# PDW: Interventionist Research: Challenges and Opportunities

August 10, 2019

Aravind Chandrasekaran
Suzanne de Treville
Tyson Browning

# Agenda

- Part 1:
  - Introduction (Suzanne de Treville and Tyson Browning, co-EICs at *JOM*)
  - Interventionist research strategy for OSCM (Aravind Chandrasekaran, *JOM* DE – Interventionist Research)
  - Importance of research questions and research strategy (Raghu Garud, co-editor – *Org Studies*, AE – *MS*)
  - Using interventionist research to avoid Type 3 error? (Arun Rai, EIC – *MISQ*)
  - Conducting interventionist research – best practices in the field. (Jan Holmström – *JOM* AE – Interventionist Research)
  - Summary and introduction to Part 2 (Suzanne and Tyson)
- Break (5 min.)
- Part 2:
  - Design requirements for interventionist research in OSCM (discussion with panelists)
  - Open Q&A with the audience

# Intervention-Based Research in Operations Management

## AOM PDW Meetings 2019

### Aravind Chandrasekaran

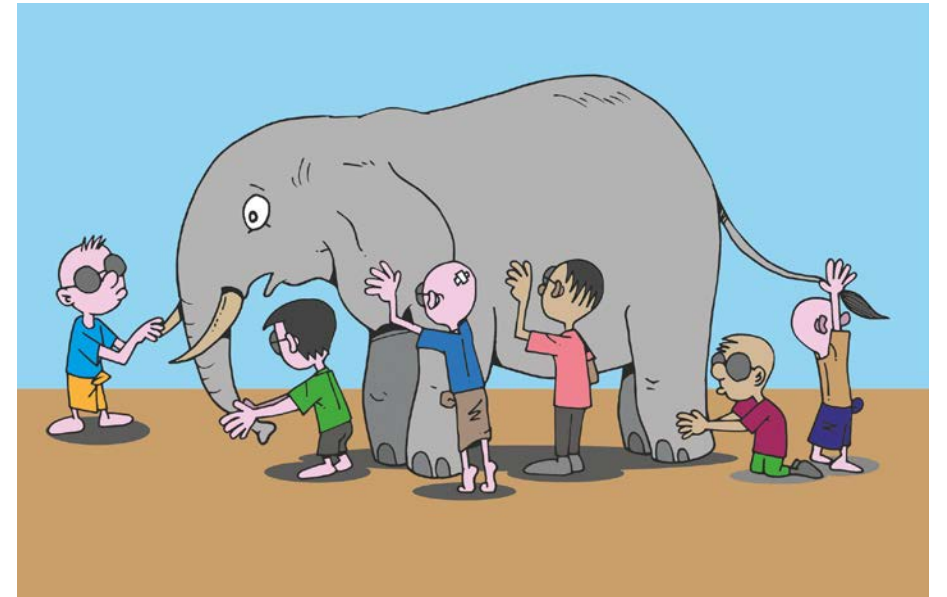Associate Professor & Associate Director, COE

The Ohio State University

# Research in Operations Management (OM)

Everything is optimal from the ivory tower!
- Van de Ven (2007)

Even if we step out by accident…..

We (Academics) are just "blind men searching" by ourselves!

# What are we talking about?

- OM (Business in general) is a professional science (March 1978)

- Knowledge co-creation occurs typically during the engagement with practice (Van de Ven and Johnson 2006)

- Three-fold benefits from Engagement with Practice
  - New Theoretical Insights
  - Practical Relevance
  - Immediate knowledge for dissemination

# Why Intervention-Based OM Research?

- OM Problems are changing in scale and scope

  - Population Health and Precision Medicine (Lai and Tayur 2019)
  - Socially Responsible Supply chains (Lee et al. 2019)
  - Big Data Management and Integrating AI (Singhal et al. 2017)
  - Sharing Economy Models (Shantikumar (2017)

- Poses threats of refutability to current and well established theories

- Requires deep engagement with practice to understand reality on what, how and why things work?

# What is Intervention-Based Research?

"Approach of engaging and solving complex problems in the field and learning from this problem solving process"

(Adapted from Van de Ven (2007))

## Caveats:

1. Problems ought to be **complex**
2. **Stakeholder (Practitioner) engaged** during the problem solving process
3. **Iterative learning** and theorizing

# An Example: Transition of Care after Surgery*
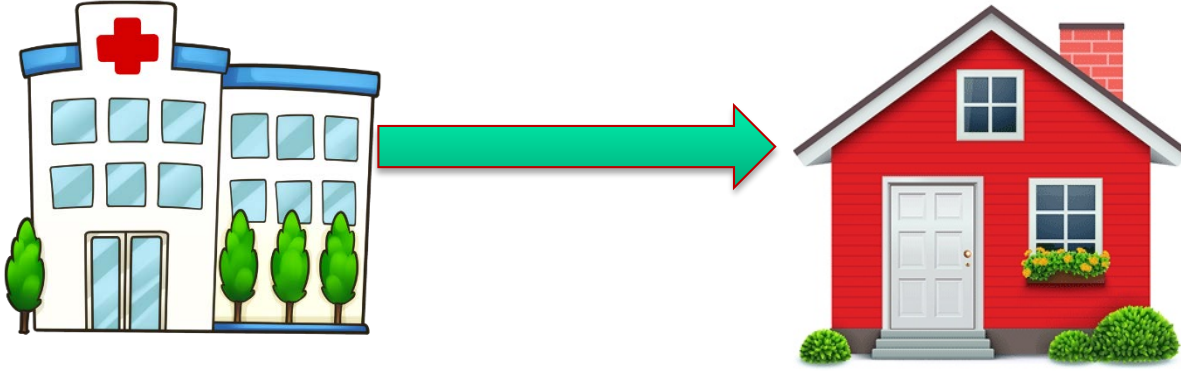


**Problem:** Care Transition resources are expensive and outcomes are poor quality and increased anxiety (1 in 3 readmitted in 30-days). Current solutions (care coordinators, technology etc.)are less useful.

**Intervention:** Using former transplant patients to act as standardized care-coordinators (Developed in **partnership between providers and patients**) using insights from TPS

**Design:** Randomized Control Trial of 100 Patients and 6 mentors matched in 13-months (Causal inference)

**Results:** Patients paired with mentors were two times more likely to get readmitted (with lower anxiety). These patients are admitted by identifying issues (in conversation with mentors) that create long-term kidney failure and rejection

**Insights:** Readmissions (early) are not necessarily bad for long-term patient outcomes. Implications beyond transplant surgery. Challenges some of our established assumptions in OM healthcare work

* J. surgical research (2016), HBR (2019), Article under review in BMJ Quality and Safety

