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Enabling Supply Networks with Collaborative Information Infrastructures

Towards a new perpective of the role of ICT in Industrial Networks

PhD. Dissertation Presentation, 27.feb.2009

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PhD. Dissertation Dates

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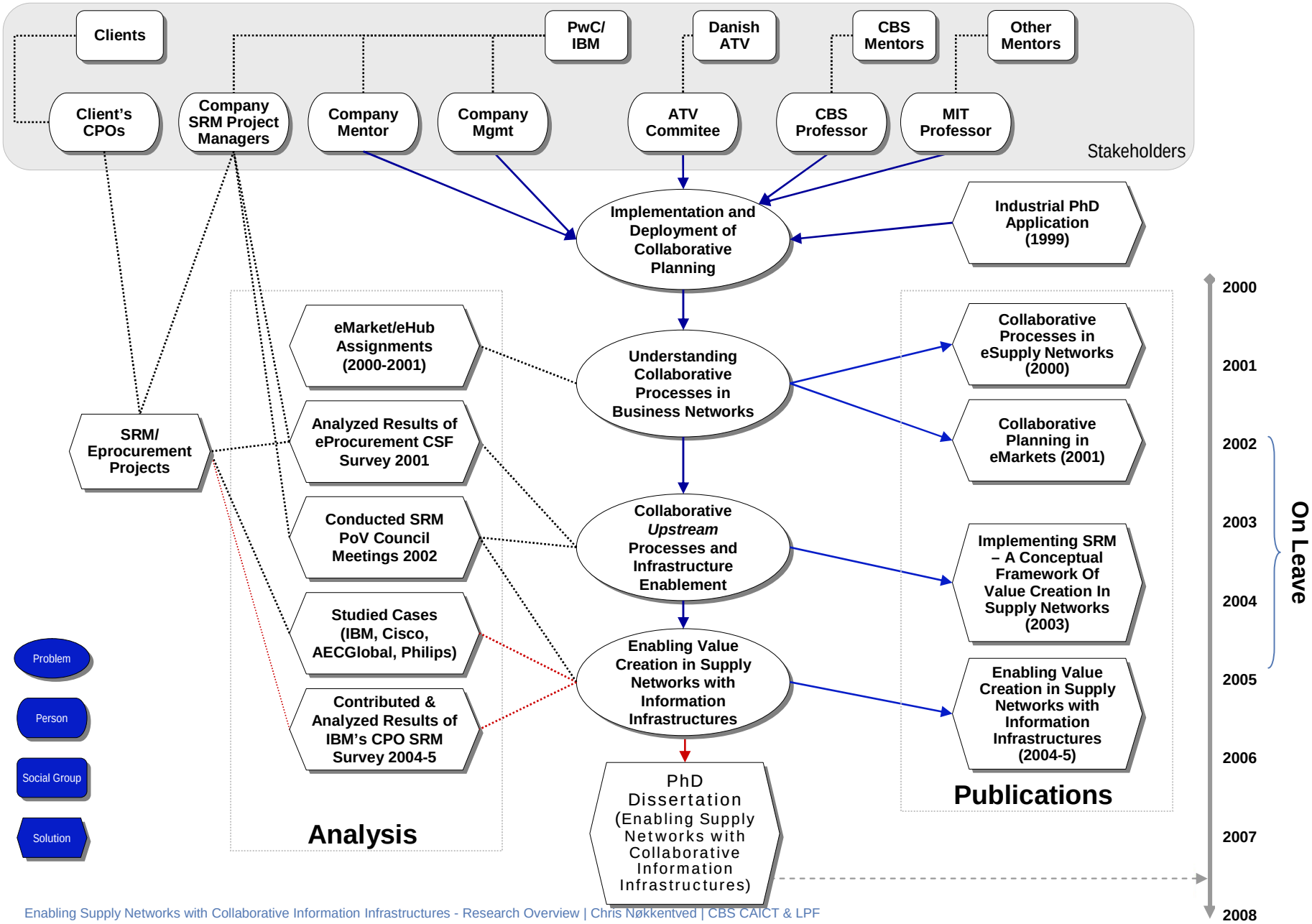
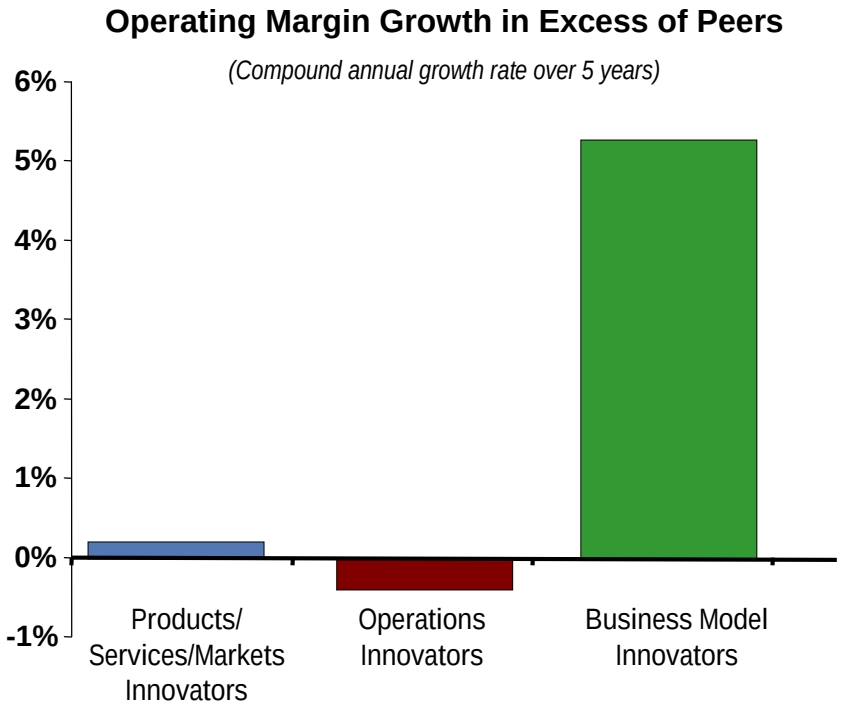
Defense: 27th of February 2009

PhD. Themes, Publications, Timeline & Stakeholders



Business Model Innovation and the role of IT...

- **Recent IBM CEO surveys provided further evidence on the importance leaders pose on the role of technology in enabling the necessary and continuous transformation towards differentiating & collaborative business models**



"The business model we choose will determine the success or failure of our strategy."

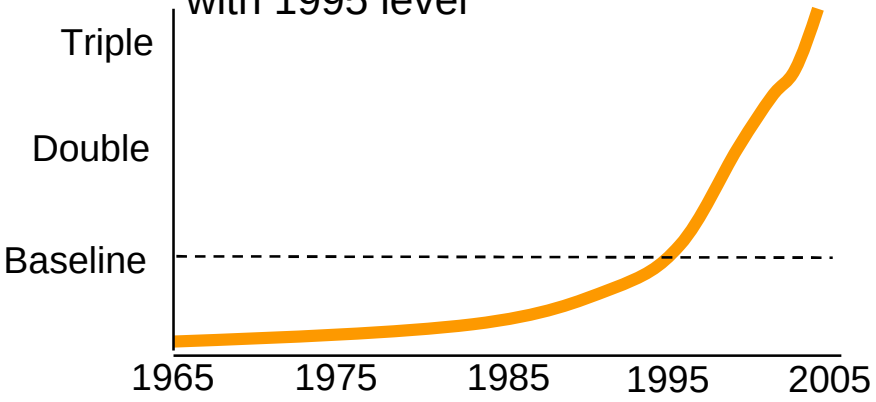
"Products and services can be copied, the business model is the differentiator."

"Our greatest focus is on business model innovation, which is where the greatest benefits lie."

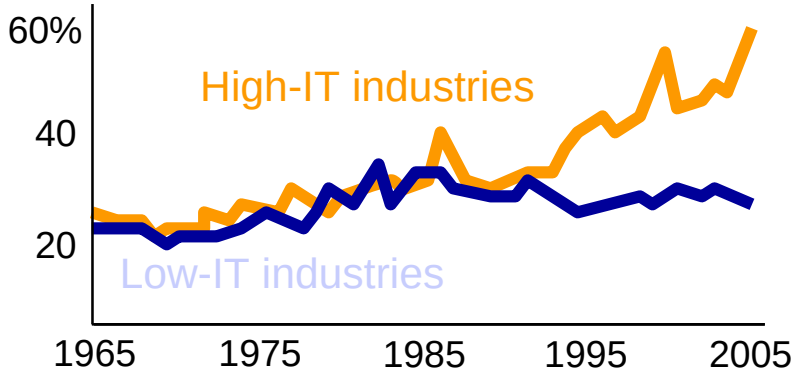
"A business model is a conceptual view that contains a set of elements and their relationships and allows expressing the business logic of a specific firm. It is a description of the value a company offers to segments of customers and of the architecture of the firm and its network of partners for creating, marketing, and delivering this value and relationship capital, to generate profitable and sustainable revenue streams." (Osterwalder et al. 2005)

Recent Studies confirm that Efficient & Aligned Use of IT affects business models, competition & performance

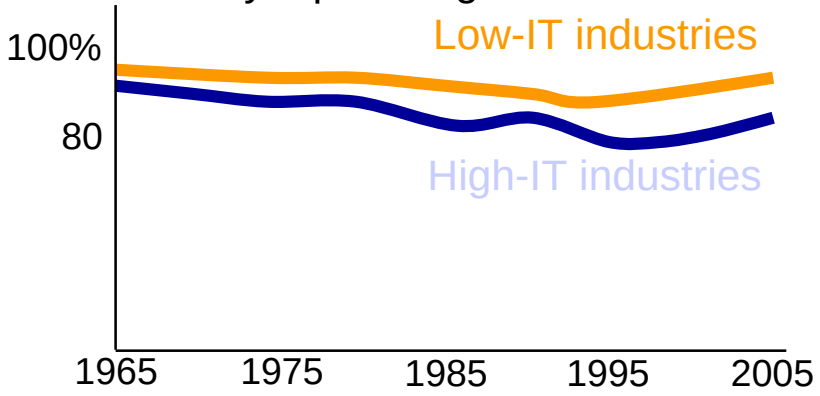
Spending compared with 1995 level



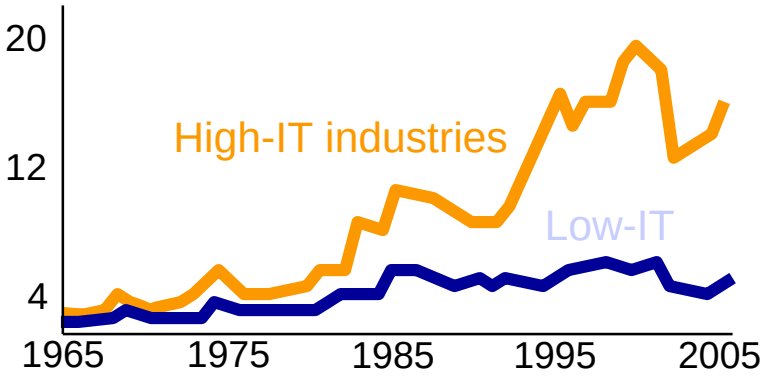
Performance gap (profit margin) between top and bottom quartiles



Concentration — market share held by top 20 largest firms



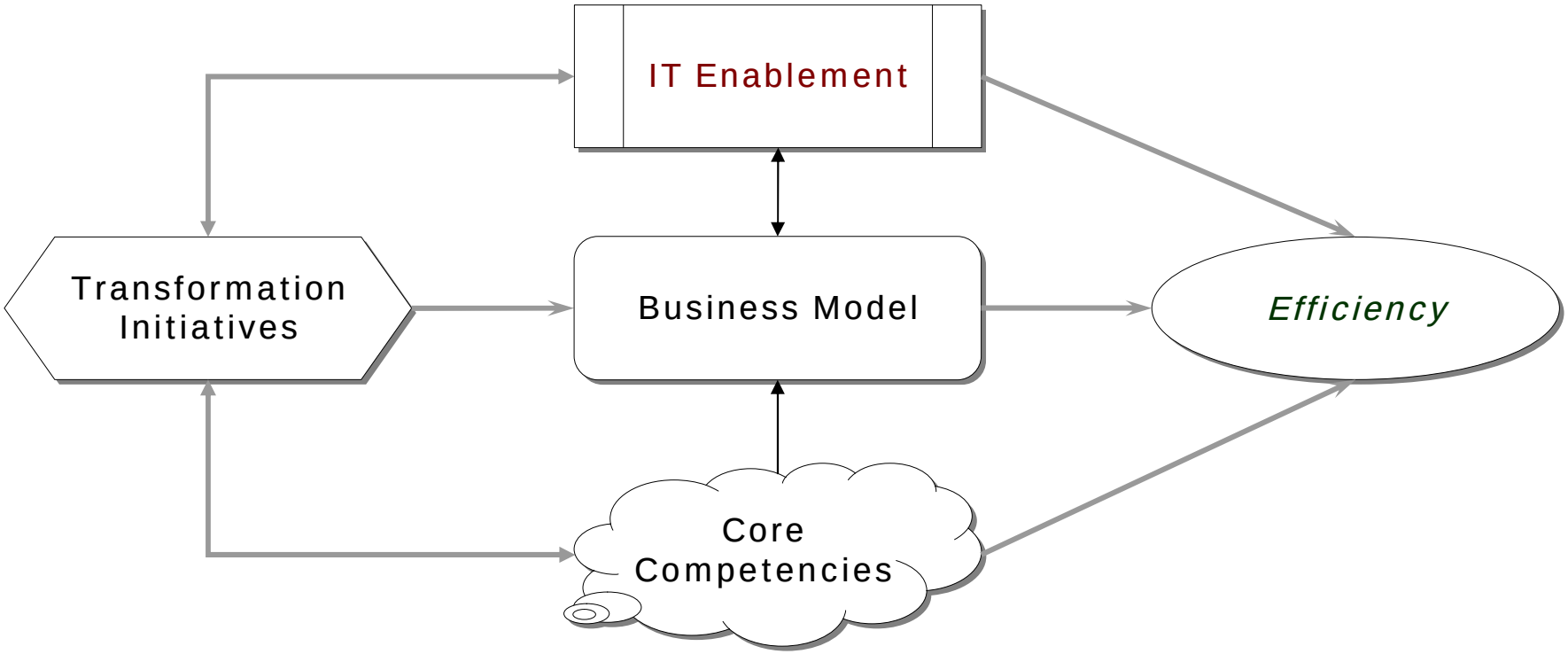
Turbulence — number ranking changes per year



Source: Andrew McAfee and Erik Brynjolfsson, "Investing in the IT That Makes a Competitive Difference," *Harvard Business Review*, July-August 2008

Objective of The Research

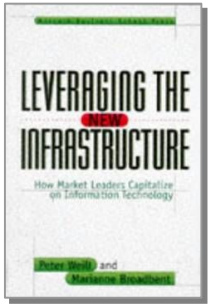
"Enabling Supply Networks with Information Infrastructures"



" How Can Transformational Initiatives Enable Business Model Innovation that Leverages IT Within Supply Networks for Value Creation?"

