Beyond Best Practices:
New Developments in Open Innovation

PICMET Address

August 9, 2022

Henry Chesbrough

Faculty Director Emeritus, Garwood Center, UC Berkeley Haas School of Business

Maire Tecnimont Professor of Open Innovation and Sustainability, Luiss University

1

Agenda for the Talk

- Definition and Motivation for Open Innovation
- The Exponential Paradox
- Recent Research in Open Innovation
- Concluding Thoughts

2

The Rise of Open Innovation

- In 2003, I did a Google search on the term "open innovation"
  - Received about 200 page links
  - "open" and "innovation" had appeared in same sentence
- For this talk, I did another search, nearly 20 years later
  - Received 2 billion page links
  - Now open innovation has become a distinct concept
  - Though open innovation had multiple potential meanings

3

- Open innovation has spread throughout the world
  - Tech industry
  - Consumer products
  - Energy
  - Materials
  - Finance
  - Automotive

- And that is just the first page of Linked In results!
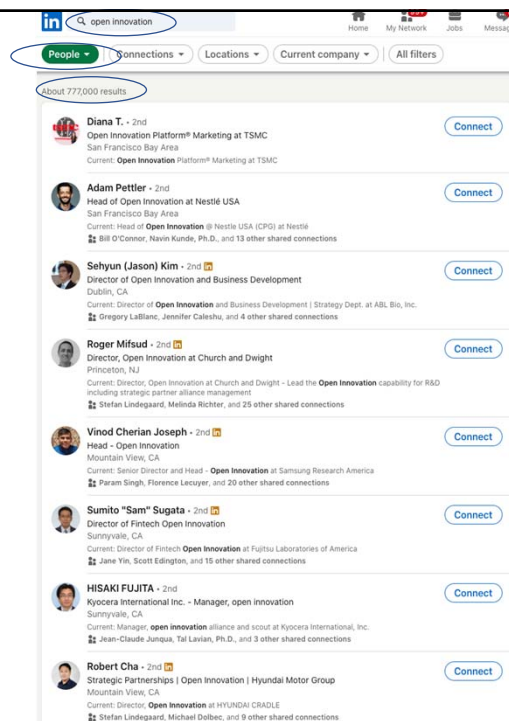
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Open Innovation Definition

- Definition: "a distributed innovation process involving knowledge flows across organizational boundaries, for both pecuniary and non-pecuniary reasons"
  - Chesbrough and Bogers, 2014

FOREWORD BY JOHN SEELY BROWN

HENRY CHESBROUGH

OPEN INNOVATION

The New Imperative for Creating and Profiting from Technology

HARVARD BUSINESS SCHOOL PRESS

5

Open Innovation Definition

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6

Open innovation is NOT (just)

- Open source
- Crowdsourcing
- IP licensing
- University collaborations
- Startup engagement
- Venture capital, corporate VC
- Supplier-driven innovation
- User innovation

7

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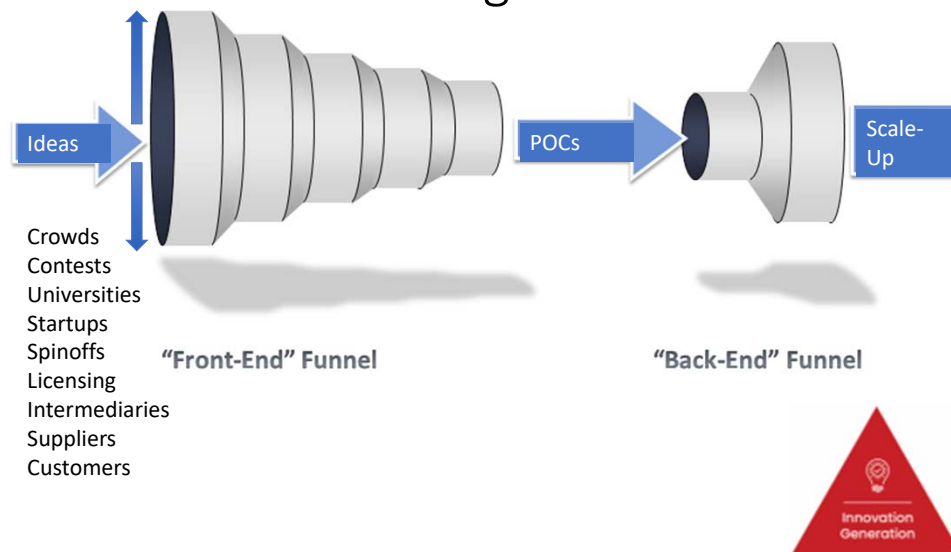Each of these involves knowledge flows across organizational boundaries