# Where does Intervention-Based Research belong?
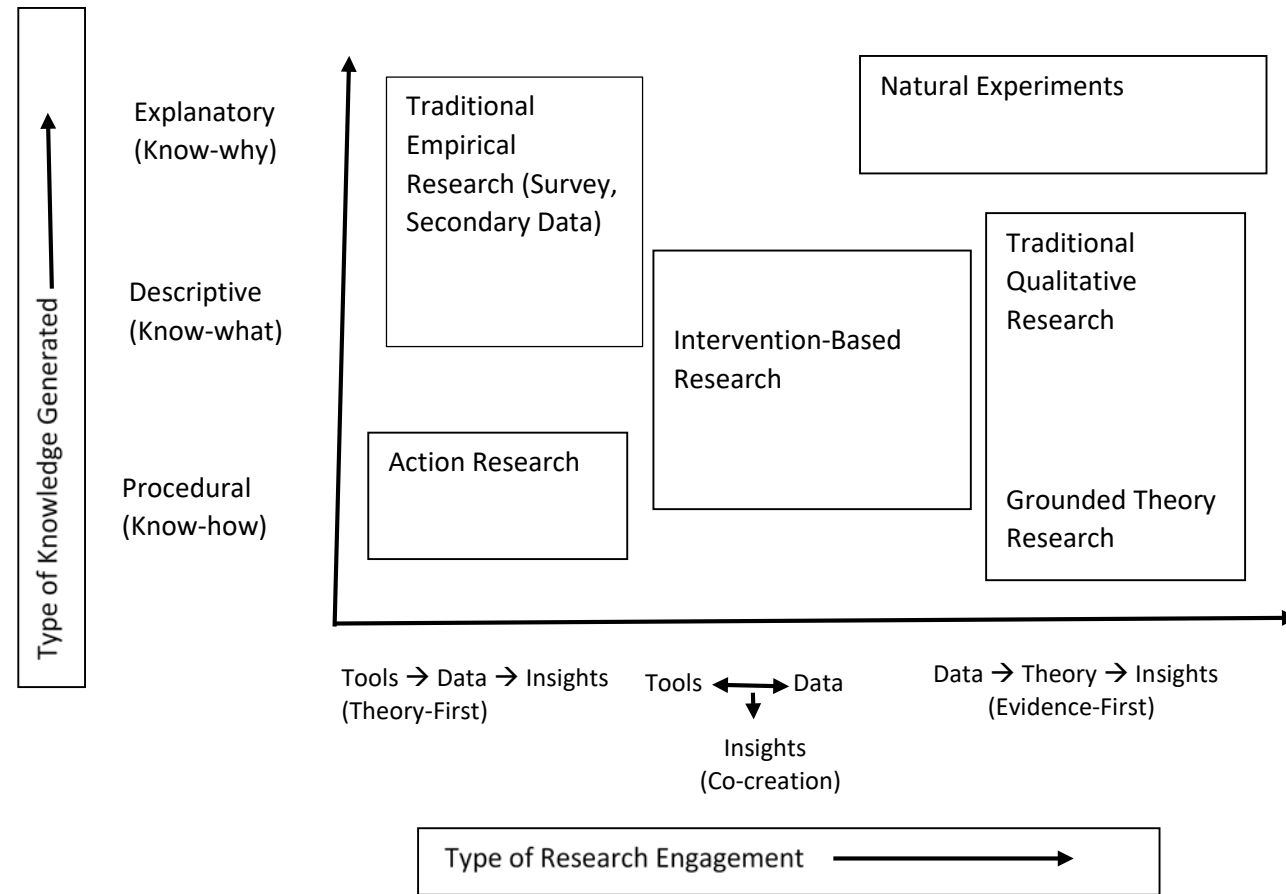
# Examples of Recently Accepted Work in JOM

| Article (authors) | Volume (Issue) | OM Context |
|---|---|---|
| Information sharing for sales and operational planning (Kaipia, Holmström, Smaros and Rajala) | Vol 52, May 2017 | Supply Chain |
| Improving home care: knowledge creations through engagement and design (Groop, Ketokivi, Gupta and Holmström) | Vol 53-56, Nov 2017 | Healthcare delivery |
| Hedging weather risks and coordination in supply chains (Brusset and Bertrand) | Vol 64, Nov 2018 | Supply chain |
| Contracting outsourced services with collaborative key performance indicators (Akkermans, van Oppen, Wynstra, and Voss) | Vol 65, Issue 1 | Outsourcing services |
| Creativity and productivity in product design for additive manufacturing: Mechanisms and platform outcomes of remixing (Frieske, Flath, Wirth, Thiesse) | Vol 65, Issue 1 | Product design and Additive Manufacturing |
| Fleet sizing for UNHCR country offices (Kunz and Van Wassenhove) | Vol 65 Issue 2 | Humanitarian Operations |
| Economies of collaboration in build-to-model operations (Hedensteirna, Disney, Eyers, Holmstrom, Syntentos, Wang) | Vol 65 | Outsourcing and 3D printing |

# How to do intervention based research work?

- Identify the type of problem and the knowledge available on the problem <span style="color:red">(establish theory – practice gap)</span>

-  Engage in the field to understand the theory-practice gap

- Iterative learning through implementation in the field <span style="color:red">(Scientific learning)</span>

-  Applicability of learning and insights outside the context

# Thank you!

chandrasekaran.24@osu.edu

# When Do Type III Errors Happen

**A researcher answers the wrong question using the right methods**

Mitroff, I. I., and Silvers, A. 2009. Dirty Rotten Strategies: How We Trick Ourselves and Others into Solving the Wrong Problems Precisely, Stanford, CA: Stanford University Press
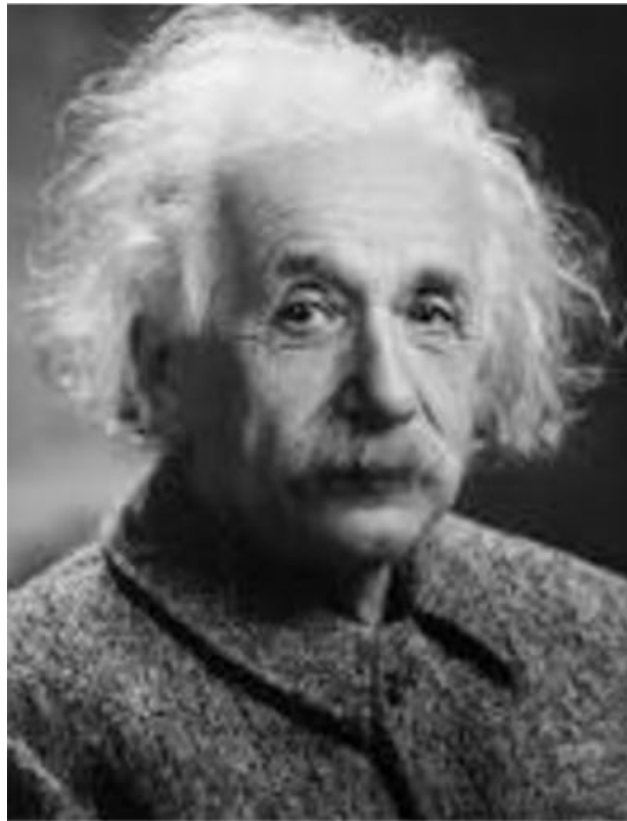
# Formulate the Research Problem So the Answer to the Question Will Matter



*"The formulation of a problem is often more essential than its solution, which may be merely a matter of mathematical or experimental skill"*

*Albert Einstein*

# Types of Value that the Answer to the Research Question Can Create



1. **Scholarly**, advancing the area under study in fundamental ways that influence future progress

2. **Practical utility**, changing the state of affairs in the world

3. **Aesthetics**, arising from *powerful simplicity*

*H.A. Simon*
*Nobel Laureate in Economic Sciences, 1978*

Simon, H. A. 1991. "Random Thoughts on Methods of Research," Unpublished Manuscript, Carnegie Mellon University, Pittsburgh, PA.