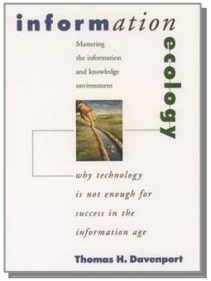
- IS research highlights that successful technology advancement may be driven by, and demand complementary organizational transformations.
- Our main proposition is that successful IT enablement is conditioned by a number of domain-specific operational contingencies or "performance enablers" embedded in the current Business Model.
- Thus, business model contingencies mediate successful IT-enabled improvements in operational efficiency!

Information Infrastructure – Research Literature



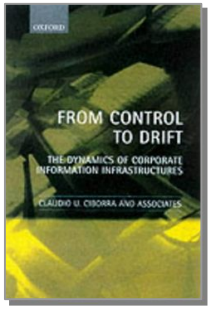
Leveraging the New Infrastructure: How Market Leaders Capitalize on Information

Peter Weill, Marianne Broadbent



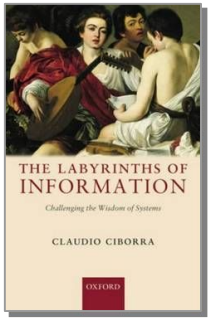
Information Ecology: Mastering the Information and Knowledge Environment

Thomas H. Davenport, Laurance Prusak



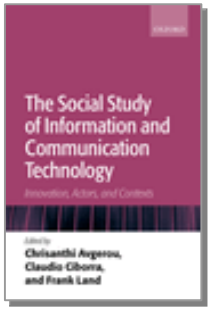
From Control to Drift: The Dynamics of Corporate Information Infrastructures

Claudio U. Ciborra



The Labyrinths of Information: Challenging the Wisdom of Systems

Claudio U. Ciborra

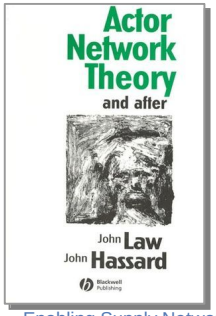


The Social Study of Information and Communication Technology: Innovation, Actors, and Contexts

Frank Land, Chrisanthi Avgerou (Editor), Claudio Ciborra (Editor)

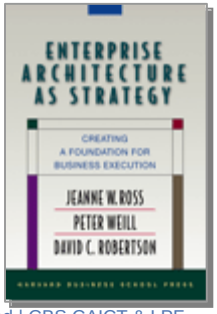
IT Governance: How Top Performers Manage IT Decision Rights for Superior Results

Peter Weill, Jeanne W. Ross



Actor Network Theory and After

John Law, John Hassard



Enterprise Architecture as Strategy: Creating a Foundation for Business Execution

Jeanne W. Ross, Peter Weill, David C. Robertson

Click on book images to read more...

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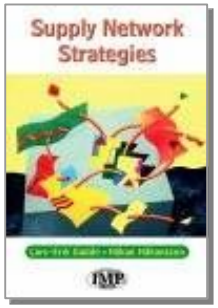
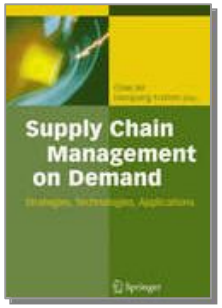
Business Networks & SCM – Research Literature



Supply Network Strategies

Lars-Erik Gadde and Hakan Hakansson



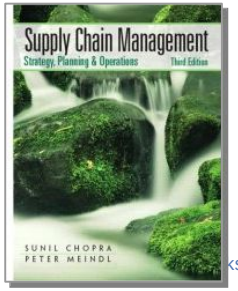
Supply Chain Management on Demand: Strategies and Technologies, Applications

Chae An and Hansjörg Fromm

(Chris Nøkkentved)

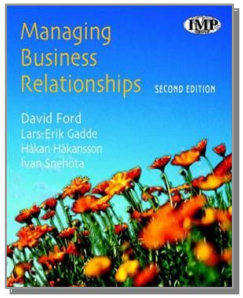
Managing and Marketing Technology

David Ford, Michael Saren



Supply Chain Management: Strategy, Planning, and Operation

Sunil Chopra & Peter Meindl

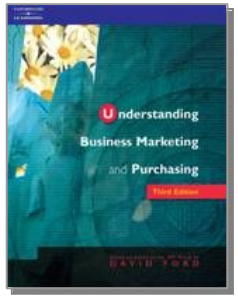


Managing Business Relationships

David Ford, Lars-Erik Gadde, Håkan Håkansson, Ivan Snehota

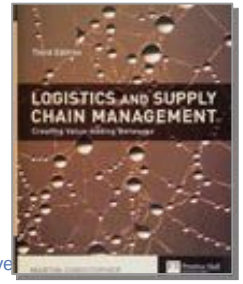
Managing Technological Development (Routledge Advances in Management and Business Studies)

Håkan Håkansson, Alexandra Waluszewski



Understanding Business Marketing and Purchasing 3ed.

David Ford (Editor)



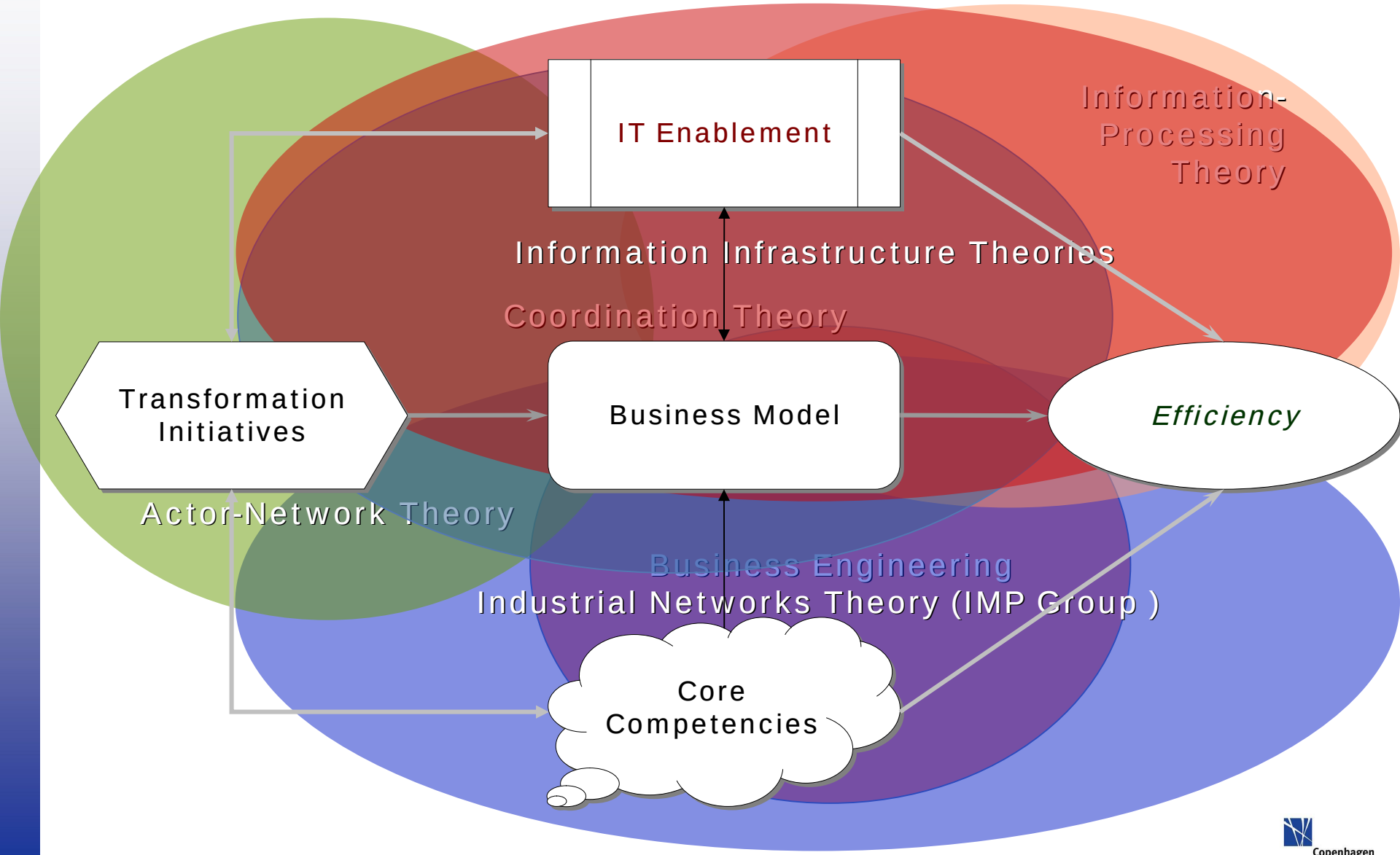
Logistics and Supply Chain Management: Creating Value-Adding Networks

Martin Christopher

Click on book images to read more…

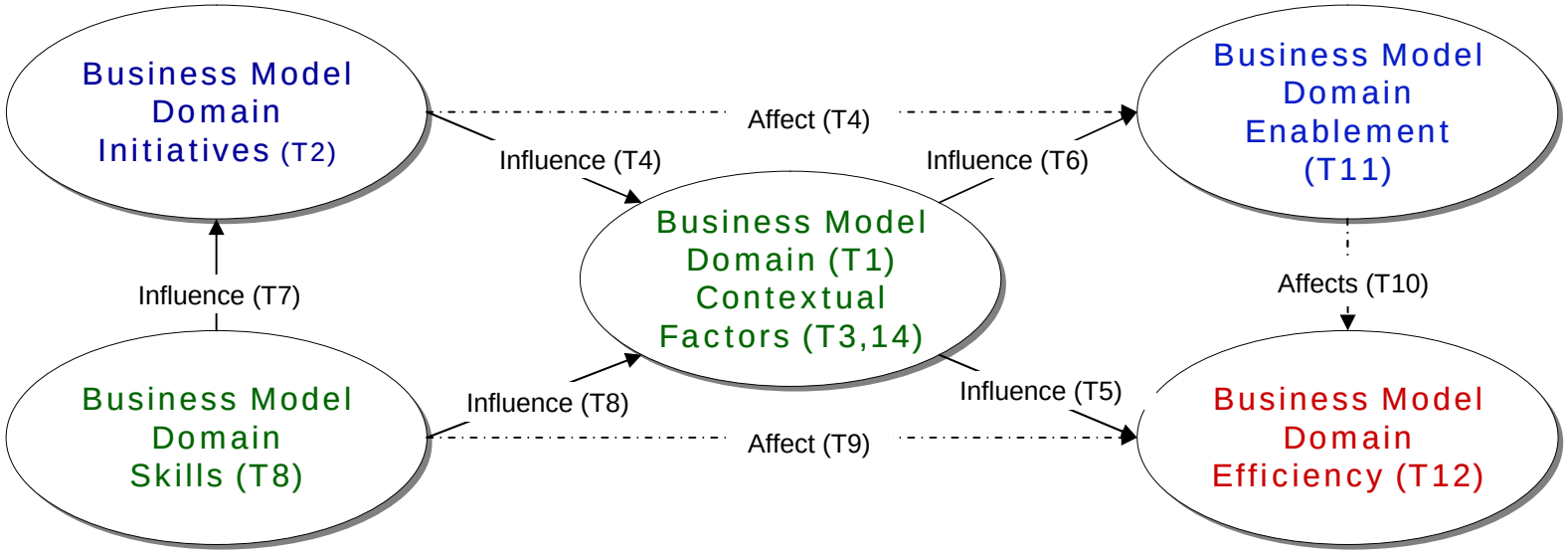
Foundational Theories of this Research Study

"Enabling Supply Networks with Information Infrastructures"



Research Themes: Original Proposition and Hypotheses

Identify the initiatives and IT enablement that drive business model transformation and study their effect on performance.



T1. What Business Models exist that sufficiently describe Collaborative Supply Networks?

T2. What are the Transformation Initiatives that typically drive change in a Business Domain Model?

T3. What are the Contextual Factors that sufficiently characterize a Business Domain Model?

T4. Which Contextual Factors are influenced by the Business Domain Initiatives driving transformation?

T5. Which Contextual factors influence Business Domain Efficiency?

T6. How does Contextual factors and Transformation Initiatives influence Business Domain IT-enablement?

T7. How does Business Domain Capabilities or Skills influence the Business Domain Initiatives?

T8. Which Business Domain Skills influence the Business Model Contextual factors?

T9. Are Business Domain Skills influencing the Business Domain Efficiency?

T10.How does Other Contingencies as Industry, Geography and Size affect our Construct?

T11.Does the state of Business Domain Enablement with IT influence Business Domain Efficiency?

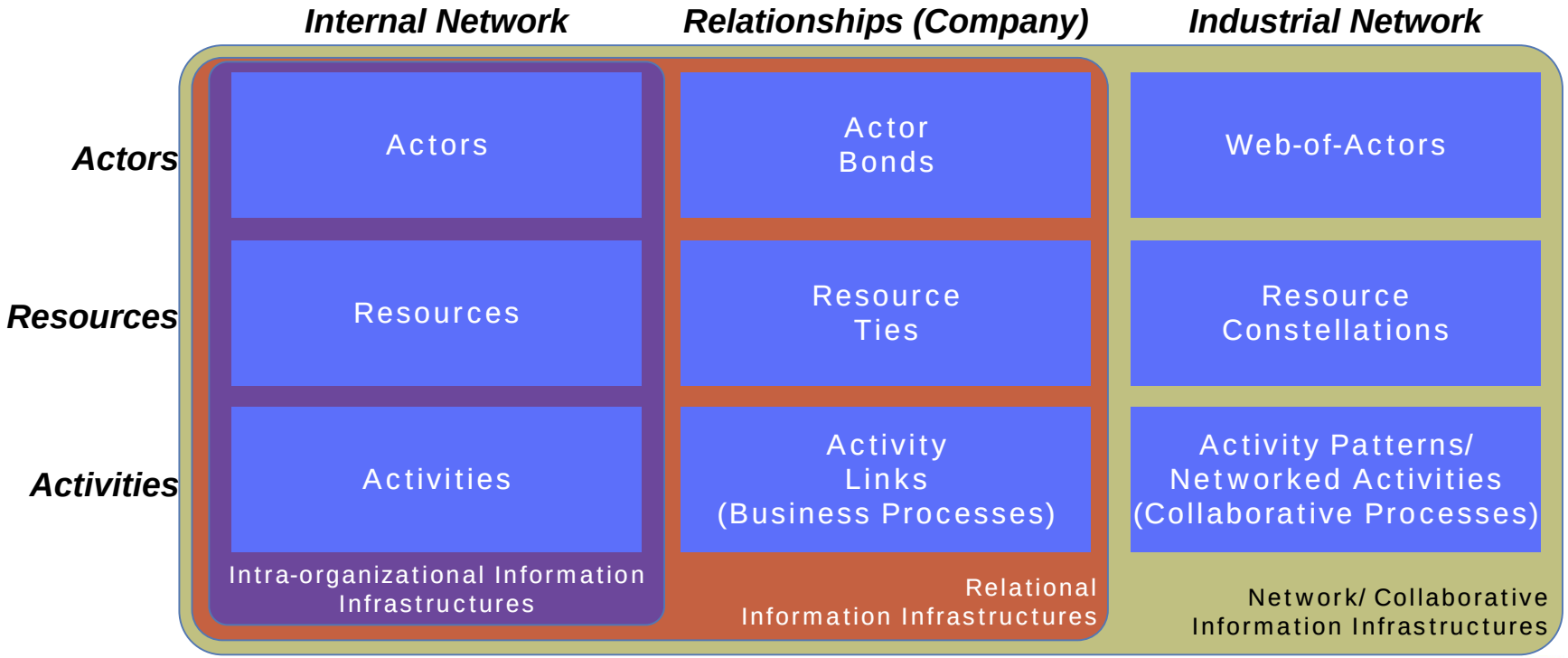
T12.What are the Value-related Metrics that help us measure Business Domain Efficiency?

