

informatics

2010
Annual
Meeting

Capability Maturity Model: The Case of Care Coordination and HIT Adoption

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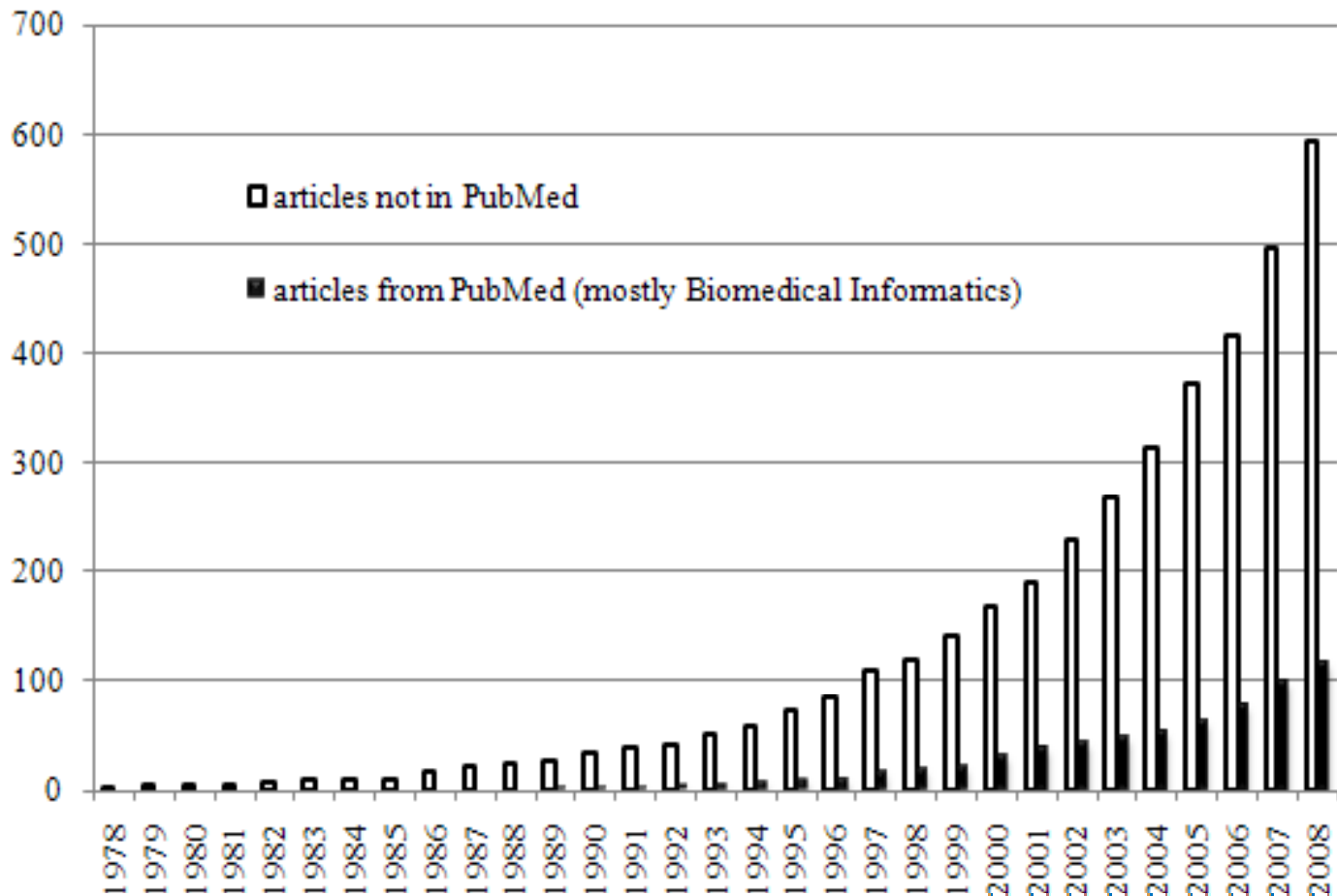
Research Objective

- Examine the mechanisms that could lead to accelerating the rate of HIT adoption.
- Extend existing adoption theory to be able to describe variance amongst types of adoption for the same innovation.
- Ground the theory-extension and validate the findings in and actual HIT example: Care Management Plus.

