

# Table of Content

<b>1</b>	<b>Introduction.....</b>	<b>1</b>
1.1	Standards in Information Systems .....	2
1.2	Motivation and research questions.....	3
1.3	Structure of the thesis.....	5
1.4	Methodology and definitions .....	7
1.4.1	Methodology .....	7
1.4.2	Standard semantics .....	7
1.4.3	Empirical data from Fortune 1,000 study.....	9
<b>2</b>	<b>Standardization problems.....</b>	<b>11</b>
2.1	A brief history of standardization .....	11
2.1.1	From DNA to railways .....	11
2.1.2	From production side to demand side economies of scale .....	12
2.2	Network effect theory as theoretical foundation.....	14
2.2.1	Basics .....	14
2.2.1.1	General findings of network effect theory.....	15
2.2.1.2	Related literature .....	17
2.2.2	Path dependency, lock-in and multiple equilibria .....	19
2.2.3	Instability ("tippy networks").....	24
2.2.4	Excess inertia: The start-up problem.....	25
2.2.5	Excess momentum: Too much standardization .....	26
2.2.6	Internalizing network effects in sponsored networks .....	26
2.2.7	Pareto-inferior market results and monopolies.....	27
2.2.8	Laissez-faire vs. dirigisme.....	28
2.3	Reconsidering network effect theory .....	29
2.3.1	Network effects versus network externalities.....	32
2.3.2	Direct vs. indirect network effects.....	33
2.3.3	Inefficiency and market failure .....	35
2.3.4	Costs of network size .....	37
2.3.5	Homogeneous network effects .....	38
2.3.6	Confusion of centralized and decentralized decision making .....	39

2.3.7	Ambiguous empirical evidence .....	39
2.3.7.1	Keyboards: QWERTY vs. Dvorak's DSK.....	39
2.3.7.2	The battle for VCR standards: beta isn't always better.....	42
2.3.7.3	Nuclear power reactors.....	43
2.3.7.4	Automobiles: Gas vs. Gasoline .....	45
2.3.8	Normative Implications.....	46
2.3.9	Summary .....	47
<b>3</b>	<b>A standardization framework .....</b>	<b>49</b>
3.1	Modeling the standardization problem: A basic model .....	49
3.1.1	A standardization model for centrally coordinated networks.....	52
3.1.2	A standardization model for decentrally coordinated networks ....	54
3.2	Equilibria in standardization problems .....	57
3.2.1	Information.....	58
3.2.2	Basic games.....	58
3.2.3	Equilibria.....	59
3.2.4	Efficiency of equilibria.....	59
3.2.4.1	Pareto efficiency.....	59
3.2.4.2	Kaldor-Hicks efficiency .....	60
3.3	Standardization games .....	61
3.3.1	Standard standardization games .....	61
3.3.2	Static non-cooperative 2-player standardization games .....	64
3.3.3	Sequential non-cooperative 2-player standardization games.....	67
3.3.3.1	Complete, perfect information.....	67
3.3.3.2	Complete, imperfect information .....	70
3.3.3.3	Incomplete information .....	70
3.3.3.4	Bayes-Nash-Equilibria .....	72
3.3.4	Dynamic n-player standardization games.....	75
3.3.4.1	Incomplete, imperfect information .....	76
3.3.4.2	Incomplete, perfect information .....	76
<b>4</b>	<b>A simulation model for the standardization problem.</b> .....	<b>80</b>
4.1	Simulation design.....	80
4.1.1	Decision functions.....	80
4.1.2	Simulation parameters and pattern .....	82
4.2	The basic standardization problem.....	85

4.2.1	The single-period basic standardization problem .....	85
4.2.1.1	The standardization gap .....	85
4.2.1.2	Stability of the standardization gap .....	88
4.2.2	The multi-period basic standardization problem .....	91
4.2.2.1	The standardization gap .....	91
4.2.2.2	Single standard implementation vs. continuous license costs ...	94
4.2.3	Sequential choice .....	96
4.2.4	Individual consequences .....	98
4.2.4.1	Individual gains and losses .....	98
4.2.4.2	Wrong decisions .....	100
4.2.5	Agent size and standardization time .....	102
4.2.5.1	Stationary state period and agent size .....	102
4.2.5.2	Stationary state period and network size .....	105
4.2.6	Variation of network structure .....	105
4.2.6.1	Errors in different topologies .....	109
4.2.6.2	Standardization costs and network density .....	110
4.2.6.3	Summary .....	112
4.2.7	Installed base effects .....	113
4.2.8	Summary of multi-period one standard problems .....	117
4.3	The extended standardization model .....	117
4.3.1	The standardization gap and the equilibrium process .....	119
4.3.1.1	Simultaneous decisions, single choice .....	119
4.3.1.2	An adapted Herfindahl index .....	121
4.3.1.3	Simultaneous choice with reversible decisions .....	124
4.3.2	Five diffusion patterns .....	127
4.3.2.1	No standardization .....	127
4.3.2.2	Mixed solution .....	127
4.3.2.3	Monopoly .....	127
4.3.2.4	Oligopoly .....	128
4.3.2.5	Dynamic equilibrium .....	128
4.3.2.6	Comparing the diffusion paths .....	128
4.3.2.7	Summary .....	132
4.3.3	Sequential choice .....	132
4.3.4	Individual consequences .....	135
4.3.5	Agent size .....	138
4.3.6	Variations of network structure .....	139
4.3.7	Installed base effects .....	144
4.4	A different decentralized anticipation calculus .....	151
4.5	Adapting the diffusion model .....	157
4.5.1	From standardization to diffusion .....	157
4.5.1.1	The diffusion model .....	157
4.5.1.2	An integration .....	159
4.5.1.3	Further research .....	162