T13.What's the Role of Actors in defining the state, outcomes & priorities of Business Domain Enablement?

T14.Are Efficient Companies pursuing a broader set of Contextual Factors characterizing a Business Domain Model?

Theoretical Background – Studying Information Infrastructures via the IMP's Actor-Resource-Activity lens

- **Information Infrastructures, creation, behavior & effects (e.g. value-creation) cannot be fully understood if we consider them as a "Resource" or "Facility"**
  - Rather, different Information Infrastructures "mirror" the components of IMP's ARA model – they may be viewed as an Actor, Resource and Activity structure!
  - Interorganizational Information Infrastructures enable Business Network Relationships through collaborative processes encompasing the Actor-webs, ressource constellations and activities.



Theoretical Background – Defining Information Infrastructures

- **An Information Infrastructure can be defined as a socio-technical construction containing actors, resources & activities enabled by ICT, yet extending beyond the boundaries of the focal firm's business network (Hanseth 1996).**
  - In information infrastructure, every conceivable form of variation in practice, culture, and norm is inscribed at the deepest levels of design.
  - As Star and Ruhleder (1994, 253) characterise it it is "fundamentally and always a relation"!
  - The larger the information infrastructure becomes, the more irreversible it turns.

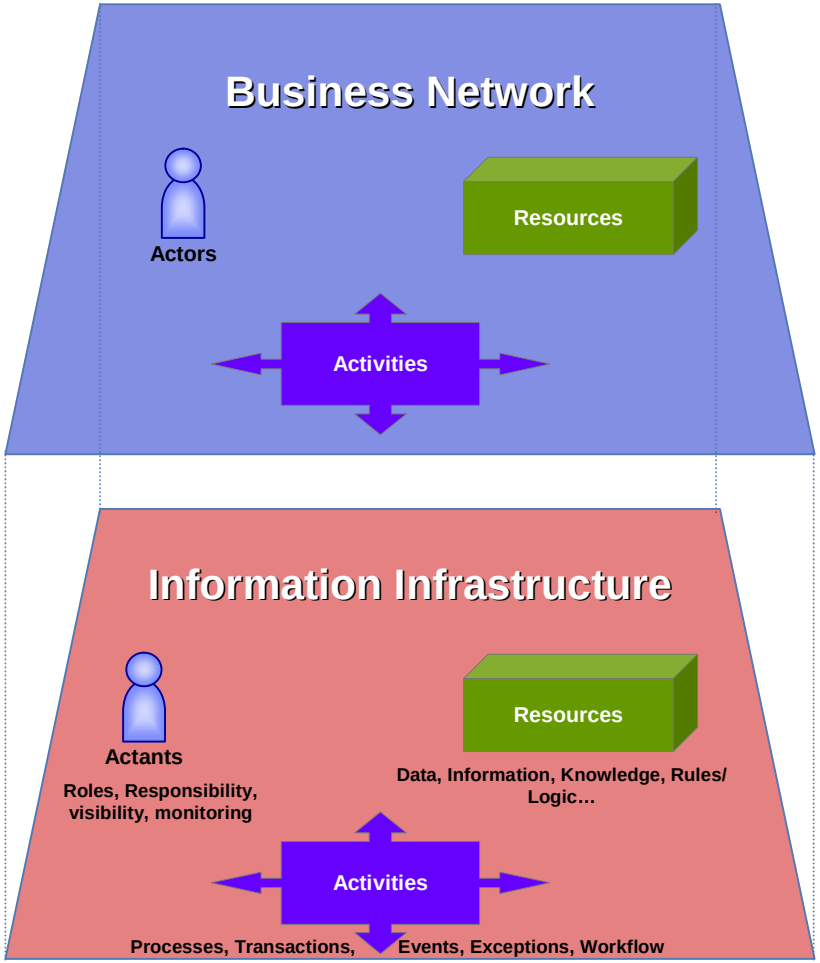
- **Information Infrastructure as the Foundation of Relationships?**
  - This vantage point is in coherence with the IMP Group's (Ford et al. 2003) view of technology as a factor affecting and being affected by relationships within the business network.

- **Yet, IMP still views Technology too Unidimensionaly as a "Managed" Resource/Facility**
  - Yet, Ford et al. (2003) writes: "Large IT systems … may drive large sections of activity structures (aka processes) within and beyond the company, "influence" actors roles and relationships and "form" the relationships that companies may be able to pursue".
  - "…information infrastructure is not just hard to change; it might also be a powerful actor influencing its own future life - its extension and size as well as its form." (Hanseth, 1996)

- **We need a "richer" picture of the infrastructure layers enabled by ICT that shapes, enables and constrains the organization and its business network**

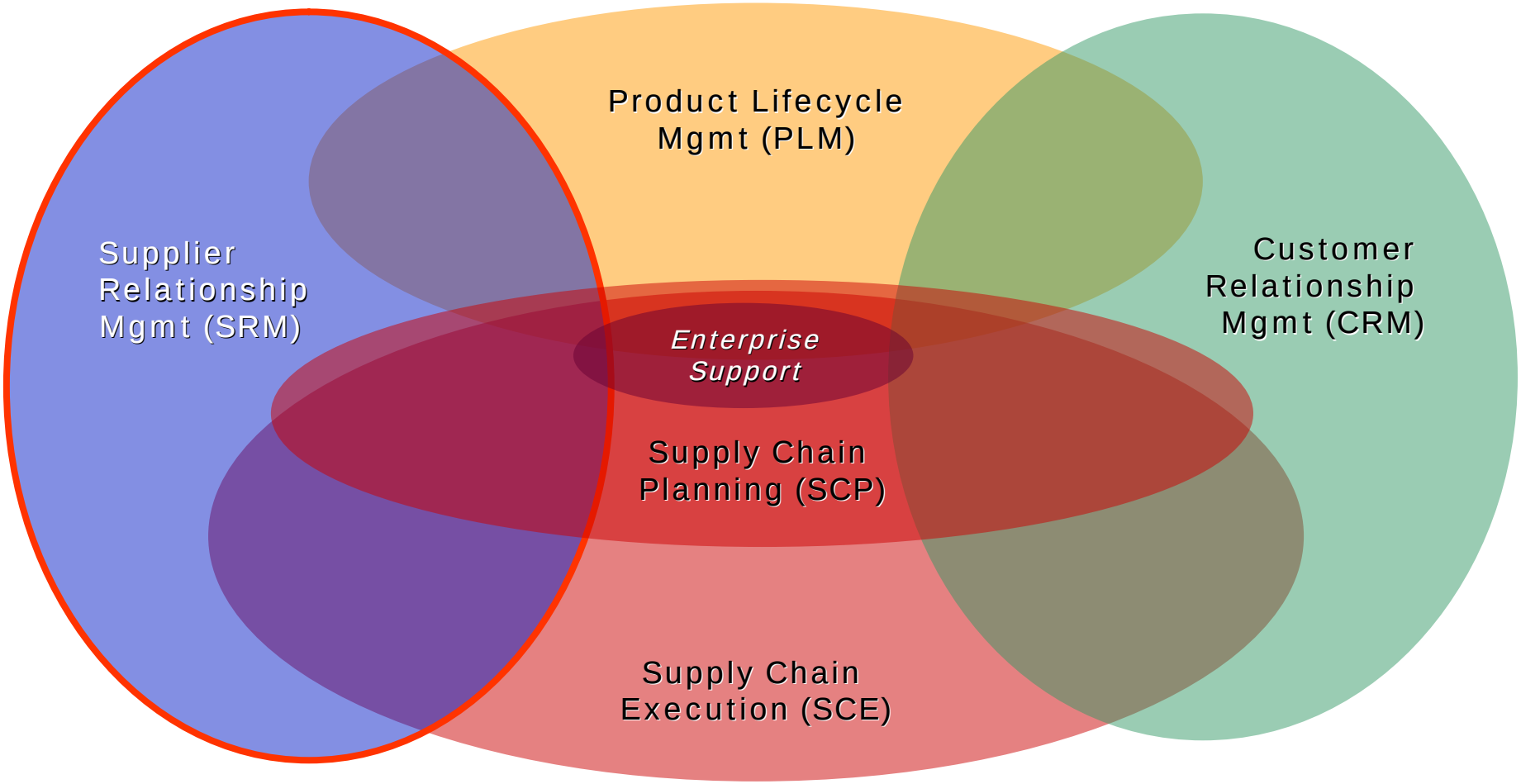
Information Infrastructures as a "mirror" of Business Study Assumptions and Propositional Framework

- **Information Infrastructures as Actant Networks**
  - An Enterprise System imposes its own logic on a company's strategy, culture & organization (Davenport, 1998)
    - ✓ "Like any actor, the technology, playing the role as a powerful change agent, leads human actors or coalitions to build ever-shifting alliances with others … become instrumental in the journey of organizational transformation". (Hanseth, 1996).
  - In considering actor's - human or non-human - ability to perform in the network, the concept of actant has been established, that is an independent entity with the potential to become an actor in a given topology.
    - ✓ An actant can become an actor in multiple topologies simultaneously, perhaps performing and behaving differently in various topologies depending on its relative position in the respective network.
    - ✓ Information Infrastructures mobilize large networks of other actants (i.e. software vendors, hardware vendors and service providers) plus actants delivering a constant stream of renewed and tested knowledge, e.g. companies collaborating closely with the software vendors (Walsham, 1997).
    - ✓ Current large information infrastructures (like ERP) do represent such actant networks in that they contain modularized, interconnected best practice business processes, skills and business rules of diverse areas, all embedded/"translated" (Mattsson, 2003) into ICT software.



Overview of Information Infrastructure Taxonomies

Business Model Segmentation and Study Delimitation

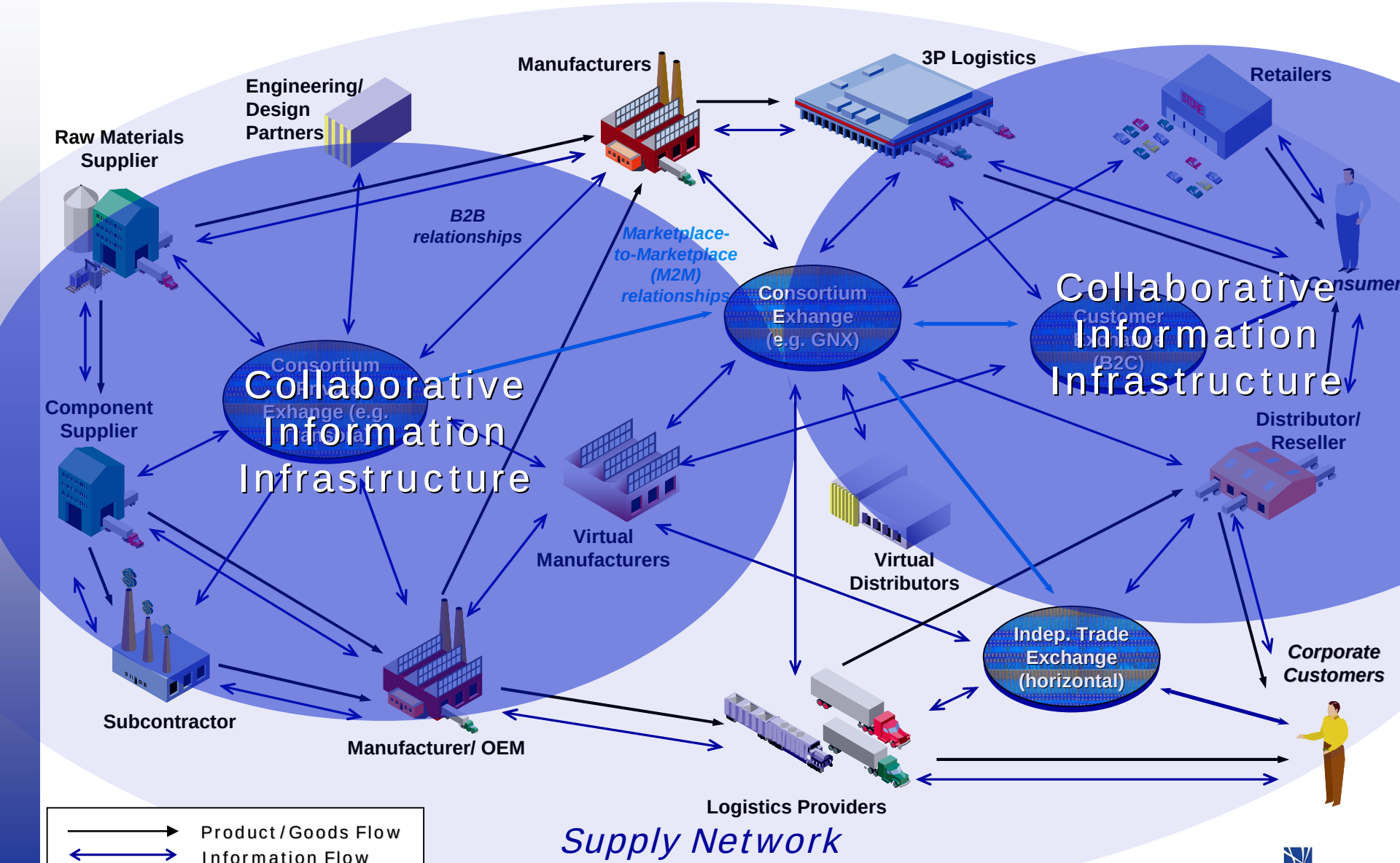


"A business model is a conceptual view that contains a set of elements and their relationships and allows expressing the business logic of a specific firm. It is a description of the value a company offers to segments of customers and of the architecture of the firm and its network of partners for creating, marketing, and delivering this value and relationship capital, to generate profitable and sustainable revenue streams." (Osterwalder et al. 2005)

