Applying the Teamwork Quality Model to an Agile Program of a Utility Organization

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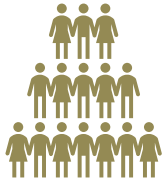
Outline

1. Motivation
2. Research Objectives & Approach
3. Results
    1. Part 1: Interviews
    2. Part 2: Survey
4. Key Findings & Future Work

Motivation

Large-scale agile development



Using agile software development patterns in large scale programs

Performance is crucial

150 FTE
100k p.a.
Δ2% → 300k p.a

Multiteam systems

Several strongly interdependent teams within a program

Limited researched

Influence factors on program performance

Sources
14th Annual State of Agile Report (2020)
J. Mathieu; M. A. Marks; S. J. Zaccaro. (2001)

Research Questions

How is a large-scale agile development program performed at a utility company?	**RQ 1**
Can the TWQ Model be applied to the team level of a large-scale agile software development program of a utility organization?	**RQ 2**
Can the TWQ Model be applied to the program level of large-scale agile software development programs?	**RQ 3**
What are commonalities and differences between the TWQ Models at team and program level?	**RQ 4**

Research Approach – Interviews

Objective

RQ1: How is a large-scale agile development program performed at a utility company?

- General understanding of the agile program

- Why did they use the Scaled Agile Framework (SAFe)?
- Concerns and best practices?
- How do they measure success?
- How do they deal with architecting?

Interview partners

- 2 Members of the Leadership Team
- 2 Agile Coaches
- 2 Product Owners
- 1 Architect

- Semi-structured
- Set of open and closed questions
- Most questions were asked to at least two people
- Video-calls
- Timebox of 60 minutes

Research Approach – TWQ Survey

Structure

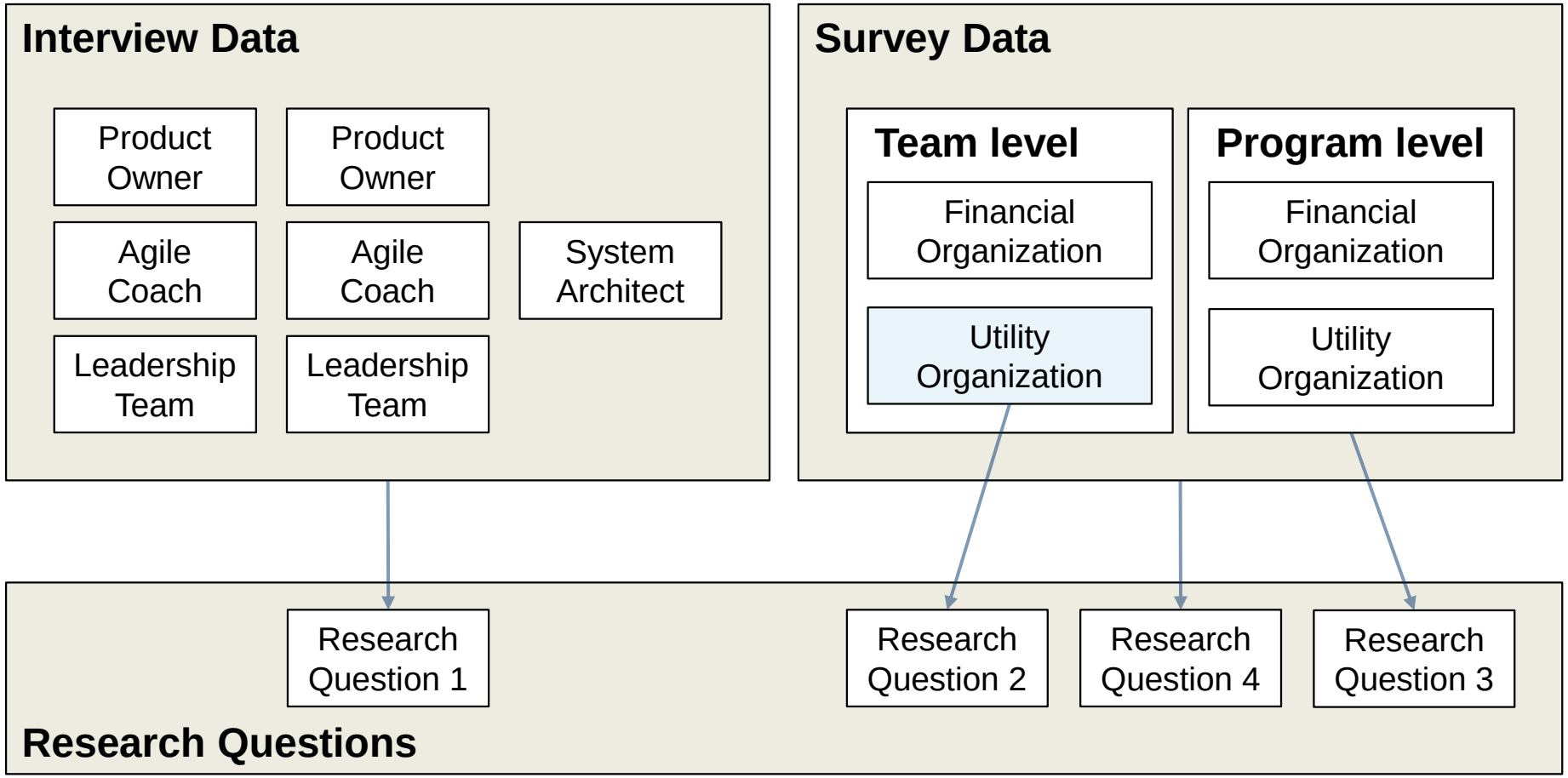
- About 10 questions to determine the context of the respondent
- 61 questions to determine the 10 TWQ factors
  - 5-Point Likert-Scale (+ do not know)
  - Based on the questions Högl and Gemünden (2001)
  - Survey is already validated
- Two Surveys
  - Team level
  - Program level