## 5 Solution mechanisms and empirical data ..... 164

5.1	Empirical data for the standardization problem .....	165
5.1.1	Standardization problems in corporate networks .....	165
5.1.2	The importance of network effects .....	167
5.1.3	Diffusion of EDI-Standards .....	168
5.1.4	EDI data: costs and benefits .....	171
5.1.4.1	Empirical EDI benefits in the literature .....	172
5.1.4.2	Empirical EDI costs in the literature .....	173
5.1.5	EDI data from large enterprises .....	174
5.1.6	EDI data from SMEs .....	176
5.1.6.1	Results of the retailers survey .....	177
5.1.6.2	Results from the producers and wholesalers survey .....	180
5.1.7	MIS managers opinion on general standardization issues .....	183
5.2	Closing the standardization gap .....	184
5.2.1	Solution designs for standardization problems .....	184
5.2.2	Problems of centralized coordination .....	185
5.2.2.1	<i>Data problem</i> .....	186
5.2.2.2	<i>Complexity problem</i> .....	186
5.2.2.3	<i>Implementation problem</i> .....	188
5.2.3	Excursion: A word on centralization and decentralization .....	188
5.3	The implementation problem .....	191
5.3.1	A case of X.500 Directory Services .....	192
5.3.1.1	Directory Services .....	193
5.3.1.2	Empirical data .....	194
5.3.1.3	Profitability analysis .....	196
5.3.2	A network ROI .....	203
5.3.2.1	A two player solution .....	203
5.3.2.2	An n-player solution .....	206
5.3.3	A network ROI for a virtual principal .....	207
5.3.4	Problems associated with the ROI .....	209
5.4	The data problem .....	210
5.4.1	An adapted Groves mechanism for the decentralized standardization model .....	211
5.4.1.1	The Groves mechanism .....	211
5.4.1.2	A Groves example .....	212
5.4.1.3	A Groves mechanism for decentralized standardization problems .....	213
5.4.1.4	Example of dominant strategies for the adapted Groves mechanism .....	214
5.4.1.5	Summary .....	220
5.4.2	Problems associated with the Groves mechanism .....	220

5.5	A bidding mechanism .....	221
5.5.1	Two examples .....	223
5.5.2	A comparison between the bidding mechanism and centralized coordination.....	226
5.6	Managerial and policy implications.....	229
5.6.1	Some general findings .....	230
5.6.2	Networks as a competitive advantage .....	231
5.6.3	Committees and consortia .....	232
5.6.4	Asymmetric network costs and gains .....	233
5.6.5	Infrastructure subsidies and SME integration.....	234
<b>6</b>	<b>Theoretical implications: towards an interdisciplinary network theory .....</b>	<b>236</b>
6.1	General Drawbacks of the neo-classical paradigm .....	236
6.1.1	Absence of Externalities.....	237
6.1.2	Complete rationality of the homo oeconomicus .....	237
6.1.3	Exclusion principle.....	238
6.1.4	Consumption paradigm .....	238
6.1.5	Separation of consumers and producers .....	239
6.1.6	Divisibility of resources .....	239
6.1.7	Concave Utility Functions / no complementarities .....	239
6.1.8	Absence of transaction costs .....	239
6.2	Towards an interdisciplinary theory of network effects ..	240
6.3	Required modeling power of an interdisciplinary theory of network effects.....	243
6.3.1	Modeling of knowledge and uncertainty / bounded rationality ...	243
6.3.2	Evolutionary System Dynamics .....	243
6.3.3	Emergence of system components and links .....	244
6.3.4	Abolishment of convexity and divisibility assumptions.....	244
6.3.5	Economics of Intermediation .....	244
<b>7</b>	<b>Conclusions and further research.....</b>	<b>245</b>
7.1	Summary of the findings.....	245
7.2	Further research.....	248

<b>Variables and symbols.....</b>	<b>253</b>
<b>List of Equatons .....</b>	<b>257</b>
<b>List of Figures.....</b>	<b>260</b>
<b>List of Tables .....</b>	<b>265</b>
<b>References .....</b>	<b>268</b>

Economics of Standards in Information Networks

Weitzel, T.

2004, XVI, 292 p. 106 illus., Softcover

ISBN: 978-3-7908-0076-0

A product of Physica-Verlag Heidelberg