Theoretical Background

Collaborative Infrastructures extend beyond the focal firm

Trade Exchanges/eMarkets – Creating Shared B2B Infrastructures in Supply Networks



Source: Nøkkentved & Hedaa, 2000

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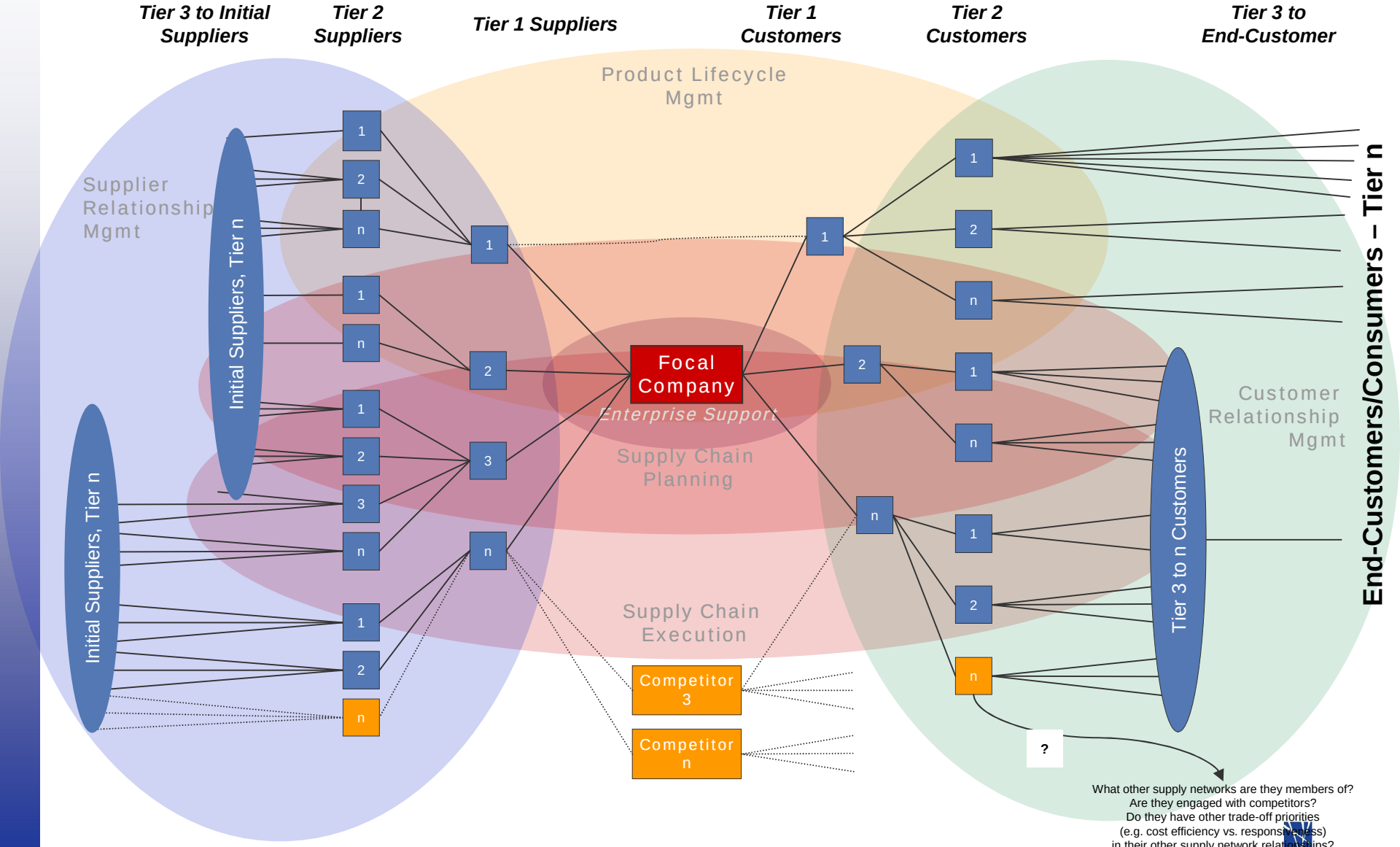
Mapping Supply Networks to Information Infrastructures



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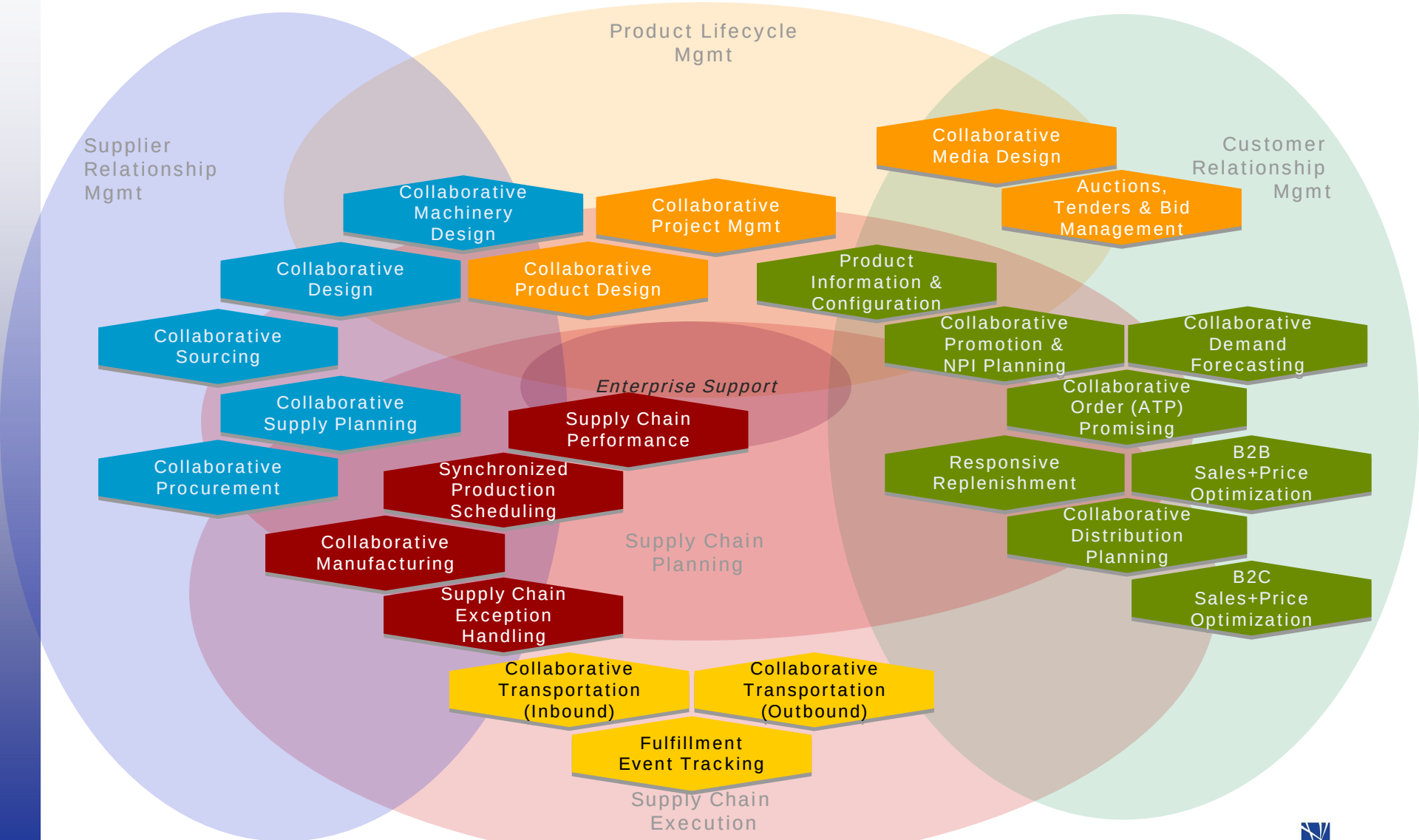
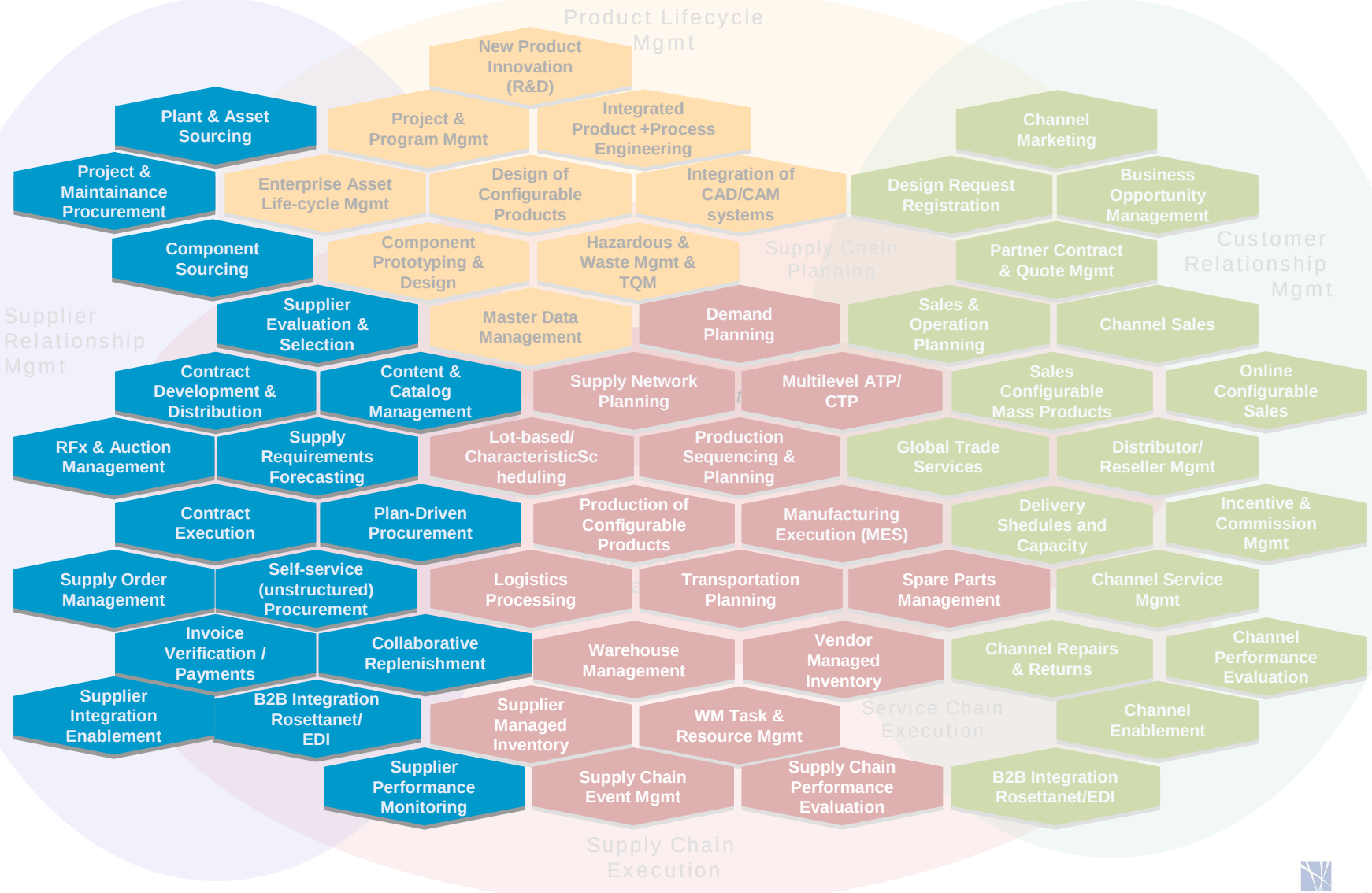
Mapping Inter-organizational Collaborative Processes to Information Infrastructures



Mapping Intra-organizational Collaborative Processes to Information Infrastructures



Research Method & Design – From Interpetism to Grounded Theory to Normative Theory

Research Design

Qualitative Survey and Interviews
Qualitative Survey of 50 eProcurement projects identified experiences, CSFs and related transformation initiatives

↓

Construct Creation and Validation via "Council"
SMEs ("board of judges") were assembled to refine and exploratively cluster value creation initiatives and their underlying contingencies

↓

Create & Conduct Survey of Construct
Utilized above findings to crerate & carry out a questionnaire-based survey of SRM practices (sample: 344 respondents)

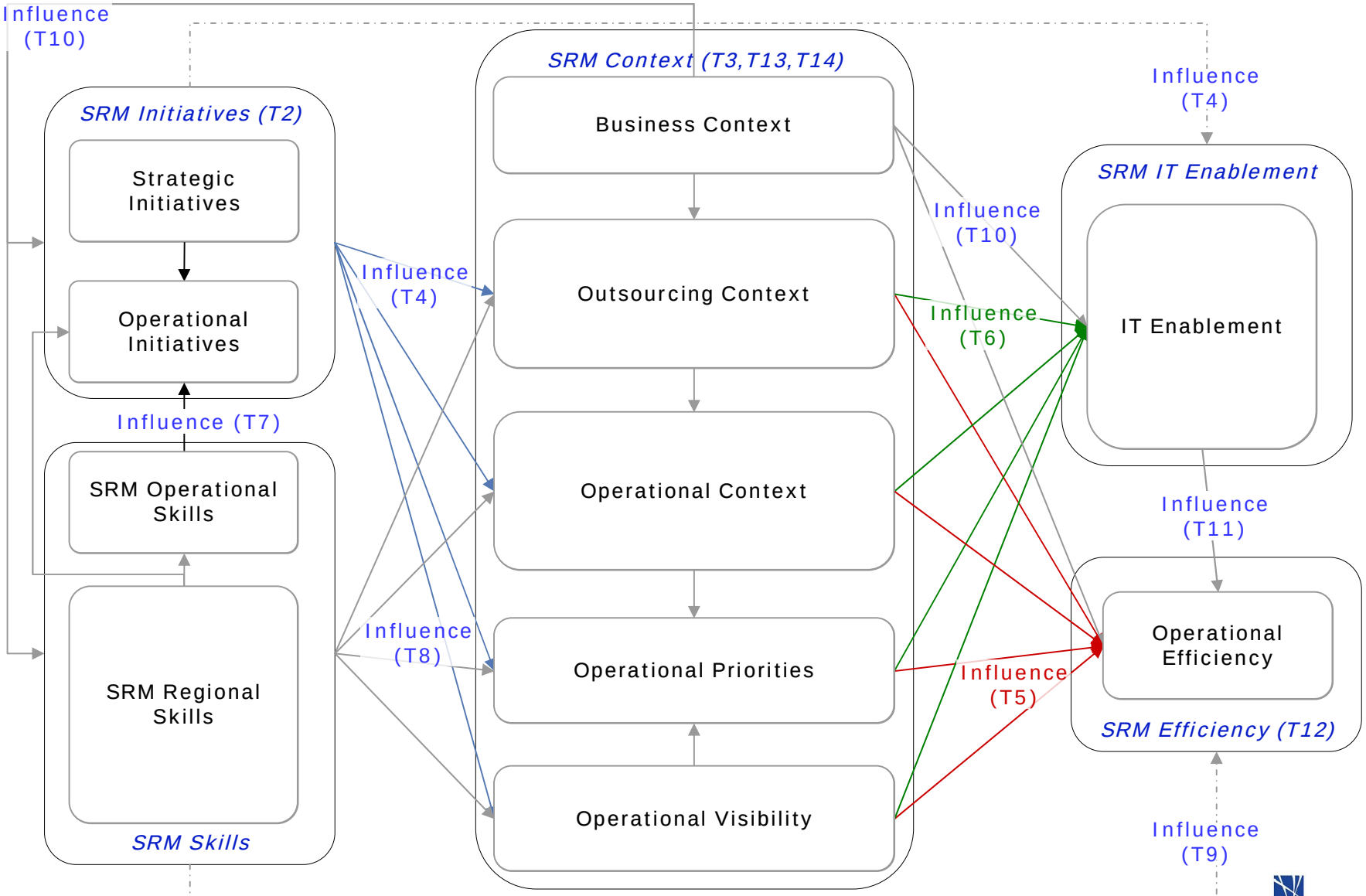
↓

Statistical Analyses of Research Themes
Evaluated plausability of Research Themes proposed with Multivariate Statistical Inference & Structural Equation Model (PLS)