HIT Literature Review

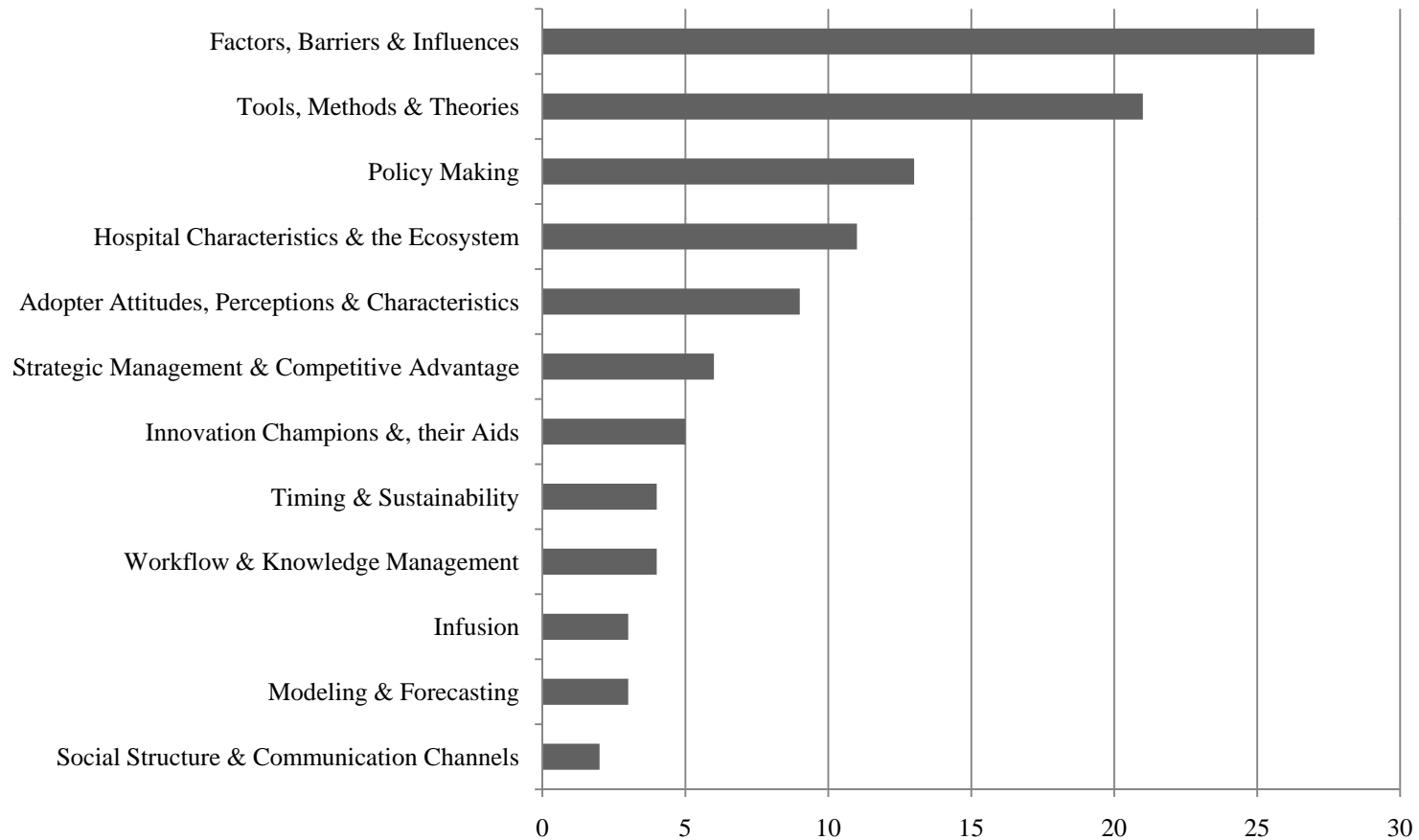
HIT can be an key facilitator to improve efficiency and effectiveness of US healthcare.	(Bates, 2002, Chaudhry <i>et al.</i> , 2006, Blumenthal and Glaser, 2007, Marmor <i>et al.</i> , 2009, 2010c).
Effective HIT use is associated with:	
improved preventive care	(Larsen <i>et al.</i> , 1989, Litzelman <i>et al.</i> , 1993, Willson <i>et al.</i> , 1995, Overhage <i>et al.</i> , 1996, Cannon and Allen, 2000, Demakis <i>et al.</i> , 2000, Teich <i>et al.</i> , 2000, Dexter <i>et al.</i> , 2004),
reduced complications	(Larsen <i>et al.</i> , 1989, Kucher <i>et al.</i> , 2005),
fewer adverse events	(Evans <i>et al.</i> , 1992)
medical errors	(Bates <i>et al.</i> , 1998, Evans <i>et al.</i> , 1998),
decreased resource utilization	(Tierney <i>et al.</i> , 1988, Tierney <i>et al.</i> , 1993, Bates <i>et al.</i> , 1999),
lower health care costs	(Tierney <i>et al.</i> , 1993).