Data processing

- M. Doepp (2019) has already conducted a survey on an agile program in the finance sector
  - The data basis is limited
  - Restricted to one program/sector
- Aggregate our data with data from Doepp
- Structural Equation Modeling (SEM)
  - Determine the correlation between the variables (latent and observed factors)
  - Determine whether the data fits the model
- Toolset
  - R
  - Package lavaan

Sources
M. Hoegl and H. G. Gemuenden (2001)
Y. Lindsjørn et al (2016)

Mixed-Methods Exploratory Research Design (Creswell and Clark (2018))



Case Study – Results 1 (SAFe Introduction)

- Major migration project in 2017
  - Develop and operate old and new system simultaneously
  - Lots of changes and uncertainties
  - Agile scaling was necessary
- A project lead recommended SAFe
- Bottom-up approach
  - More and more teams and projects joined SAFe
  - Later, program and portfolio level were added
- Scrum Masters and Agile Coaches attended trainings and shared their knowledge

Case Study – Results 2

Adaptions to the Framework

- Changing of names
- Added elements
  - Theme Lead
  - Chief Test Manager
  - Architects
  - Business Analysts
- Further changes
  - System Demo only once during the PI
  - No dedicated Scrum Masters → Agile Chapter
  - Leadership Team: All coordination roles
  - PI Plannings last almost a week

Adaptions to the Organization

- Abolition of
  - Hierarchies
  - Authority to issue directives
  - Disciplinary management
- New Mindset
  - Self-organization
  - Incremental and iterative value creation
  - Collaboration between teams and architects
- Roles of framework had to be filled

Case Study – Results 3 (Agile Architecting)

Goals of the architects

- Scalability
- Flexibility
- Reliability
- Security
- Cloud-Driven

Approach

- Domain-driven design
- Mix of synchronous and asynchronous communication
- Use of proof of concepts
- Decisions at the macro level by the architecture team, and at the micro level by the agile teams
- Mix of upfront and emergent architecture

Case Study – Results 4

Challenges

- Agile working was new for some of the employees
- Overwhelming scope of the framework
- In the beginning, lac of top management support
- Rapid growth
- Large number of dependencies
- Capacity planning
- Estimations and forecasts on program level
- Costumer involvement