Research Methods

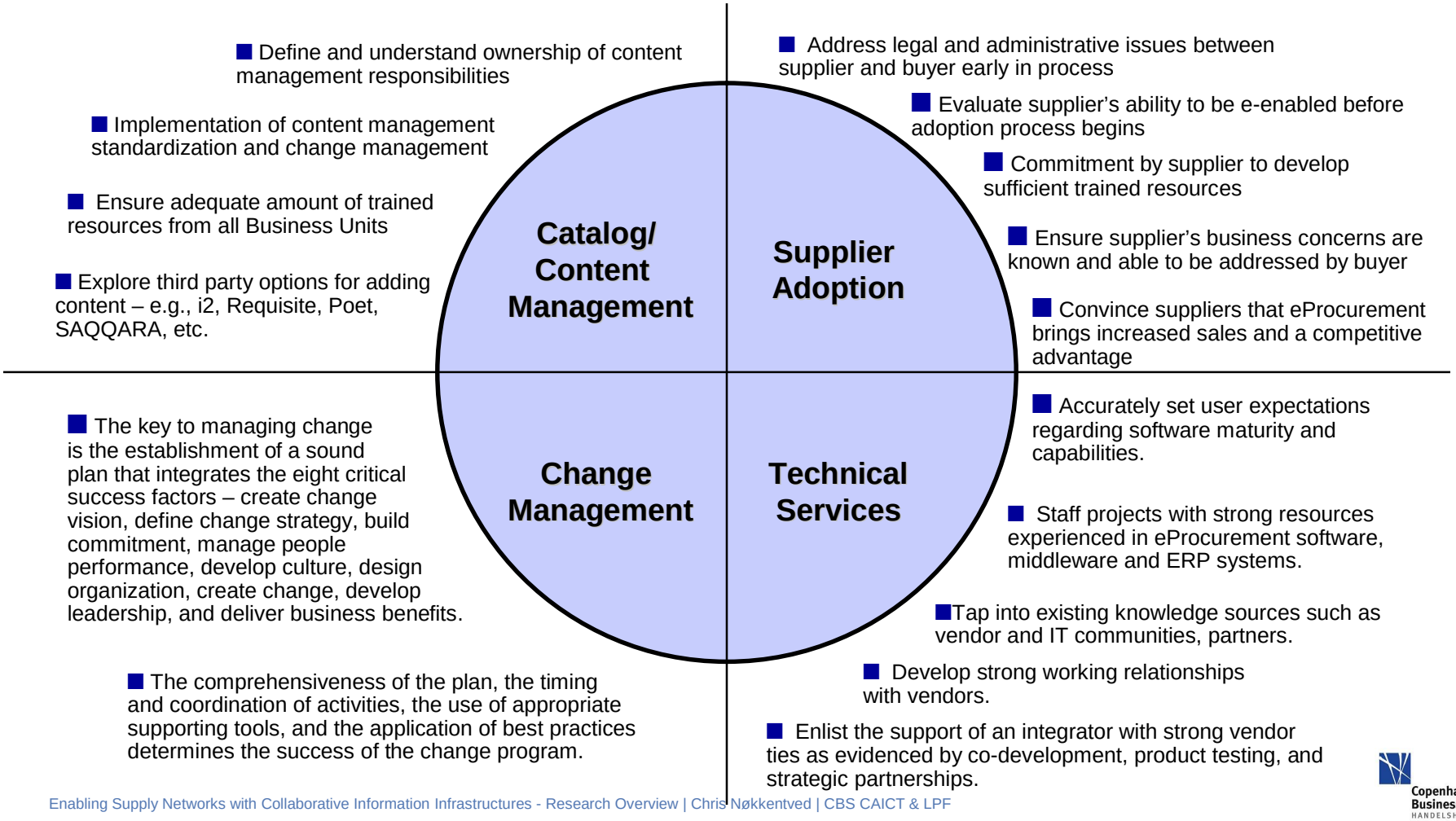
Research Analysis for the Quantitative Analysis

Hypothesized Constructs with Parameters and Research Themes



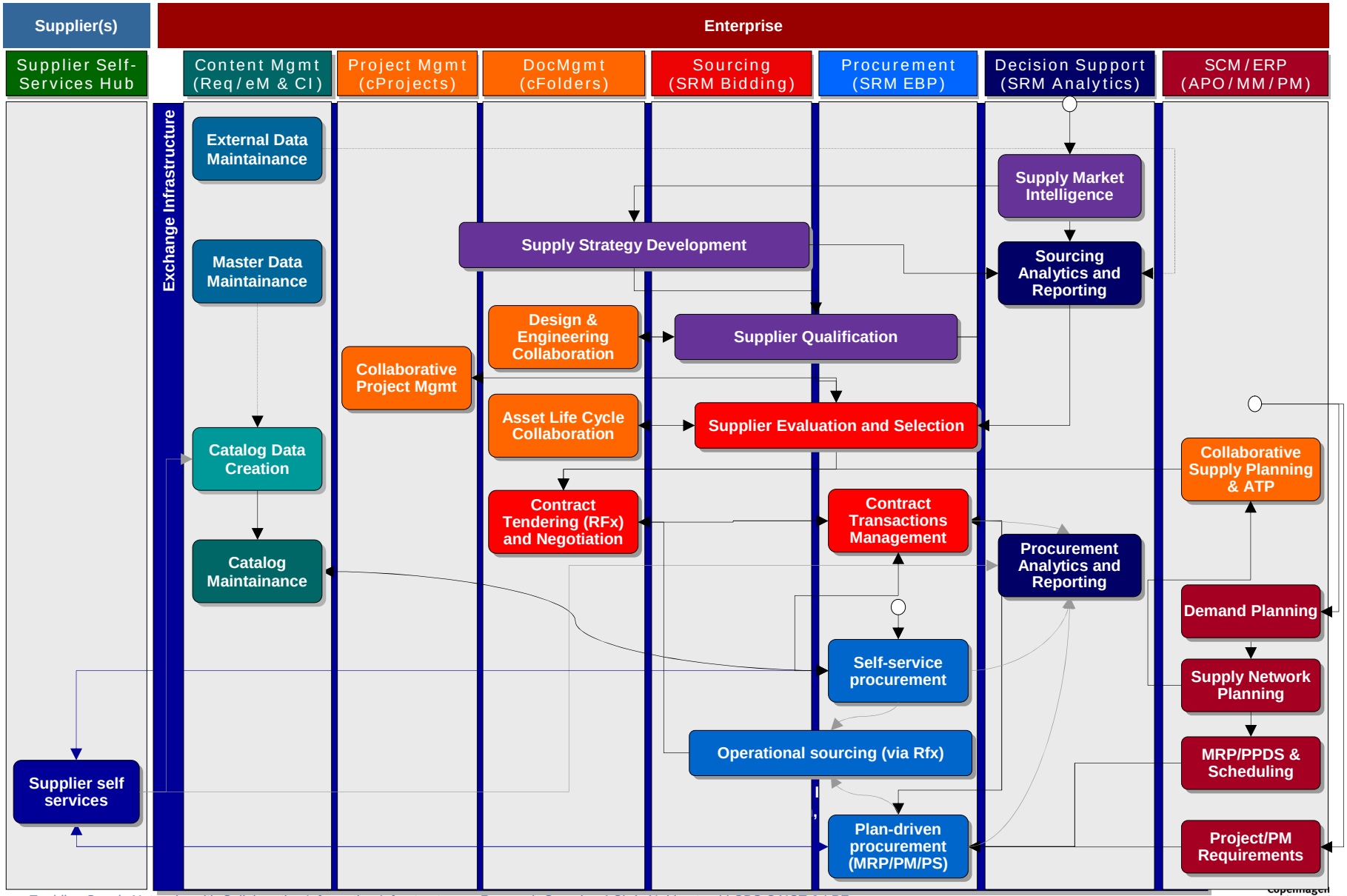
Research Analysis: Qualitative Investigation
Identified CSFs of eProcurement Projects from 2000-02

We have discovered that successful projects adhere to certain critical success factors. When unchecked, catalog management, supplier adoption, change management, and technical services issues contributed to scope reductions in 46% and budget increases in 32% of eProcurement projects.



Research Analysis: Qualitative Investigation

Identification of SRM Processes, Roles and related Initiatives



Research Analysis: Qualitative Investigation

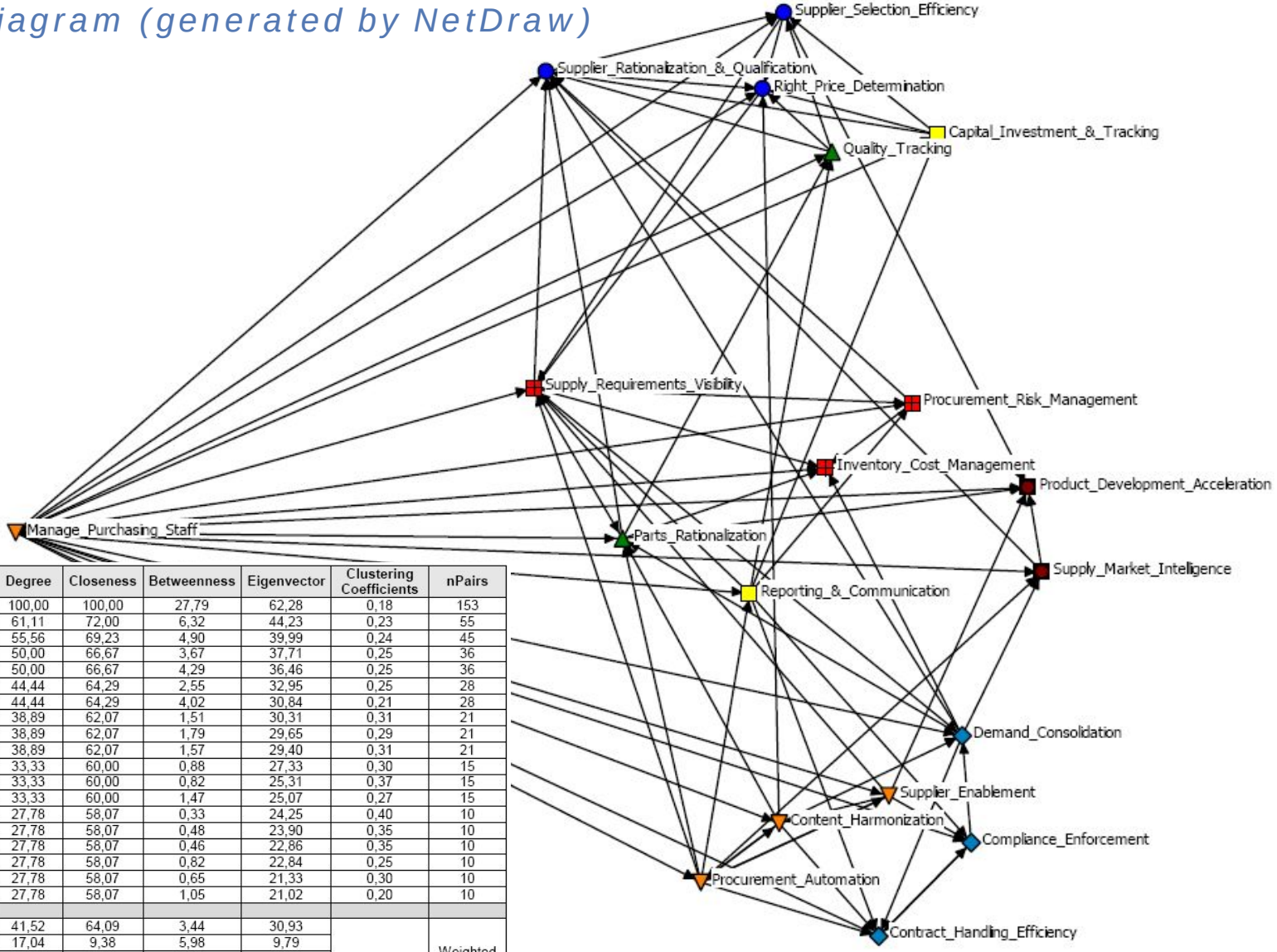
Overview of the Results of the Initial Council Meeting - SRM Value Themes and Transformation Initiatives

- **Based on the "Council of Experts" workshops, an SRM Adoption Model was developed that consolidated a "richer" model of value creation**
- **The Council identified 6 Value Drivers driving Upstream SCM Performance**
  - Each value driver is attained via a cluster of related transformation initiatives.
  - SRM initiatives represent concrete actions that companies can pursue in their attempts to reach a number of strategic objectives.