HIT Adoption Publications (30 years)



Behkami N, Daim T, Methodological Analysis of Health Information Technology (HIT) Diffusion Research to identify Gaps and Emerging Topics in Literature. *Portland State University: Department of Engineering & Technology Management Working Paper Series*. Portland, Or: 2009.

Subject of HIT Adoption Studies in Literature



Behkami N, Daim T, Methodological Analysis of Health Information Technology (HIT) Diffusion Research to identify Gaps and Emerging Topics in Literature. *Portland State University: Department of Engineering & Technology Management Working Paper Series*. Portland, Or: 2009.

List of Theories used to study HIT Adoption

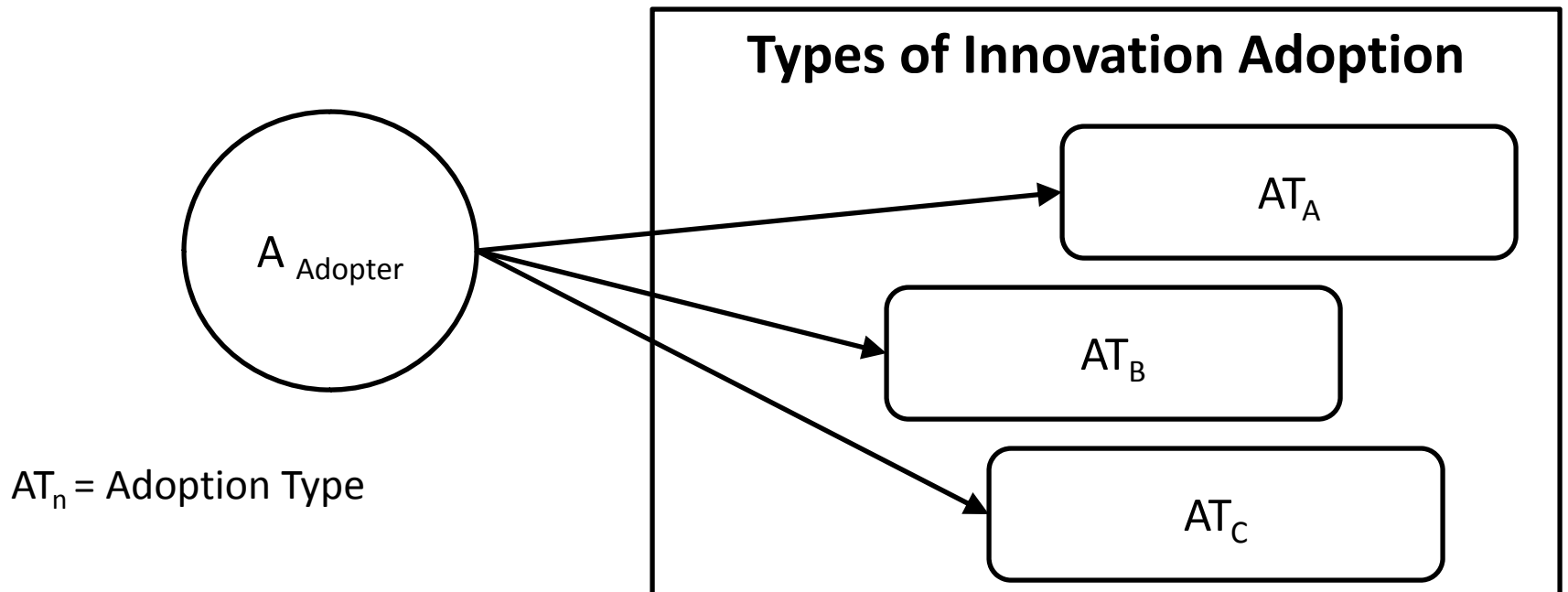
Name	Main dependent construct	Main independent construct	Originating Area	Level of Analysis
Technology Acceptance Model (TAM)	Behavioral Intention to Use, System Usage	Perceived Usefulness, Perceived Ease of Use	Information Systems	Individual
Theory of Reasoned Action (TRA)	Behavioral Intention, Behavior	Attitude Toward Behavior, Subjective Norm,	Social psychology	Individual
Theory of Planned Behavior (TPB)	Behavioral Intention, Behavior	Attitude Toward Behavior, Subjective Norm, Perceived Behavioral Control	Social psychology	Individual
Unified Theory of Acceptance and Use of Technology (UTAUT)	Behavioral intention, Usage behavior	Performance expectancy, Effort expectancy, Social influence, Facilitating conditions, Gender, Age, Experience, Voluntariness of use	Information Systems	Individual
Technology-Organization-Environment Framework (TOEF)	Likelihood of Adoption, Intention to Adopt, Extent of Adoption	Technological Context Organizational Context Environmental Context	Organizational Psychology	Firm/Organization
Matching Person & Technology Model (MPTM)	Behavior	Attitude	Social Sciences	Individual
Lazy User Model (LUM)	Behavior	Attitude	Engineering	Individual

Gaps:

For the same exact implementation (adoption) of an Innovation (product) we can observe multiple type of seemingly similar adoptions.

