Techno-Service-Profit Chain:
The Impacts of IoT-Enabled Algorithmic Customer Service Systems from an Interdisciplinary Perspective

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Practical Motivations

- **Customer Service**
  - A "high touch" environment
  - Traditional Service Profit Chain (SPC): Happy employees → Happy customers
  - Especially salient in the B2B context, powerful corp. customers

- **Customer Service Automation**
  - Shift "**high touch**" → "**high tech**"
  - Internet of Things (IoT)-enabled Algorithmic Customer Service System (IACS) "ice"
    - Cloud-enabled information hub
    - IoT-enabled 24/7 monitoring + tracking
    - Algorithm-enabled real-time analytic decision making
  - Real World Examples: Diebold, GE Aviation, Coca Cola (*see next slides*)

Practical Motivation

- **Smart Vending Machine – Coca Cola**

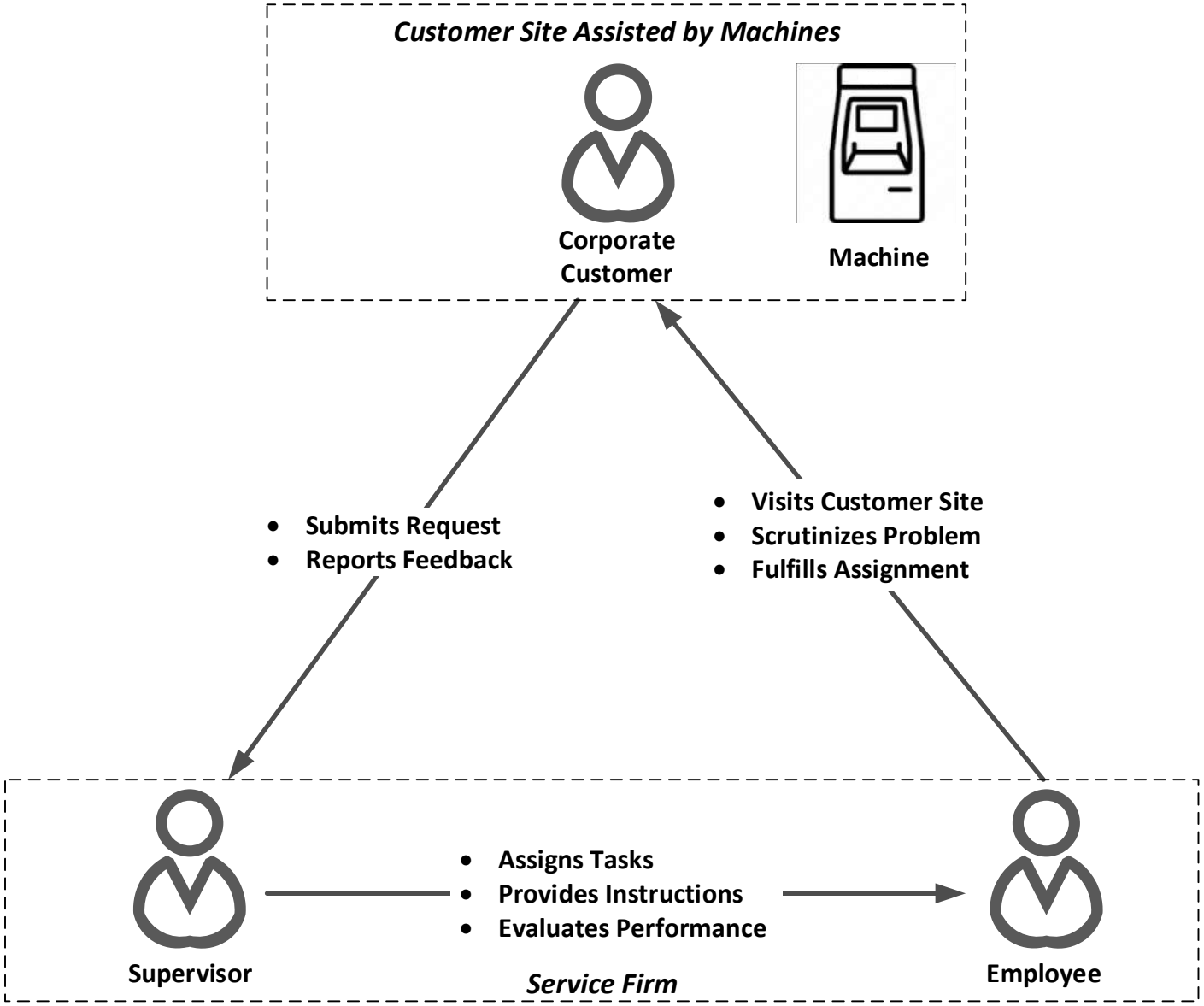
+ Operational efficiency
+ Economic efficiency

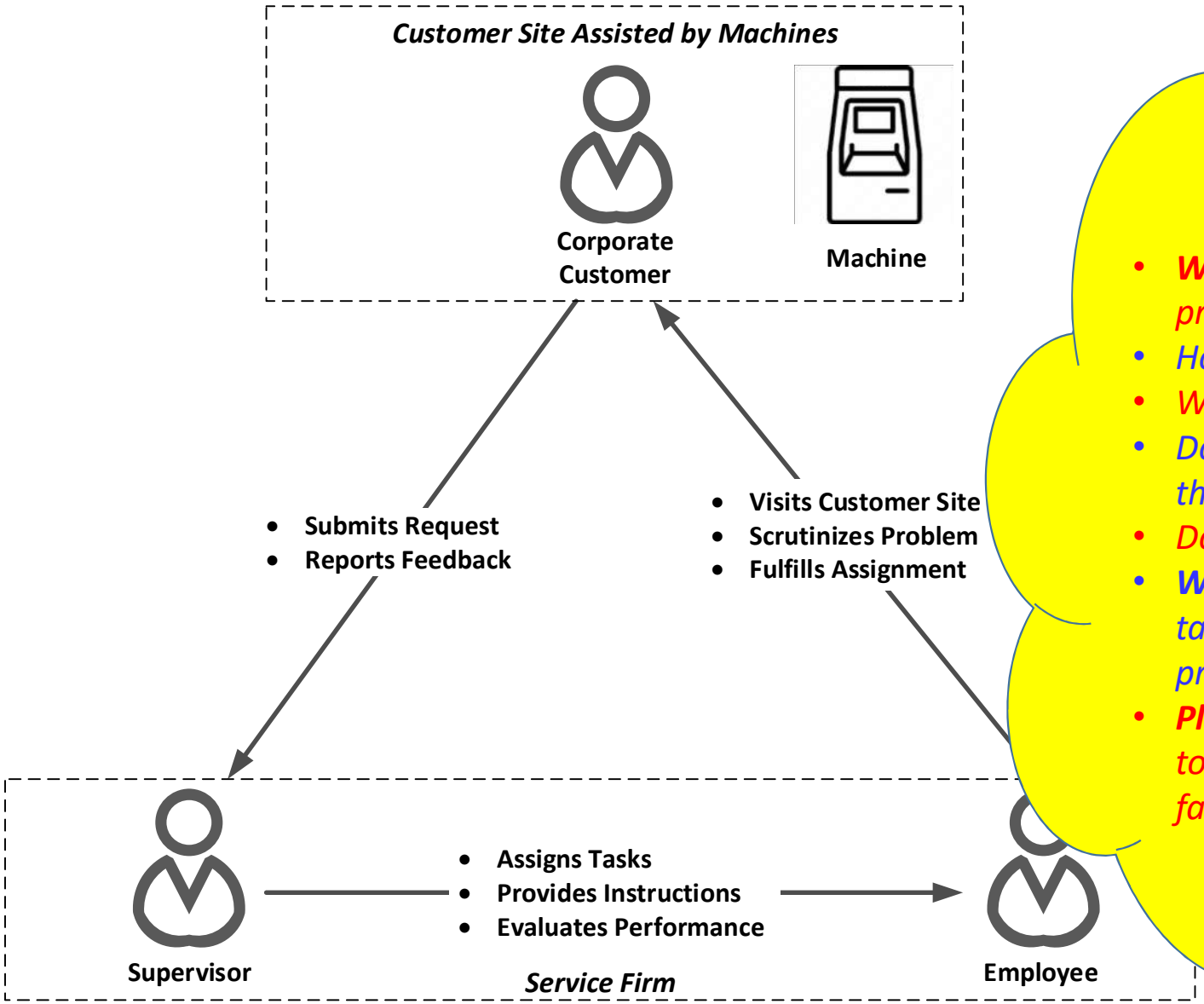
What's the tradeoff with "high tech"?

Does "high tech " challenges "high touch"?


GE
Aviation

Diebold – Smart ATM

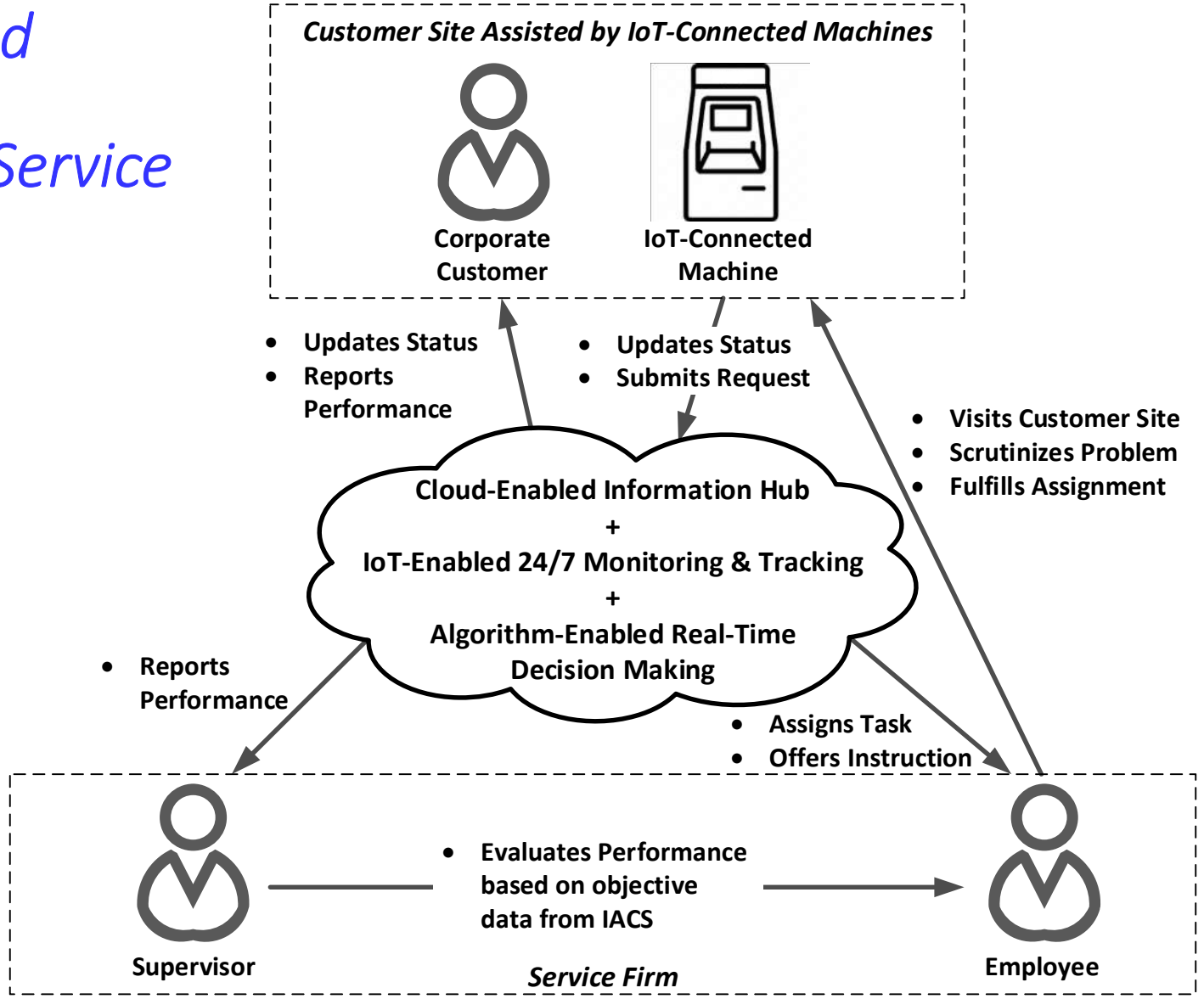

Customer Site Assisted by Machines
Corporate Customer
Machine
Submits Request
Reports Feedback
Visits Customer Site
Scrutinizes Problem
Fulfills Assignment
Supervisor
Assigns Tasks
Provides Instructions
Evaluates Performance
Service Firm
Employee



Practical Challenges

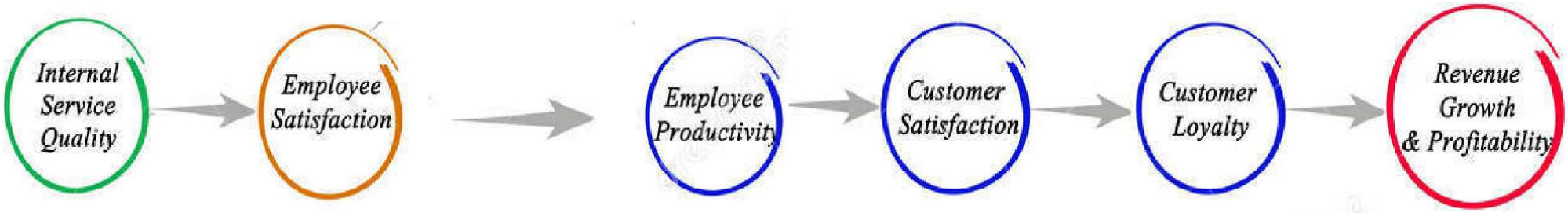
- ***When*** *&* ***How*** *do you know there is a problem?*
- *How* ***soon*** *can you send ppl to fix it?*
- *What kind of* ***problems*** *exactly?*
- *Do we have the* ***knowledge*** *to solve this problem?*
- *Do we bring the* ***right parts****?*
- ***Where*** *are (were) you? Why does it take such* ***a long time*** *to fix this problem?*
- ***Pleasing the customers****… (small token, greeting cards, personal favor, etc.)*

IoT-enabled Algorithm Customer Service Systems



Theoretical Motivation

- **Service-Profit Chain (SPC)** (Heskett et al.@HBR 1994; 2008)
  - HBR Best Selling Paper of the Decade (2008)
  - Harvard Prof: Gary Loveman → CEO & Chairman of Harrahs & Caesars Palace (USD 8.3 B.)