**Formulate the Research Problem So the Answer to the Question Will Matter**
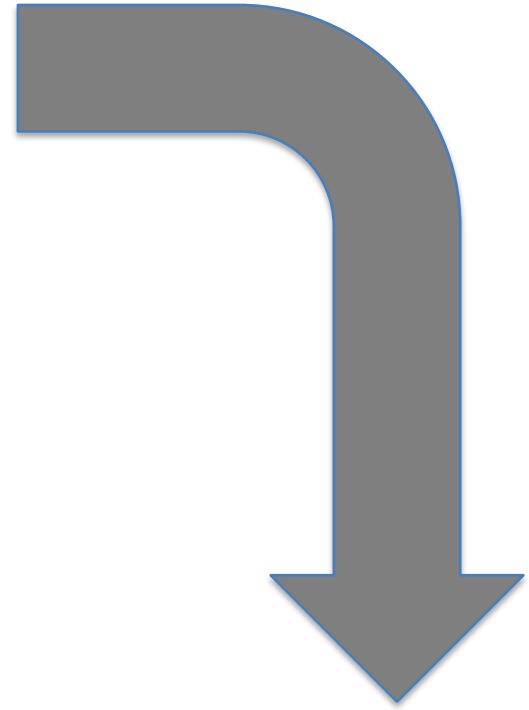
**Safeguard Against Key Risks in Formulating Problems**

# 1. The Streetlight Effect



**CAUTION**
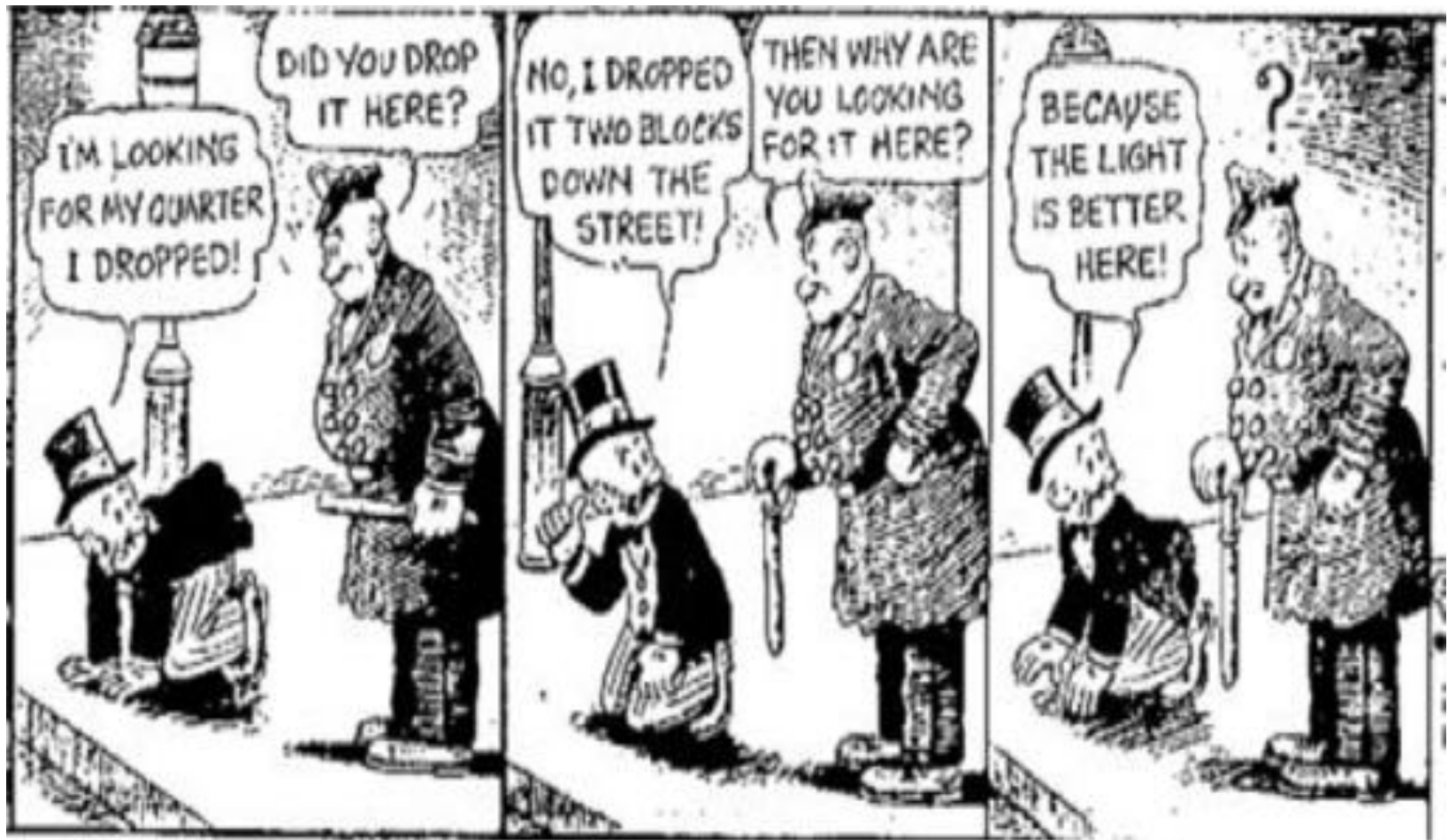Maintain focus on important problems, not easy-to-access datasets and easy-to-access settings for interventionist work

# 2. Being Solution-Driven Rather Than Problem-Minded

Advancing a new method or theory for an <span style="color:red">unclear or pseudo problem</span>

More likely the researcher will solve the wrong problem by applying the right methods

The Law of the Hammer



If the only tool you have is a hammer, everything looks like a nail.

Abraham Maslow - The Psychology of Science - 1966

# 3. Gap-Spotting and Gap-Patching— But Does the Gap Matter





**<span style="color:red">Alternative Approaches to Formulate Problems</span>**

**Building Bridges vs. Filling Gaps**

**Problematizing by Challenging Assumptions**

# 4. Affirming Gravity Works in My Kitchen

- **Reifying well-established models or theories in a new context**

- **Concluding that the solution works in a different setting**

- **Straight-up applications of knowledge from another discipline**

*"Novelty is an essential component of contributions to science. No prizes are awarded for being second to discover a scientific law" (Simon 1991).*