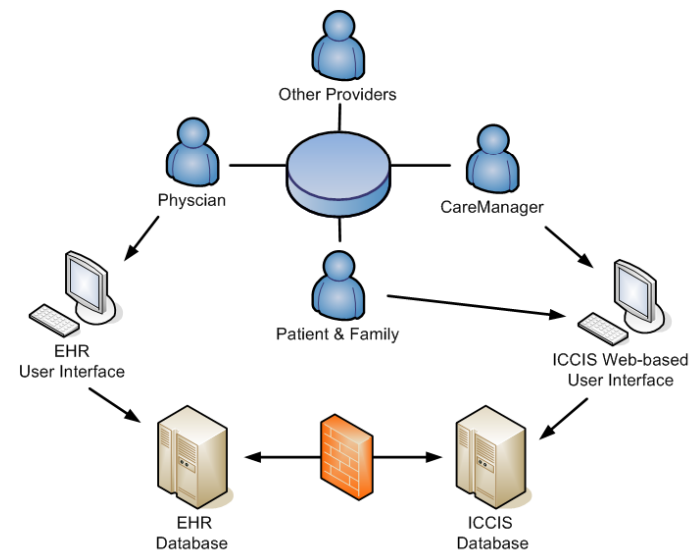
Gap1: There are no theories to describe different type of Adoption for the same Innovation: Are T_A , T_B and T_C really similar?

Gap2: There is no way to know which type of Adoption of an innovation has take place: Which one of AT's has A_{Adopter} adopted?



HIT Casestudy: Care Management Plus

- CMP is a validated Health IT for older adults with chronic conditions.
- 10% of older adults live with five or more conditions and account for two-thirds of Medicare dollars.
- CM+ provides clinics staff training and HIT for patient tracking.
- Developed at Intermountain Healthcare of Utah and Disseminated by OHSU



Dorr DA, Wilcox A, Burns L, Brunker CP, Narus SP, Clayton PD.
Implementing a multidisease chronic care model in primary care using
people and technology. *Disease Management*. 2006; 9(1):1-15

Research Questions

Gap1: There are no theories to describe different type of Adoption for the same Innovation: Are T_A , T_B and T_C really similar?

RQ1: Can we meaningfully identify Capabilities responsible for implement an HIT innovation (in this case : Care Management Plus)?

RQ1.1: What are those Capabilities?

RQ1.2: Can we group them into bundles of resources?