1. Value Optimisation	*2. Sourcing Optimization*	*3. Process efficiency*	*4. Complexity reduction*	*5. Supplier collaboration*	*6. Organizational Empowerment*
1.1 Compliance Enforcement	2.1 Supplier Rationalization & Qualification	3.1 Procurement Automation	4.1 Content Harmonization	5.1 Product Development Acceleration	6.1 Manage & Evaluate Purchasing Staff
1.2 Demand Consolidation	2.2 Procurement Risk Management	3.2 Contract Handling Efficiency	4.2 Parts Rationalization	5.2 Inventory Cost Management	6.2 Reporting & Communication
1.3 Right Price Determination	2.3 Supply Market Intelligence	3.3 Supplier Selection Efficiency	4.3 Capital Investment & Tracking	5.3 Supply Requirements Visibility	
		3.4 Supplier Enablement		5.4 Quality Tracking	

Research Analysis: Qualitative Investigation

Social-Network Analysis (SNA) Non-parametric Principal Components Network Diagram (generated by NetDraw)



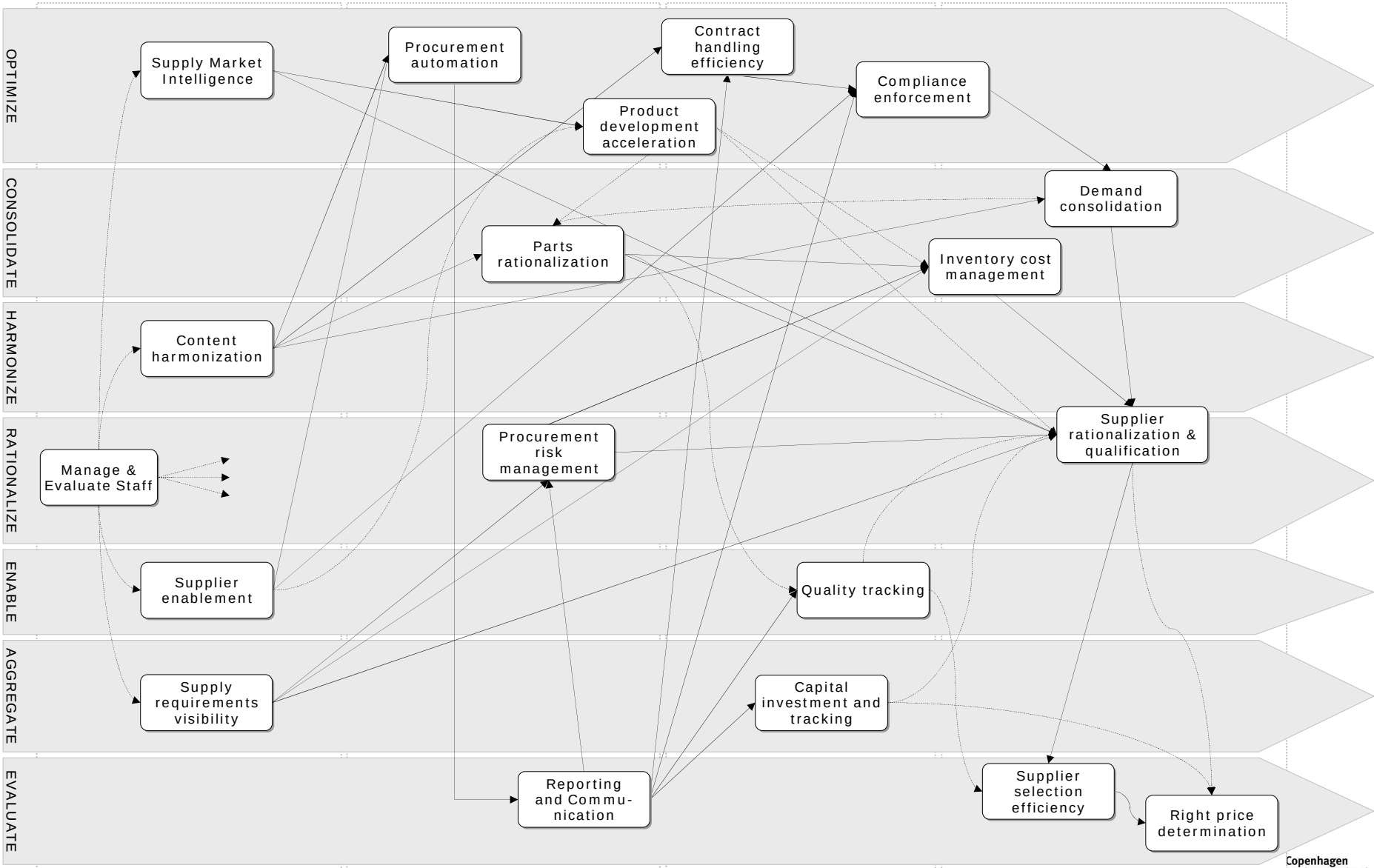
SNA Centrality Statistics per Initiative	Degree	Closeness	Betweenness	Eigenvector	Clustering Coefficients	nPairs
Manage_Purchasing_Staff	100,00	100,00	27,79	62,28	0,18	153
Supply_Requirements_Visibility	61,11	72,00	6,32	44,23	0,23	55
Supplier_Rationalization_&_Qualification	55,56	69,23	4,90	39,99	0,24	45
Parts_Rationalization	50,00	66,67	3,67	37,71	0,25	36
Demand_Consolidation	50,00	66,67	4,29	36,46	0,25	36
Procurement_Automation	44,44	64,29	2,55	32,95	0,25	28
Reporting_&_Communication	44,44	64,29	4,02	30,84	0,21	28
Right_Price_Determination	38,89	62,07	1,51	30,31	0,31	21
Content_Harmonization	38,89	62,07	1,79	29,65	0,29	21
Supplier_Selection_Efficiency	38,89	62,07	1,57	29,40	0,31	21
Quality_Tracking	33,33	60,00	0,88	27,33	0,30	15
Contract_Handling_Efficiency	33,33	60,00	0,82	25,31	0,37	15
Supplier_Enablement	33,33	60,00	1,47	25,07	0,27	15
Inventory_Cost_Management	27,78	58,07	0,33	24,25	0,40	10
Procurement_Risk_Management	27,78	58,07	0,48	23,90	0,35	10
Capital_Investment_&_Tracking	27,78	58,07	0,46	22,86	0,35	10
Supply_Market_Intelligence	27,78	58,07	0,82	22,84	0,25	10
Compliance_Enforcement	27,78	58,07	0,65	21,33	0,30	10
Product_Development_Acceleration	27,78	58,07	1,05	21,02	0,20	10
SNA Univariate Statistics						
Mean	41,52	64,09	3,44	30,93		
Std Dev	17,04	9,38	5,98	9,79		
Sum	788,89	1217,73	65,36	587,71		
Variance	290,35	88,01	35,80	95,84		
SSQ	38271,61	79717,70	905,00	20000,01		
MCSSQ	5516,57	1672,16	680,16	1821,04		
Euc Norm	195,63	282,34	30,08	141,42		
Minimum	27,78	58,07	0,33	21,02		
Maximum	100,00	100,00	27,79	62,28		

Overall graph clustering coefficient: **0.279**

Weighted Overall graph clustering coefficient: **0.244**

Research Analysis: Qualitative Investigation

From Identification to Sequencing of SRM Initiatives



Research Analysis: Qualitative Investigation

Final SRM Transformation Matrix

	Sourcing *Identify and manage sources of supply*	Purchasing *Purchase materials and services*
Strategic		
Development	1. Focus Sourcing Strategy • Supplier Selection Efficiency • Supplier Rationalisation & Qualification • Right Price Determination	6. Enforce Corporate Standards • Demand (Spend) Consolidation • Compliance Enforcement • Contract Handling Efficiency
Collaboration	7. Improve Supply Visibility • Product Development Acceleration • Supply Market Intelligence	4. Improve Demand Visibility • Supply Requirements Visibility • Procurement Risk Mgt • Inventory Cost Mgmt
Operational		
Execution	3. Optimal Supplier Management • Parts Rationalisation • Quality Tracking	2. Efficient Purchasing Processes • Reporting & Communication • Capital Investment & Tracking
Enablement	5. Efficient Supplier Content Mgmt • Supplier (Content) Enablement • Manage Sourcing Staff • Content Harmonization	5. Efficient Enablement+Integration • Procurement Automation • Manage Purchasing Staff • Supplier (B2B) Enablement

Research Analysis: Quantitative Survey

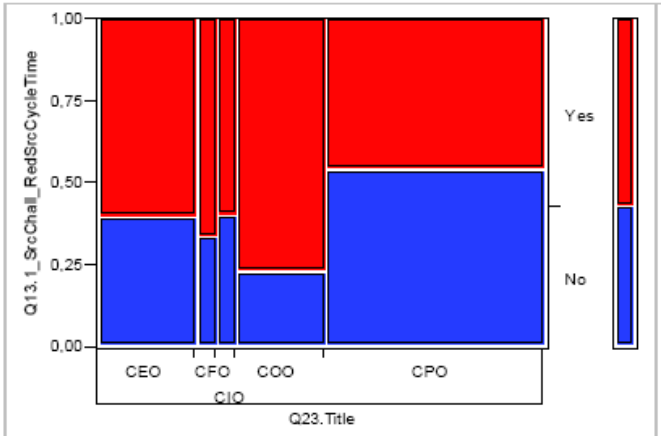
Initial Survey Constructs with Parameters and Effect

- **During the Council study we detailed the SRM transformation initiatives**
- **The exercise also exposed some of the background capability-based actions and impacts that they had.**
- **These were classified under the headings of our preliminary *concepts* and then defined in greater detail.**
- **A detailed measurement model was developed by the author based on current research and was used to build the questionnaire.**

Research Analysis: Quantitative Survey

Contingency & ANOVA results of Actor Title vrs Significant Parameters

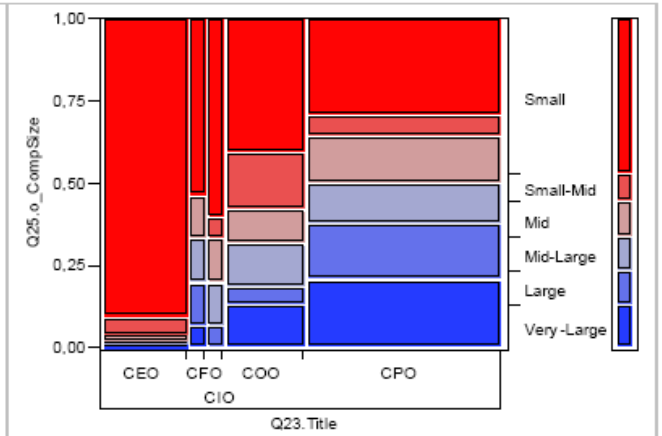
- **Assessing T13: *"Actors Define State & Enablement of SRM Domain"***
- **In summary, we have found significant support for our research theme that different Actor Roles as defined by Titles in our survey have different perspectives on how SRM is supposed to be transformed and enabled via technology, in correspondence with Gadde and Håkansson (2001).**



Contingency Analysis – Mosaic Plot & Statistics

N	DF	-LogLike	RSquare (U)
344	4	10,890847	0,0463

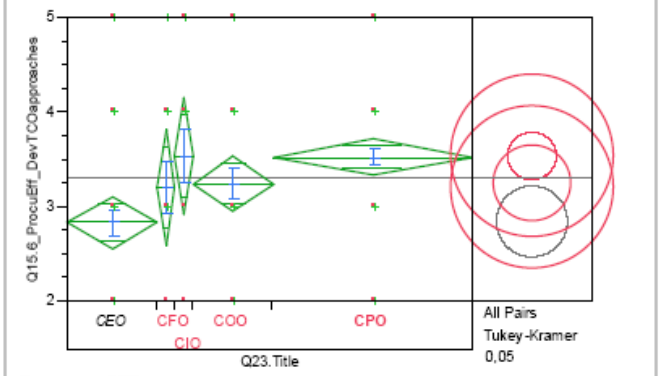
Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	21,782	0,0002
Pearson	21,032	0,0003



Contingency Analysis – Mosaic Plot & Statistics

N	DF	-LogLike	RSquare (U)
343	20	59,145805	0,1124

Test	ChiSquare	Prob>ChiSq
Likelihood Ratio	118,292	<,0001
Pearson	102,988	<,0001

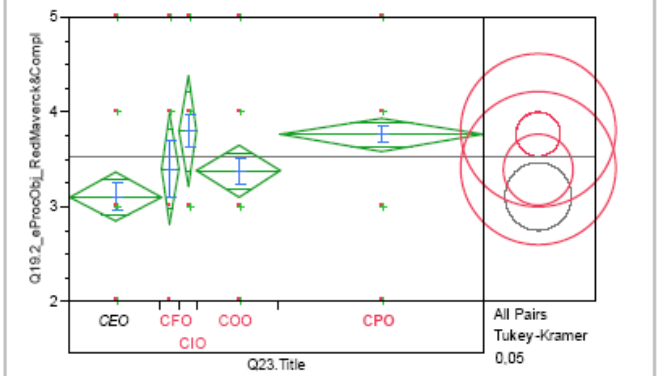


Summary of Fit

Rsquare	0,049534
Adj Rsquare	0,038252
Root Mean Square Error	1,229038
Mean of Response	3,298246
Observations (or Sum Wgts)	342

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q23.Title	4	26,52924	6,63231	4,3907	0,0018
Error	337	509,04971	1,51053		
C. Total	341	535,57895			



Summary of Fit

Rsquare	0,053925
Adj Rsquare	0,042762
Root Mean Square Error	1,157116
Mean of Response	3,526163
Observations (or Sum Wgts)	344

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob > F
Q23.Title	4	25,87120	6,46780	4,8306	0,0008
Error	339	453,89334	1,33892		
C. Total	343	479,76453			

Research Analysis: Quantitative Survey

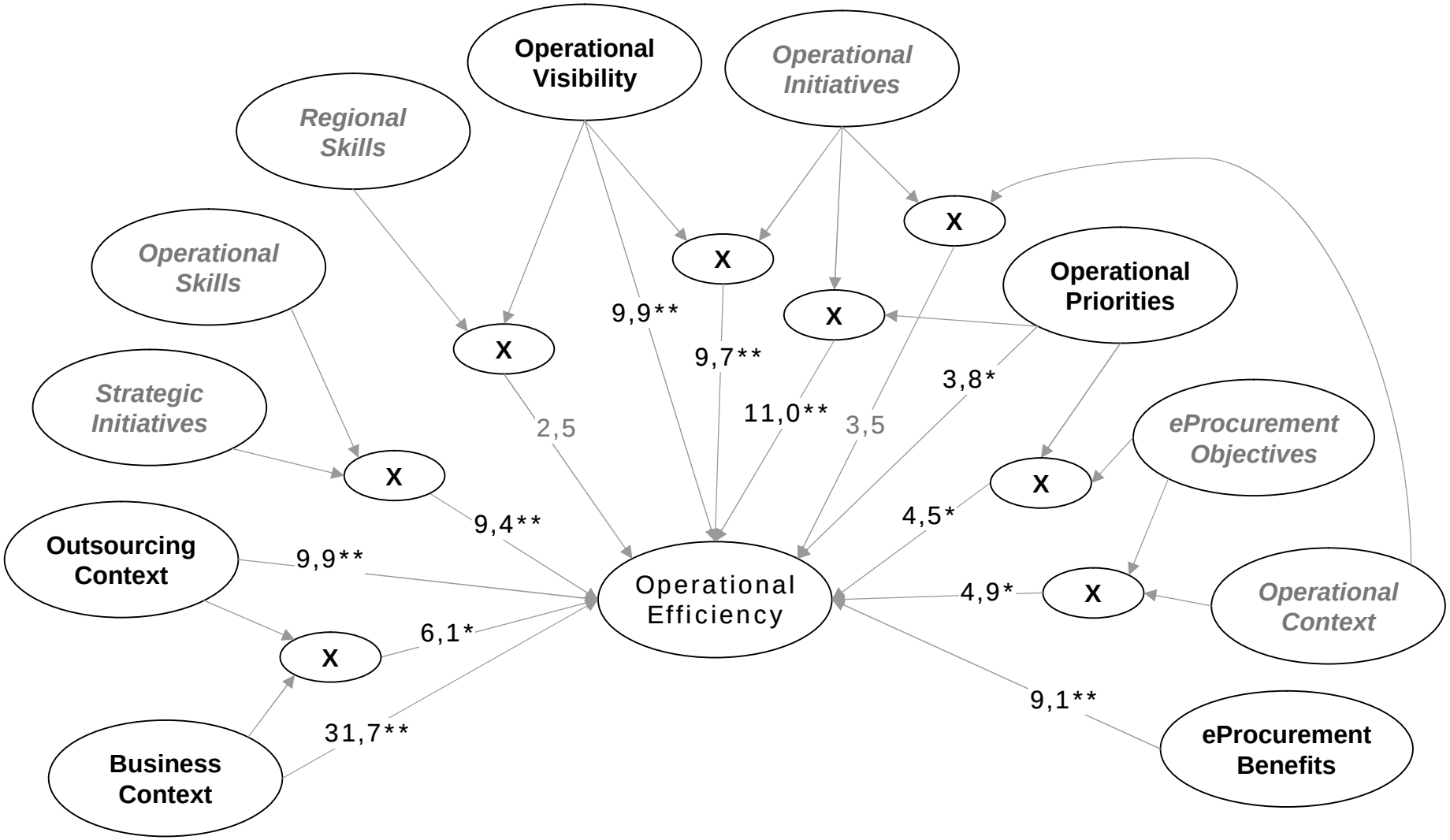
Assessing T14: "High Performers Focus on Broader Transformation"