- View IT as generic tools → infusion of agentic technologies within SPC (Hogreve. 2022)

- ***Research Objective:***

Revamp the SPC by Proposing the New Techno-SPC in the Techno-Service Context

The Agentic Nature of "IoT-enabled" + "Algorithm" CSS (IACS)

1. **Cloud-based information hub** (Andersson and Mattsson 2015)
   - centralizes & disseminates large amount of data to all parties in SPC (including customers, employees, and supervisors)

The Agentic Nature of "IoT-enabled" + "Algorithm" CSS (IACS)

1. **Cloud-based information hub**

2. **IoT-enabled 24/7 monitoring and tracking** (Porters and Saar-Tsechansky 2014)

   automatically

   - detects & updates the status of customers' product
   - submits service requests
   - keeps track of employees' location, traveling route, and service outcome anywhere, anytime or (everywhere, every time)

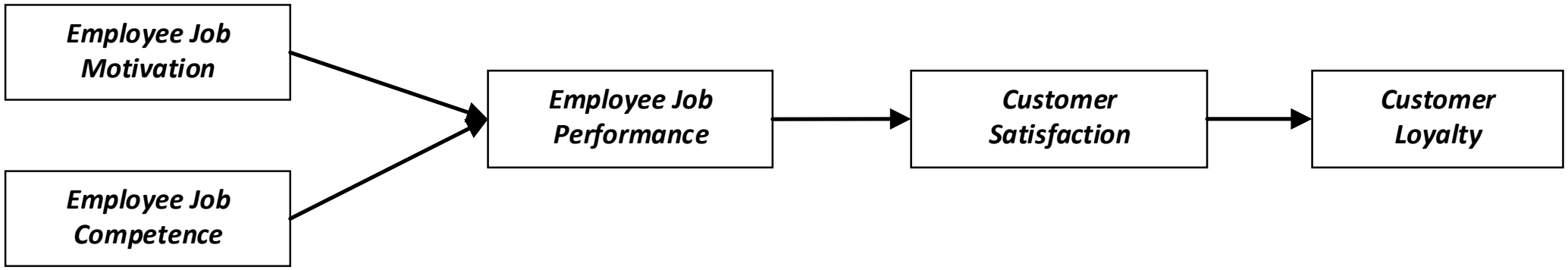
The Agentic Nature of "IoT-enabled" + "Algorithm" CSS (IACS)

1. **Cloud-based information hub**

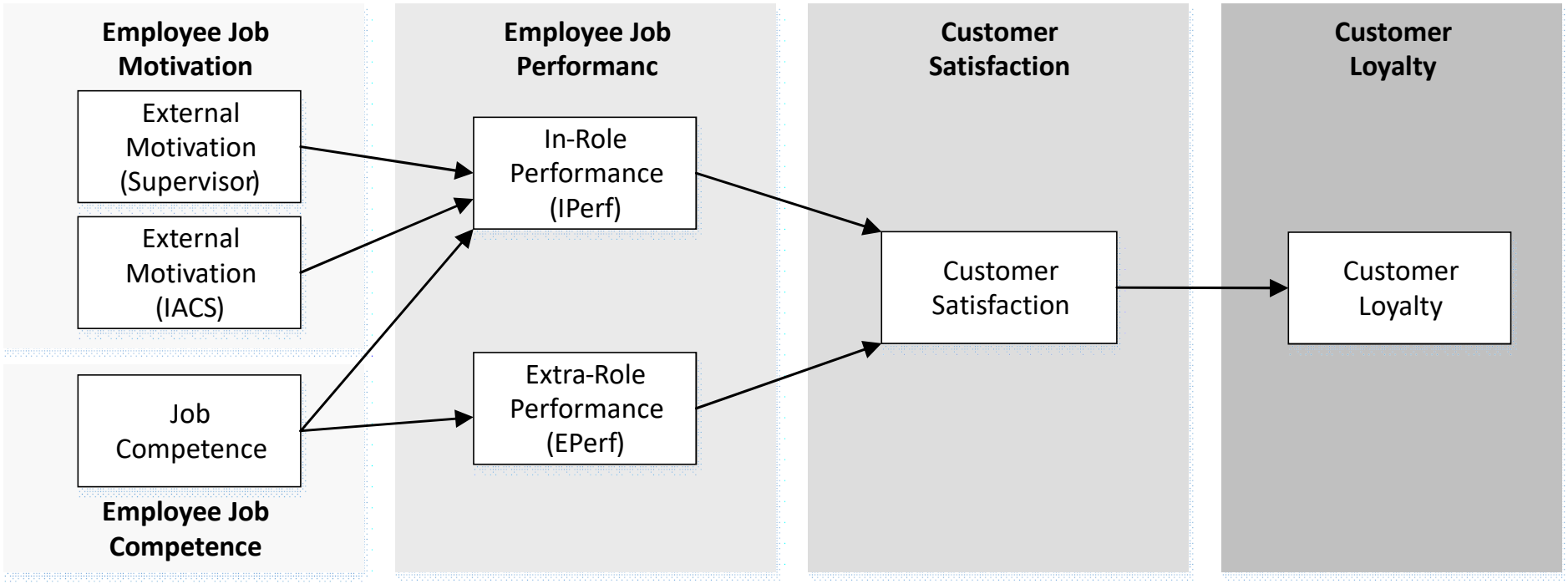
2. **IoT-enabled 24/7 monitoring and tracking**

3. **Algorithmic Real-time decision-making** (Porters & Saar-Tsechansky 2014)
   immediately & ***Intelligently***
   - optimizes employee task assignment based on employee work schedule, availability, and physical proximity to the customer site
   - recommends appropriate solutions and tools/parts to fulfill customer requests

Service Profit Chain (SPC)

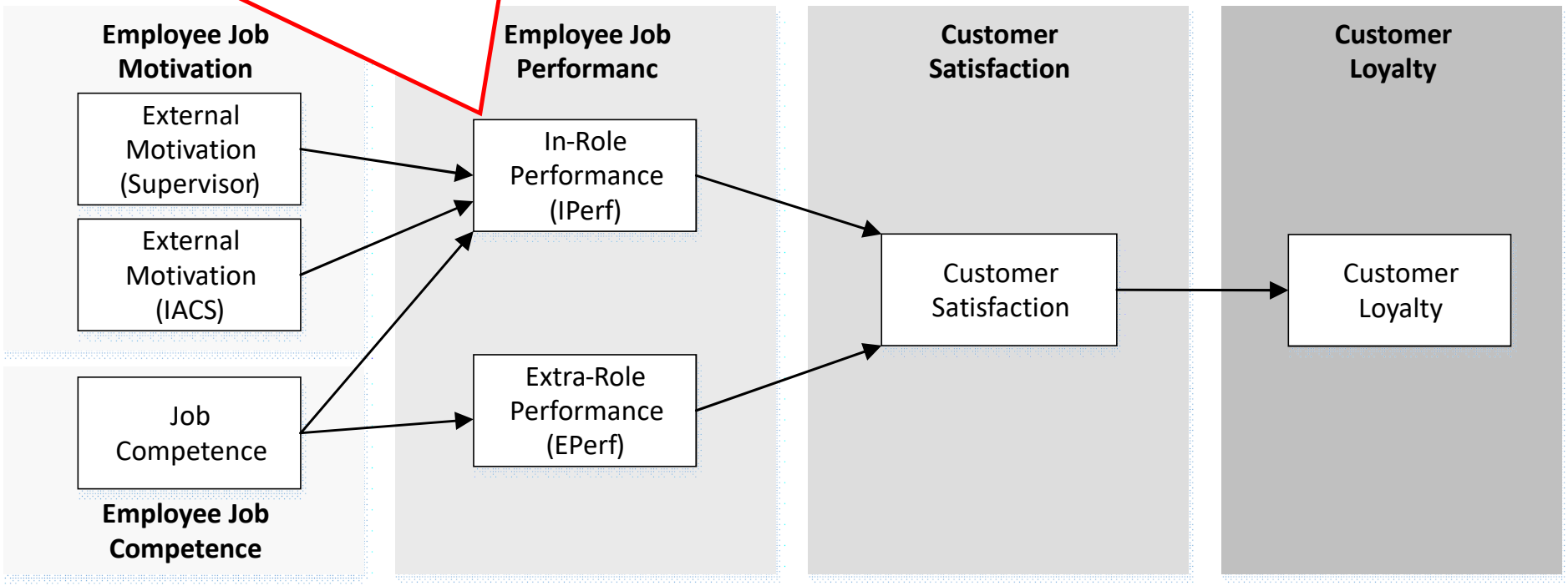


Techno-Service Profit Chain (TSPC)

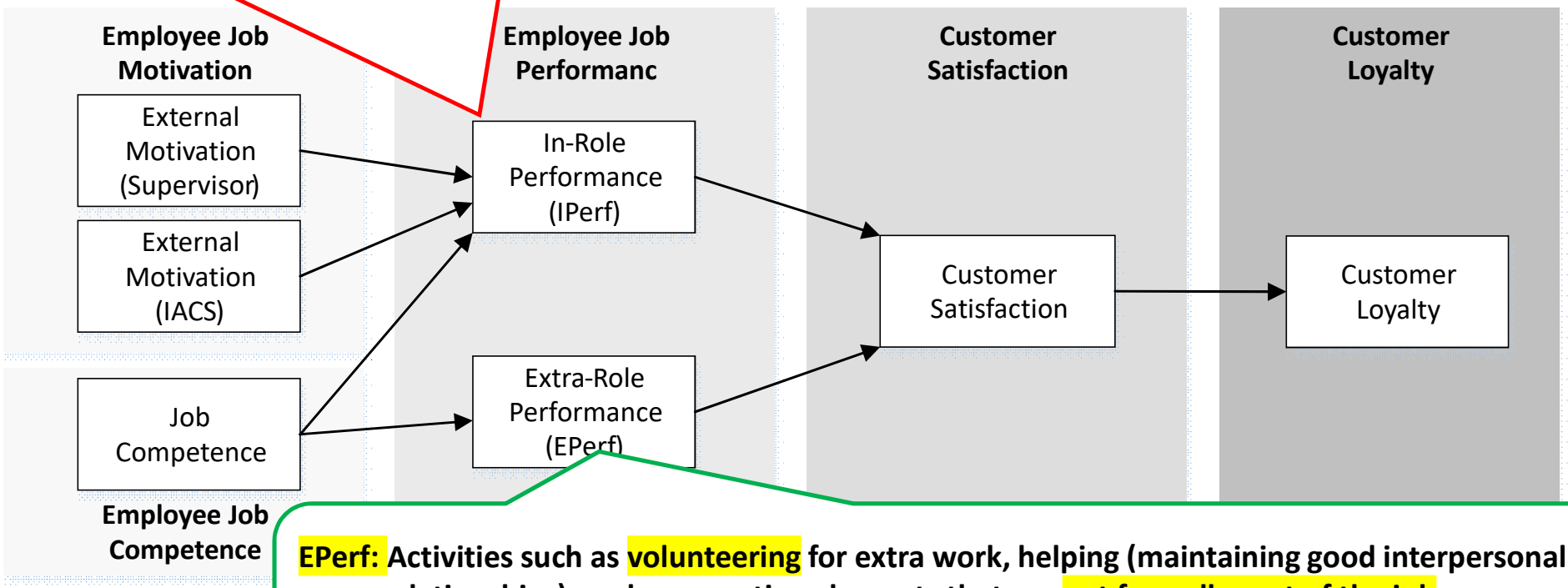


Decomposing SPC in the IACS context (Johns 2006; 2017; Hong et al. 2014)

IPerf: **Role-prescribed activities like those that usually appear on formal job descriptions and affect the organization's technical core as employees either execute technical processes or maintain the technical requirements** (Borman and Motowidlo 1993; Motowidlo and Van Scotter 1994).