8

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9

Open Innovation has greatly expanded the intake of new technologies

Ideas

Crowds
Contests
Universities
Startups
Spinoffs
Licensing
Intermediaries
Suppliers
Customers

POCs

Scale-Up

"Front-End" Funnel

"Back-End" Funnel

Innovation
Generation

10

But congestion can be the result

- Evaluations
- Legal
- HR
- Finance
- Purchasing

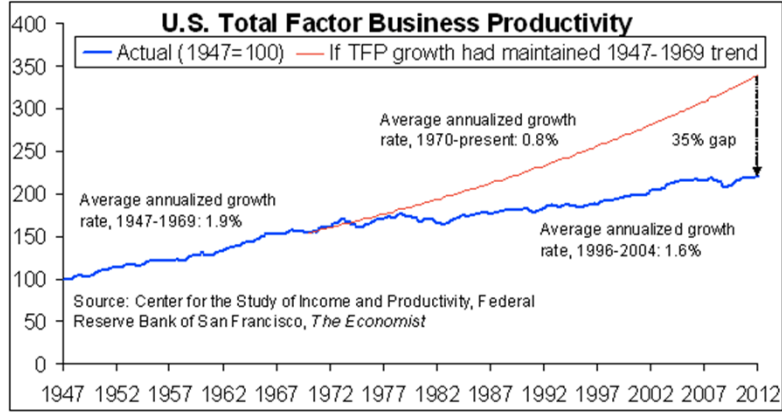 Need support capacity to manage wider intake

11

The Exponential Paradox

- The Pace of Technology is Accelerating
- Exponential Technologies
- The Lifespan of F500 companies is shortening

- Yet US productivity growth is slowing down
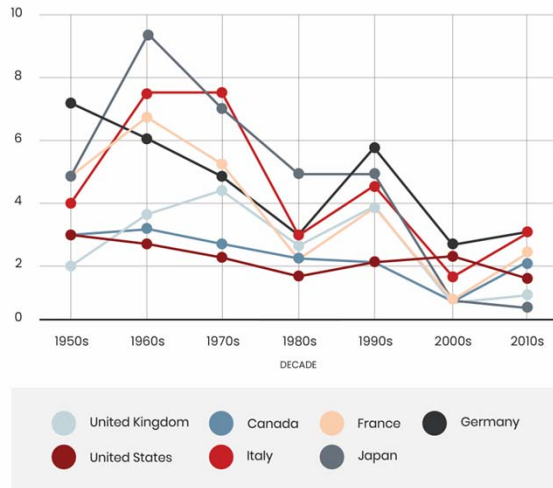 - US wage growth is even more stagnant

12

Where is the exponential growth?