- **From this analysis it is evident that groupings like Operational-Objectives, -Outsourcing, -Focus, -Visibility and the Contingency/ Context, each explain more than 8% of the total variation among the Performance Levels/Clusters.**
- **On the other hand, it seems that Strategic Initiatives, Operational Skills and eProcurement Objectives explain less of the total variance.**
- **Hence indicating that these groups are part of a background set of effects affecting our primary effects.**

OLR Hypothesized Groups (with R^2)	Parameters	Chi^2 Ratio	Prob > Chi2
Operational Priorities (Rsq=0,0868*)	Q2.1_OperObj_Reduce_Prod_Costs	13,2	**0,00**
	Q2.3_OperObj_ReducMaverickSpend	3,3	0,07
	Q2.4_OperObj_ResponsiveToDemand	4,4	**0,04**
	Q2.7_OperObj_FindGlobalSupplier	3,3	0,07
	Q2.10_OperObj_Intr_eSourcingSys	5,1	**0,02**
Outsourcing Context (Rsq=0,1088*)	Q5.2_OperTrend_IndirectSourcing	9,0	**0,03**
	Q6.1_OutsStatus_IndirectMats	12,6	**0,01**
	Q6.3_OutsStatus_Sourcing	13,5	**0,01**
Operational Skills (Rsq= 0,0383*)	Q9.1_OperSkil_Glob_SourcDirects	7,9	**0,02**
	Q9.5_OperSkil_ContractComplianc	5,1	0,08
Regional Skills (Rsq=0,0608*)	Q8.0_SourcDir_GlobDirSourcInits	18,3	**0,00**
	Q11.3_OperFutSkil_Latin_America	4,2	**0,04**
	Q11.6_OperFutSkil_SouthEastAsia	3,7	0,05
Operational Context (Rsq=0,1155*)	Q4.1_Oper%_IndirectMaterials	6,5	0,09
	Q4.2_Oper%_DirectMaterials	11,4	**0,01**
	Q4.3_Oper%_Services	7,5	0,06
	Q12.3_SrcCrit_Environmental	11,4	**0,00**
	Q12.10_SrcCrit_SupCollaboration	2,9	0,09
	Q13.4_SrcChall_Spend_Visibility	5,7	**0,02**
Operational Initiatives (Rsq=0,0492*)	Q15.2_ProcuEff_SupplCollProdDev	3,7	0,05
	Q15.4_ProcuEff_SupplierPerfMgmt	4,0	**0,05**
	Q15.5_ProcuEff_RFIDusage	8,5	**0,00**
Strategic Initiatives (Rsq=0,0153*)	Q16.3_ProcuStrat_BPprocs_eSourc	5,4	**0,02**
Operational Visibility (Rsq=0,1294*)	Q17.1_ProcuKPI_ProcEfficie&Cost	3,0	0,08
	Q17.4_ProcuKPI_ProcurServicPerf	5,1	**0,02**
	Q17.5_ProcuKPI_Prod&ServQuality	5,2	**0,02**
	Q17.7_ProcuKPI_eProcBenefits	4,3	**0,04**
	Q17.8_ProcuKPI_TCO	3,1	0,08
	Q18.2_ProcuMon_ChallengBUdemand	3,2	0,07
	Q18.4_ProcuMon_DevInfSupplStrat	14,5	**0,00**
eProcurement Objectives (Rsq=0,0288*)	Q19.9_eProcObj_ProvidTranspData	3,9	**0,05**
eProcurement Benefits (Rsq=0,0804*)	Q20.4_eProcBen_RedTransactCosts	3,2	0,07
	Q20.9_eProcBen_ProvidTranspData	4,9	**0,03**
Business Context (Rsq=0,179*)	Q23.Title	8,2	0,08
	Q24.0_Industry	34,1	0,08
	Q25.o_CompSize	14,1	**0,01**

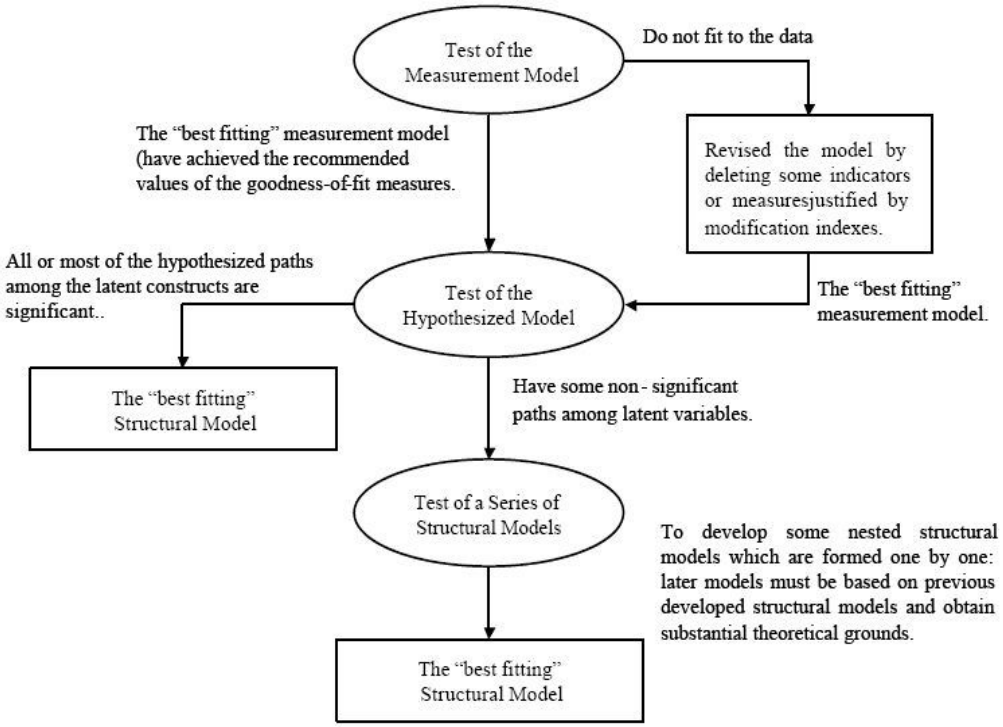
Research Analysis: Quantitative Statistical Assessment

OLS Regression of the direct & interaction effects identified many backround interaction effects influencing performance



Research Analysis: 2nd Quantitative Analysis with SEM
Selecting the Partial-Least Squares to test our Performance hypotheses

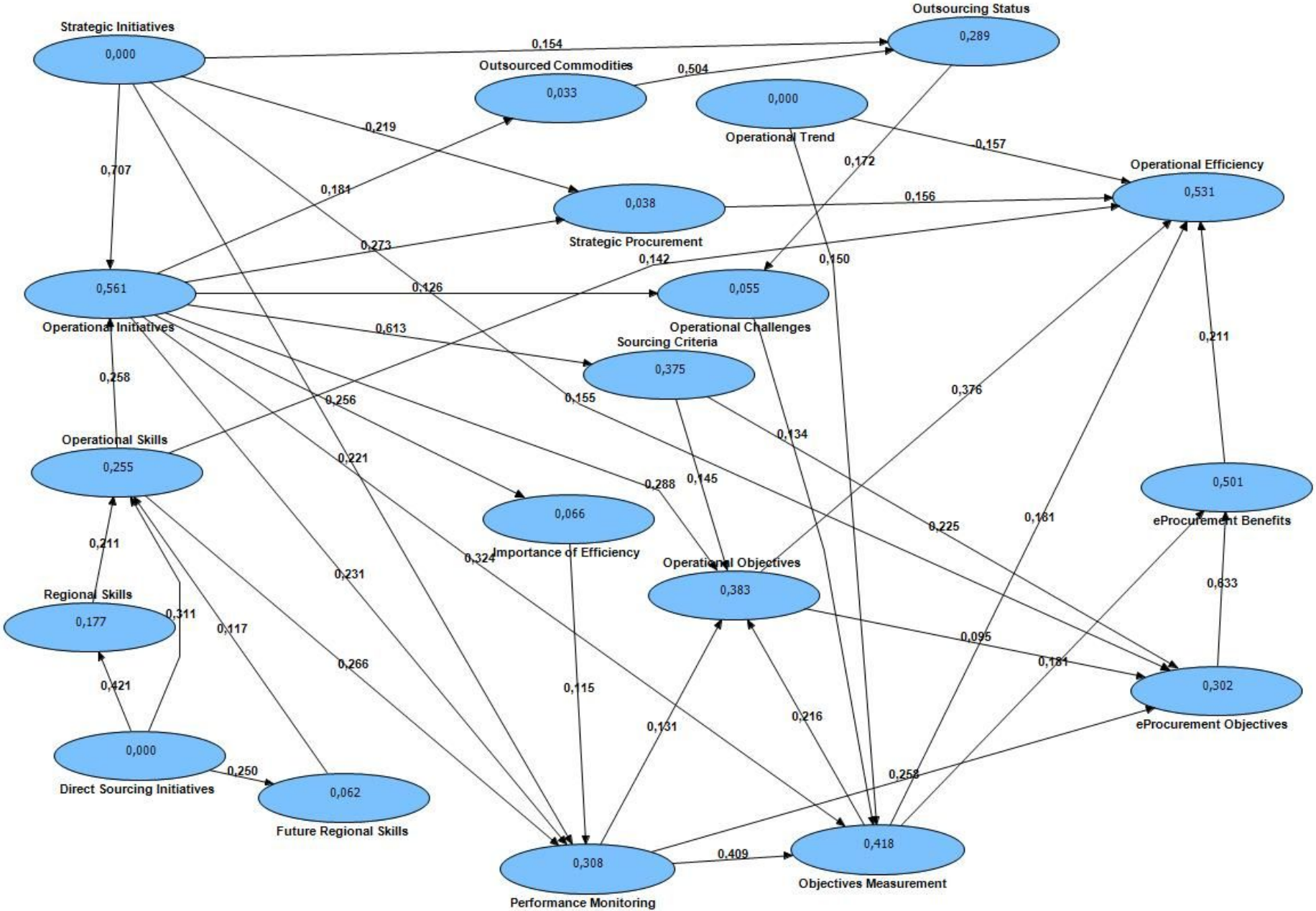
- **The partial least square (PLS) method is a variance-based causal modeling approach, developed in the 1960s by Herman Wold (1989).**
  - In contrast to PLS, most other SEM are covariance-based, with LISREL (Linear Structural Relation) being the most. Both approaches are used to analyze similar models and PLS and LISREL are considered to be complementary rather than competitive prominent (Gefen, Straub, & Boudreau, 2000).



- **Why did we select PLS?**
  - The degree of influence of the constructs on each other and on performance is of interest.
    - ✓ Only then can the model provide decision making support for companies as to where to set priorities in improvement and transformation initiatives.
  - The underlying theory has not been fully developed yet, and even though the survey design was well founded in previous research, it was certainly not all inclusive with regards to the parameters that could have been measured, so it was deemed highly probable that there exists an inherent measurement error to some degree.
  - Though the overall sample size is relatively large (N=344), when it comes to the Technology Enablement parameters (i.e. eProcurement), we did validate app. 127 answers, which is not considered a sufficient sample size for a covariance methods (i.e. LISREL).
- **How did we build the PLS Model?**
  - We used Chen's (2000) recommendations and iterated through a number of models by studying their overall power and statistical significance (via T-stats).
  - Identified the "best fiting" model