Success Factors & Lessons Learned

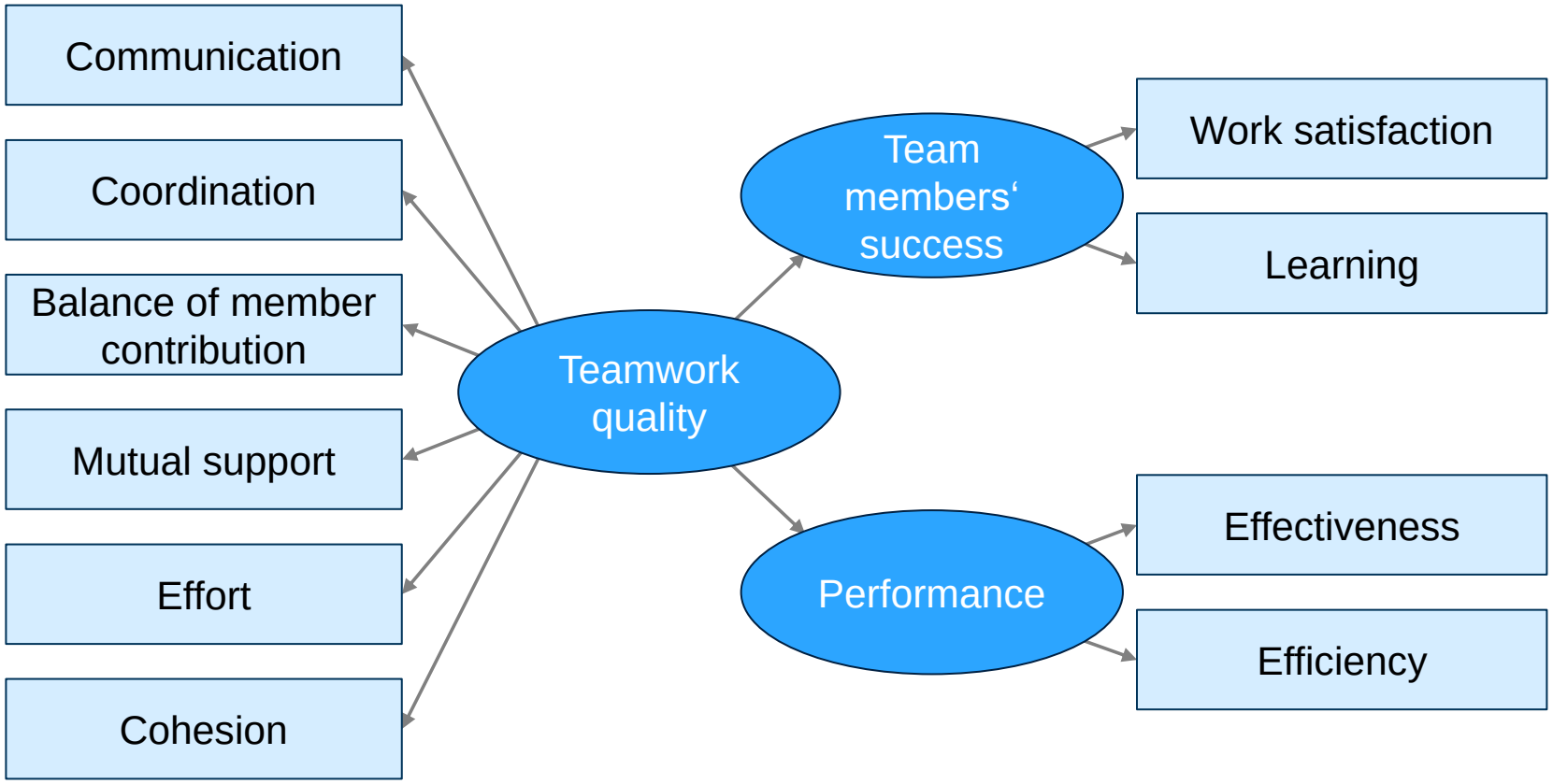
Success factors

- Culture
- Established processes
- The setup incl the adaptions
- Skilled people

Lessons learned

- Follow the SAFe introduction guideline
- Involve top management in the decision-making process
- Involve the teams in architectural decisions
- Spend even more time on education people
- Engage external consultants

Teamwork Quality Model



Why do we use this model:

- Model is already established on team level
- Model is validated for agile and classic teams
- Questionnaire is already developed and validated
- There are existing data to compare our results with

Sources
M. Hoegl and H. G. Gemuenden (2001)
Y. Lindsjørn et al (2016)