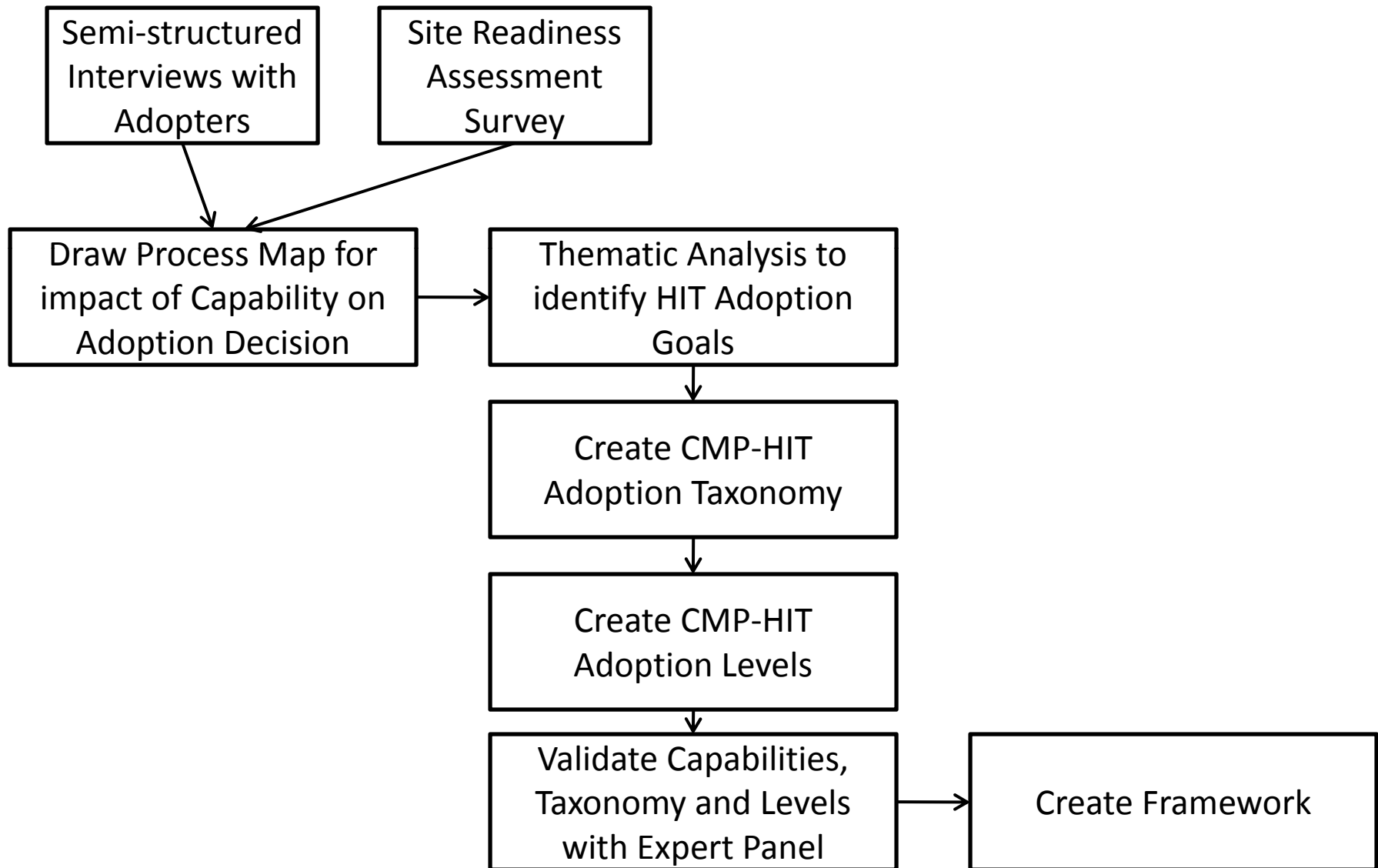
Gap2: There is no way to know which type of Adoption of an innovation has take place: Which one of AT's has A_{Adopter} adopted?

RQ2: How can we use Capabilities to further refine the act of HIT Adoption?

RQ2.1: How can capabilities used define HIT adoption types?

RQ2.2: Can we group the capabilities into level of graduating HIT adoption?