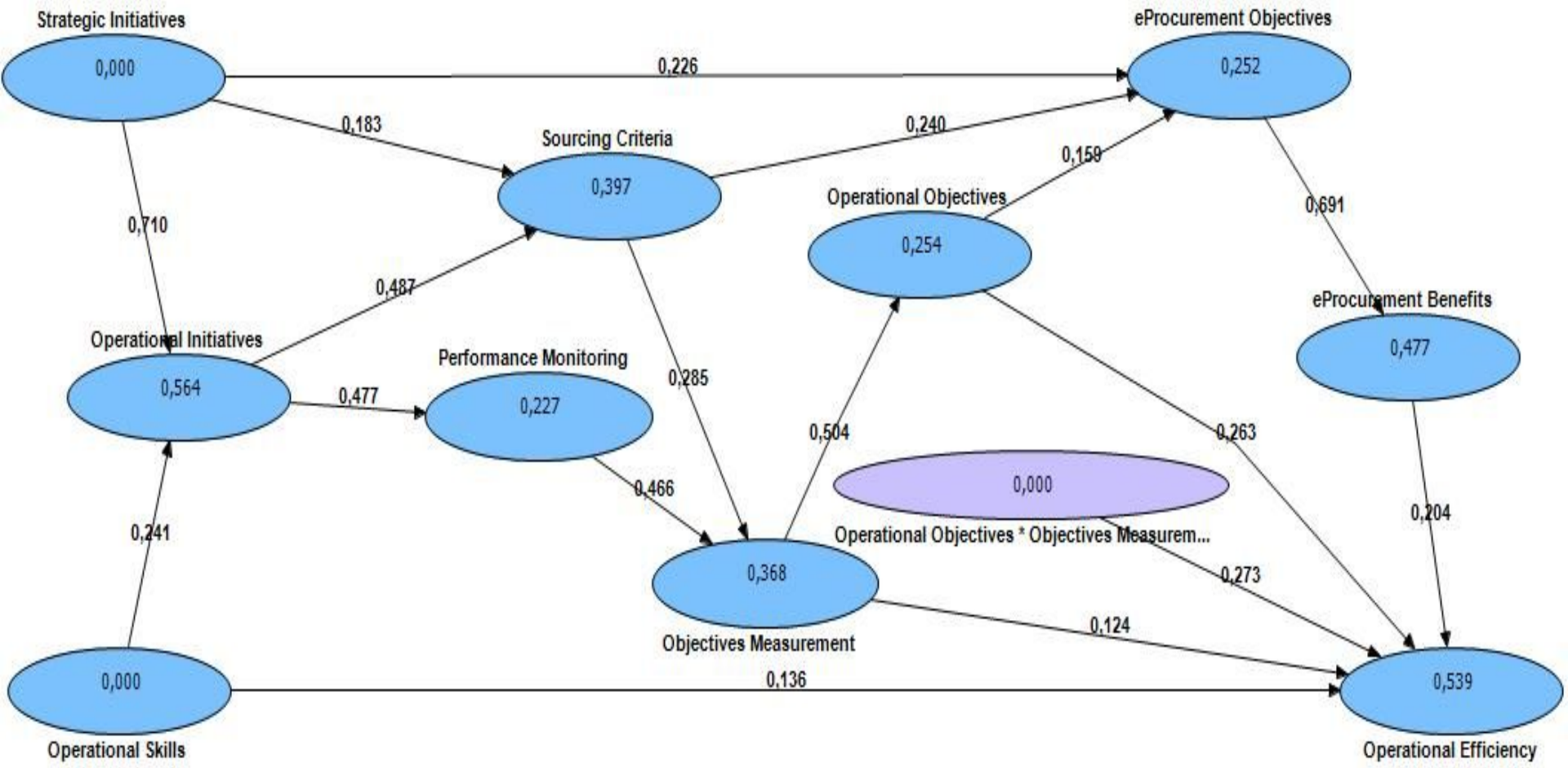
Research Analysis: Quantitative SEM Analysis

Iterating towards the best costruct with PLS



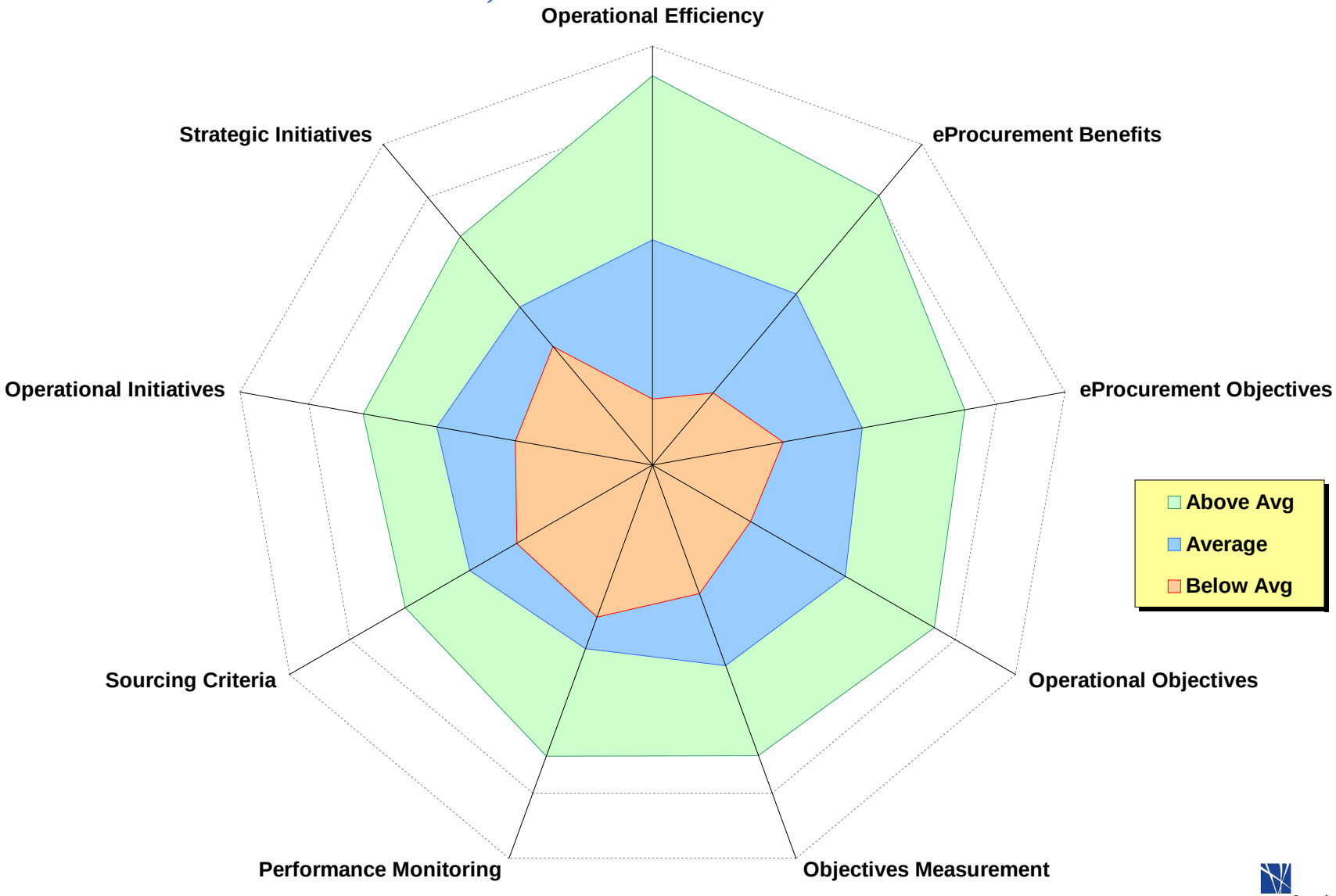
Research Analysis: Quantitative SEM Analysis

Final Partial-Least Squares Model with Interaction Effects of the expanded hypotheses



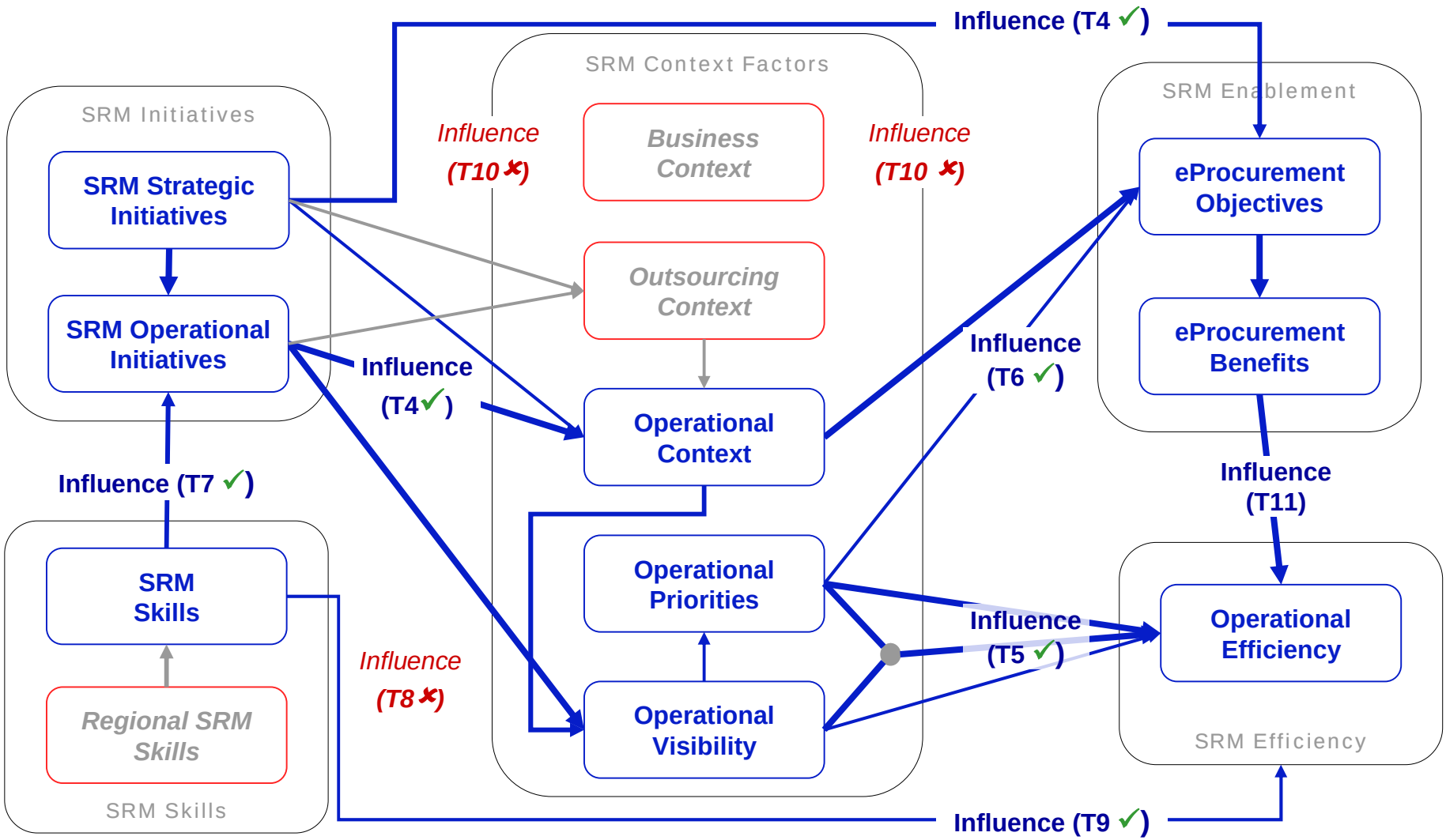
Research Analysis: Quantitative Analysis

Levels of Performance versus relevant factors (T14.Are Efficient Companies pursuing a broader set of Contextual Factors characterizing a Business Domain Model?)



Summary of Quantitative Analysis

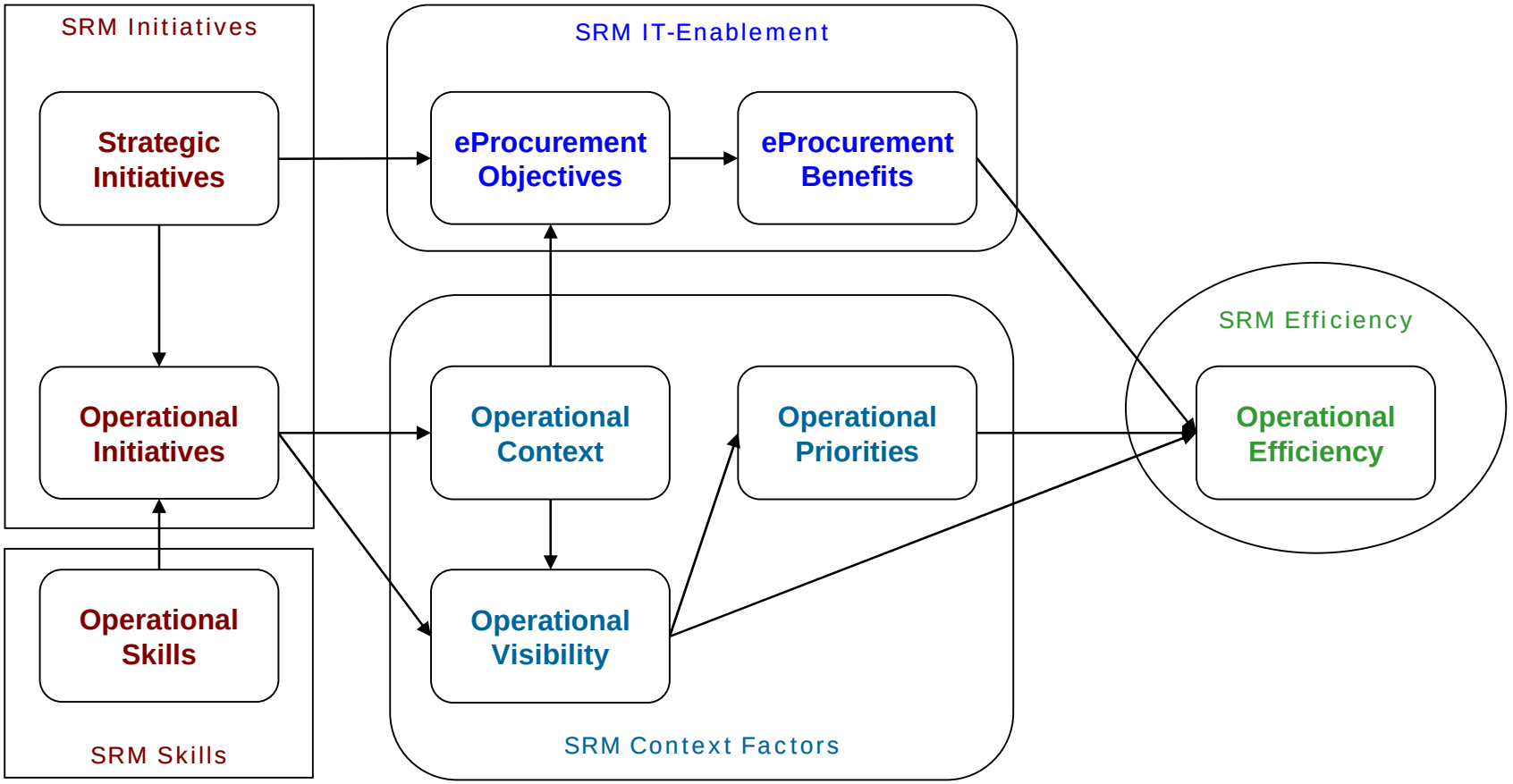
State of Hypotheses after after the Statistical Analysis



Note: Path line-thickness depict the strength of the path causation, while all characters in italics mean that either that the factor was removed or the postulated research proposition/theme was not proved.

Summary of the Study Findings

SRM Adoption and Transformation Framework



- **Definition of Domain Criteria, -Objectives and Monitoring mechanisms are pivotal for companies that successfully enable their operations with IT for higher Efficiency.**

Future Research – Towards Dynamic-, Self-transforming Information Infrastructures

- **Information Infrastructures as Actant Networks**
  - Who is controlling whom? technology or humans?
- **Large Collaborative Information Infrastructures tend to "drift" towards "inertia"**
  - Just like their intra-organizational application landscapes, like large ERP systems, Collaborative application landscapes tend to reach difficulties with change.
  - High degrees of "structuredness" lead to higher "inertia".
- **There is a need to research how such information infrastructures may be triggered to commence a new life-cycle**
  - We need to identify ways to introduce Information Entropy in the continuous evolution of large applications.