 340 | 80,19% |
| Trust – Faith | 1 | 0,24% | 340 | 80,19% |

**[Grouping-Page 3D] COMPETITION**

| Coopetition – Homogeneity | 2 | 0,47% | 339 | 79,95% |
| Coopetition – Cooperation | 1 | 0,24% | 337 | 79,48% |
| Coopetition – Competition | 2 | 0,47% | 336 | 79,25% |

**[Grouping-Page 4A] MOTIVATION**

| Social Affiliation Indicator – 1 | 0 | 0,00% | 334 | 78,77% |
| Social Affiliation Indicator – 2 | 2 | 0,47% | 334 | 78,77% |
| Professional Affiliation Indicator – 1 | 0 | 0,00% | 332 | 78,30% |
| Professional Affiliation Indicator – 2 | 2 | 0,47% | 332 | 78,30% |

**Comments, Raffle, Study: Yes/No**

| Filter Comments, Raffle, Study Filter | 0 | 0,00% | 330 | 77,83% |
| Neither of all = End-page (Status = 31) | 0 | 0,00% | 330 | 77,83% |
| Diversion for Data Protection (Status = 31) | 0 | 0,00% | 330 | 77,83% |
| Thank You, Contact Details = End-page (Status = 31) | 0 | 0,00% | 330 | 77,83% |

**Total – Aborted** | 94 | 22,17% |
**Total – Completed without pause** | 303 | 71,46% |
**Total – Completed after pause** | 27 | 6,37% |
C. CD-ROM

The CD-ROM contains the following files:

1. Anonymized IUB forum log-file data (Excel-file)
2a. HTML and PDF version of the online questionnaire
2b. Excel- and SPSS-version of the survey data
3. SPSS-output of the ANOVA-analysis
4. SPSS-output of scale-development
5. AMOS-files of the SEM-Analysis

Data are property of Felix Schmitz-Justen and/or IUB, must be kept strictly private, and must not be circulated without permission of the author.