Methodology

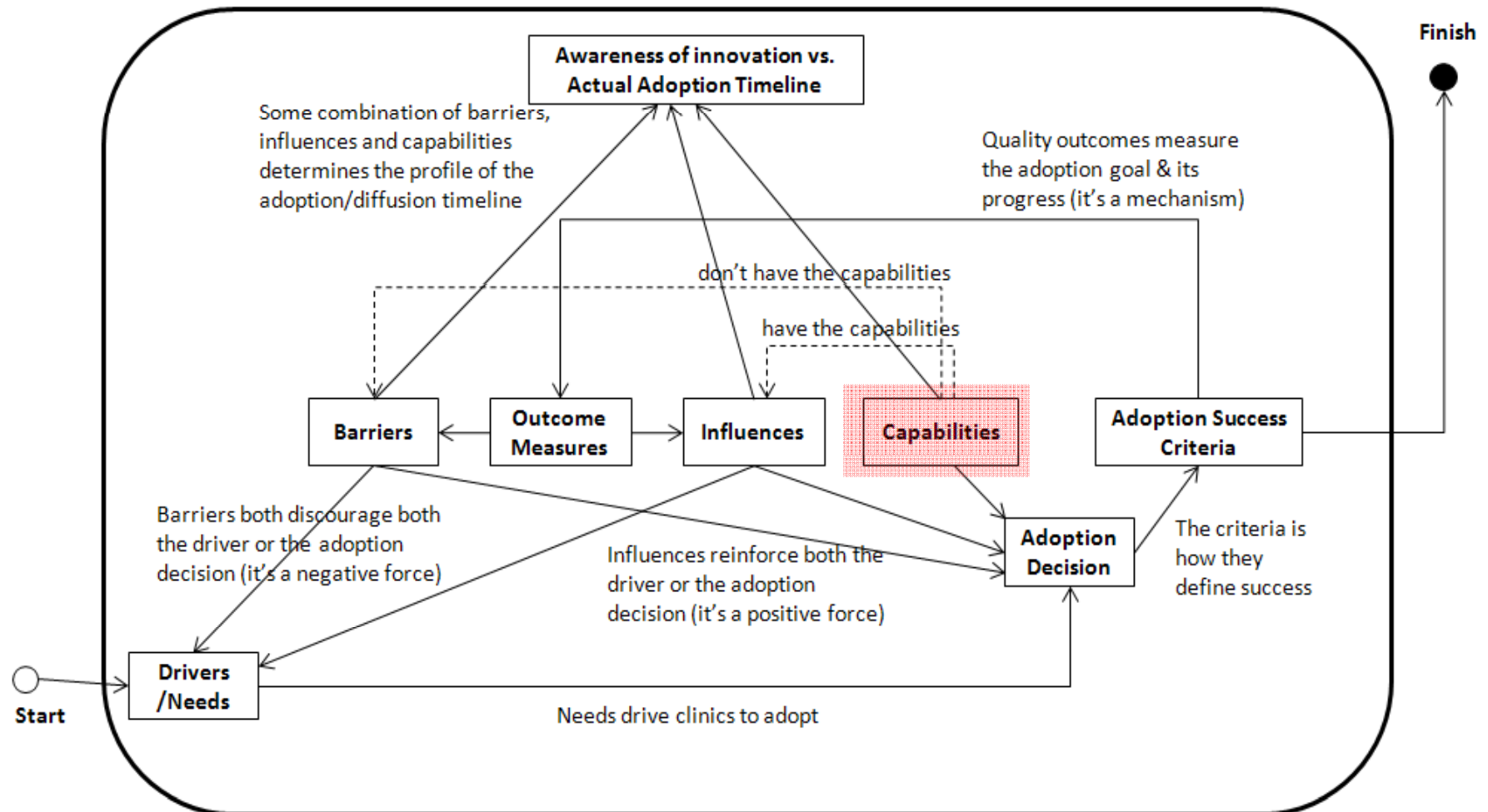


Research Tools & Sample

Research Tool	Description
Semi-structured Interviews	9 Sites Oregon & California (Care Management Plus program participants)
Site Readiness Assessment Survey	120 sites National including large University hospitals, small clinics and Veterans Affairs Hospitals
Expert Panel	<ul style="list-style-type: none">• Physician• Nurse Care Manager• Technologists• Program Managers

Results

Process Map: Clinic Workflow with Capabilities



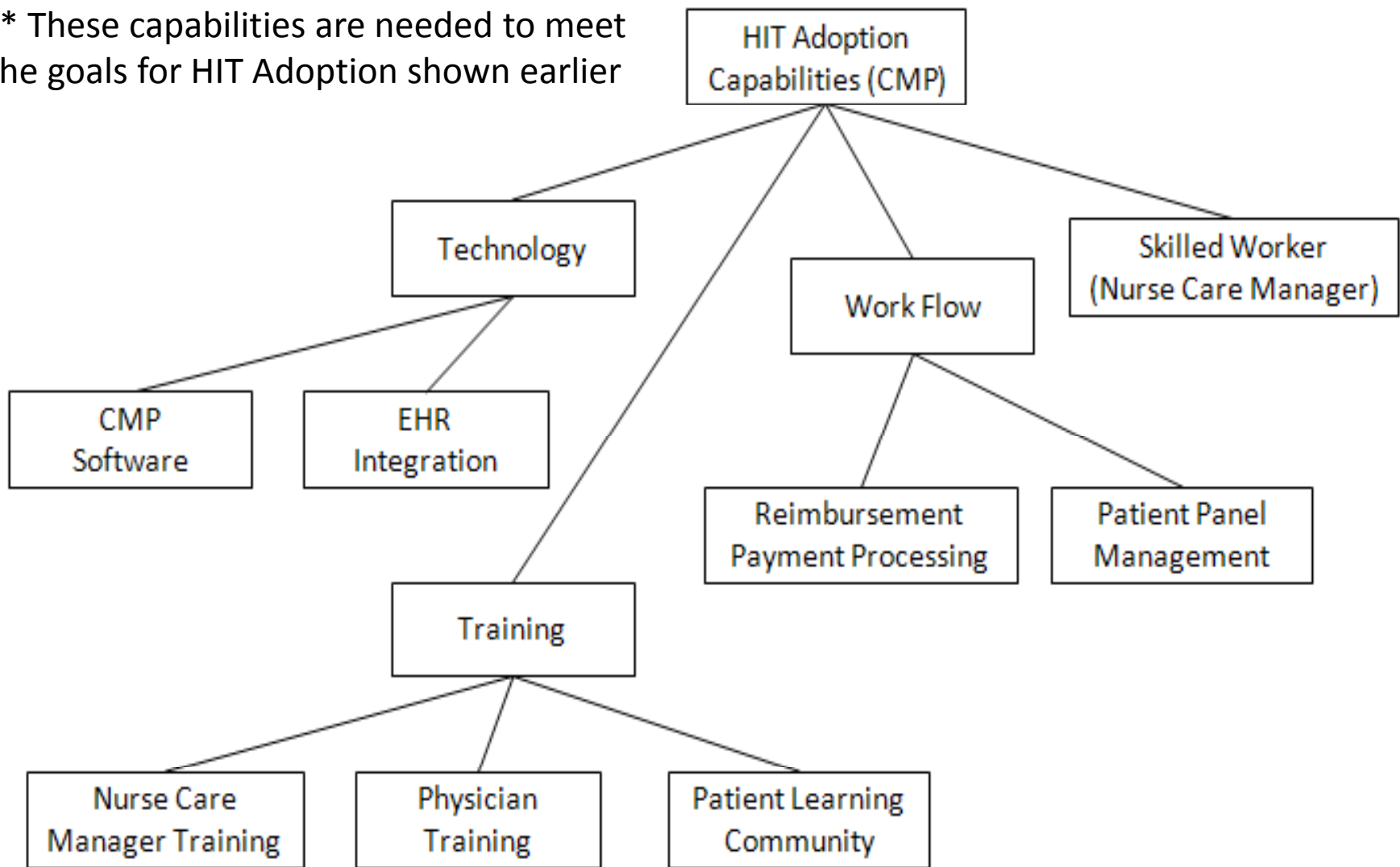
Behkami NA, Dorr DA, Daim TU. Modeling Healthcare Information Technology (HIT) Adoption Using Systems Dynamics. In: *Canadian Operational Research Society Joint International Meeting*. Toronto, Canada: 2009