# Affirming Gravity Works in My Kitchen: Exacerbated by Chasing Novel Contexts



**Novelty of the immediate practical context in relation to the <u>archetypal</u> problem?**

CAUTION: TREES OBSCURING VIEW OF FOREST NEXT 5 MILES

EDITOR'S COMMENTS

Seeing the Forest for the Trees

MIS Quarterly

December 2017

# Key Risk: Myopic Problem Formulation, Overlooking the Archetypal Problem



**Problematizing Archetypal Problem With Distinctive Aspects of Contextual Problem**
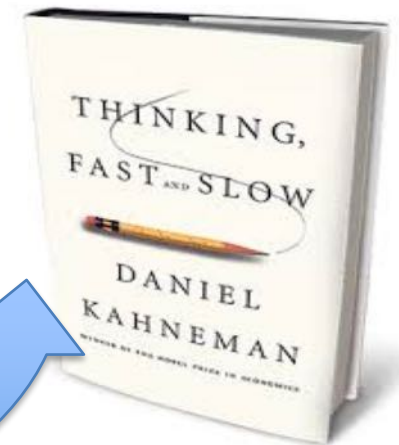
# Scholarly Impact: Connecting Novelty With Accreted Knowledge
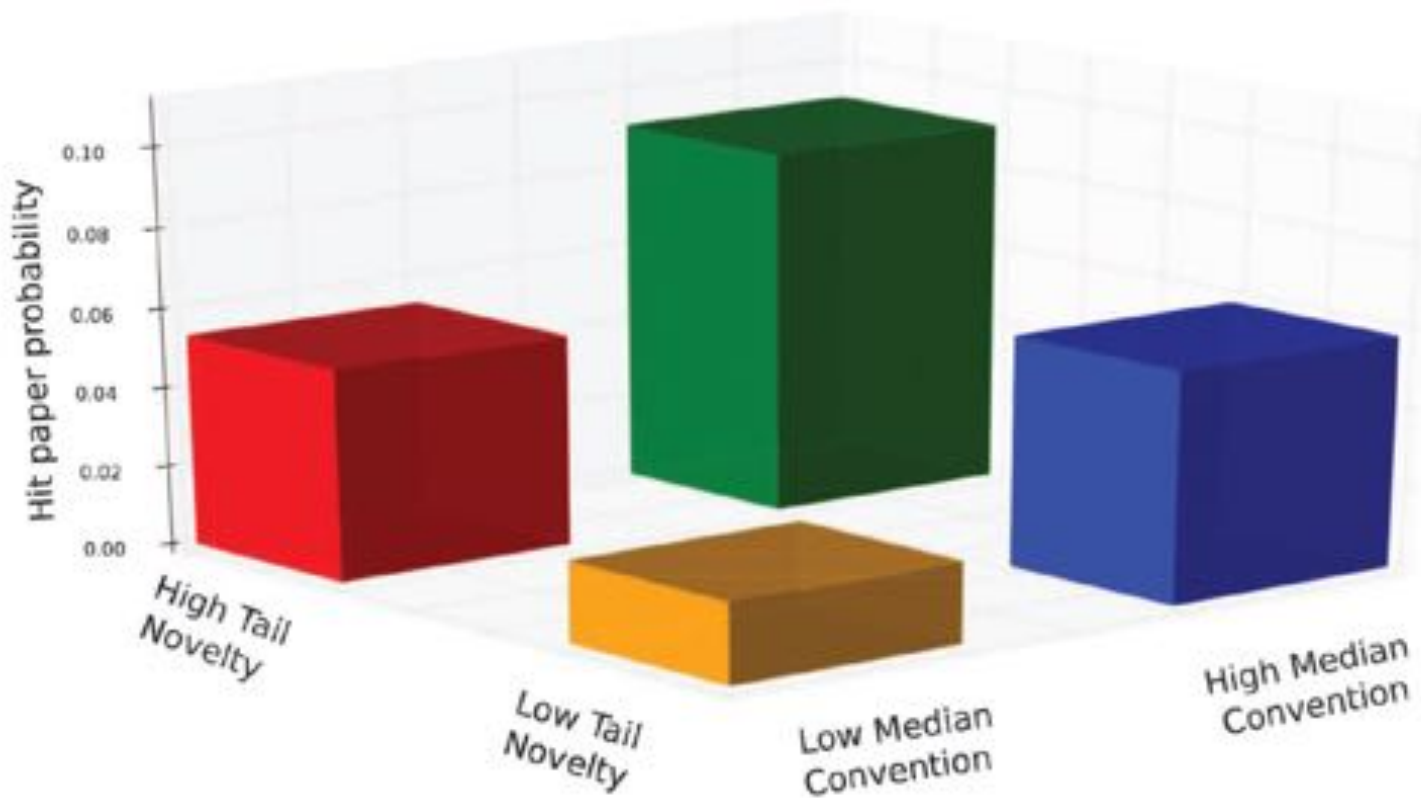


**Atypical Combinations and Scientific Impact**

*Science*, 2013

Brian Uzzi,[1,2] Satyam Mukherjee,[1,2] Michael Stringer,[2,3] Ben Jones[1,4]*

# 6. Linear Process to Formulate and Solve Problems
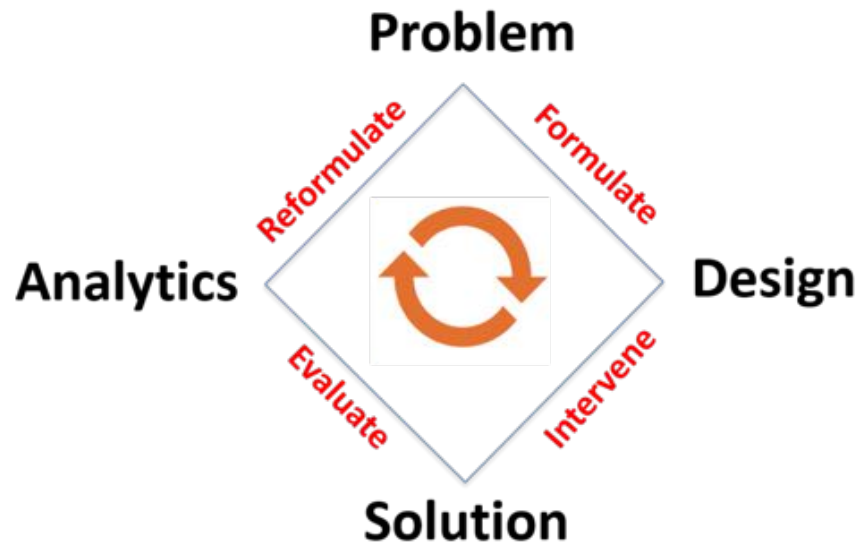


**Diagnostic errors: 6- 17% of adverse events**

**28% of diagnostic errors due to cognitive errors that lead to premature closure**
*Source: jointcommission.org (October 2016)*
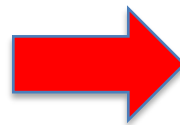
**Iteratively design and evaluate solutions to mitigate premature closure**

# 7. Narrow Construal of Engagement



**Study Context:** Research problem, purpose, perspective

**Research Design**
Develop variance or process model to study theory

Engage methods experts & people providing access & information

Criterion – Truth (Verisimilitude)

