Complementarities between Organizational IT Architecture and IT Governance Structure

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Agenda

- Research Problem
- Theoretical Development
- Methods & Results
- Contributions & Implications
IT Alignment: A Slippery Slope

- #1 driver of IT business value
- Static dynamic process
  - Correction of emergent misfits
    - New competitive pressures
    - New opportunities
    - Business process changes
- Inflexible IT can be a paralyzing bottleneck
  - Business processes deeply embedded in IT
    - IT apps must rapidly adapt
  - IT agility - critical, underappreciated role in sustaining alignment
IT Alignment

Old priorities → New priorities

1990 Cost → 2005 Quality

2001 $6 “Yuppie Lattes” → 2008 $2 “regulars”

IT apps must support *different* objectives
Two Lenses Used in Isolation

IT Architecture
- Structure, properties of relns b/w apps in IT portfolio

IT Governance
- Getting IT decision rights “right”
Two Research Gaps

How do IT architecture and IT governance structure *jointly* influence IT alignment?

**RQ:** How do IT architecture and IT governance structure *jointly* influence IT alignment?
Two Ideas Developed

Idea #1: Mediation
- IT Architecture
- Modularity
- IT Agility

Idea #2
- Complementarities

"How"

IT Governance Structure
- Strengthens

IT Agility
- IT Alignment

Tiwana @ Iowa State
Modular Systems Theory

- **Modularity** ~ design principle for complex systems
  - Any system = *interacting subsystems* independent and interdependent
    - intentionally ↑independence between subsystems
    - modular = interaction within subsystems > among subsystems

- **Continuum** rather than integral-modular dichotomy

- Two forms ~ **Technical** and **organizational** property
IT Architecture Modularity

Org IT portfolio **loosely-coupled** linked via **standardized interfaces**

Internal changes in one app don’t disrupt others

Org-wide standards & policies prespecify how apps
  • connect
  • interoperate

E.g., SOA, Web services, CORBA

APIs, WSDL, SOAP

Don’t necessarily covary
IT Architecture Modularity → IT Agility

- Constraint = **cross-application dependencies**
  - Changes in one application might require **parallel changes** in others
  - ↑ Modularity “encapsulates”
    - Isolates cross-application perturbances
    - **Standards**: Prespecify how apps interact & interoperate
    - **LC**: Lowers need for overt coordination of changes
IT Agility → IT Alignment

- Responsiveness to line function demands
- Rapid correction of emergent misalignments
Example: Li & Fung (Hong Kong)

Web services architecture
- Loosely-coupled apps
- Standardized interfaces

7,500 suppliers in 40 countries

LI & FUNG

Web services architecture benefits
- Agility
  - Political instability
  - Capability needs
  - Supply glitches

Cycle times (3 wks)
- Client responsiveness
- Margins
Hypothesis 1

IT Architecture Modularity → IT Agility → IT Alignment

Mediates
IT Governance Decentralization

“Who decides what”

2 Classes of IT decision rights

IT specification DRs

“What”
Decisions about…
• what biz processes
• priorities
• constraints (time, $)
• performance metrics
• service levels

IT Implementation DRs

“How”
Decisions about…
• methods
• programming languages
• platform choices
• definition of IT standards/policies
• IT sourcing

Don’t necessarily covary

Greater decentralization (line) ~ Greater alertness
Alertness matters less if constrained by IT architecture
- Lowers need for overt coordination among departments
- IT arch modularity provides flexibility to benefit from alertness

Alertness + flexibility → IT agility
Example: Li & Fung, Again

- Supplier autonomy over: (1) IT apps & (2) IT decisions
  - within framework of interconnection standards (WDSL)
- Flexibility to rapidly add/ delete suppliers
- Seamless interoperability (compliance with WSDL standards)
Hypothesis 2

IT Architecture Modularity → IT Agility

IT Governance Decentralization

Strengthens

IT Agility → IT Alignment
Methodology

Survey of 223 firms (24.6% response rate)

- MIS directors (N = 223) + line managers (N = 90)
- Experienced (16+ years)
- Variety of industries (e.g., manufacturing, services, technology)
- New measures for **IT modularity**, **IT governance** decentralization; rest adapted

**2nd order formative**
- IT arch. loose-coupling
- IT standardization

**2nd order formative**
- IT specification DRs
- IT implementation DRs
Hypothesis Testing Strategy

H1: Sobel mediation test

IT Architecture Modularity + IT Agility + IT Alignment

IT Governance Decentralization

H2: Mediated-moderation test (Muller 2005 procedure)

Rival Explanations (controls)
1. IT-line interunit ties
2. IT unit’s business knowledge
3. Line fn technical knowledge
4. Requirements codifiability
5. CIO on board
6. IT unit age
7. IT investment intensity
8. Firm size