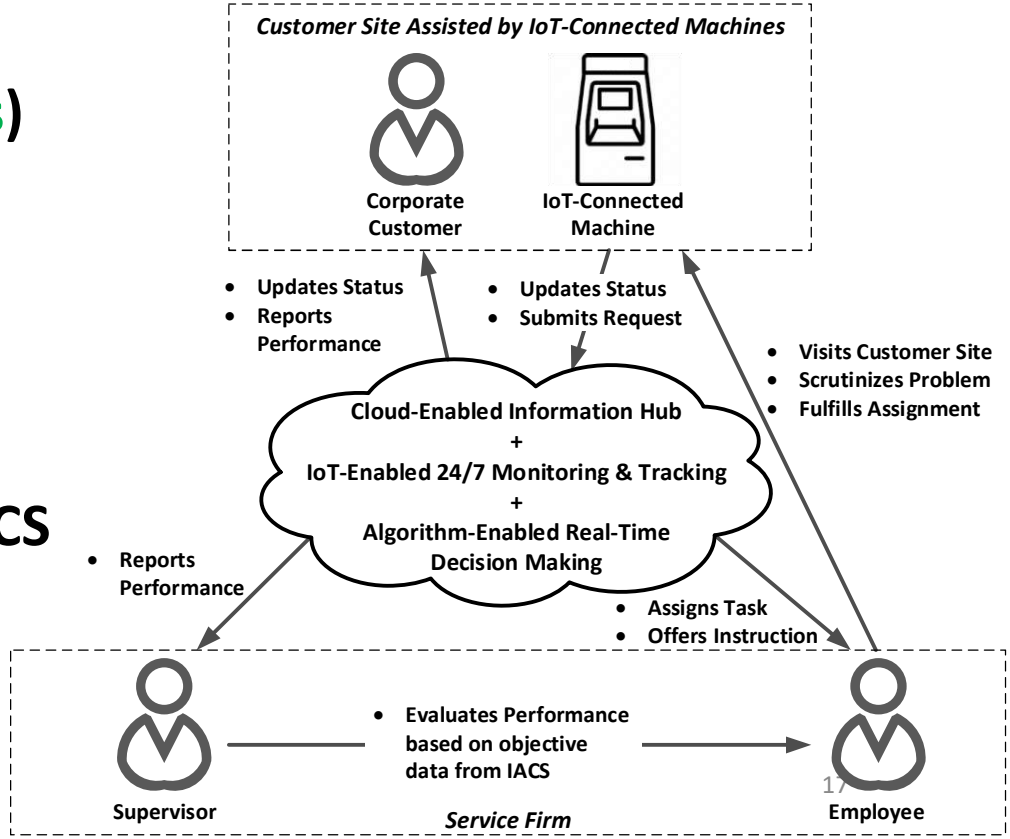
IPerf: Role-prescribed activities like those that usually appear on formal job descriptions and affect the organization's technical core as employees either execute technical processes or maintain the technical requirements (Borman and Motowidlo 1993; Motowidlo and Van Scotter 1994).



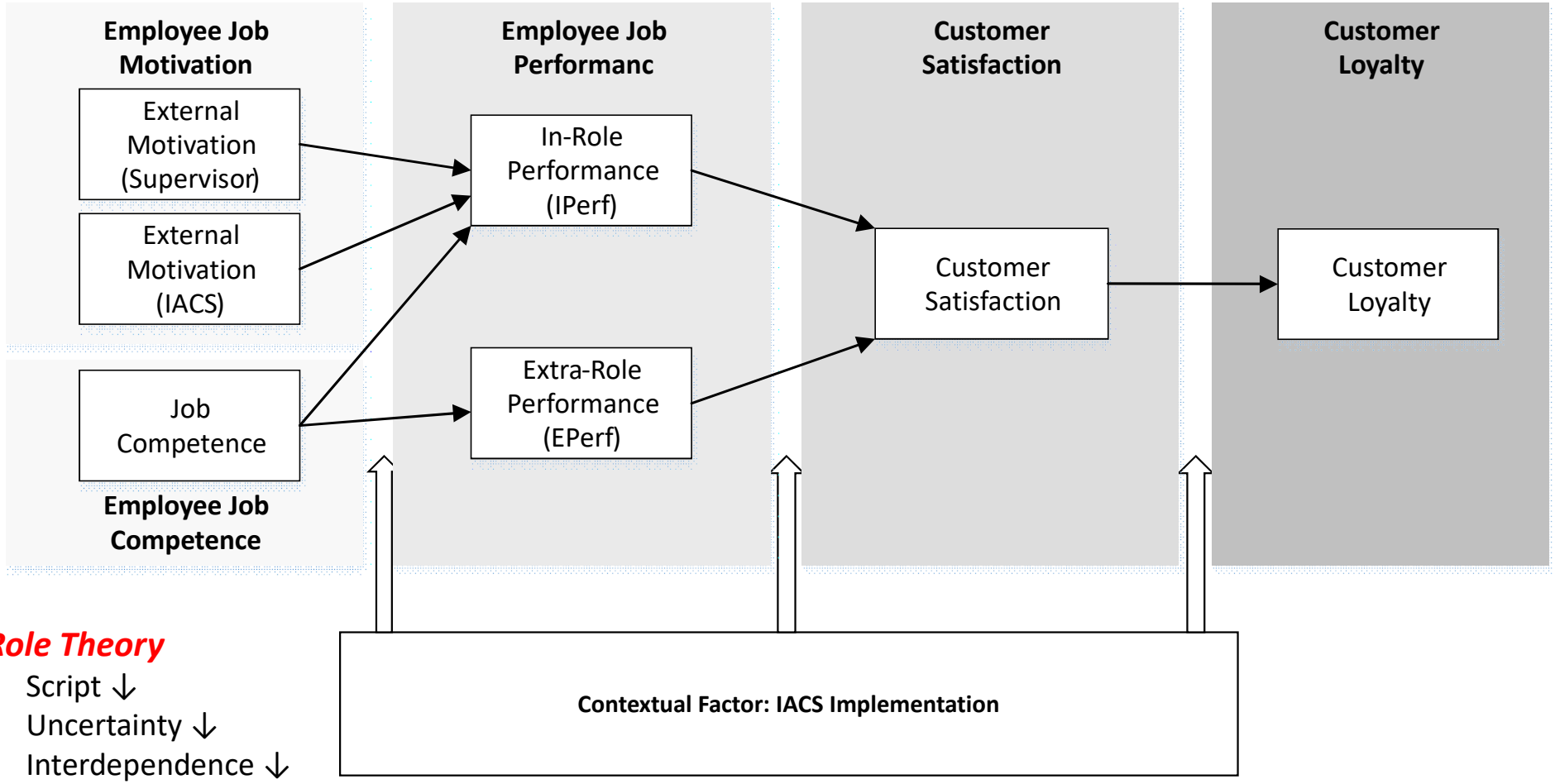
EPerf: Activities such as volunteering for extra work, helping (maintaining good interpersonal relationships), and cooperating elements that are not formally part of the job (Conway 1996; Johnson 2001)**, but "support the organizational, social, and psychological environment in which the technical core must function"** (Borman and Motowidlo 1993, p.73)

Role Theory: informs the interplay between SPC & IACSs in the TSPC framework

- **In-Role Performance (IPerf) vs. Extra-Role Performance (EPerf)**
- **Role Script (i.e. how to perform the tasks)**
  → **Standardized after IACS**
- **Script Uncertainty ↓ after IACS**
- **Stakeholder Interdependency ↓ after IACS**



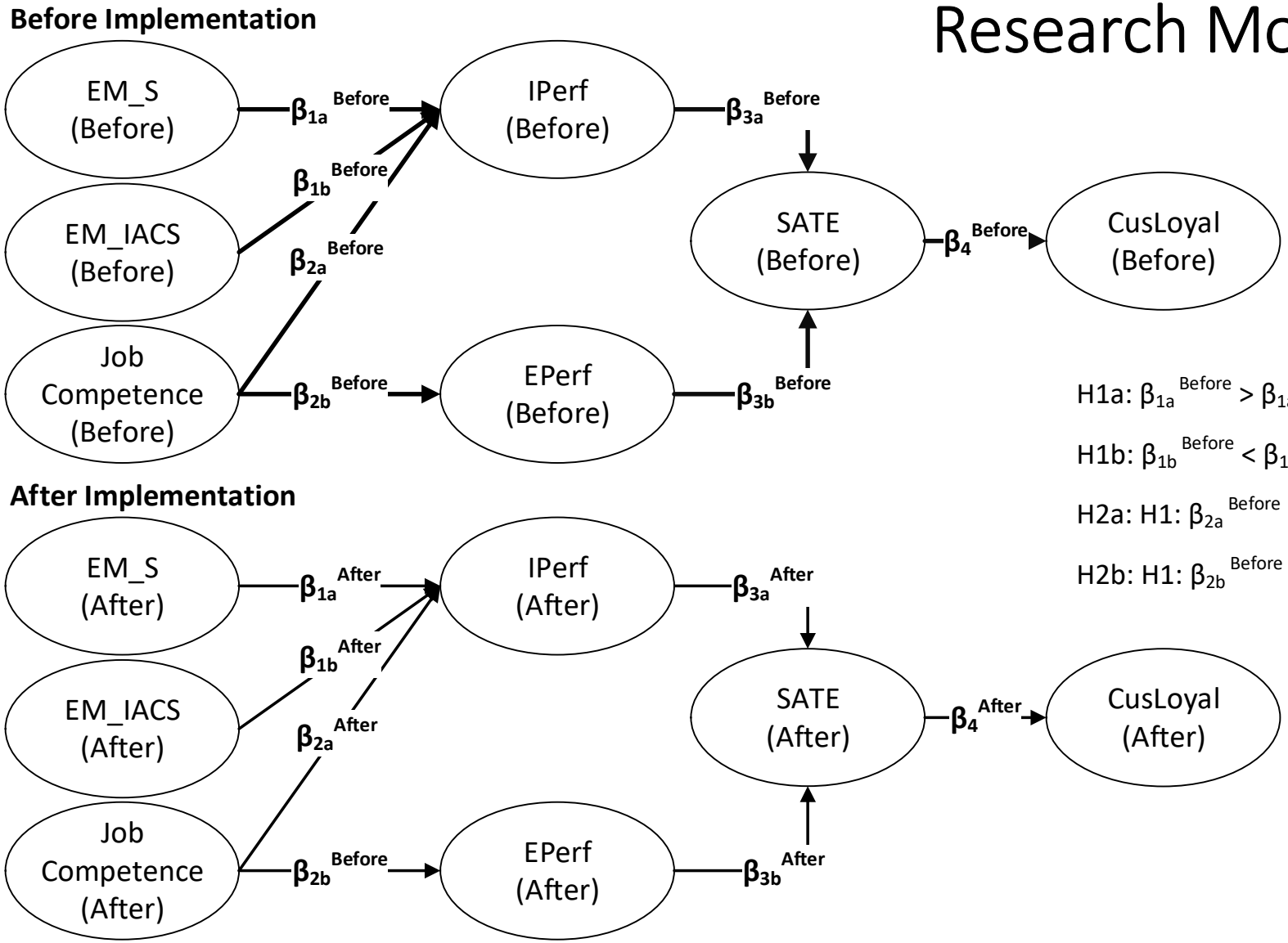
Techno-Service Profit Chain



Role Theory

- Script ↓
- Uncertainty ↓
- Interdependence ↓

Research Model (Quick)



