

Overview of Contents

Part I Introduction: Solution Space for User Innovation and Design	1
1 The Challenge of Simplifying Solution Space	3
2 Framing for the Dissertation.....	11
3 Definitions of Significant Terms.....	17
4 Structure of the Dissertation.....	21
Part II Using Solution Space: Exploring Users Simplifying Solution Space	27
1 Needs and Objectives.....	29
2 Understanding the Context.....	32
3 Theoretical Underpinning.....	40
4 Method and Data.....	44
5 Findings	64
6 Discussion	76
Part III Structuring Solution Space: Exploring Toolkits Simplifying Solution Space.....	79
1 Needs and Objectives.....	81
2 Understanding the Context.....	85
3 Theoretical Underpinning.....	90
4 Method and Data.....	94
5 Findings: Simplifying Solution Space for Users	100
6 Discussion	113
Part IV Generating Solution Space: Designing a Toolkit to Generate and Recommend Solutions	117
1 Needs and Objectives.....	119
2 Theoretical Foundations for Design.....	123
3 Method and Context.....	129
4 Findings: Describing the Artifacts.....	135
5 Findings: Evaluations.....	147

6	Discussion	155
Part V Discussion: Simplifying Solution Space.....		159
1	Summary of Studies	161
2	Theoretical Contributions	169
3	Implications for Practice.....	177
4	Limitations and Future Research	181
5	Conclusion.....	184
References		185
Annexes		199

Table of Contents

Foreword	V
Preface.....	VII
Overview of Contents.....	IX
Table of Contents	XI
List of Figures.....	XVII
List of Tables	XIX
List of Abbreviations	XX
Part I Introduction: Solution Space for User Innovation and Design	1
1 The Challenge of Simplifying Solution Space	3
2 Framing for the Dissertation.....	11
2.1 Characteristics of Artifacts	11
2.2 Modularity in Products.....	12
2.3 Modularity in Organizations	13
2.4 Modularity for Simplifying Solution Space	15
3 Definitions of Significant Terms.....	17
4 Structure of the Dissertation.....	21
Part II Using Solution Space: Exploring Users Simplifying Solution Space	27
1 Needs and Objectives.....	29
2 Understanding the Context.....	32
2.1 User Innovation	32
2.1.1 <i>User Firms as Innovators</i>	32
2.1.2 <i>End Users as Innovators</i>	34
2.1.3 <i>Sticky Information</i>	35
2.2 Toolkits for User Innovation	36
2.3 Solution Space for Making	38
3 Theoretical Underpinning.....	40
3.1 Operations in Modularity.....	41
3.2 Interfaces in Modularity	42

4	Method and Data.....	44
4.1	Research Approach	44
4.2	Research Design.....	46
4.2.1	<i>Research Design for Sub-study 1</i>	48
4.2.2	<i>Research Design for Sub-study 2</i>	50
4.3	Case details	53
4.3.1	<i>Case Details for Sub-study 1</i>	53
4.3.2	<i>Case Details for Sub-study 2</i>	57
5	Findings	64
5.1	Findings from Sub-study 1.....	64
5.1.1	<i>Modular Organization</i>	65
5.1.2	<i>Modular Product Design</i>	65
5.2	Findings from Sub-study 2.....	68
5.2.1	<i>Modular Organization</i>	68
5.2.2	<i>Modular Product Design</i>	71
5.3	Cross Findings from Sub-studies	73
5.3.1	<i>Stages of User Innovation</i>	73
5.3.2	<i>Dynamic Interfaces to Simplify Solution Space</i>	75
6	Discussion	76
6.1	Solution Space for User Innovation	76
6.2	Conclusion	77

Part III Structuring Solution Space: Exploring Toolkits Simplifying Solution

	Space.....	79
1	Needs and Objectives.....	81
2	Understanding the Context	85
2.1	Expert toolkits	85
2.2	Basic toolkits.....	86
2.3	Solution Space Development	88
3	Theoretical Underpinning.....	90
3.1	Modularity-in-use.....	90
3.2	Modularity-in-design	92
4	Method and Data.....	94