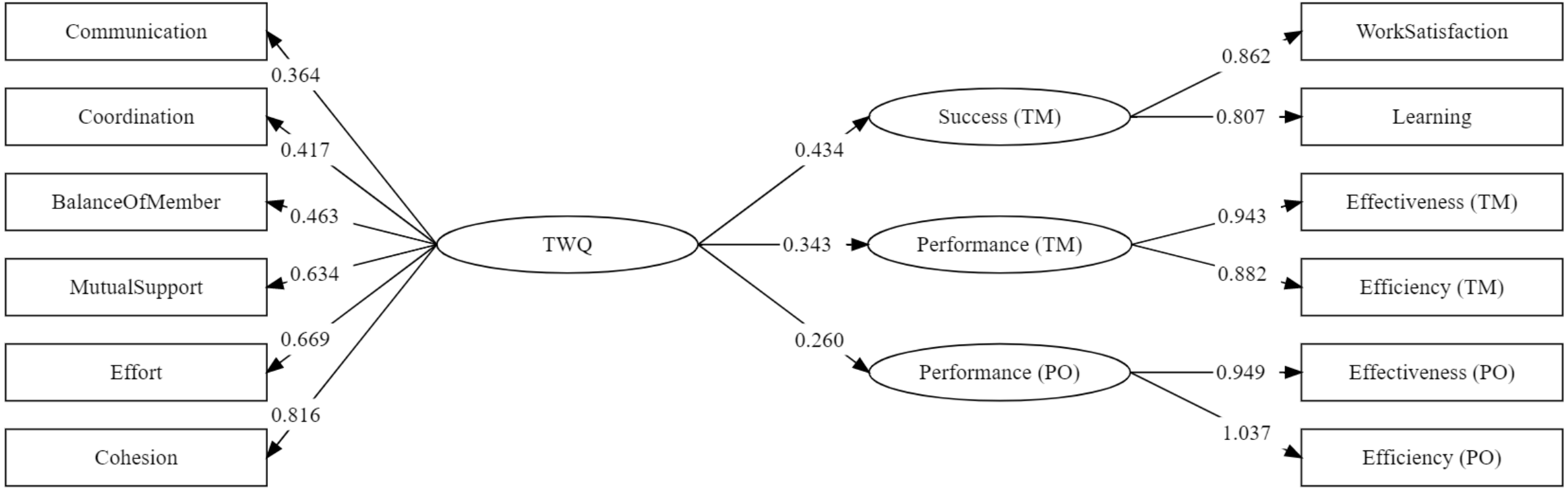
Descriptive Statistics – Team Level

Indicator	Rater	Items	Utility Company					Merged Data				
			Responses	Mean	SD	Alpha	VIF	Responses	Mean	SD	Alpha	VIF
Communication	TM	10	32	4.3	0.29	0.34	2.0	79	4.0	0.59	0.33	3.0
Coordination	TM	4	32	4.3	0.43	0.18	2.2	79	3.9	0.76	0.19	3.9
Mutual Support	TM	7	32	4.7	0.33	0.71	2.0	79	4.5	0.53	0.71	3.8
Effort	TM	4	32	4.3	0.47	0.46	2.2	79	3.9	0.78	0.45	3.7
Cohesion	TM	10	32	4.5	0.35	0.70	2.5	79	4.0	0.73	0.71	5.4
Balance of member contrib.	TM	3	32	4.4	0.49	0.38	2.2	79	4.0	0.75	0.34	3.0
Work satisfaction	TM	4	32	4.6	0.44	0.71	2.0	79	4.3	0.70	0.87	4.0
Learning	TM	4	32	4.3	0.69	0.85	2.0	79	4.2	0.75	0.85	3.0
Effectiveness	TM	10	32	4.4	0.44	0.85	1.8	79	4.0	0.68	0.90	2.6
Efficiency	TM	5	32	4.3	0.50	0.60	1.8	79	3.7	0.90	0.90	2.6
Effectiveness	PO	10	6	4.4	0.85	0.96	15.4	13	3.8	0.86	0.95	4.2
Efficiency	PO	5	6	4.2	0.80	0.92	15.4	13	3.5	1.02	0.92	4.2
Effectiveness	SM	10	4	4.5	0.39	0.92	1.1	8	4.0	0.76	0.96	3.6
Efficiency	SM	5	4	4.5	0.53	0.78	1.1	8	4.1	0.86	0.92	3.6
Effectiveness	SH	10	5	4.3	0.52	0.92	1.9	15	4.2	0.49	0.88	1.8
Efficiency	SH	5	5	4.5	0.56	0	1.9	15	4.2	0.69	0.88	1.8