H1a: $\beta_{1a}^{Before} > \beta_{1a}^{After}$

H1b: $\beta_{1b}^{Before} < \beta_{1b}^{After}$

H2a: H1: $\beta_{2a}^{Before} > \beta_{2a}^{After}$

H2b: H1: $\beta_{2b}^{Before} > \beta_{2b}^{After}$

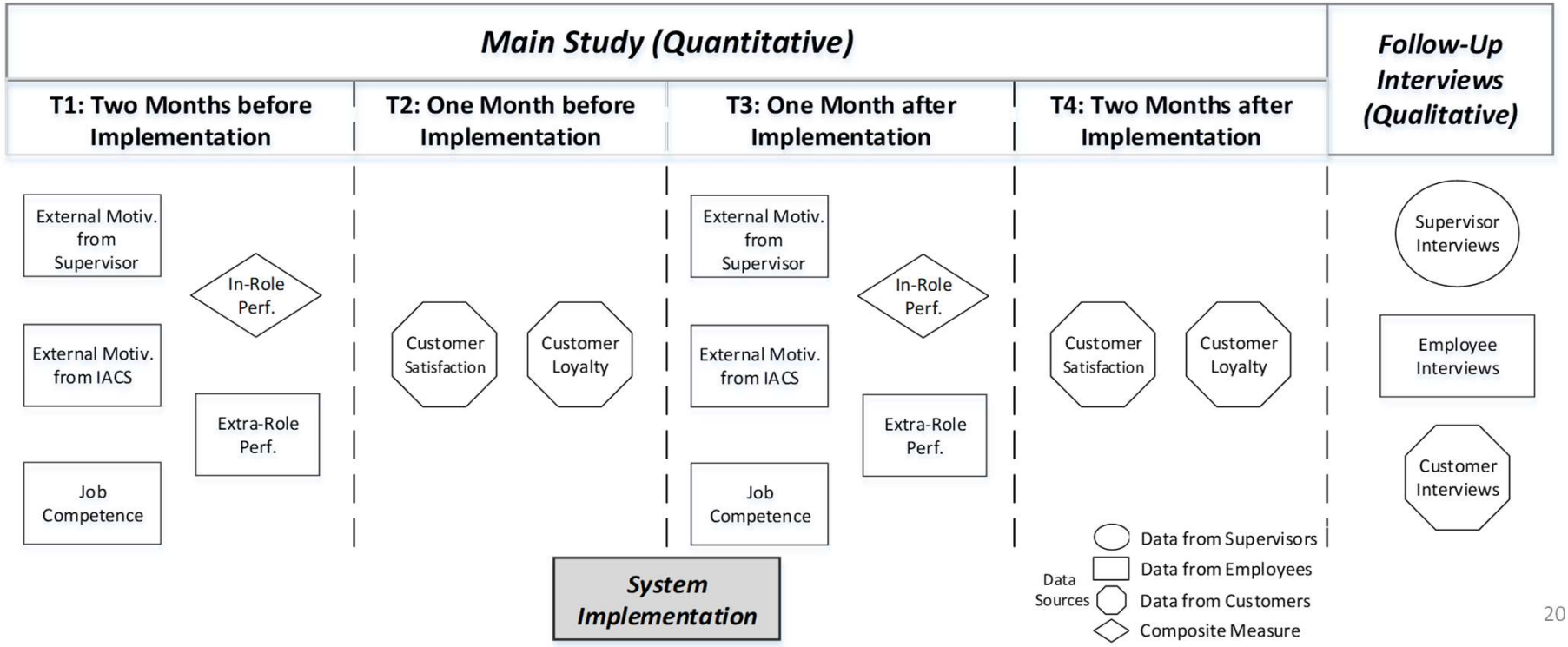
H3a: $\beta_{3a}^{Before} < \beta_{3a}^{After}$

H3b: $\beta_{3b}^{Before} > \beta_{3b}^{After}$

H4: $\beta_{4}^{Before} > \beta_{4}^{After}$

A Sequential Quan-Qual Mixed-Method Design

- Research Setting: A Large ATM Maintenance Service Firm
- Pilot Study: 30 employees, 15 supervisors, and 18 corporate customers
- Quan : Four-Wave Multi-Sourced Survey 259 → 202 (n = 202), *Cross-legged SEM*
- Qual: *Semi-Structured Interviews* with Employees, Supervisors, & Customers



Measures

Construct Name	Sources
Employee External Motivation -(Supervisor) -(Algorithm)	Malhotra et al. (2008); Ryan and Connell (1989)
Employee Job Competence	Spreitzer (1995)
Employee Extra-Role Performance	Netemeyer et al. (2005)
Employee In-Role Performance	Jassen (2001); Janssen and Van Yperen (2004)
Customer Satisfaction toward Employees	Chan et al. (2010); Homburg et al. (2009) Bettencourt 1997
Customer Loyalty	Chaudhuri and Holbrook (2001); Yim et al. (2008)

Control Variables:

- Employees : age, gender, education level, tenure, & internal motivation
- Customers: age, gender, education level, tenure, & satisfaction to firm

Sample Demographics

	Category	Employees		Customers	
Gender	Female	1.5%		49.0%	
	Male	98.5%		51.0%	
Education	Secondary/High School	8.3%		4.5%	
	Post-Secondary	87.5%		48.0%	
	University or Higher	4.2%		47.5%	
		Mean	**SD**	**Mean**	**SD**
Age (Years)		26.13	3.30	31.9	87.2
Tenure (Months)		29.25	21.37	49.5	39.2

Table 3. Descriptive Statistics and Psychometric Properties *before* Implementation

Construct	Mean	S.D.	1	2	3	4	5	6	7
1. EM-S	5.66	1.38	0.85						
2. EM-IACS	5.77	0.83	-0.04	0.91					
3. JobComp	6.01	0.66	0.16**	0.22***	0.86				
4. IPerf	5.59	0.66	0.30***	0.04	0.31***	N/A			
5. EPerf	5.71	0.88	0.13*	0.12*	0.58***	0.35***	0.79		
6. SATE	6.27	0.57	0.06	0.21***	0.45***	0.14**	0.37***	0.85	
7. CusLoyal	5.47	0.92	0.11	0.13*	0.23***	0.02	0.20***	0.42***	0.86
Cronbach's Alpha			0.88	0.84	N/A	N/A	0.83	0.85	0.89
Composite Reliability			0.91	0.90	N/A	N/A	0.84	0.89	0.90
AVE			0.72	0.82	N/A	N/A	0.63	0.73	0.74

§ Square root AVE is shown on the main diagonal.

Table 4. Descriptive Statistics and Psychometric Properties *after* Implementation

Construct	Mean	S.D.	1	2	3	4	5	6	7
1. EM-S	5.24	1.06	0.80						
2. EM-IACS	6.07	0.61	0.01	0.89					
3. JobComp	5.99	0.80	0.25***	0.18**	0.87				
4. Iperf	4.70	0.57	0.12	0.18***	0.35***	N/A			
5. EPerf	5.81	0.88	0.26***	0.27***	0.52***	0.47***	0.87		
6. SATE	6.21	0.71	0.08	0.03	0.25***	0.25***	0.28***	0.85	
7. CusLoyal	5.61	0.87	0.09	-0.01	0.06	0.16**	0.17**	0.16**	0.85
Cronbach's Alpha			0.86	0.91	N/A	N/A	0.90	0.91	0.85
Composite Reliability			0.88	0.88	N/A	N/A	0.90	0.89	0.89
AVE			0.64	0.79	N/A	N/A	0.75	0.72	0.73

§ Square root AVE is shown on the main diagonal.

Table 3. CFA Fit Indices

Fit Indices	Before	After	Desired Level
X^2/D.F.	1.744	1.949	< 5
CFI	0.948	0.931	> 0.9
SRMR	0.047	0.059	< 0.08
RMSEA	0.061	0.072	< 0.08

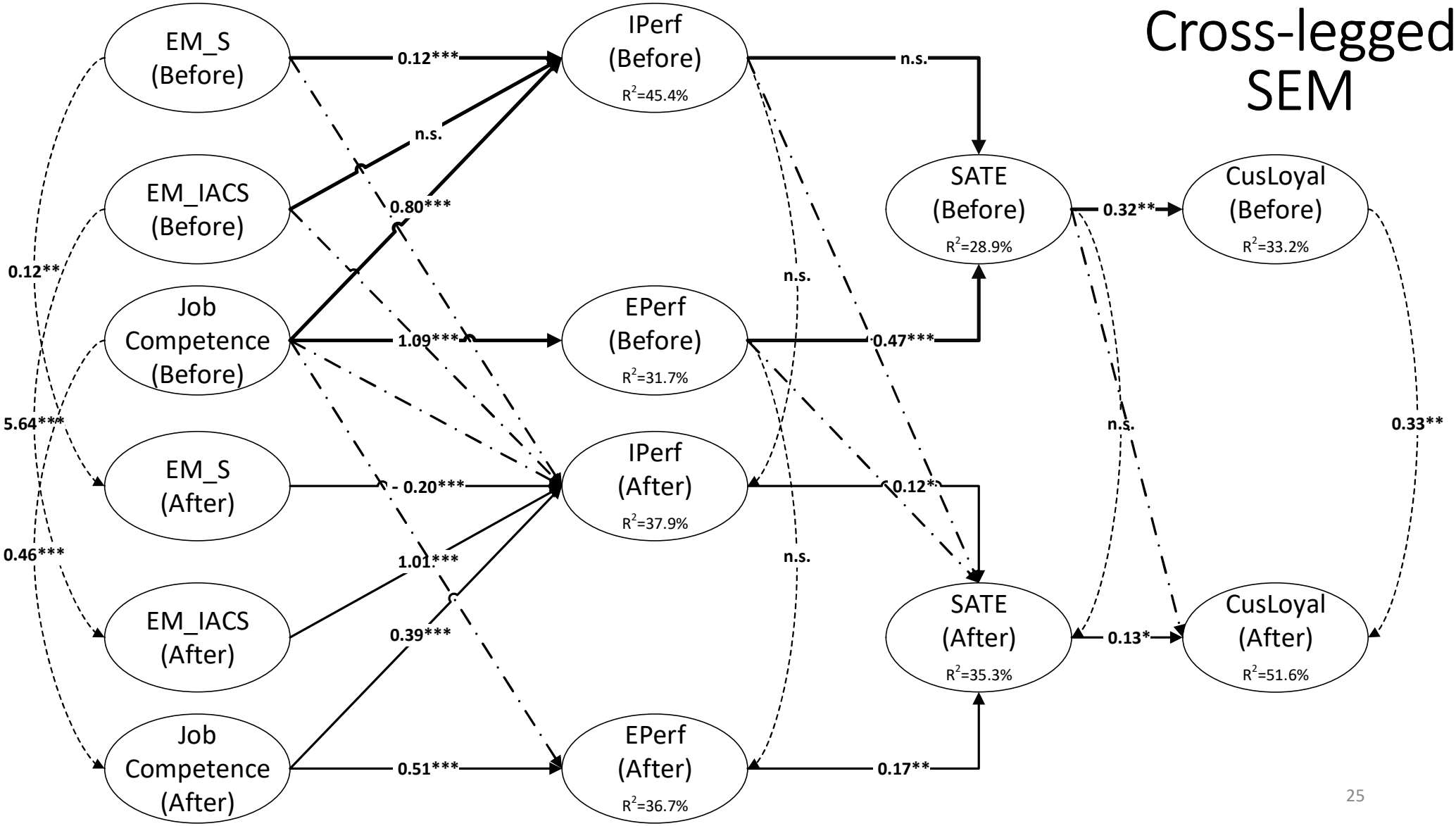
Table D1. Measurement Invariance Analyses

Fit Indices	Before versus After Implementation			Desired Level
	Configural Invariance	Metric Invariance	Scalar Invariance	
X2 / D.F.	1.902	1.966	2.067	< 5
CFI	**0.938**	**0.931**	**0.923**	> 0.9
SRMR	0.0469	0.0603	0.0597	< 0.08
RMSEA	0.047	0.049	0.052	< 0.06

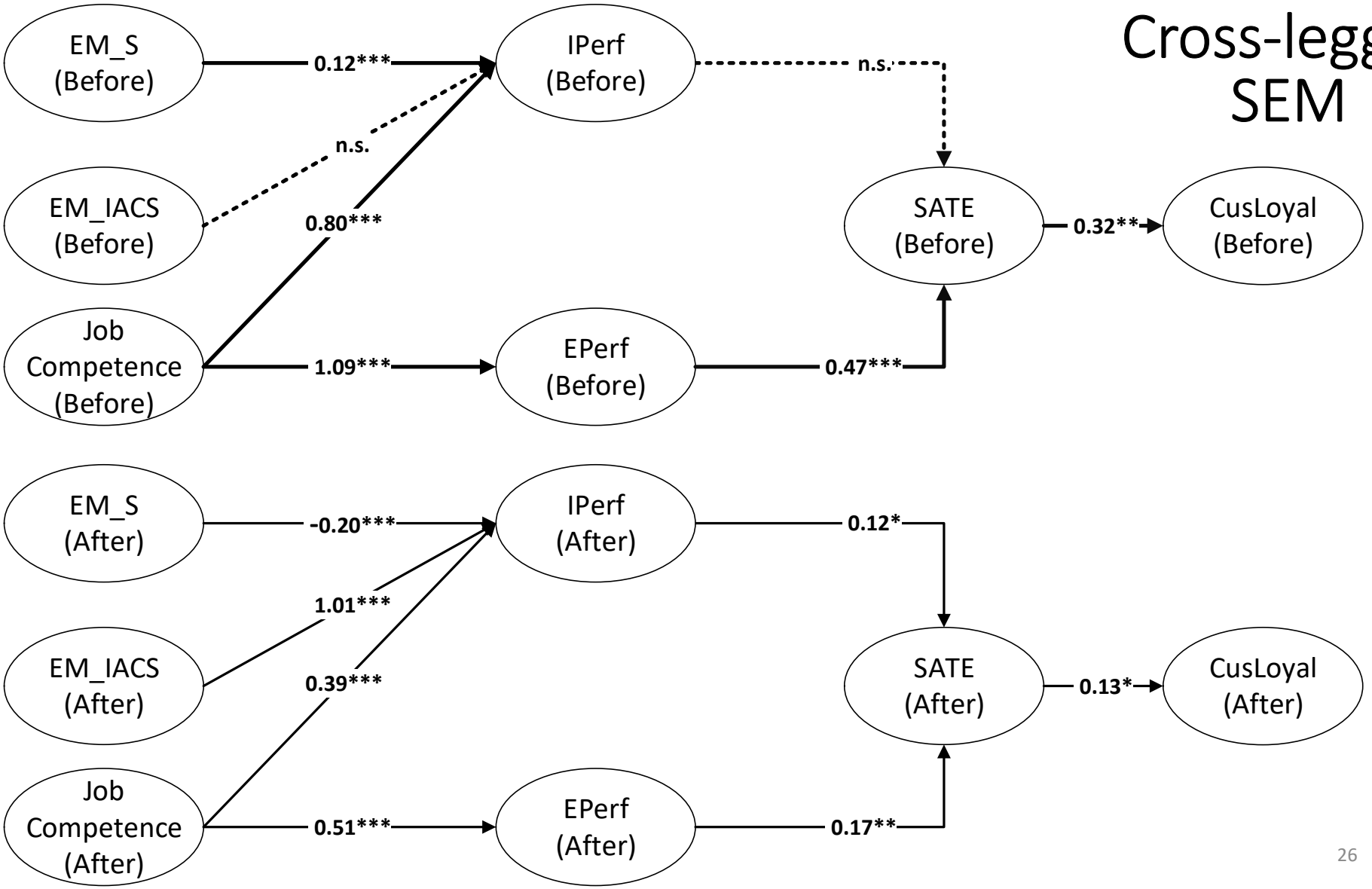
Table 6. Fit Indices of Structural Model (Cross-Legged SEM)