**Theory Building**
Create, elaborate & justify a theory by abduction, deduction & induction

Engage knowledge experts in relevant disciplines & functions

Criterion - Validity

Model

Theory

Solution

Iterate & Fit

Reality

**Problem Solving**
Communicate, interpret & negotiate findings with intended audience.

Engage intended audience to interpret meanings & uses

Criterion - Impact

**Problem Formulation**
Situate, ground, diagnose & infer the problem up close and from afar

Engage those who experience & know the problem

Criterion - Relevance

**Source**

ENGAGED SCHOLARSHIP
A GUIDE FOR ORGANIZATIONAL AND SOCIAL RESEARCH
ANDREW H. VAN DE VEN

# Formulating Problems in Interventionist Research to Avoid Type III Errors

**Arun Rai**
**Editor-in-Chief, *MIS Quarterly***
**Georgia State University**
**arunrai@gsu.edu**

**Presented at the Academy of Management**

**August 10, 2019**

# Example of explorative design science research &
# Portfolio perspective on conducting interventionist research

**Jan Holmström**
jan.holmstrom@aalto.fi

August 10, 2019

**A"**
**Aalto University**
**School of Science**

# My research approach:
# *Explorative* design science research

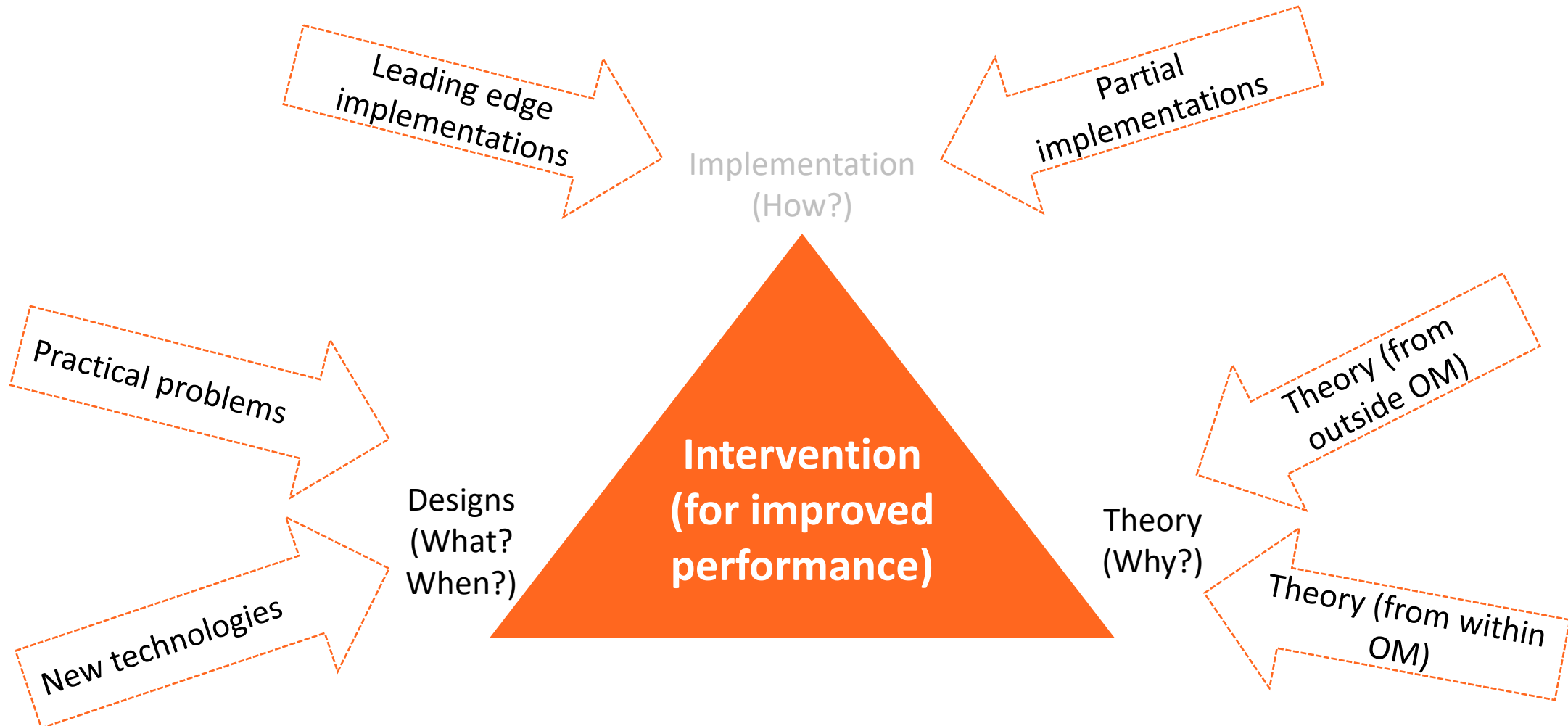- Focus on new ways of operating (transferrable designs)
  - 1990's: Vendor Managed Inventory, Category forecasting
  - 2000's: Last-mile-logistics, Collaborative planning, Intelligent product centric operations (IoT), Digital spare parts
  - 2010's: Build-to-model operations, Digital product fitting, Frontlog scheduling
- Change with the wider world: Novelty through abduction of new knowledge from outside OM
- Forward-looking, often not possible to fully implement (yet)
- Leading edge, partial implementations (at best)
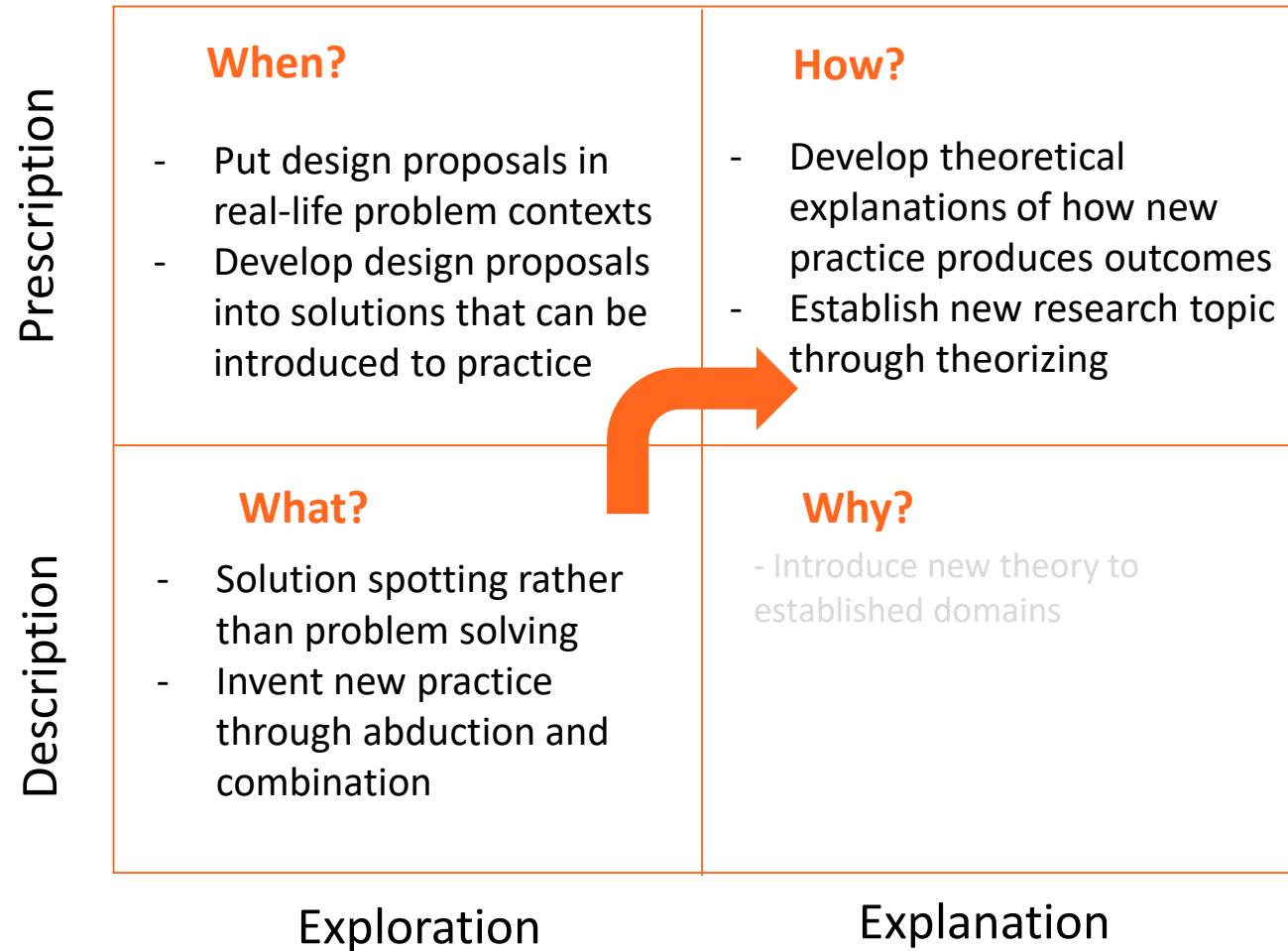
Key reference: Holmström, J., Ketokivi, M., & Hameri, A. P. (2009). Bridging practice and theory: a design science approach. *Decision Sciences*, *40*(1), 65-87.