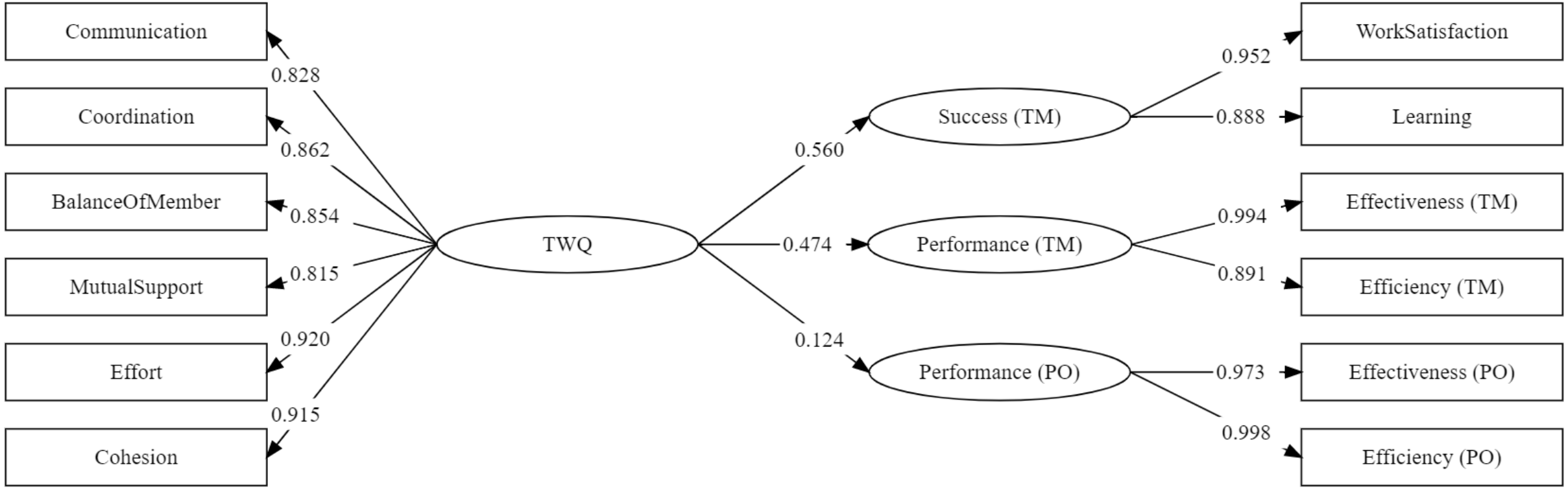
Descriptive Statistics – Program Level

Indicator	Rater	Items	Utility Company					Merged Data				
			Responses	Mean	SD	Alpha	VIF	Responses	Mean	SD	Alpha	VIF
Communication	TM	10	23	3.6	0.55	0.75	2.1	39	3.5	0.59	0.75	2.7
Coordination	TM	4	23	3.6	0.67	0.80	3.3	39	3.5	0.74	0.79	2.8
Mutual Support	TM	7	23	4.1	0.57	0.87	3.7	39	3.8	0.70	0.87	4.1
Effort	TM	4	23	3.8	0.60	0.75	2.1	39	3.6	0.79	0.74	3.3
Cohesion	TM	10	23	4.1	0.46	0.83	4.1	39	3.8	0.61	0.83	6.0
Balance of member contrib.	TM	3	23	3.9	0.62	0.59	1.8	39	3.7	0.72	0.60	2.7
Work satisfaction	TM	4	23	4.0	0.67	0.90	5.6	39	3.9	0.76	0.90	5.6
Learning	TM	4	23	4.1	0.61	0.88	5.5	39	3.9	0.92	0.92	6.1
Effectiveness	TM	10	23	3.7	0.73	0.95	3.2	39	3.6	0.84	0.94	3.8
Efficiency	TM	5	23	3.7	0.95	0.96	3.2	39	3.4	1.03	0.94	3.8
Effectiveness	PO	10	4	3.8	1.06	0.95	36.4	11	3.2	0.92	0.95	8.1
Efficiency	PO	5	4	3.5	1.24	0.96	36.4	11	3.0	0.95	0.93	8.1
Effectiveness	SM	10	4	4.5	0.33	0.77	17.8	9	4.0	0.68	0.93	2.4
Efficiency	SM	5	4	4.7	0.30	0.60	17.8	9	3.9	0.81	0.91	2.4
Effectiveness	SH	10	4	4.4	0.36	0.86	7.1	13	3.8	0.85	0.94	7.6
Efficiency	SH	5	4	4.2	0.28	0.67	7.1	13	3.5	1.11	0.94	7.6

