

### III Table of Contents

I	Abstract .....	III
II	Preface .....	IV
III	Table of Contents .....	VII
IV	List of Figures .....	XII
V	List of Tables .....	XIV
VII	Acknowledgement .....	XVII
VIII	Author's Declaration .....	XVIII
IX	Definitions .....	XIX
X	Abbreviations .....	XXI
1	Introduction .....	1
1.1	Research Overview .....	3
1.2	Theoretical Background .....	6
1.3	Practical Background.....	9
1.3.1	The Manufacturing Industry .....	10
1.3.2	The Consumer Market .....	10
1.3.3	The Retail Market .....	13
1.3.4	Delivery and Transportation.....	16
1.3.5	Operational Utilisation Structures of DPS in UMTD .....	19
1.4	Importance and Attractiveness .....	22
2	Research Question .....	23
2.1	Definition of the Research Question .....	23
2.2	Definition of UMTD Delivery with Time Windows .....	25
2.3	Narrowing the Focus of the Research Problem.....	27
2.4	Generalisability of the Research Question.....	30
2.5	Importance of the Cost Problem in Distribution for UMTD .....	32

2.6	Reflections on the Formulated Cost Problem .....	35
2.7	Cost of Delivery for UMTD .....	36
2.7.1	Identifying Cost Parameters .....	36
2.7.2	Delivery Cost as a Share in Total Cost.....	38
2.8	Summary and Conclusions .....	41
3	Literature Review .....	43
3.1	Distribution Planning Approaches .....	43
3.1.1	Historical Development .....	44
3.1.2	Tactical and Strategic Planning .....	51
3.1.3	Heuristic and meta-heuristic Models .....	54
3.1.4	Stochastic & Dynamic Simulation based Planning in DPS .....	58
3.1.5	Planning under Certainty and Uncertainty .....	61
3.1.6	Tabu Search and Genetic Search.....	62
3.1.7	Simulated Annealing .....	64
3.1.8	Capacitated Vehicle Routing .....	65
3.2	TWC in Distribution Planning.....	67
3.2.1	Classification of TWC in VRP.....	69
3.2.2	Use of complex DPS for VRPTW .....	75
3.3	Distribution Planning for UMTD .....	78
3.3.1	SCM in Production and Distribution.....	84
3.3.2	Approaches for UMTD.....	90
3.3.3	UMTD Distribution Planning under TWC.....	94
3.4	Simulation Techniques in Logistics.....	97
3.4.1	Appraisal of existing Simulation Models.....	104
3.4.2	Application of Simulation in Decision Support Models .....	109
3.4.3	Sensitivity Considerations.....	112
3.5	Experimental Research .....	114

3.5.1	Experimental Research in Logistics.....	114
3.5.2	Risks in Experimental Design .....	115
3.5.3	Sampling and Pilot Studies in Experimental Research .....	116
3.6	Coherence between Simulation and Experimental Research .....	119
3.7	Summary and Conclusion .....	122
4	Methodology .....	125
4.1	Research Framework.....	125
4.1.1	Mapping the Research Design .....	126
4.1.2	Experimental Research Design .....	127
4.1.3	Simulation in the Environment of Positivistic Research .....	131
4.1.4	Combining Qualitative and Quantitative Research.....	133
4.1.5	Combining Inductive and deductive Methodologies .....	136
4.1.6	Parameters of Validity Substantiation .....	137
4.1.7	Practical and Phenomenological Research Initiations .....	139
4.2	Definition of the Cost Function.....	144
4.2.1	Influences on Delivery Cost.....	144
4.2.2	Supporting Cost Parameters .....	149
4.2.3	Cost Function and Objective Function .....	153
4.3	Choice of the Simulation Model .....	157
4.3.1	Structural and Methodological Approach .....	158
4.3.2	Logistics Optimisation through Simulation .....	160
4.3.3	Summary of the applied Simulation Model .....	161
4.4	Sampling and Data Input Configurations .....	163
4.4.1	Data Sampling .....	164
4.5	Analysis .....	168
4.5.1	Application of Descriptive Statistics .....	169
4.5.2	Other Multivariate Analyses .....	170

4.6	Critical Reflections on the chosen Methodological Approach .....	172
5	Research Process .....	175
5.1	Definition of the Research Process and DPS Selection .....	176
5.1.1	Research Process Definition .....	176
5.1.2	System Requirements.....	179
5.1.3	System Selection Process .....	179
5.1.4	System Use and Operational Specifications .....	181
5.1.5	Explanatory Example of the Data Simulation Process .....	182
5.1.6	Critical Reflections on the Chosen Approach .....	190
5.2	Data Collection and Processing .....	191
5.2.1	Data Cleansing and Selection Parameters .....	198
5.2.2	Validity and Reliability of the Screening.....	199
5.2.3	Research Process Validation .....	202
5.2.4	Data Request, Origin and Delivery .....	207
5.2.5	Data Input Format.....	209
5.2.6	Data Purification .....	214
5.2.7	Data Collection Strategy .....	216
6	Analysis of Results .....	221
6.1	Descriptive Base Data Analysis.....	221
6.1.1	Results - Base Data-1 .....	222
6.1.2	Results -Base Data-2 .....	224
6.1.3	Results - Base Data-3 .....	226
6.1.4	Summary and Conclusions.....	228
6.2	Customer Service Perspective .....	229
6.3	Sensitivity Analysis .....	233
6.4	Summary and Conclusions of the Data Analysis .....	236
7	Supporting Environmental Considerations.....	239

7.1 Externalities of Road Transport .....	239
7.2 Pre-Requisites for Environmental Considerations.....	241
7.3 Implications of Environmental Considerations .....	253
7.4 Considerations on other Freight Transport Externalities .....	256
7.5 Conclusions and Summary.....	260
8 Conclusions .....	263
8.1 Contribution to theoretical Knowledge .....	265
8.2 Contribution to Literature .....	268
8.3 Transferability and Generalisability .....	270
8.4 Implications on Operational Practice.....	274
8.4.1 Significance of the Cost Advantage .....	275
8.4.2 Reflections on the Customer Service Dimension .....	279
8.4.3 Implementation Scenarios .....	280
8.4.4 Summary of Implications.....	282
8.5 Further Research Opportunities .....	283
XI Appendix .....	287
XI.A Trends and Strategies in Logistics and SCM.....	288
XI.A.i Customer Focus .....	294
XI.A.ii Logistics Information Systems for the VRP .....	297
XI.A.iii Competitive Advantage by Cost Leadership.....	299
XI.B Supplements to the Practical Background .....	301
XI.B.i The Furniture Industry in Germany and Europe .....	301
XI.B.ii Production Planning for UMTD .....	311
XII References .....	315