## Contents

1 Introduction .................................................. 1  
   1.1 On Sustainability ........................................ 2  
   1.2 On Green ICT ............................................ 4  
      1.2.1 Definition of green ICT ............................ 5  
      1.2.2 The environmental impact of ICT ................. 7  
   1.3 Thesis Goal ............................................. 10  
   1.4 Relevancy of Thesis .................................... 12  
   1.5 Research Questions .................................... 13  
   1.6 Outline of the Thesis and Publications ............... 14  

2 Green ICT Research Challenges .............................. 19  
   2.1 Introduction ............................................ 19  
   2.2 Methodology ............................................ 20  
   2.3 Results ................................................ 22  
   2.4 Discussion ............................................. 25  
      2.4.1 Conflicting trends ................................ 25  
      2.4.2 People awareness strategy effects ............... 26  
      2.4.3 Research direction and research gaps .......... 27  
   2.5 Conclusion ............................................. 28  

3 Factors of Influence on the Environmental Impact of ICT 29  
   3.1 Introduction ............................................ 29  
   3.2 Design of the Literature Review ....................... 31  
      3.2.1 Chapter research questions ....................... 31  
      3.2.2 Search process .................................... 31  
      3.2.3 Study selection ................................... 32  
      3.2.4 Data analysis ..................................... 32  
   3.3 Results ................................................ 35  
      3.3.1 Factors of influence found ....................... 35  
      3.3.2 Classification of factors of influence ........... 36  
      3.3.3 Taxonomy of factors of influence ................ 37  
      3.3.4 Description of taxonomy and the factors of influence 38  
      3.3.5 Comparison between taxonomy and conceptual framework 41  
      3.3.6 Coverage and spread of domains and factors .... 42  
   3.4 Discussion ............................................. 43  
      3.4.1 Factors found ..................................... 43  
      3.4.2 On the taxonomy ................................... 45  
      3.4.3 Gaps in the taxonomy .............................. 47  
      3.4.4 State of the art of the research field .......... 48
3.4.5 Impact of findings on practice ........................................ 49
3.5 Threats to Validity ......................................................... 49
3.6 Conclusions .............................................................. 50

4 Green ICT Maturity Model .................................................. 53
4.1 Introduction ............................................................... 53
4.2 Creation of the SURF Green ICT Maturity Model ................. 55
4.3 Description of the SURF Green ICT Maturity Model ............ 56
4.4 Evaluation of the SURF Green ICT Maturity Model ............. 57
4.5 Results of the Evaluation ............................................... 58
4.6 Related Work .............................................................. 62
4.7 Conclusion from Survey ................................................. 64
4.8 SURF Green ICT Maturity Model Version 2 ....................... 66

5 Assessment of Green ICT in Organisations ......................... 69
5.1 Introduction ............................................................... 69
5.2 Related Work ............................................................. 70
  5.2.1 On green ICT maturity models .................................... 70
  5.2.2 On green ICT adoption ............................................. 71
5.3 Method of Field Study .................................................. 73
  5.3.1 Data collection ....................................................... 73
  5.3.2 Method of analysis ................................................ 76
5.4 Results ........................................................................... 76
  5.4.1 Results from the maturity scan and questionnaire ............ 77
  5.4.2 Readiness to adopt green ICT ..................................... 79
5.5 Discussion ................................................................. 81
5.6 Conclusion ................................................................. 83

6 Adoption of Green ICT in Organisations ............................. 85
6.1 Introduction ............................................................... 85
6.2 Method ...................................................................... 86
6.3 Field Study ............................................................... 87
  6.3.1 Organisation A ......................................................... 87
  6.3.2 Organisation B ........................................................ 94
  6.3.3 Organisation C ........................................................ 99
6.4 Discussion ................................................................. 105
  6.4.1 Many factors influence the adoption of green ICT .......... 105
  6.4.2 Tools help adoption once an organisation is ready .......... 107
  6.4.3 Green ICT adoption needs a systemic approach ............ 109
6.5 Conclusions .............................................................. 110
7 Conclusions

7.1 Main Contributions

7.1.1 RQ1.1. How is the potential of green ICT reflected in research? 113

7.1.2 RQ1.2. What are the factors of influence on the environmental impact of ICT? 114

7.1.3 RQ2. How can the potential of green ICT be modelled for organisations? 115

7.1.4 RQ3. How is the quality of the SGIMM assessed by its potential users? 116

7.1.5 RQ4. How does the SGIMM function in practice? 116

7.1.6 RQ5. What factors of influence affect the adoption of green ICT practices? 117

7.1.7 The main research question: How can organisations make use of the potential of green ICT? 118

7.2 Future Directions

7.2.1 The human factor 119

7.2.2 Cycle of factors of influence 119

7.2.3 A tool with a systemic approach 120

7.3 Final Thoughts 120

Summary 123

Samenvatting 127

Acknowledgements 131

Bibliography 158

A Overview of Kinds of Effect of ICT on the Environment 159

B Community on Green ICT in Dutch Higher Education 167

C The SURF Green ICT Maturity Model in detail 175

D Primary Studies in SLR on Green ICT Research Challenges 185