Extracted Goals for HIT Adoption from interviews and assessment survey

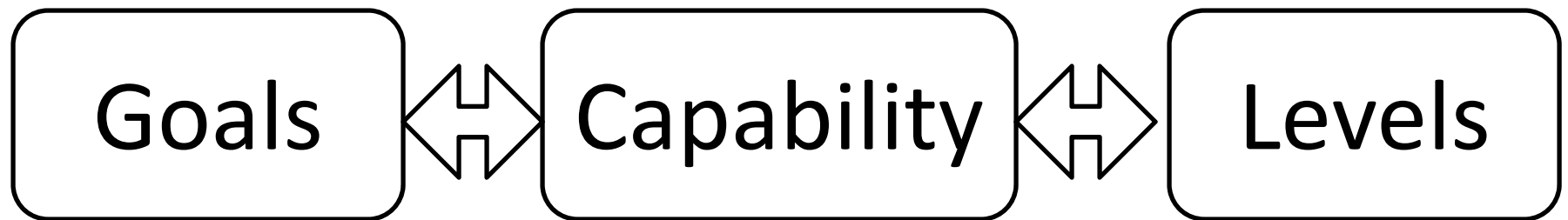
Key Process Area	Goal(s)
Referral	Better intra-clinic communication
	More patient inclusion
	Ability for external communication
	Scheduling
	Encounter tracking
Assessment	Standardization
	Communication
	Accuracy (error reduction)
Care & Follow-up	Good patient experience
	Timeliness
	Better communication
	Meet quality goals
	Scheduling
Communication	Scheduling
	Notification
	Exchange of key information
	Efficiency
Evaluation	Timeliness
	Correctness
	Communication

New Taxonomy of CMP Capabilities

** These capabilities are needed to meet
The goals for HIT Adoption shown earlier



Relationships between discovered Constructs



Capability Maturity Model Levels for Care Management Plus

Level		Capability	Result
5	Integration with HER	Physician Productivity & Improved care
4	Implement CM IT	Risk & Waste
3	Implement CM Clinic Processes	
2	Care Manager Training	
1	<u>Adhoc</u> Care Management	