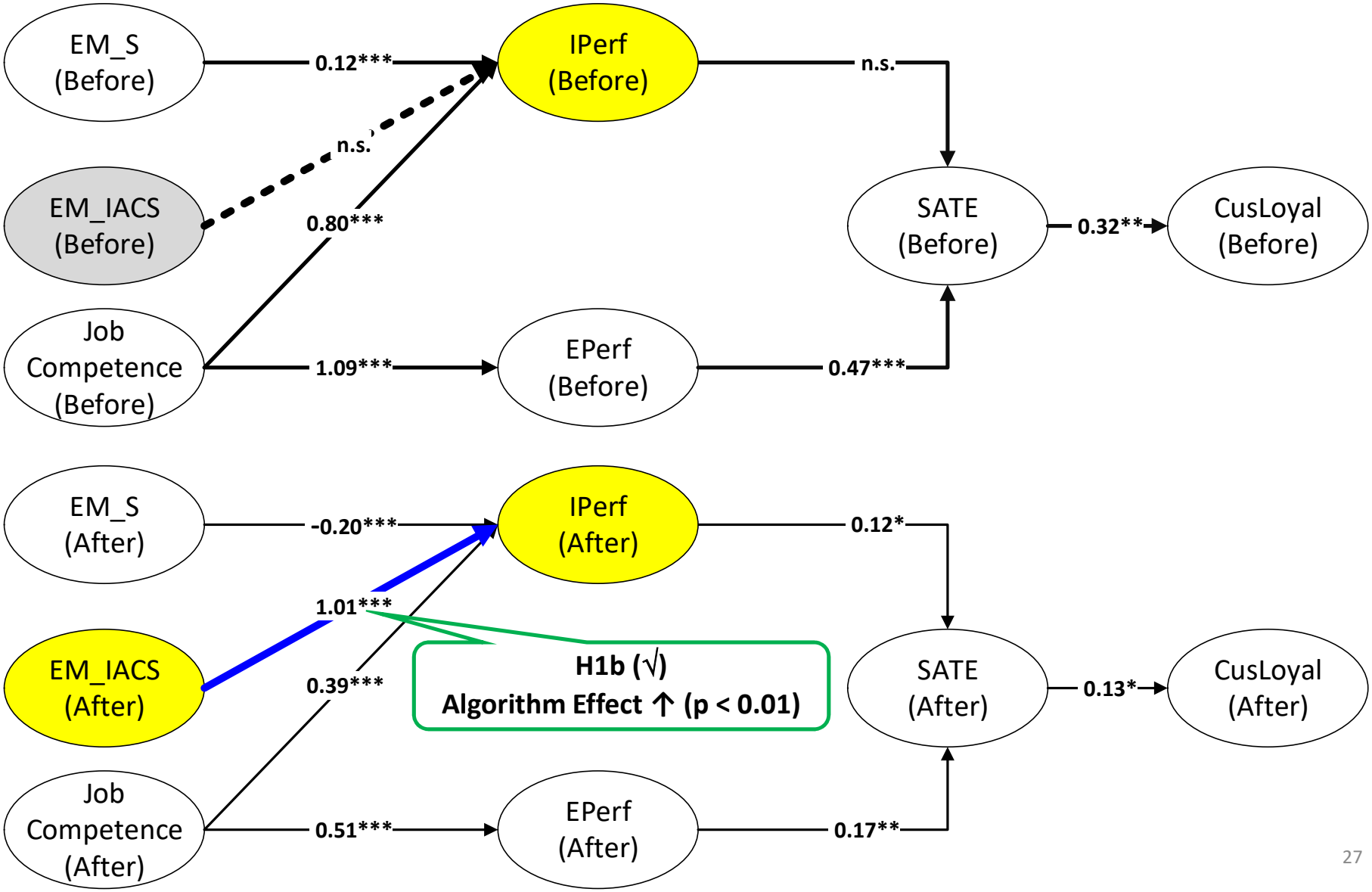
Fit Indices	Structural Model	Desired Level
X^2/D.F.	1.652	< 5
CFI	0.900	> 0.9
SRMR	0.073	< 0.08
RMSEA	0.054	< 0.08