# Principle: Go outside OM to create novel interventions within OM

# Explorative design science research process can be systematic *



**Practical relevance**

Prescription

**When?**
- Put design proposals in real-life problem contexts
- Develop design proposals into solutions that can be introduced to practice

**How?**
- Develop theoretical explanations of how new practice produces outcomes
- Establish new research topic through theorizing

Description

**What?**
- Solution spotting rather than problem solving
- Invent new practice through abduction and combination

**Why?**
- Introduce new theory to established domains
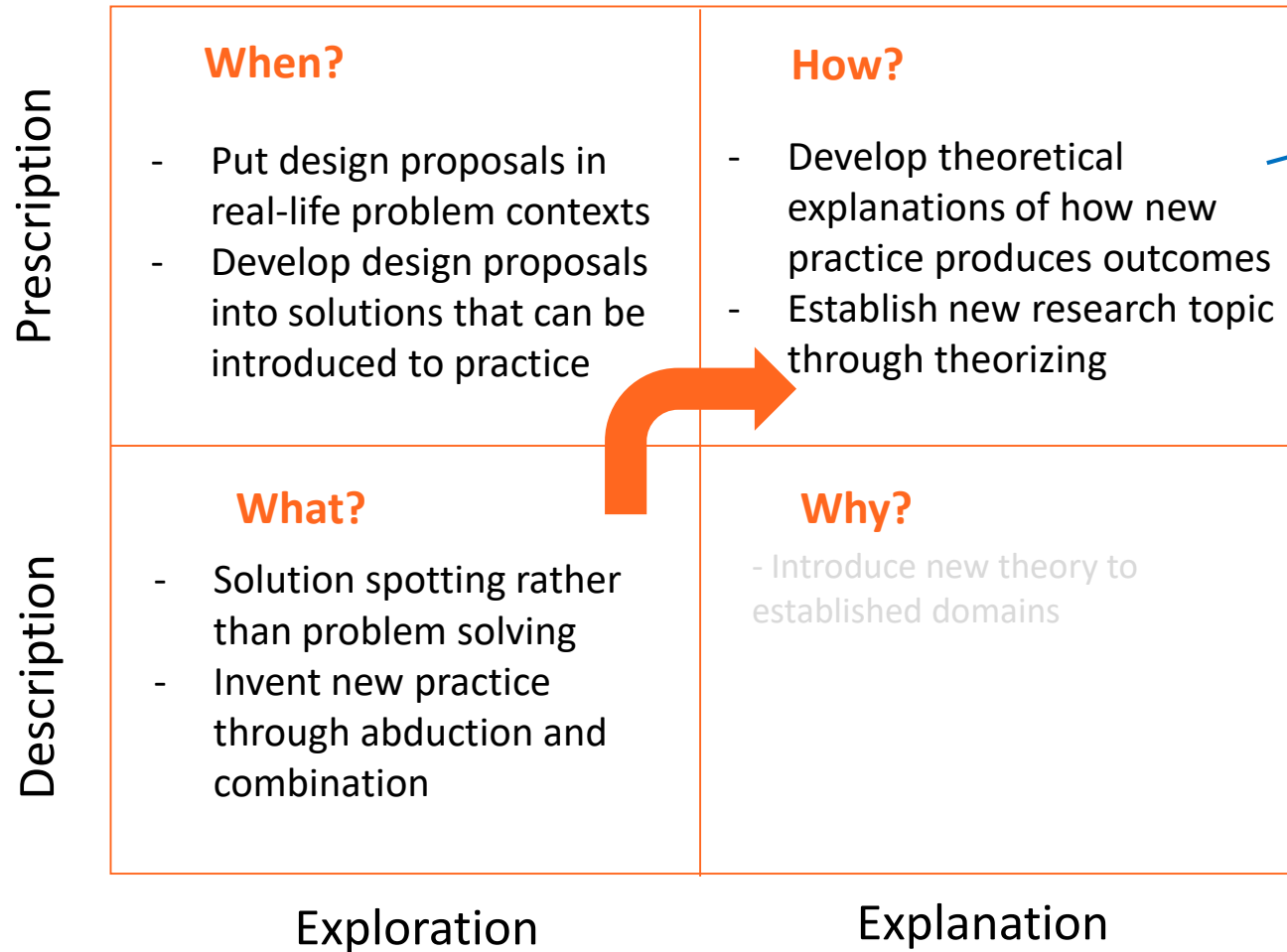
Exploration

Explanation

**Theoretical rigor/research stream maturity**

*Inspired by:
- *Corley, K. G., & Gioia, D. A. (2011). Building theory about theory building: what constitutes a theoretical contribution?. Academy of management review, 36(1), 12-32.*
- *Stokes, D. E. (2011). Pasteur's quadrant: Basic science and technological innovation. Brookings Institution Press.*

# Explorative design science research process can be systematic *

**Practical relevance**

**Prescription**

**When?**
- Put design proposals in real-life problem contexts
- Develop design proposals into solutions that can be introduced to practice

**How?**
- Develop theoretical explanations of how new practice produces outcomes
- Establish new research topic through theorizing

**Description**

**What?**
- Solution spotting rather than problem solving
- Invent new practice through abduction and combination

**Why?**
- Introduce new theory to established domains

Exploration

Explanation

**Theoretical rigor/research stream maturity**

Example:
*How can manufacturers improve performance when everybody is 3D printing?*

*Inspired by:
- Corley, K. G., & Gioia, D. A. (2011). Building theory about theory building: what constitutes a theoretical contribution?. Academy of management review, 36(1), 12-32.
- Stokes, D. E. (2011). Pasteur's quadrant: Basic science and technological innovation. Brookings Institution Press.

# Proposal:
# *Collaborative outsourcing* of *Build-to-model* operations

Hedenstierna, C. P. T., Disney, S. M., Eyers, D. R., Holmström, J., Syntetos, A. A., & Wang, X. (2019). Economies of collaboration in build-to-model operations. *Journal of Operations Management*.

New way of operating:

- **What?:** In Build-to-model the digital product model fully specifies the manufacturing of the product
- **What?:** Any 3DP manufacturer can both outsource and act as subcontractor
- **When?:** This sharing of 3D printing capacity is a continuous and operational decision making process

New practice shifts the performance frontier

- **How?:** Improved delivery with less resources through collaboration

# Theorizing intervention:
# Effect of introducing the new practice
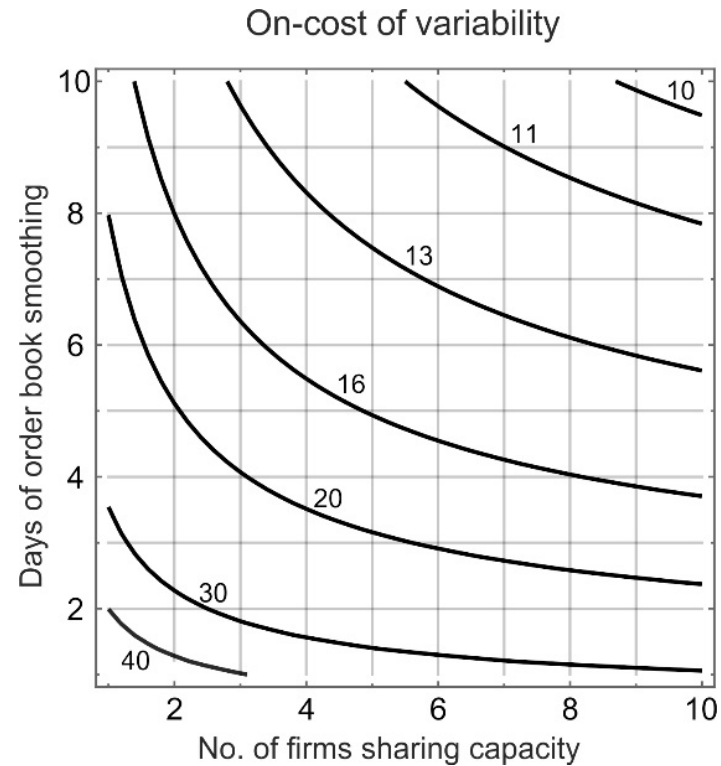


On-cost of variability can be reduced by increasing the number of firms sharing capacity