4.1 Research Approach	94
4.2 Research Design	96
4.2.1 Keyword Search	97
4.2.2 Create Data Repository	97
4.2.3 Sampling Cases	97
4.2.4 Solution Space Attributes	98
4.2.5 Enrich cases	98
4.3 Data Sample	98
5 Findings: Simplifying Solution Space for Users	100
5.1 Analysis of Toolkit Solution Space	101
5.1.1 Solution Space Categorization based on Modularity-in-use	101
5.1.2 Solution Space and Modularity-in-design	108
5.2 Mechanisms for Simplifying Solution Space	110
6 Discussion	113
6.1 Meta-toolkit for User Created Toolkits	114
6.2 Conclusion	115
 Part IV Generating Solution Space: Designing a Toolkit to Generate and	
Recommend Solutions	117
1 Needs and Objectives	119
2 Theoretical Foundations for Design	123
2.1 Need solution Pairs	123
2.2 Making Design Decisions	124
2.3 Focused Navigation in Toolkits	125
2.4 Recommender Systems	126
2.4.1 Knowledge-Based and Constraint-Based Recommender Systems	127
3 Method and Context	129
3.1 Research Approach	129
3.2 Research Design	130
3.2.1 Problem Identification and Motivation	132
3.2.2 Objectives of a Solution	132
3.2.3 Design & Development	132
3.2.4 Demonstration	133

3.2.5	<i>Evaluation</i>	133
3.2.6	<i>Communication</i>	134
4	Findings: Describing the Artifacts	135
4.1	Artifact 1: Web-based Interface (View)	136
4.2	Artifact 2: Algorithm for Solutions (Controller)	140
4.2.1	<i>Explicit needs Validation</i>	141
4.2.2	<i>Solution Generation</i>	141
4.2.3	<i>Solution Reduction</i>	142
4.3	Artifact 3: Ontology for Need-based Recommendations (Model)	142
4.3.1	<i>Explicit Database</i>	144
4.3.2	<i>Implicit database</i>	144
4.3.3	<i>Input Reader</i>	146
4.3.4	<i>Solution Model</i>	146
5	Findings: Evaluations	147
5.1	Observational Studies	147
5.2	Experiments	148
5.2.1	<i>Method</i>	148
5.2.2	<i>Results</i>	151
6	Discussion	155
6.1	General Discussions	155
6.1.1	<i>Reflections</i>	155
6.1.2	<i>Limitations and Future Research</i>	156
6.2	Summary of Results	157
6.2.1	<i>Designed Artifacts</i>	157
6.2.2	<i>Hypotheses Validation</i>	157
6.3	Conclusion	158
	Part V Discussion: Simplifying Solution Space	159
1	Summary of Studies	161
1.1	Summary of Part II	163
1.2	Summary of Part III	165
1.3	Summary of Part IV	167
2	Theoretical Contributions	169

2.1 Summarized Theoretical Contributions	169
2.1.1 <i>Theoretical Contributions of Part II</i>	169
2.1.2 <i>Theoretical Contributions of Part III</i>	171
2.1.3 <i>Theoretical Contributions of Part IV</i>	172
2.2 Cross Study Contributions	173
2.2.1 <i>Mechanisms for Simplifying Solution Space</i>	173
2.2.2 <i>Bottom-up Modularity for User Innovation</i>	174
2.2.3 <i>Model for Simplifying Solution Space</i>	175
3 Implications for Practice	177
4 Limitations and Future Research	181
4.1 Limitations of the Studies	181
4.2 Future Research	182
5 Conclusion	184
References	185
Annexes	199
Annex A: Questionnaire for user innovators	201
Annex B: Structure of Case Studies for Part II	202
Annex C: Survey Questions for Maker Event Participants	203
Annex D: Survey used in Experiment	204
Annex E: Glossary of Technologies and Organizations	205