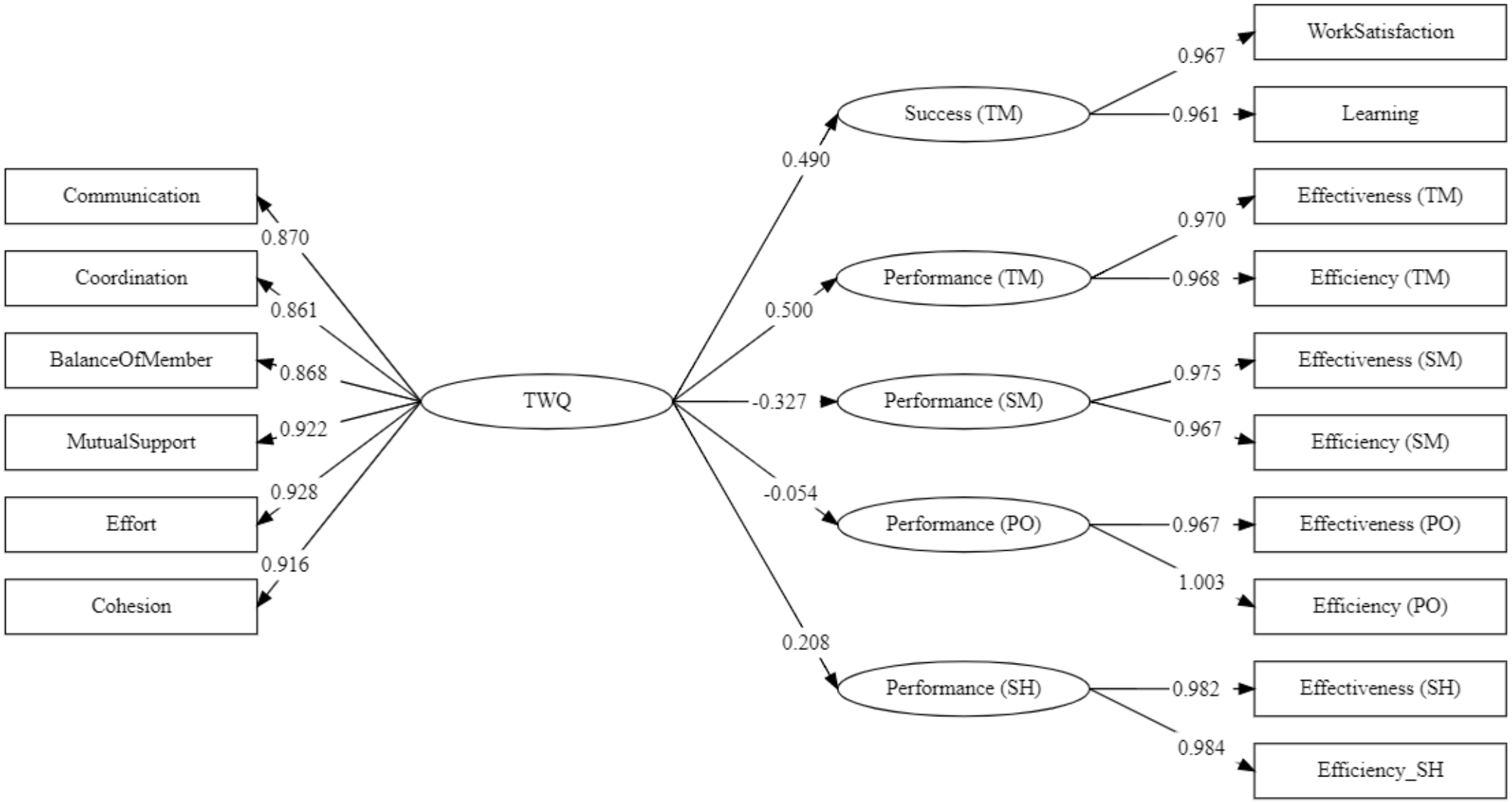
Application of the TWQ Model – Team Level (Utility Company)