General purpose manufacturing (3DP) transforms make-or-buy into make-**and**-buy ( ... and a continuous, operational process)

# My contribution to the paper – Build-to-model – is the result of a long process of design exploration

**2002**          **2003**          **2007 …**          **2016**          **2017**

collaborative planning => intelligent products => product centric supply chain …. => direct kitting => build-to-model

*Peer-to-peer computing*

Holmström et al. (2002). *Collaborative planning forecasting and replenishment: new solutions needed for mass collaboration.* SCM:IJ, 7(3), 136-145.

*Digital product identification*

Kärkkäinen et al. (2003). *Intelligent products—a step towards a more effective project delivery chain.* Computers in industry, 50(2), 141-151.

*Design patterns*

Främling, K., Ala-Risku, T., Kärkkäinen, M., & Holmström, J. (2006). Agent-based model for managing composite product information. Computers in Industry, 57(1), 72-81.

Främling et al. (2007). *Design patterns for managing product life cycle information.* Communications of the ACM, 50(6), 75-79.

**First (partial) implementation**

Lyly-Yrjänäinen et al. (2016). *Effects of combining product-centric control and direct digital manufacturing: The case of preparing customized hose assembly kits.* Computers in Industry, 82, 82-94.

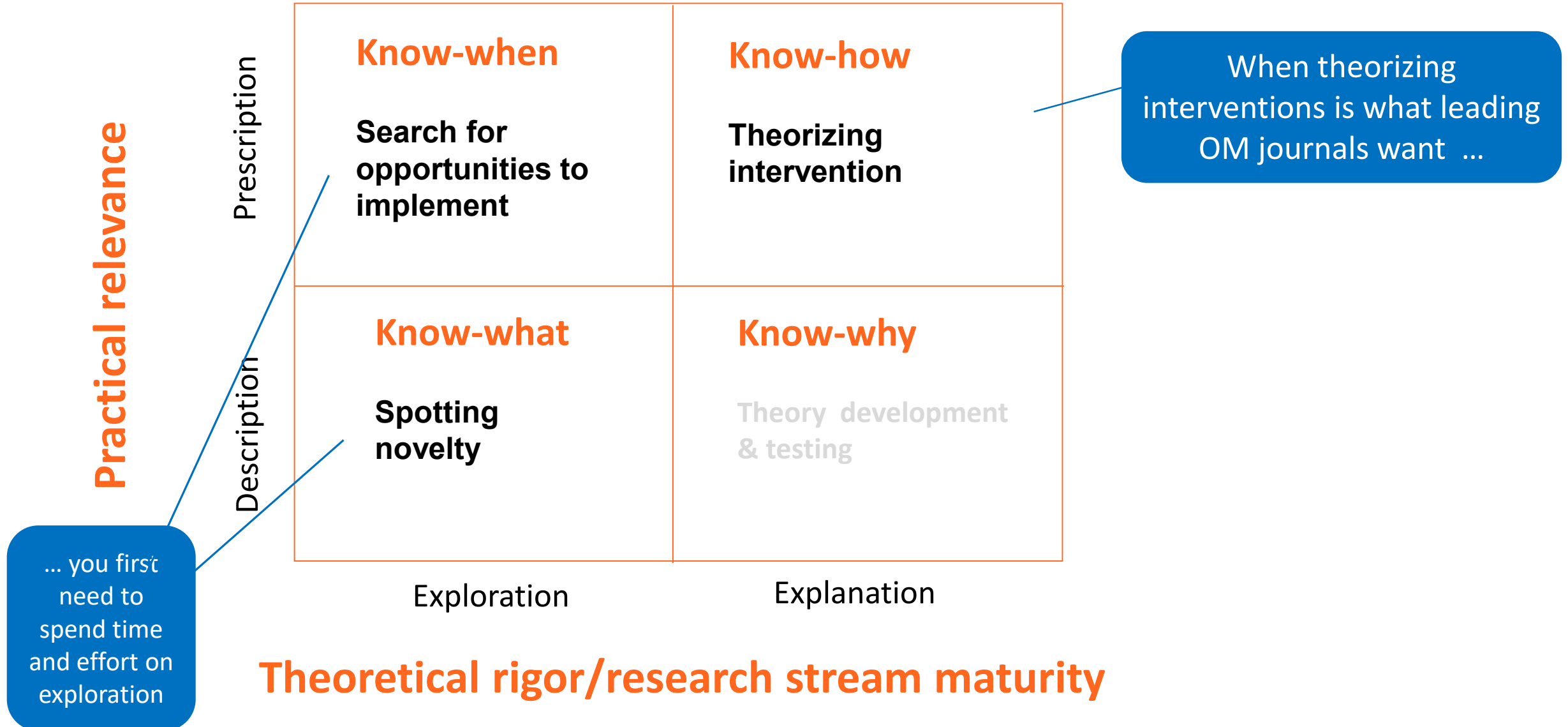*Direct manufacturing, 3D printing*

Holmström et al. (2017). *Sustainability outcomes through direct digital manufacturing-based operational practices: A design theory approach.* Journal of Cleaner Production, 167, 951-961.