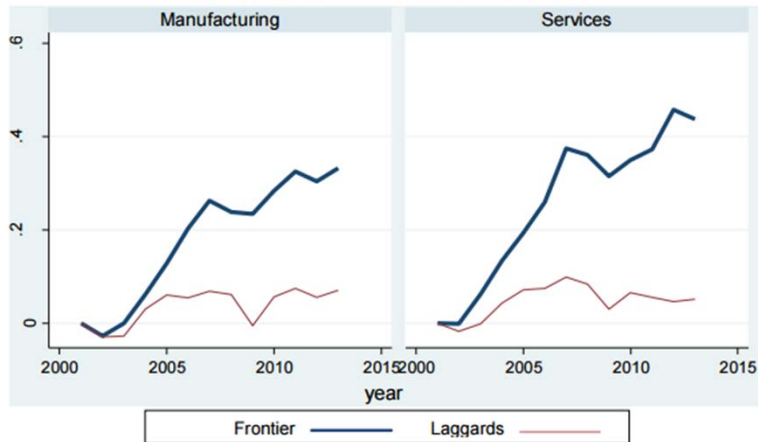13

14

Investing in our future
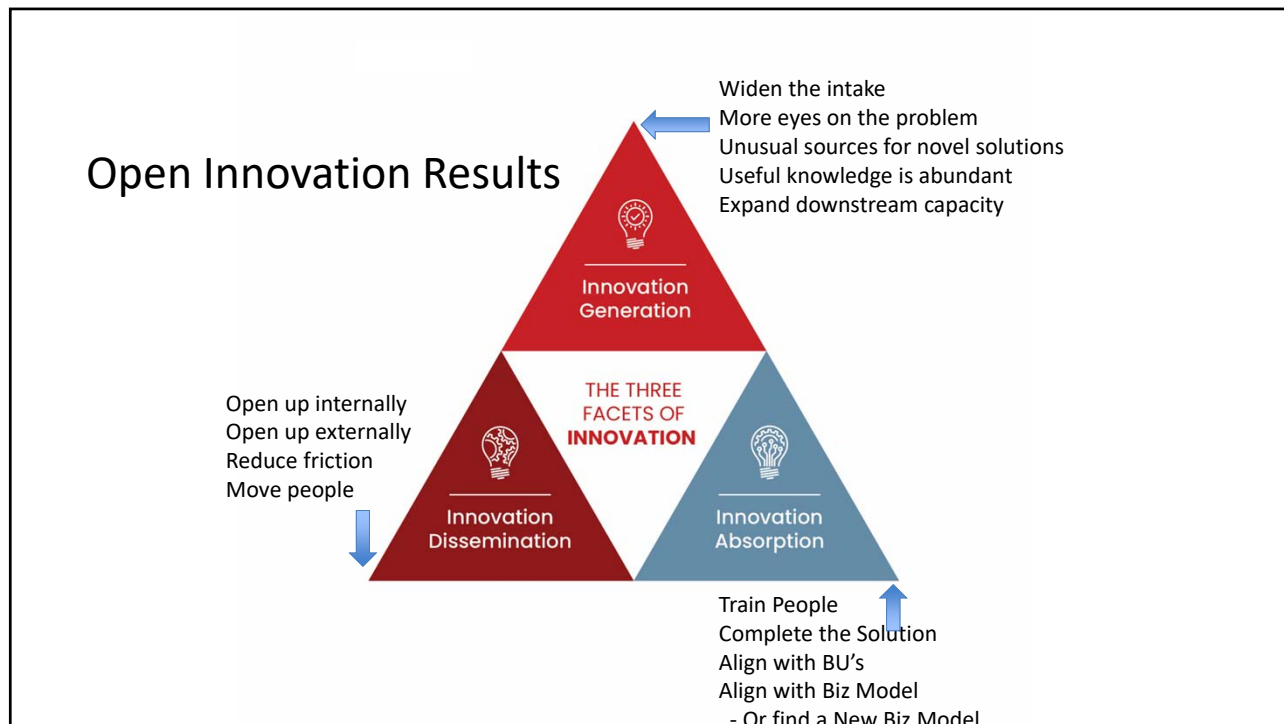
Federal R&D as Share of GDP
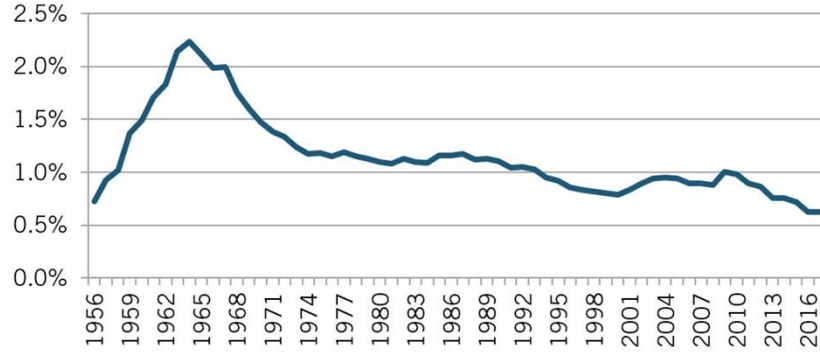
15