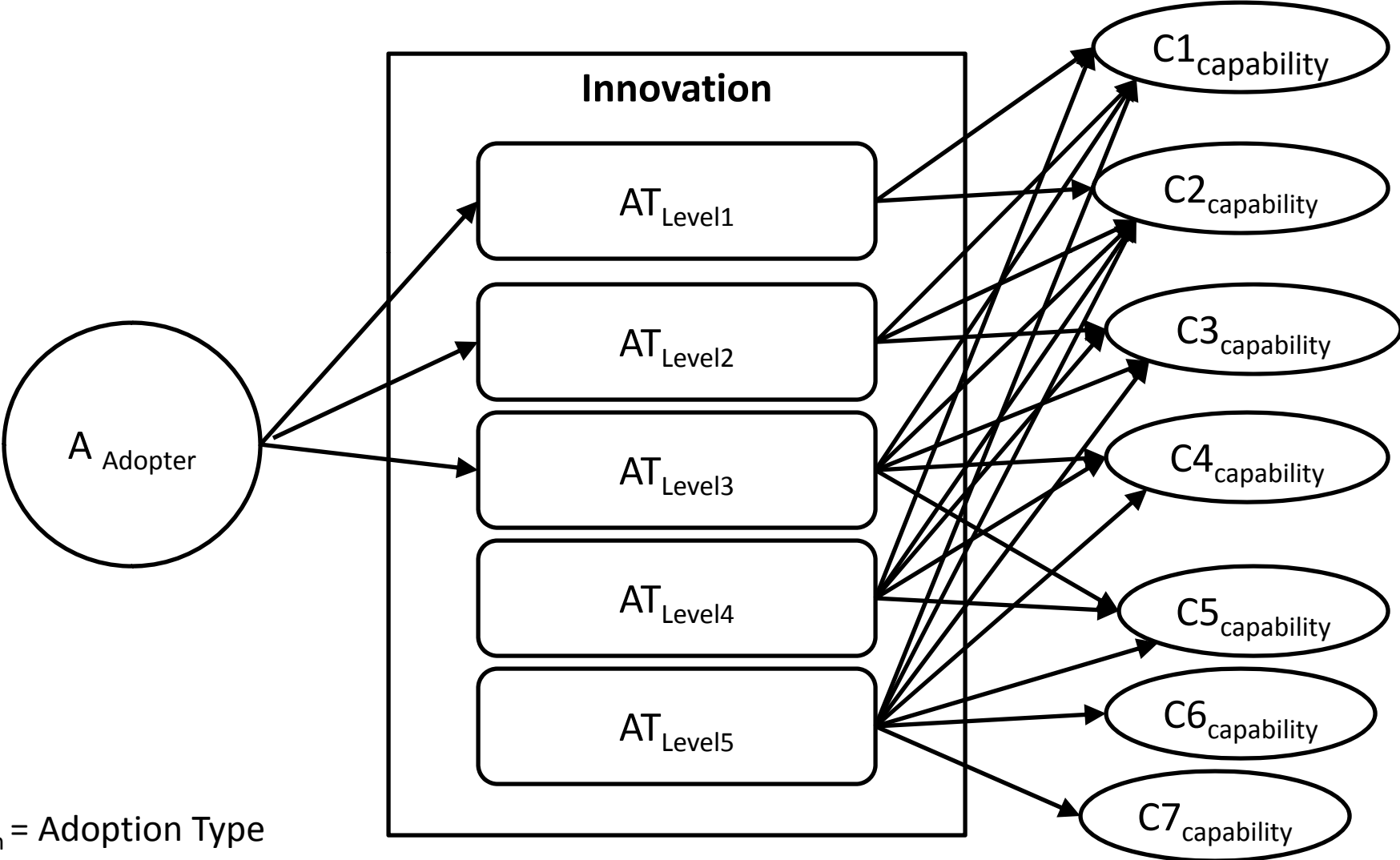
Behkami NA, Dorr DA. User centered design in complex healthcare workflows: the case of care coordination and care management redesign. *AMIA Annual Symposium Proc. 2009;2009:39-43.*

Framework Validation

- Content Validation with Experts positive.
- Applied new framework to 20 sites using information from their site readiness data.

	CMMI- CMP Level	Number of Site at this level
5	Integration wit EHR	0
4	Implement CM IT	3
3	Implement CM Clinic Processes	5
2	Care Manager Training	7
1	Adhoc Care Management	5

New Resulting Research Framework



$AT_n = \text{Adoption Type}$

Results

- We know how many types of Adoption there are in the field for Care Management Plus.
- We know what are the various stakeholder goals for HIT Adoption.
- We Know the Capabilities need for each type (level) of Adoption
- We know from potential adopters, who is likely to be what level of an adopter.

Discussion

Gap1: There are no theories to describe different type of Adoption for the same Innovation:
Are T_A , T_B and T_C really similar?

RQ1: Can we meaningfully identify Capabilities responsible for implement an HIT innovation (in this case : Care Management Plus)?

RQ1.1: What are those Capabilities? **We extracted the goals for Adoption.**

RQ1.2: Can we group them into bundles of resources? **We created an evidence-based Taxonomy of Capability for CMP.**

Gap2: There is no way to know which type of Adoption of an innovation has take place:
Which one of AT's has $A_{Adopter}$ adopted?

RQ2: How can we use Capabilities to further refine the act of HIT Adoption?

RQ2.1: How can capabilities used define HIT adoption types? **We have defined Levels of HIT adoption using the taxonomy of Capabilities we created.**

RQ2.2: Can we group the capabilities into level of graduating HIT adoption? **We have created the CMMI-CMP which include 5 levels of graduating Capabilities.**