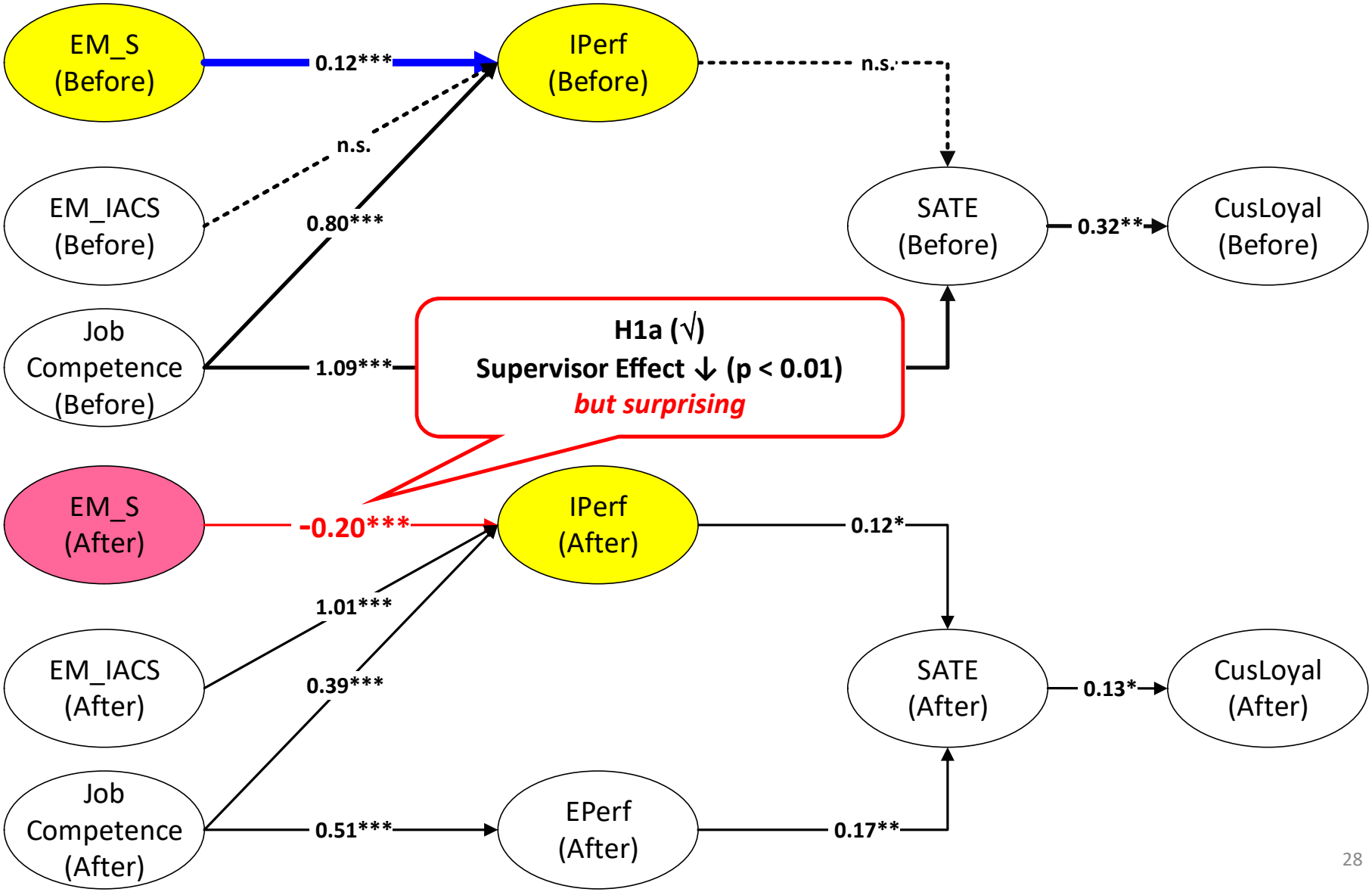
Cross-legged SEM

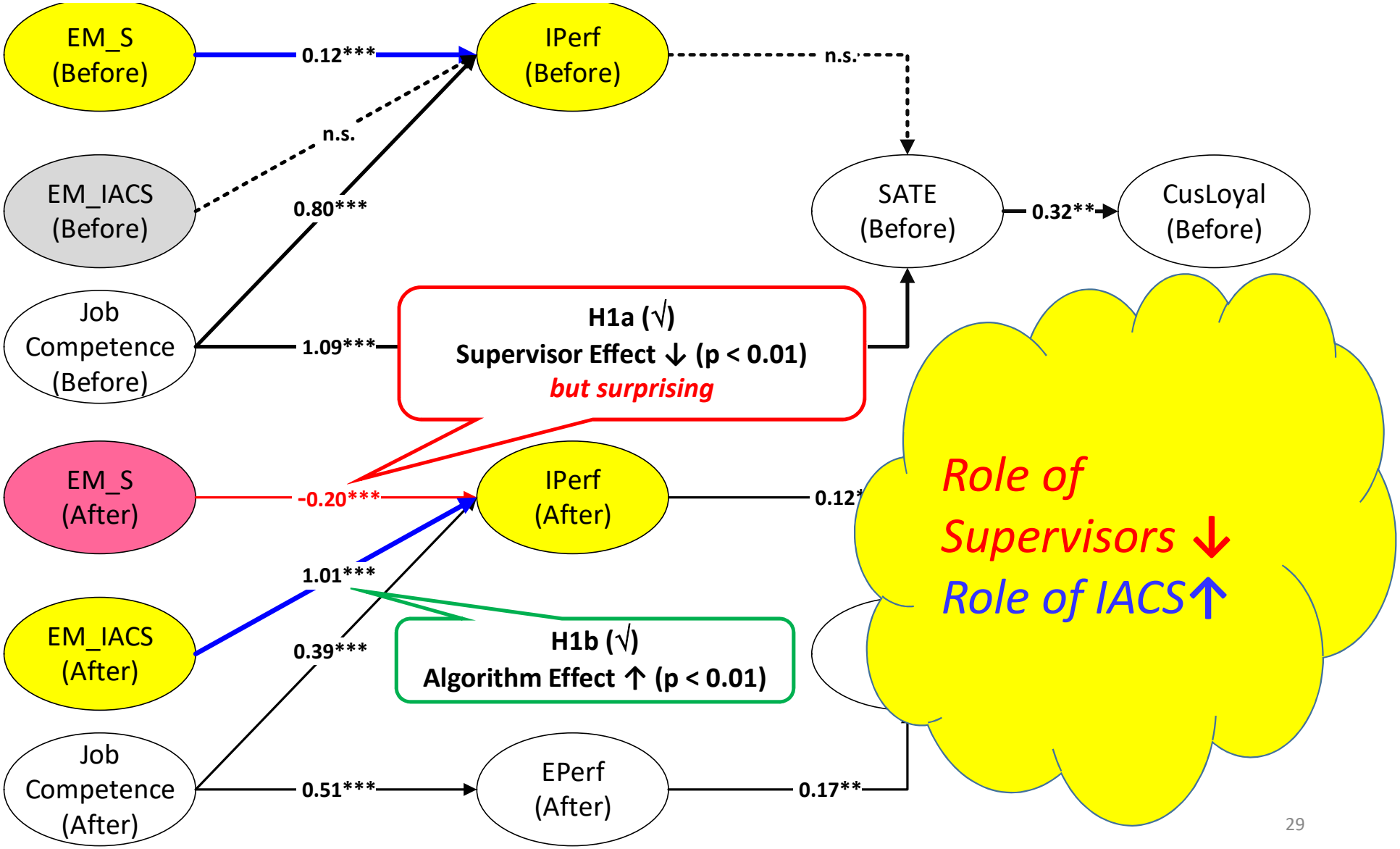


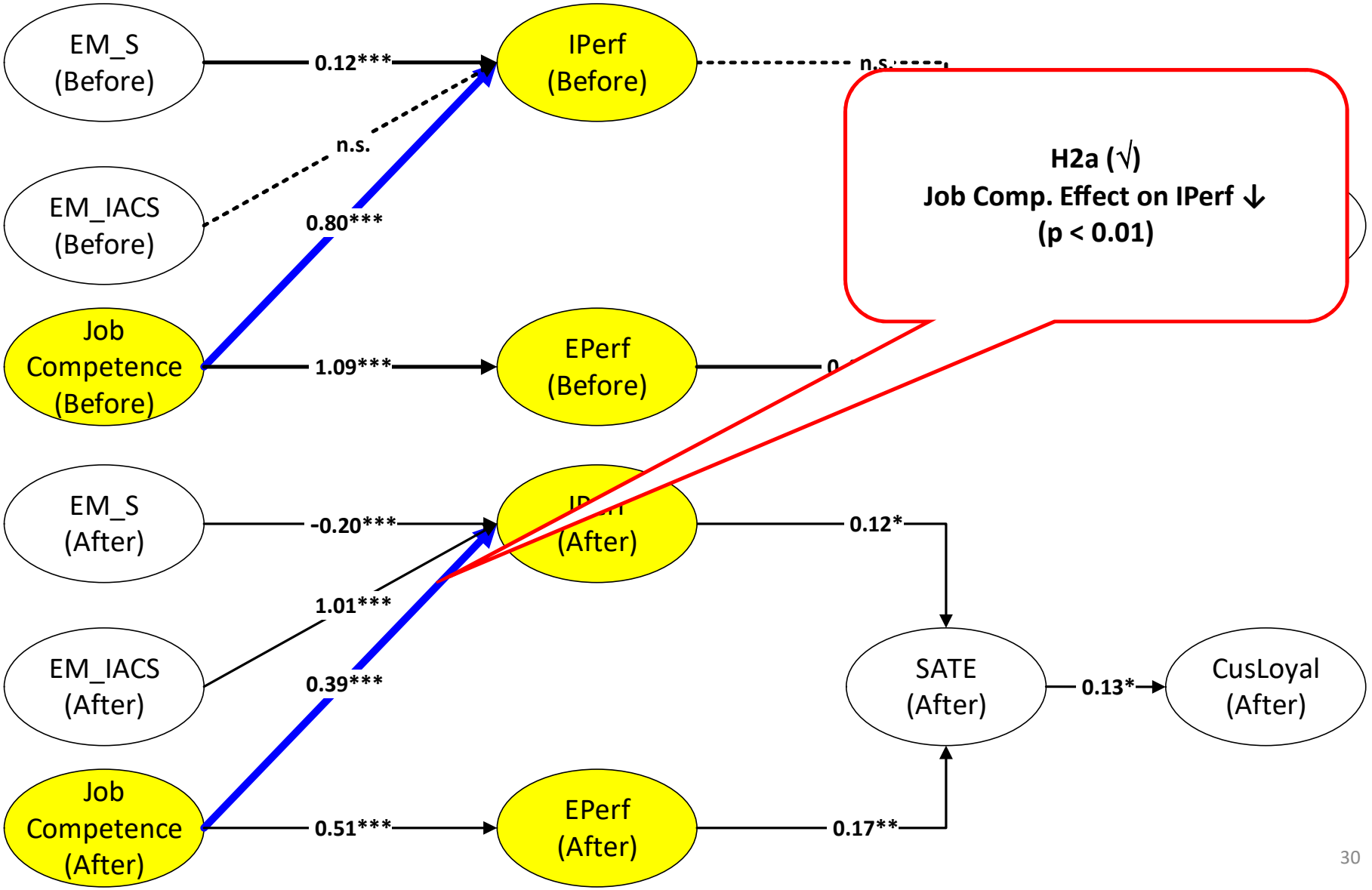
Cross-legged SEM

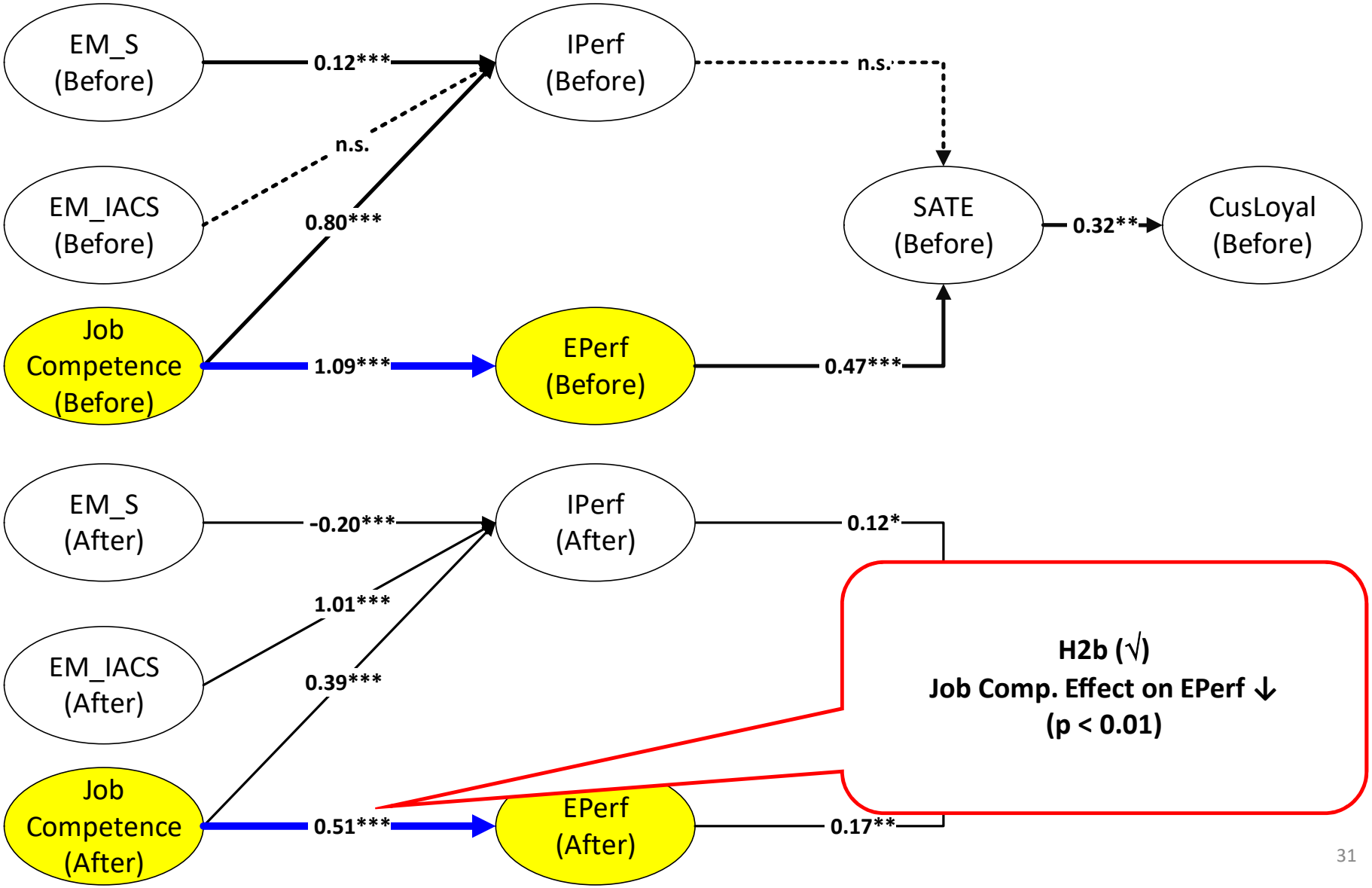



EM_S (Before)
0.12***
IPerf (Before)
n.s.
n.s.
EM_IACS (Before)
0.80***
SATE (Before)
0.32**
CusLoyal (Before)
Job Competence (Before)
1.09***
EPerf (Before)
0.47***
EM_S (After)
-0.20***
IPerf (After)
0.12*
1.01***
EM_IACS (After)
0.39***
H1b (√)
Algorithm Effect ↑ (p < 0.01)
SATE (After)
0.13*
CusLoyal (After)
Job Competence (After)
0.51***
EPerf (After)
0.17**


EM_S (Before)
0.12***
IPerf (Before)
n.s.
n.s.
EM_IACS (Before)
0.80***
SATE (Before)
0.32**
CusLoyal (Before)
Job Competence (Before)
1.09***
H1a (√)
Supervisor Effect ↓ (p < 0.01)
but surprising
EM_S (After)
-0.20***
IPerf (After)
0.12*
1.01***
EM_IACS (After)
0.39***
SATE (After)
0.13*
CusLoyal (After)
Job Competence (After)
0.51***
EPerf (After)
0.17**


EM_S (Before)
0.12***
IPerf (Before)
n.s.
n.s.
EM_IACS (Before)
0.80***
SATE (Before)
0.32**
CusLoyal (Before)
Job Competence (Before)
1.09***
H1a (√)
Supervisor Effect ↓ (p < 0.01)
but surprising
EM_S (After)
-0.20***
IPerf (After)
0.12*
Role of Supervisors ↓
Role of IACS↑
1.01***
EM_IACS (After)
0.39***
H1b (√)
Algorithm Effect ↑ (p < 0.01)
Job Competence (After)
0.51***
EPerf (After)
0.17**


EM_S (Before)
0.12***
IPerf (Before)
n.s.
n.s.
EM_IACS (Before)
0.80***
H2a (√)
Job Comp. Effect on IPerf ↓
(p < 0.01)
Job Competence (Before)
1.09***
EPerf (Before)
EM_S (After)
-0.20***
(After)
0.12*
1.01***
EM_IACS (After)
0.39***
SATE (After)
0.13*
CusLoyal (After)
Job Competence (After)
0.51***
EPerf (After)
0.17**