The Best vs. the Rest

Labour productivity: value added per worker (2001-2013)

Notes: the global frontier is measured by the average of log labour productivity for the top 5% of companies with the highest productivity levels within each 2-digit industry. Laggards capture the average log productivity of all the other firms. Unweighted averages across 2-digit industries are shown for manufacturing and services, normalized to 0 in the starting year. The time period is 2001-2013. The vertical axes represent log-differences from the starting year: for instance, the frontier in manufacturing has a value of about 0.3 in the final year, which corresponds to approximately 30% higher in productivity in 2013 compared to 2001. Services refer to non-financial business sector services. See details in Section 3.3.

16

Open Innovation Results

Widen the intake
More eyes on the problem
Unusual sources for novel solutions
Useful knowledge is abundant
Expand downstream capacity

Innovation Generation

THE THREE FACETS OF **INNOVATION**

Open up internally
Open up externally
Reduce friction
Move people

Innovation Dissemination

Innovation Absorption

Train People
Complete the Solution
Align with BU's
Align with Biz Model
 - Or find a New Biz Model

17

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18

Extending Open Innovation:
Tracing Knowledge Flows from Corporate Venture Capital

Tobias Gutman, Christopher, Chochoiek, Henry Chesbrough

winner, Best Paper Award, WOIC 2021
forthcoming, California Management Review, 2023

19

FIGURE 1: OPEN INNOVATION – KNOWLEDGE FLOW FRAMEWORK

20

10

FIGURE 1: OPEN INNOVATION – KNOWLEDGE FLOW FRAMEWORK

Application of Knowledge
(Demand-side)

Outside — Inside-Out

Inside — Outside-In

Inside | Outside

Origin of Knowledge
(Supply-side)

3

21

FIGURE 1: OPEN INNOVATION – KNOWLEDGE FLOW FRAMEWORK

Application of Knowledge
(Demand-side)

Outside — Inside-Out

Inside — Inside-In | Outside-In

Inside | Outside

Origin of Knowledge
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22

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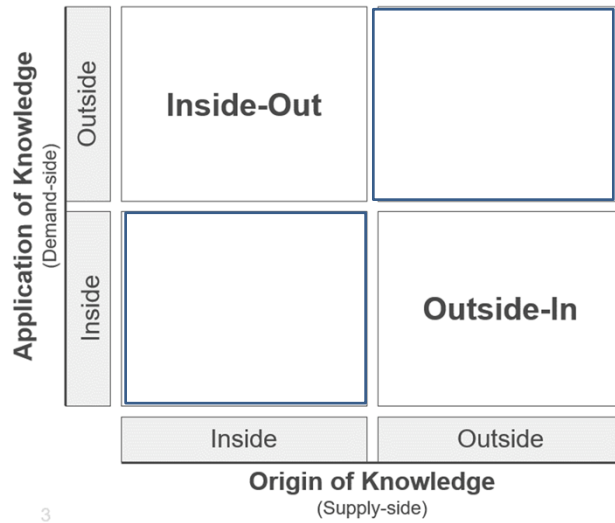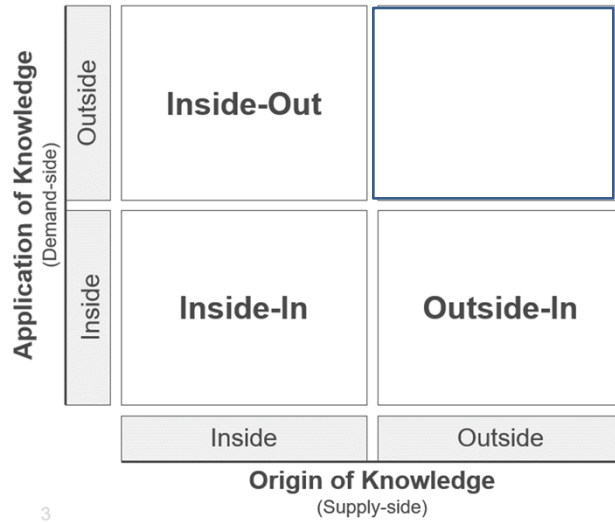
Inside-In Knowledge Flows