Bootstrap of 1,000, 500, and 200 model reestimates in PLS model
Results

H1 supported

IT Architecture Modularity

Loose coupling

IT standardization

* Interaction term *

IT Governance Decentralization

IT specification DRs

IT implementation DRs

Sobel T = 3.9***

H2 supported

IT Agility

Sobel T = 2.1*

IT Alignment

R² = 57%

R² = 31%

Control Variables
- IT-line interunit ties 0.29*** (4.14)
- IT unit's business knowledge 0.13* (2.03)
- Line function's technical knowledge 0.02 (0.31)
- Requirements codifiability 0.05 (0.98)
- CIO on board -0.04 (-0.67)
- IT unit age -0.02 (-0.61)
- IT investment intensity -0.03 (-0.71)
- Firm size 0.002 (0.01)

Significant
Non-significant

N = 223 firms

0.13*

0.40***

0.38***

0.17**

-0.33***

0.5**

.9***

.4*

.7***

.5**

0.7***

.31**

.9***
Decentralized Governance Amplifies Modularity’s Benefits

IT Governance Decentralization

Steeper slope
How IT architecture modularity enhances IT alignment

- IT agility ~ important intervening explanatory mechanism

Implications

- Rigidity (in enforcing IT architecture) increases IT agility
  - Flexibility @ higher level requires discipline @ lower
    - Modularity implied but never measured in IS research
- Evidence for untested modularity’s adaptation arguments
Contribution #2: Complementarities

How IT architecture*IT governance complementarities translate into stronger IT alignment

- via IT agility

Implications

- The two must work in tandem ~ mutual “fit”
  - Highlights underappreciated interactions b/w architecture and governance

- “Do modular tech architectures require modular org structures?”
  - Both asserted challenged in modularity literature
  - Results reconcile disagreements
Implications for Practice

1. Alignment ~ ongoing *dynamic process* of fixing IT-business misfits
2. IT architecture + IT governance = *system of interdependent choices*
   - Neglecting one erodes the others’ benefits
Questions

Full paper @ www.bus.iastate.edu/tiwana
Appendix: Muller’s Mediated-Moderation Test

Must show four things to demonstrate mediated moderation:

1. a significant relationship between the mediator and DV
2. that the relationship between the IV and mediator is moderated by governance decentralization
3. the interaction term’s effect on the DV is mediated by agility
4. the direct effect of the moderator on mediator decreases in magnitude in the presence of the interaction term

Future Work

1. Causal ordering ~ longitudinal data
2. Role of “peripheral knowledge” in IT-client departments?
3. Over- versus under-modularization (Ethiraj-Levinthal 2007)
Limitations

1. Cross-sectional data
2. Smaller firms might limit generalizability
   - Post hoc tests show no systematic bias
3. Industry not controlled for
   - Brown (Org. Sci 1997) Industry poor predictor of IT org structure
# Appendix: 4x Common Methods Bias Tests

<table>
<thead>
<tr>
<th>Test</th>
<th>Bias?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harman’s one factor test</td>
<td>X</td>
</tr>
<tr>
<td>Lindell-Whitney marker variable test</td>
<td>X</td>
</tr>
<tr>
<td>IT-line inter-rater triangulation (N=90)</td>
<td>X</td>
</tr>
<tr>
<td>Model retest with matched pair data subset</td>
<td>X</td>
</tr>
</tbody>
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### Variants of the Two Types of Decision Rights

<table>
<thead>
<tr>
<th>Type of decision right</th>
<th>Disciplinary home</th>
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</thead>
<tbody>
<tr>
<td>What IT should accomplish</td>
<td>How IT should accomplish it</td>
</tr>
<tr>
<td>Specification DRs</td>
<td>Implementation DRs</td>
</tr>
<tr>
<td>Strategic DRs</td>
<td>Execution DRs</td>
</tr>
<tr>
<td>Specification DRs</td>
<td>Production DRs</td>
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<tr>
<td>Strategic DRs</td>
<td>Operational DRs</td>
</tr>
<tr>
<td>Decision control rights</td>
<td>Decision management rights</td>
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</table>
Measures
## Summary of Construct Measures

<table>
<thead>
<tr>
<th>Construct</th>
<th>Definition</th>
<th># items</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT architecture modularity</td>
<td>The degree of decomposition of an organization’s IT portfolio into loosely-coupled subsystems that communicate through standardized interfaces.</td>
<td>9</td>
</tr>
<tr>
<td>IT governance decentralization</td>
<td>The degree to which IT specification and IT implementation decisions are made by the line functions vis-à-vis the IT department. IT specification decisions pertain to what business processes in the line functions IT must support, the associated constraints (schedule, budget, quality), objectives, priorities, and performance expectations (e.g., service levels). IT implementation decisions pertain to the methods, programming languages, platforms, definition of IT standards and policies, and IT sourcing.</td>
<td>10</td>
</tr>
<tr>
<td>IT Agility</td>
<td>The capacity of the IT function to rapidly adapt to changing line function demands and opportunities.</td>
<td>6</td>
</tr>
<tr>
<td>IT Alignment</td>
<td>The degree to which the IT function supports the goals and priorities of an organization’s line functions.</td>
<td>6</td>
</tr>
</tbody>
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