EM_S (Before)
0.12***
IPerf (Before)
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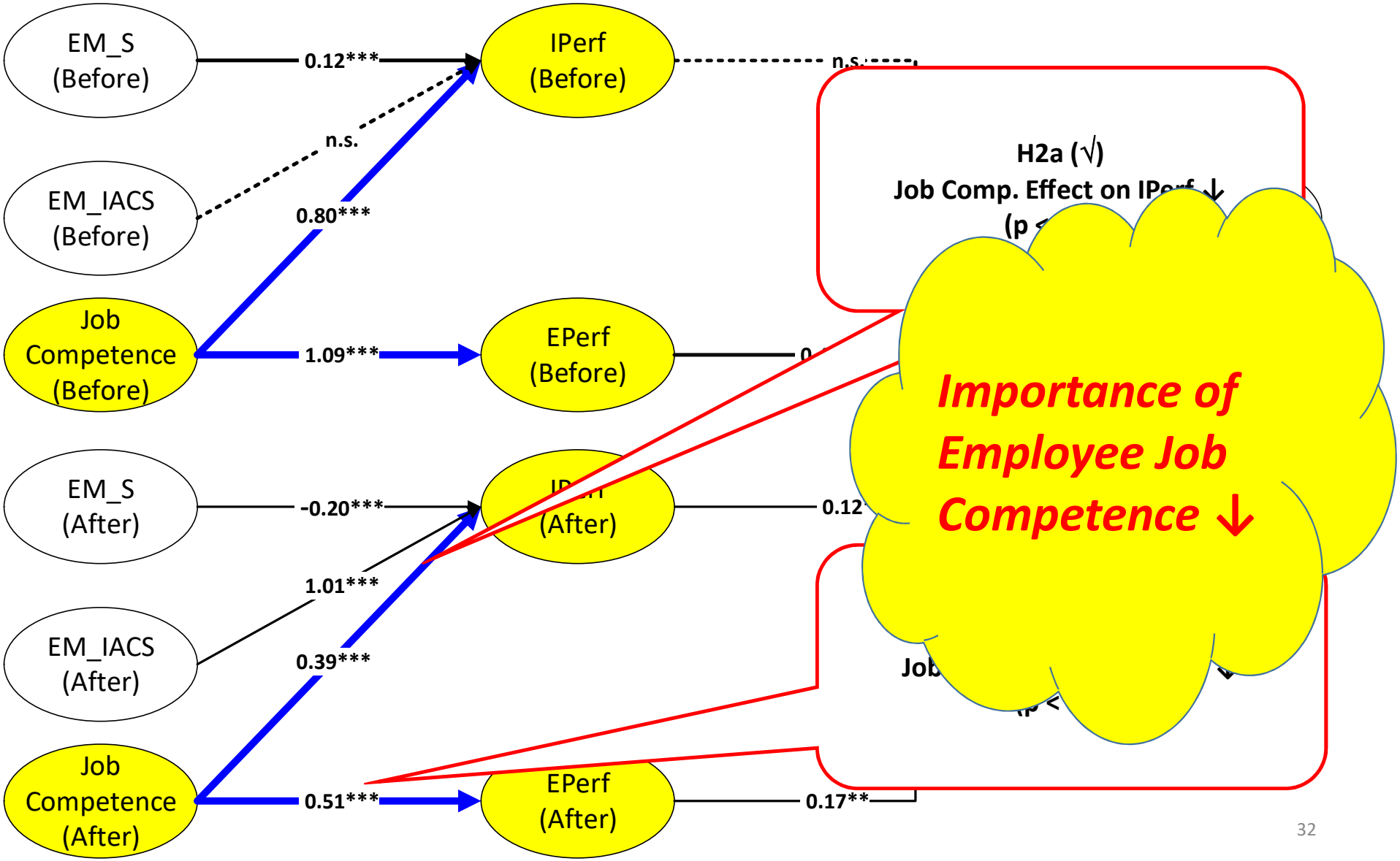
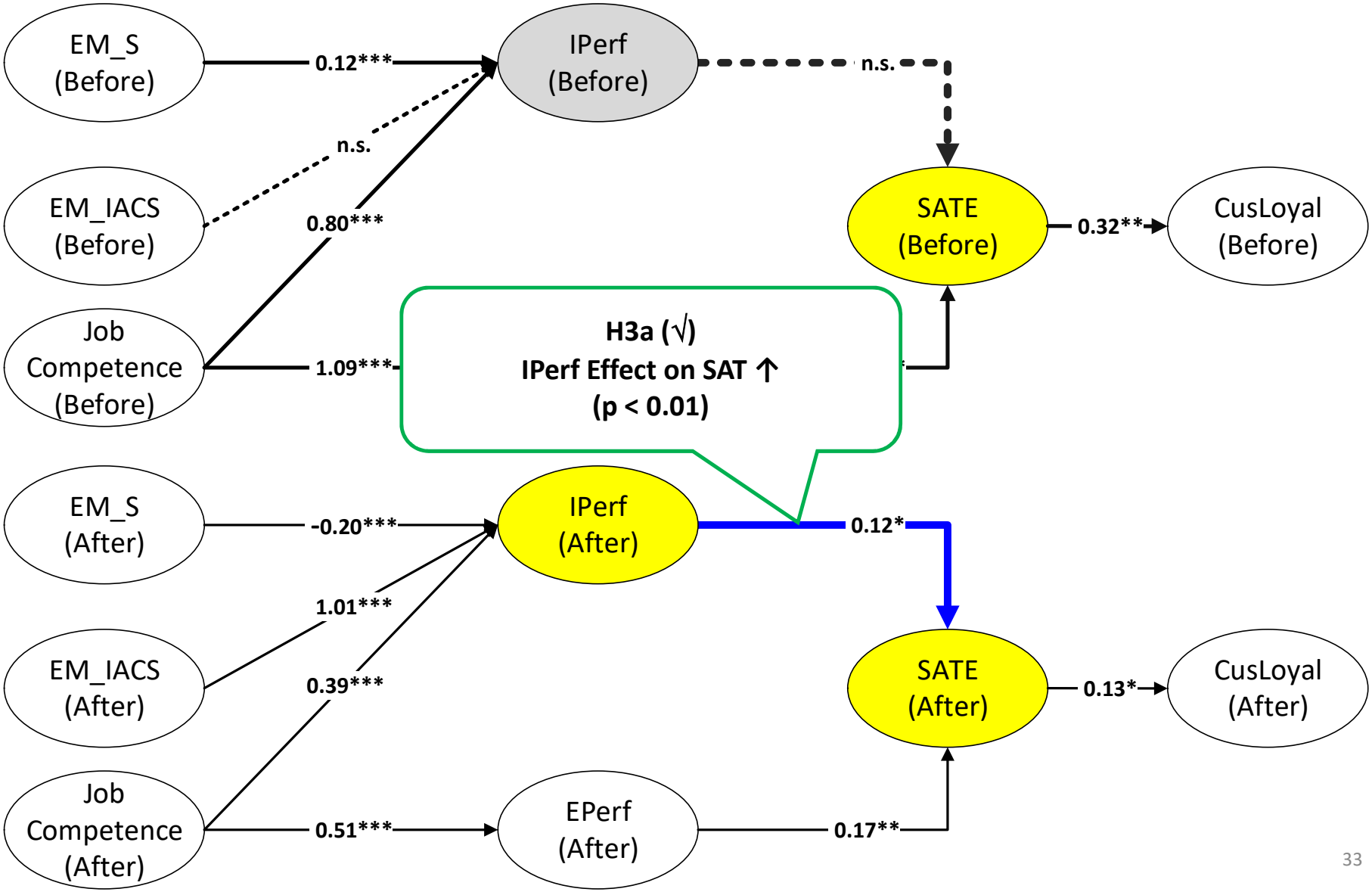
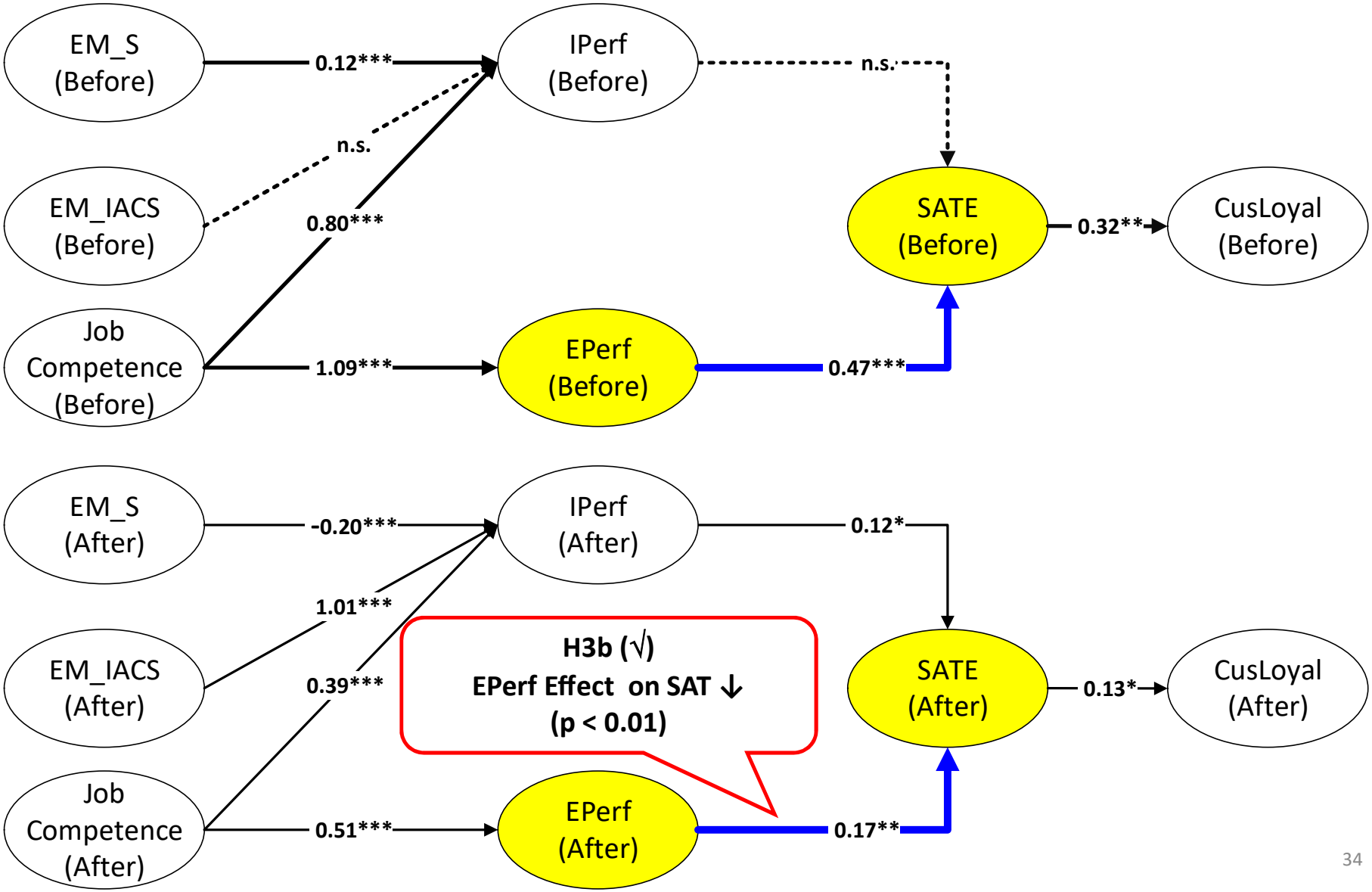
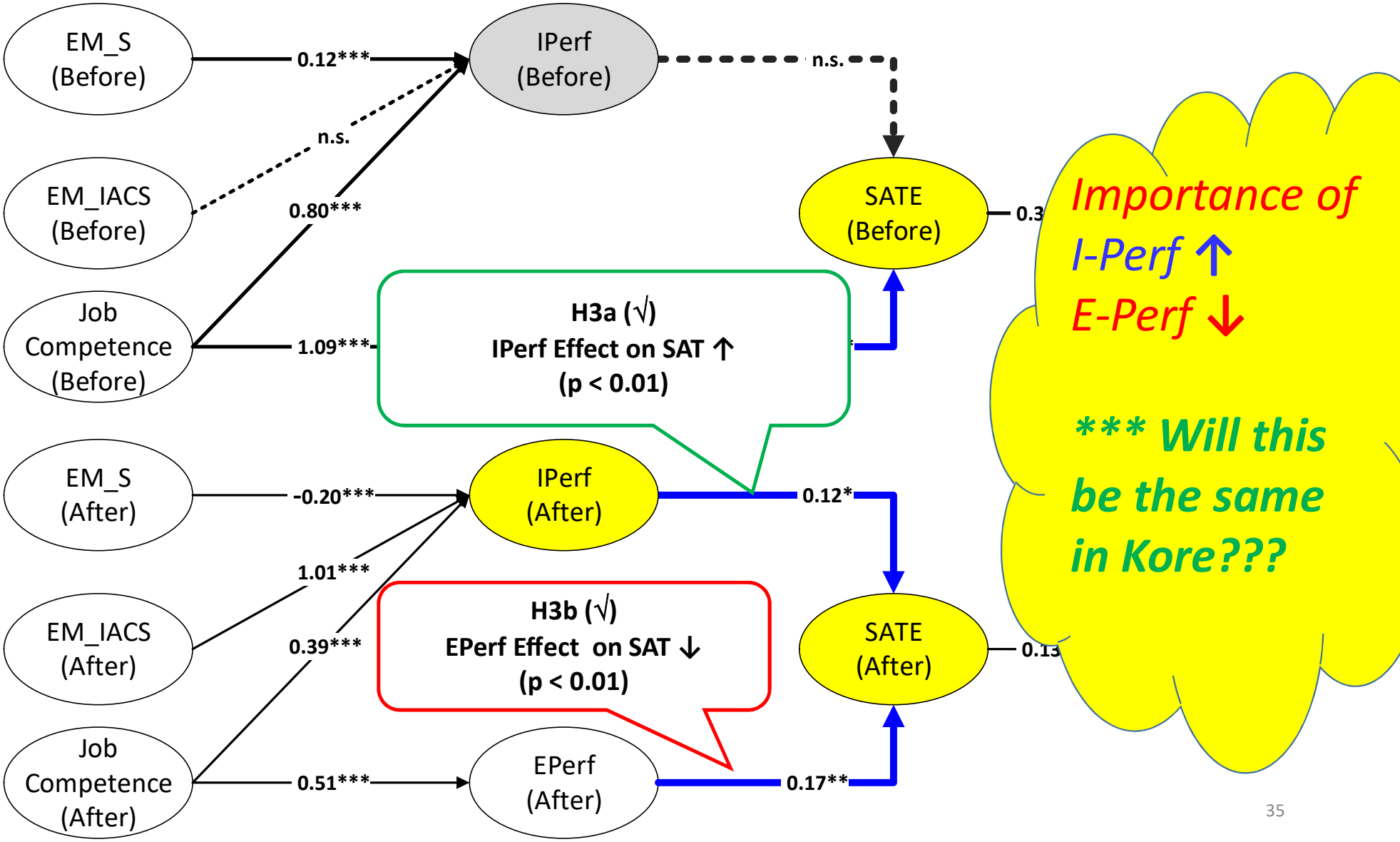
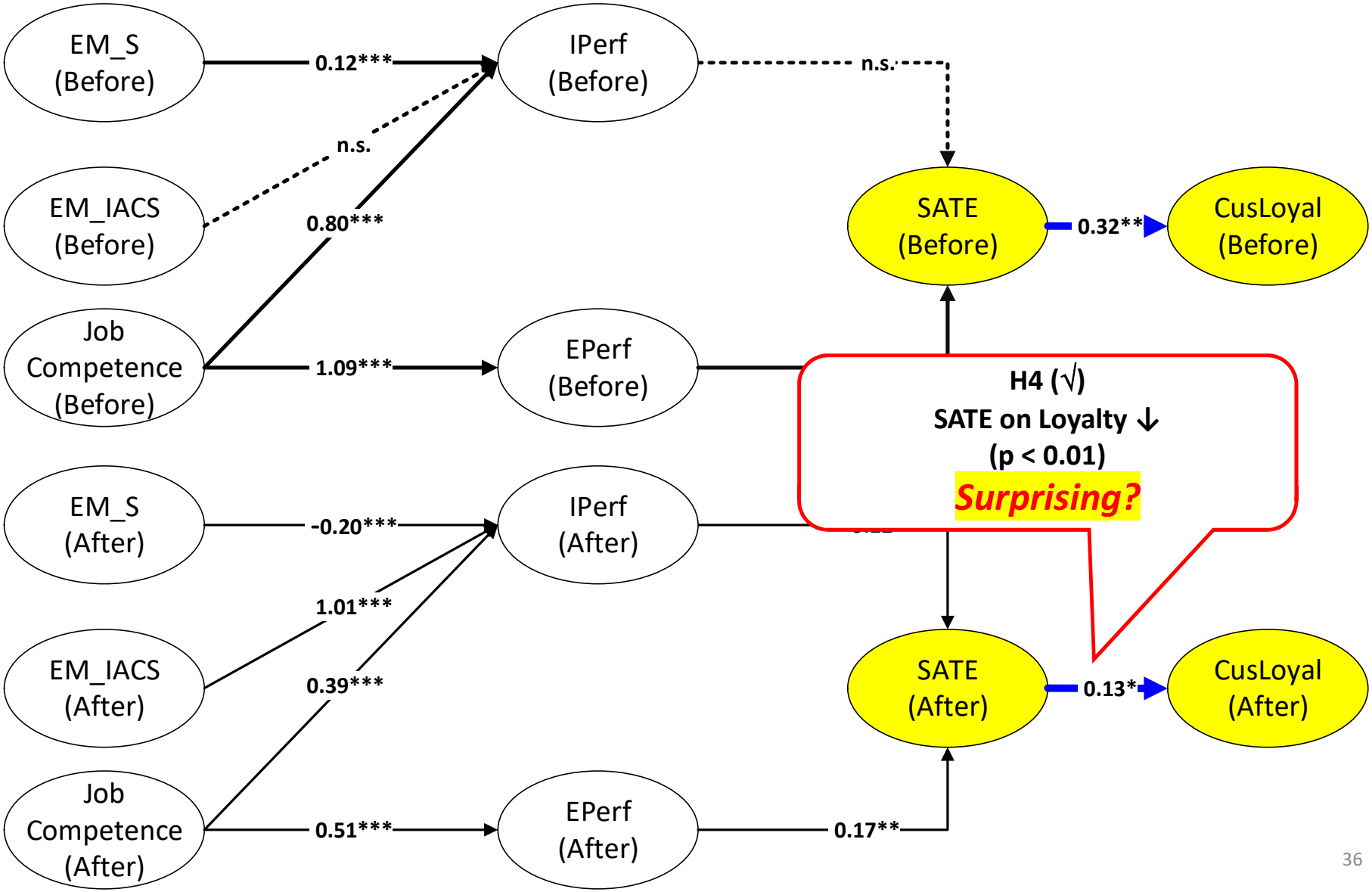
n.s.
EM_IACS (Before)
0.80***
SATE (Before)
0.32**
CusLoyal (Before)
Job Competence (Before)
1.09***
EPerf (Before)
0.47***
EM_S (After)
-0.20***
IPerf (After)
0.12*
1.01***
EM_IACS (After)
0.39***
H2b (√)
Job Comp. Effect on EPerf ↓
(p < 0.01)
Job Competence (After)
0.51***
EPerf (After)
0.17**