- Technically, not covered by OI definition
  - But critically important to achieve the desired innovation outcomes
- Overcome internal siloes between innovation groups and BU's
  - Remember the logjam?
- Practices
  - Educate and guide senior level strategic decisions
  - Create reciprocal exchanges between CVC and domain experts in BU's
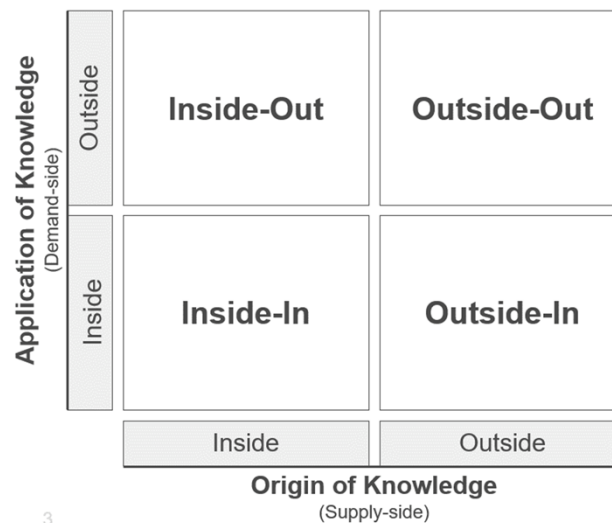 - Recruit and inspire intrapreneurs; share venture best practices with them

23

FIGURE 1: OPEN INNOVATION – KNOWLEDGE FLOW FRAMEWORK

24

12

Outside-Out Knowledge Flows

- Also technically outside definition of open innovation
- Orchestrate external knowledge across ecosystem
  - Examples: connect promising startup to leading customer; certification programs for external complementors to support customers
- Practices
  - Curate and validate promising ventures, match with partners and customers
  - Use your operations as a test-bed to validate new external technologies
  - Share venture knowledge with other external VC investors, syndicate investment

25

How IBM Failed to Prosper from Watson

Jialei Yang, Henry Chesbrough, Pia Hurmelinna-Laukkanen
California Management Review, 2022, 64:3, 24-48

- Watson was technical leader in AI, won Jeopardy in 2011
- IBM invested significantly behind it
- IBM signed many partnerships with hospitals to apply Watson

- And it largely failed! (Watson was sold to Francisco Partners in early 2022)

26

Hypothesis vs. Result

- AI could help radiologists identify cancer
- Hospitals would welcome better diagnoses
- Error rates would be very low

- IBM can co-create directly with customers

27

Hypothesis vs. Result

- AI could help radiologists identify cancer
- Hospitals would welcome better diagnoses
- Error rates would be very low

- IBM can co-create directly with customers

- AI did fine with typical cases, but struggled with corner cases
- MD Anderson audit: $60M (not including staff time), no benefit
- False positive errors very expensive
- False negative errors even worse
- Lack of third-party support meant no exploration of alternative uses for Watson

28

What IBM's experience teaches us

- The best applications for General-purpose technologies (GPTs) are unclear ex ante
- IBM did many things right, built many complementary assets
  - But was <u>way too closed</u> in its Go-To-Market for Watson
  - A Black Box: no APIs, no SDKs, no reference designs, no third party support
- Open innovation helps appropriate value from GPTs, because it enables multiple market experiments to take place in parallel to find good markets
  - Updates and qualifies Teece (1986) Profiting from Innovation framework
  - An open community may be a valuable complementary asset

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29

Technovation

Available online 3 December 2021, 102434

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Measuring open innovation practices through topic modelling: Revisiting their impact on firm financial performance

Qinli Lu [a] ⊠, Henry Chesbrough [b, c] ⊠

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https://doi.org/10.1016/j.technovation.2021.102434

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30

Motivations for the Research

Evidence of Open Innovation's impact on business performance is mixed:

- Surveys use proxy measures, often have limited response rate
- Knowledge flows are difficult to observe
- Several studies of Open Innovation and Firm Performance Show Mixed Results

Natural language processing (NLP) approaches are moving into the social sciences:

- Private Equity firms using NLP to create better measures of ESG
- Can we better measure Open Innovation practices with NLP methods?
- With more data, can we explain the mixed results for Open Innovation and Firm Performance?