Application of the TWQ Model – Team Level (Merged Data)



Application of the TWQ Model – Program Level (Merged Data)



Application of the TWQ Model – Model fit

Fit Measure	Team Level (Utility)	TWQ Team Level (merged)	TWQ Program Level (merged)
P-value	0.12	0.00	0.05
SRMR	0.09	0.03	0.03
RMSEA	0.07	0.07	0.06

Key Findings

Research Question 1

How is a large-scale agile development program performed at a utility company?

- The utility program uses SAFe as scaling agile framework
- The utility company used a bottom-up approach for the introduction of SAFe
- There were several adaptions made to the framework and to the organization

- External consulting is crucial
- The culture is a critical success factor

Research Question 2

Can the TWQ Model be applied to the team level of a large-scale agile software development program of a utility organization?

- There were several limitations with the data
  - High alpha values
  - Low significances for the factor loadings of the latent structures.
  - Poor values for the fit-measures
- Nevertheless
  - Measurement model fits quite well
  - Positive influence of TWQ on performance and success

→ TWQ model can be conditionally applied to the team level of the case organization's program

Key Findings

Research Question 3

Can the TWQ Model be applied to the program level of large-scale agile software development programs?

- Descriptive statistics are mostly in an acceptable range
- Factor loadings of the measurement model are quite high
- Measurement model is highly significant
- Positive influence of TWQ on success and performance except for Scrum Master's performance ratings
- Fit-measures of the overall model are ok

Research Question 4

What are commonalities and differences between the TWQ Model at team and program level?

- Descriptive Statistics
  - Mean values at program level lower than at team level
  - Other values are quite similar
- TWQ model
  - Structural model fits for both quite well and has similar factor loadings
  - Latent structures behave also quite similar
  - Effect of TWQ on Product Owner's performance ratings behave slightly different

Conclusion, Limitations & Future Work

Conclusion

- TWQ model is applicable to the program level of large-scale agile programs
- Data can be used for other studies too
- Culture and adaptions to the frameworks are necessary for a successful large-scale agile program

Limitations

- Only two programs studied yet (Both using SAFe)
- Some poor statistical values

Future Work

- Conduct more interviews with several different roles (e.g., external stakeholders, developers)
- Only two studied program yet
  - Study more programs
  - Study programs using another framework than SAFe
- Investigate the reasons for the differences of the mean values at team and program level
- Investigate the reason for the negative influence of TWQ on Scrum Master’s performance ratings on the program level

References

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Case Description

- Company
  - Utility company
  - About 35.000 Full time employees
  - Based in Essen
  - Several agile programs
- Program
  - Product: Platform for charging stations across Europe
    - Go-live: Last year
  - Using Scaled Agile Framework (SAFe)
  - About 67 program members
    - 9 Coordinating roles
    - 3 Architects
    - 55 Developers in 9 Teams
  - International setting (Germany, Slovakia, Vietnam, Spain)

Source
https://www.electrive.net/wp-content/uploads/2018/02/innogy-daimler-ladestation-charging-station.png

Responses

Team Level

Utility Company

- 48 respondents
- Participation rate 71.6%

Finance Company

- 79 respondents
- Participation rate 53.4%

Program Level

Utility Company

- 41 respondents
- Participation rate 61.2%

Finance Company

- 43 respondents
- Participation rate: 29.1%

Survey – Example questions

- There is frequent communication within the team
- There is frequent communication within the program

- The team members communicate often in spontaneous meetings, phone conversations, etc.
- The program members communicate often in spontaneous meetings, phone conversations, etc.

- In the team there are conflicts regarding the openness of the information flow
- In the program there are conflicts regarding the openness of the information flow

- So far, the team can be pleased with its work
- So far, the program members can be pleased with its work

- Going by the results, this teamwork can be regarded as successful
- Going by the results, this teamwork in the program can be regarded as successful

Sources
M. Hoegl and H. G. Gemuenden (2001)
Y. Lindsjørn et al (2016)

Case Study – Adjusted SAFe 4.6