# Explorative design based research 'portfolio'
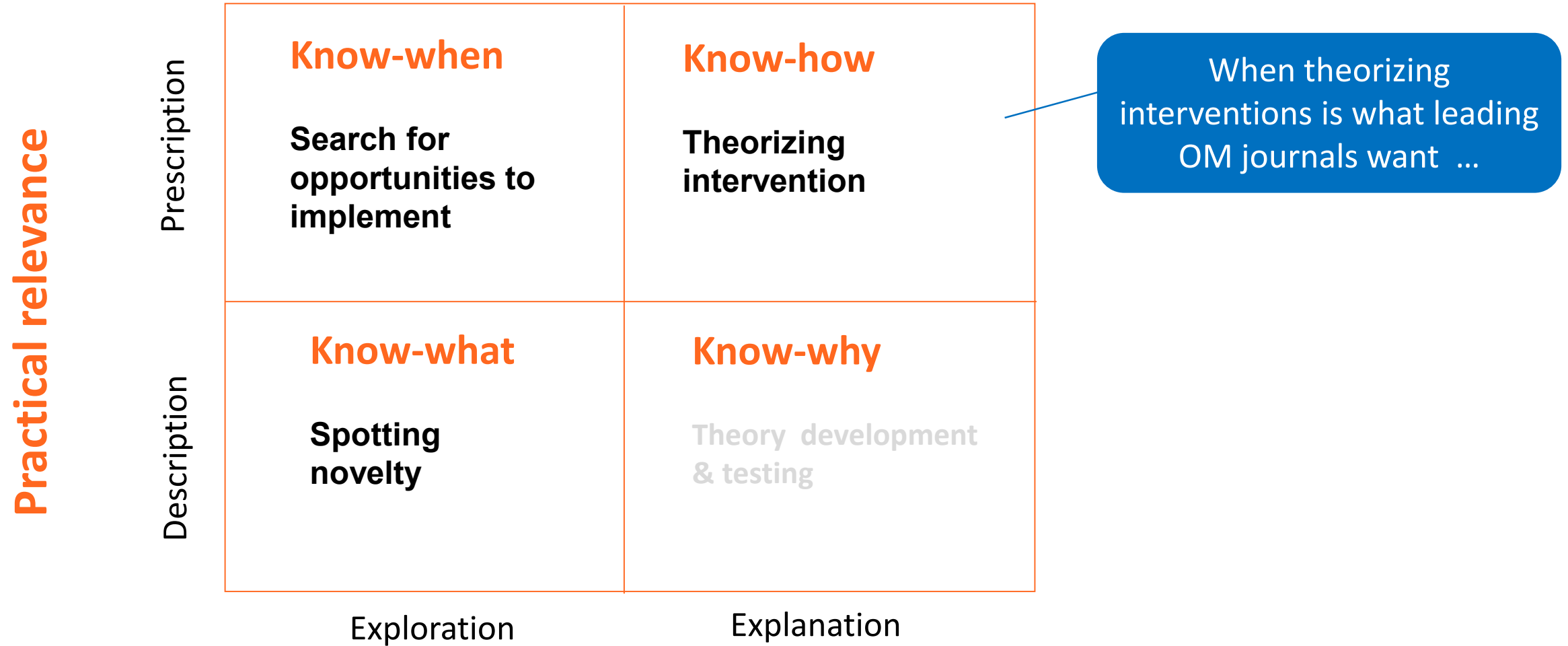


**Practical relevance**

Prescription

**Know-when**

**Search for opportunities to implement**

**Know-how**

**Theorizing intervention**

When theorizing interventions is what leading OM journals want ...

Description

**Know-what**

**Spotting novelty**

**Know-why**

Theory development & testing

Exploration

Explanation

**Theoretical rigor/research stream maturity**

# Explorative design based research 'portfolio'

**Practical relevance**

Prescription

**Know-when**

**Search for opportunities to implement**

**Know-how**

**Theorizing intervention**

When theorizing interventions is what leading OM journals want ...

Description

**Know-what**

**Spotting novelty**

**Know-why**

Theory development & testing

... you first need to spend time and effort on exploration

Exploration

Explanation

**Theoretical rigor/research stream maturity**

# Explorative design based research 'portfolio'

**Practical relevance**

Prescription

Description

## Know-when

**Search for opportunities to implement**

## Know-how

**Theorizing intervention**

## Know-what

**Spotting novelty**

## Know-why

Theory development & testing

Exploration

Explanation

**Theoretical rigor/research stream maturity**

# Need of evaluation criteria for explorative design science

**Practical relevance**

| | Exploration | Explanation |
|---|---|---|
| **Prescription** | **Search for opportunities toImplement (Know-when)**<br>*Criteria:*<br>• Is technology-oriented research used for outlining constraints and enablers?<br>• Is theory used in conceptualization of mutability/ maturity of the design? | Know-how<br><br>Theorizing intervention |
| **Description** | **Spotting novelty (Know-what)**<br>*Criteria:*<br>• Are theory and designs from outside OM novel?<br>• Is proposed OM design based on identifiable, tested designs from outside?<br>• How are expected outcomes justified? (External theory?) | Know-why<br><br>Theory development & testing |

**Theoretical rigor/research stream maturity**

# Thank you for listening!
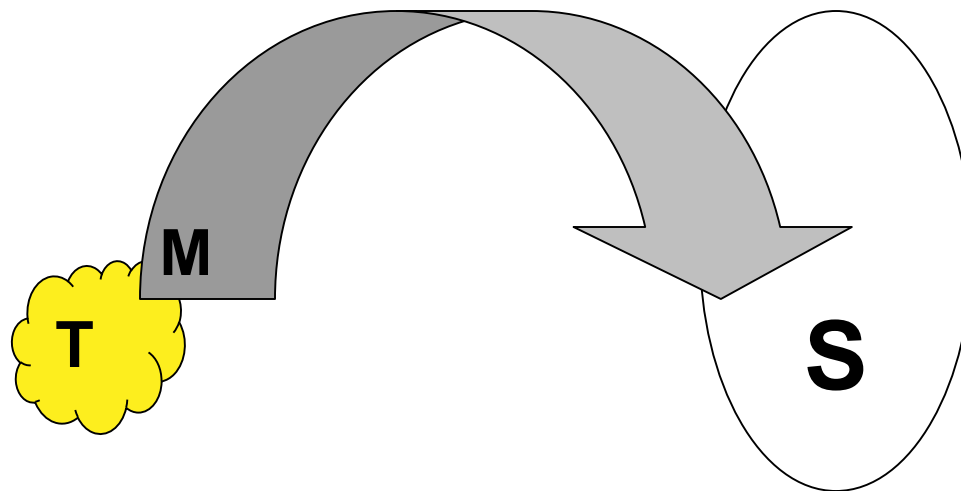
jan.holmstrom@aalto.fi

# Draft Paper

- **http://bit.ly/AOM_interventionist_research_draft**

# Learning from an Intervention

**An intervention in a problem situation (S) guided by a deliberate approach (M), (*design*) that makes use of specific theoretical framework (T) …**

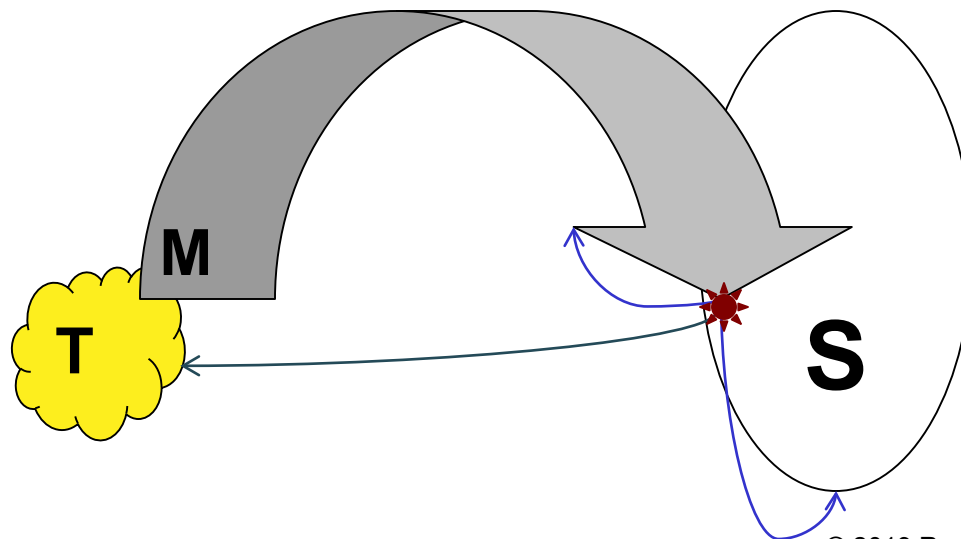**… can yield surprises (learning) in three different contexts**



Source: Adapted from Checkland (1985)

# Learning from an Intervention

- **Lessons about the problem situation**
  - **This is what permits the problem to be solved**
- **Lessons about the theoretical framework used during the intervention**
- **Lessons about the approach used to solve the problem**

Source: Adapted from Checkland (1985)

# Purpose of an Intervention

- **An intervention is made to *change* S**
  - **This is what improves the problem situation**

- **How did we get there?**
- **Why did get there?**