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31

31

Data

Open innovation Practices:

- Annual reports of U.S. publicly traded companies pooled for 2016 -2018.
- Russell 3000 Index Stocks (98% US public equity market).
- Business section of each firm's 10-K report to SEC for text extraction.
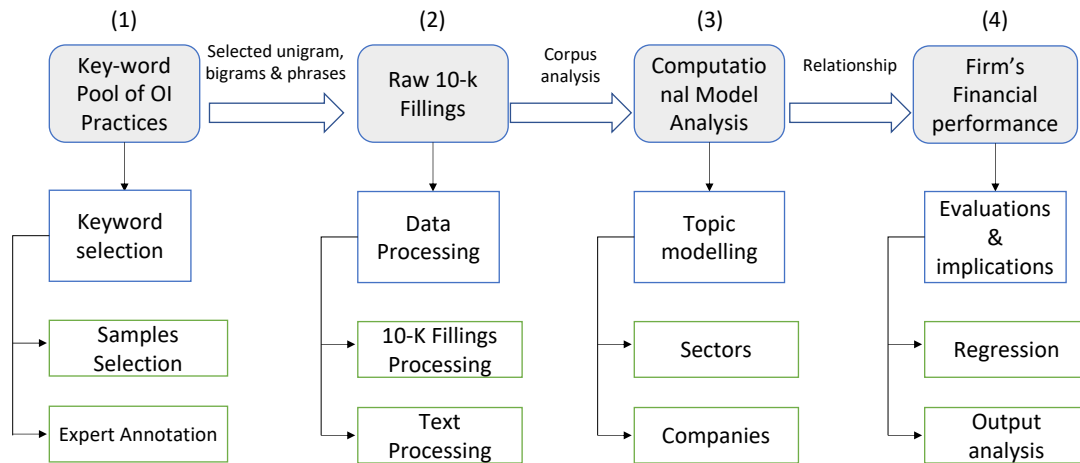
Firm financial performance:

- **Tobin's Q** (2017 - 2019): firm market value/replacement cost of its assets
- Control variables (firm size; capital intensity; prior performance (ROA); R&D intensity; year fixed effect; sector fixed effect). WRDS CRSP Database.

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32

32

Research process

(1)	(2)	(3)	(4)

Key-word Pool of OI Practices → *Selected unigram, bigrams & phrases* → Raw 10-k Fillings → *Corpus analysis* → Computational Model Analysis → *Relationship* → Firm's Financial performance

Keyword selection | Data Processing | Topic modelling | Evaluations & implications

Samples Selection | 10-K Fillings Processing | Sectors | Regression

Expert Annotation | Text Processing | Companies | Output analysis

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33

33

Selected topics of OIPs derived from keywords

Topics	Key words
1. Network & community	data, advertis, **campaign**, measur, **platform** , buyer, collect, technolog, content, **third-parti**
2. Customer engagement	**custom**, softwar, solut, **partner**, data, servic, provid, **platform**, manag, applic
3. Partnership & joint venture activities	**properti**, **partnership**, oper, interest, real, **joint_ventur**, estat, **partner**, manag, million
4. Industry-academia collaboration	Program, **institute**, educ, student, **author**, school, **univers**, titl, require, **educ_program**
5. Contracts & IP licensing	**licens**, **agreement**, **patent**, product, develop, commerci, certain, **collabor**, **grant**, exclus
6. Bilateral transactional activities	**franchise**, restaur, oper, develop, **agreement**, **franchis**, sale, market, local, **licens**