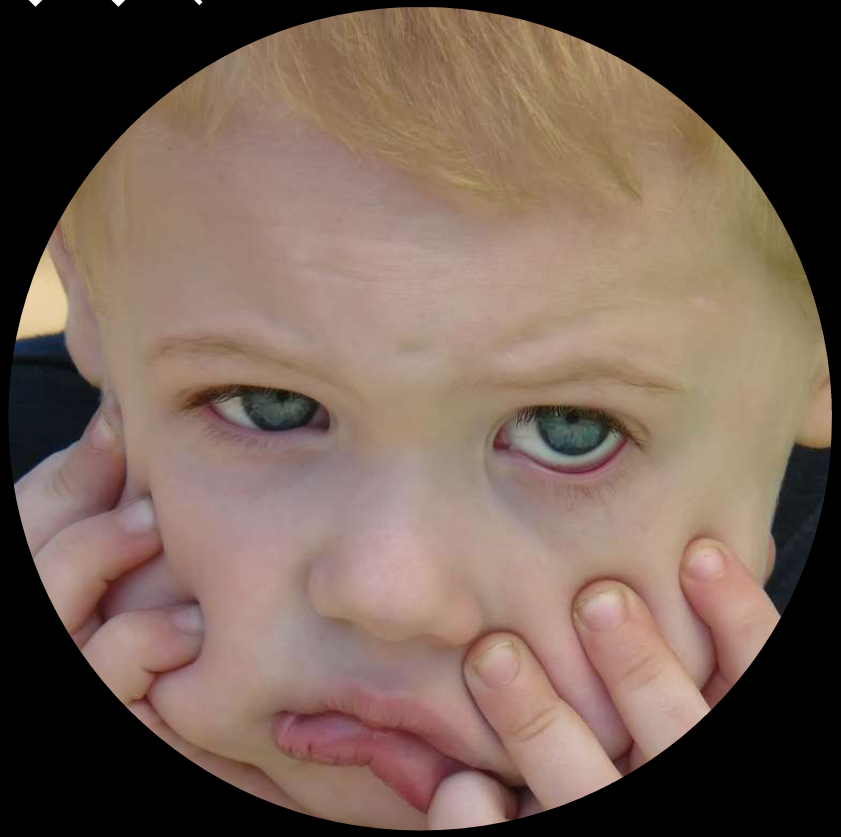

EM_S (Before)
EM_IACS (Before)
Job Competence (Before)
EM_S (After)
EM_IACS (After)
Job Competence (After)
IPerf (Before)
EPerf (Before)
(After)
EPerf (After)
0.12***
n.s.
0.80***
1.09***
-0.20***
1.01***
0.39***
0.51***
0.17**
H2a (√)
Job Comp. Effect on IPerf ↓
Importance of Employee Job Competence ↓


EM_S (Before)
0.12***
IPerf (Before)
n.s.
n.s.
EM_IACS (Before)
0.80***
SATE (Before)
0.32**
CusLoyal (Before)
Job Competence (Before)
1.09***
H3a (√)
IPerf Effect on SAT ↑
(p < 0.01)
EM_S (After)
-0.20***
IPerf (After)
0.12*
1.01***
EM_IACS (After)
0.39***
SATE (After)
0.13*
CusLoyal (After)
Job Competence (After)
0.51***
EPerf (After)
0.17**


EM_S (Before)
0.12***
IPerf (Before)
n.s.
n.s.
EM_IACS (Before)
0.80***
SATE (Before)
0.32**
CusLoyal (Before)
Job Competence (Before)
1.09***
EPerf (Before)
0.47***
EM_S (After)
-0.20***
IPerf (After)
0.12*
1.01***
EM_IACS (After)
0.39***
H3b (√)
EPerf Effect on SAT ↓
(p < 0.01)
SATE (After)
0.13*
CusLoyal (After)
Job Competence (After)
0.51***
EPerf (After)
0.17**


EM_S (Before)
0.12***
IPerf (Before)
n.s.
n.s.
EM_IACS (Before)
0.80***
SATE (Before)
0.3
Job Competence (Before)
1.09***
H3a (√)
IPerf Effect on SAT ↑
(p < 0.01)
EM_S (After)
-0.20***
IPerf (After)
0.12*
1.01***
EM_IACS (After)
0.39***
H3b (√)
EPerf Effect on SAT ↓
(p < 0.01)
SATE (After)
0.13
Job Competence (After)
0.51***
EPerf (After)
0.17**
Importance of I-Perf ↑
E-Perf ↓
*** Will this be the same in Kore???


EM_S (Before)
0.12***
IPerf (Before)
n.s.
n.s.
EM_IACS (Before)
0.80***
SATE (Before)
0.32**
CusLoyal (Before)
Job Competence (Before)
1.09***
EPerf (Before)
H4 (√)
SATE on Loyalty ↓
(p < 0.01)
Surprising?
EM_S (After)
-0.20***
IPerf (After)
1.01***
EM_IACS (After)
0.39***
SATE (After)
0.13*
CusLoyal (After)
Job Competence (After)
0.51***
EPerf (After)
0.17**



Follow-Up Interviews

- **Supervisors:**
  - Still valuable but for different purpose
    - **Backend** logistic arrangement
    - **Backend** HR management
    - **Emergency Intervention**
  - A sense of **Power Loss**
  - Sweet and sour sentiment:

    Since all the task assignments are now being handled by IACS, why bother me when running into issues?

Follow-Up Interviews

- **Employees:**
  - Now act as "*nothing but the vehicle that carries the digitized instructions and standardized knowledge to fix the problem in the physical world,*" anywhere, any time…
  - Nostalgia: "*miss the good old days*" when human supervisors, instead of IACS, were in charge of task assignments
  - Do we still need these supervisors?

After the IACS, our work becomes more challenging, but the supervisors have fewer things to do and yet still enjoy the same level of salary and benefits!

Follow-Up Interviews

- **Customers**
  - Significant Decrease in Customer Complaints
  - Enabled a common understanding about ATM maintenance protocol and standards among the service firm, employees, and customers, minimizing confusion customers used to experience with the firm and employees.
  - … "*as long as the service employees do what they are paid for—keep the machines up and running [i.e., IPerf]—I don't really care whether I see or talk to the employees in person. Although I appreciated their personal greetings and small tokens [i.e., EPerf] before the IACS, it is much better now that I can spend less time handling these ATM chores*."

Follow-Up Interviews

- **General Manager:**
  - *"At first, the IACS was only designed to facilitate employees' task assignments and standardize and streamline the service process. To our surprise, it has become a **game changer** for our business and in our sector.*

Meta Inferences based on Mixed-Method Results

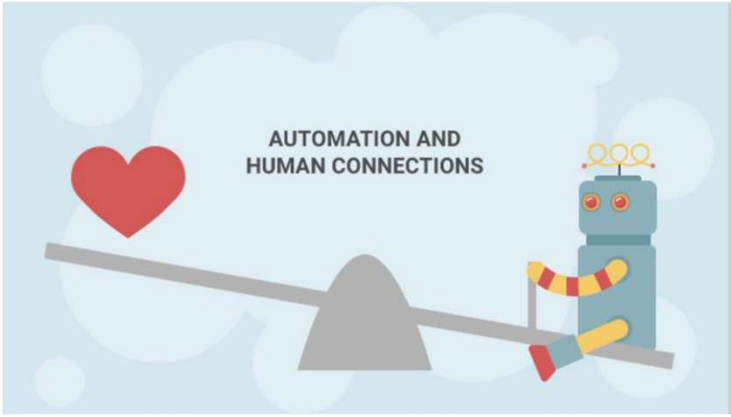
- Salient Service employees' ***spillover effect*** in SPC both *before* & *after* IACS
- With IACS,
  - The role of employees ↓ after IACS
  - The role of supervisors ↓ after IACS
  - The interdependency among supervisors, employees, & customers ↓
  - The Role of IACS ↑
- *Competing Bosses*… (IACS vs. Human Supervisors)
- *Competing Employees…* (IACS vs. Human Employees)
- *Dehumanizing* Supervisors, Employees, & Interpersonal Relationships

Theoretical Implications

- A contextualized theoretical approach to revamping ***Traditional SPC*** to ***Techno-SPC*** (Hogreve et al. 2022), capturing
  - the **Agentic Nature** of IACS (Baird and Maruping 2021) by decomposing **context-generic** SPC in the IACS context
  - the interplay between **human agents (employees, customers, supervisors)** vs. **technology agents** (IACSs).

- Role Theory (script, uncertainty, interdependence) → How algorithms + IoTs ↑ or ↓ TSPC relationships between **three stakeholder groups** both ***within*** and ***across*** the organizational boundary
  - ***Internal Mgt***: Employee Motivation & Competence → Job Performance
  - *External Mgt*: Employee Performance → Customer Satisfaction & Loyalty

- Dehumanizing Effect: Employees (Taskin et al. 2019) & Supervisors
- Algorithmic Power Struggle: (Competing Boss) & (Competing Employee)
- Extant literature: Extra-Role Perf > In-Role Perf… Is it really the case?



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