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34

34

OIP distribution
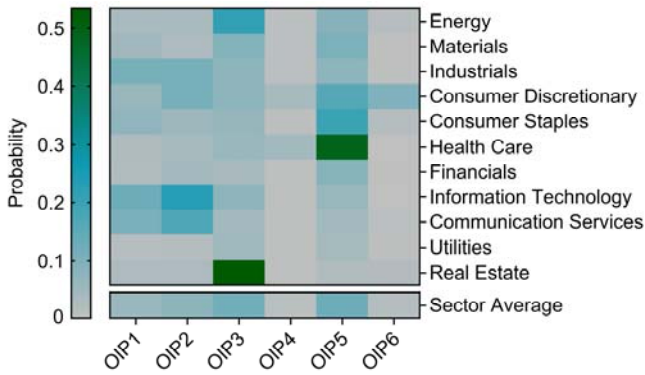
OIP1: Network & community;
OIP3: Partnership & joint venture activities;
OIP5: Contracts & IP licensing;

OIP2: Customer engagement;
OIP4: Industry-academia collaboration;
OIP6: Bilateral transactional activities.

OIP distribution: not evenly distributed. OIP5 (*Contract & IP licensing*) and OIP3 (*Partnership & joint venture activities*) are adopted more frequently compared to other OIPs.

Missing OIPs: Two OIPs were not found in our corpus: crowdsourcing and intermediaries

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35

35

The relationship between OIPs and firm performance

OIP impacts on firm performance

	Model 1	Model 2
DV	Tobin's Q	Tobin's Q
OIP1		0.286
		(0.238)
OIP2		1.590***
		(0.207)
OIP3		0.179
		(0.214)
OIP4		1.327***
		(0.414)
OIP5		0.329**
		(0.164)
OIP6		1.513***
		(0.370)
OIP_sum	0.657***	
	(0.109)	
Control variables	Yes	Yes
No. of Obs.	6590	6590
R-squared	0.360	0.364

Internal R&D moderation effect

	Model 5	Model 6
DV	Tobin's Q	Tobin's Q
OIP1		0.586** (0.249)
OIP2		0.956*** (0.235)
OIP3		0.104 (0.222)
OIP4		0.659 (0.462)
OIP5		0.642*** (0.169)
OIP6		1.654*** (0.357)
OIP_sum	0.762*** (0.110)	
RDI*OIP_sum	-1.640*** (0.619)	
RDI*OIP1		-5.815*** (1.836)
RDI*OIP2		7.551*** (1.615)
RDI*OIP3		-0.498 (0.866)
RDI*OIP4		2.195** (1.107)
RDI*OIP5		-1.754*** (0.640)
RDI*OIP6		-50.078 (30.813)
Control variables	Yes	Yes
No. of Obs.	6590	6590
R-squared	0.406	0.416

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36

36

18

Discussion

- New methods allow new insights!

  - 3,000 firms able to be measured, across 11 sectors

  - Open innovation <u>is</u> associated with improved firm performance

  - BUT, open innovation practices vary in their performance impact

  - AND, the impact of open innovation practices varies by economic sector

  - THEREFORE, **<u>no uniform set of Best Practices exists</u>** to practice open innovation effectively.

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37

37

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38

Open Innovation Challenges Today?

- The Dark Side of Open Innovation
  - Who owns the data?
  - What rights do users have?
  - When is licensing pro-competitive, and when is it anti-competitive?
- From Globalization to Resilience
  - Is Closed Innovation making a comeback?
  - How will geopolitical tensions affect the use of Open Innovation?
  - Can Open Innovation contribute to the achievement of the SDGs?

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39

39

The Growth of Open Innovation Institutions

- Several dedicated conference events each year
  - OUI
  - AOM PDW (also Best Scholar-Practitioner award at AOM this year)
  - WOIC
- Weekly research seminar on open innovation at Berkeley
- Several special issues and special sections on Open Innovation
- Several dedicated Chairs in Open Innovation
  - LUISS
  - TU/e
  - Purdue Engineering School
- Many young Open Innovation scholars receiving promotions
- Today's PICMET Fellow award – may it inspire others to go further

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40

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2003

2006

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2011

2014

41

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41