

IMPACT OF ACADEMIC ENTREPRENEURSHIP ON SCIENTIFIC ACTIVITIES: AN EXAMPLE OF POLICY RESEARCH FROM SOCIOLOGY OF SCIENCE

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SHARING OF SCIENTIFIC RESOURCES IN ACADEMIA

- ✘ Common practice
 - + Frequent sharing: e.g., 4-5 requests per year in biomedicine (Walsh, et al., 2007)
 - + High compliance: 80%-90% of requests (Campbell, et al., 2002; Walsh, et al., 2007)
 - * Scientific resources: research data and materials
- ✘ Underpinned by a strong norm for sharing
 - + Sharing is important for progress of science: replication, efficiency, standardization, cumulative discovery
 - + Consistent with the norm of communism (Barber, 1952; Merton, 1973)
- ✘ Policies for sharing (Eisenberg, 2006; Schofield et al., 2009)
 - + UPSIDE (National Academies): share with all, free and without conditions
 - + NIH sharing policies
- ✘ Mechanism to suppress non-sharing & enforce norm
 - + Sanctions (Coleman, 1990; Hechter, 1987): obstruction for employment, bad rumors, no support in the future , etc.
 - + Regulations by funding agencies, academic journals: obligation of sharing for grantees and authors

SHARING OF SCIENTIFIC RESOURCES IN ACADEMIA

- ✘ Still, norms are contextual, not completely followed
 - + Science is integrated in a socio-political system (Blume 1974)
 - + Norms depend on social, economic, and political system of society (Blume 1974, Frickel 2005)
 - + Norms are influenced by scientific fields, historical periods, organizational contexts (Hackett 1990)

- ✘ Existence of counter-norms (Mitroff 1974)
 - + Scientists are under the tension between norms and counter-norms

- ✘ Systemic anti-normative forces against sharing
 - + Competition, cost of sharing, commercialism, etc. (Cohen and Walsh, 2008; Merton, 1973; Stephan, 1996)

- ✘ Thus, practice/norm for sharing is affected by social context

ACADEMIC ENTREPRENEURSHIP (AE) VS. SHARING PRACTICE

- Growing concern about adverse effects of academic entrepreneurship (AE)
 - + Emphasis on commercialization, link with industry, etc. (e.g., Slaughter & Leslie 1997; Etzkowitz 1998)
 - + Global phenomenon: policy changes in US, Japan, Europe, etc.
 - + Undermines the norm of communism (scientific commons) and deters scientific advancement (e.g., Dasgupta & David 1994; Nelson 2004)

- × Empirical evidence
 - + Commercial activity, industry collaboration, and patenting
 - × Discourage sharing of research data and materials (e.g., Blumenthal et al., 1997; Blumenthal et al. 2006; Walsh et al., 2007; Campbell, 2000; Murray & Stern 2007; Vogeli, 2006)
 - + Increasing denial of requests for material transfers (Walsh 2007; Campbell 2002)

COMPLIANCE AND DENIAL IN US

× Frequency of requests

- + US Agriculture: 3 times/year (Lei 2009)
- + US Biomedical: 3.5 times/year (Walsh 2007)
- + US Life science: 3 times/year (Campbell 2002)

× Denial

- + US Genomics: 18% (2003-2004: Walsh 2007)
 - × Increase from 10% (1997-1999: Campbell 2002)

MOTIVATION OF THE STUDY

- ✘ Strong evidence on the conflict between AE and sharing specifically in the US
 - + How about the case in other countries like in Japan?
- ✘ Still remains theoretical questions about the impact of AE context on sharing
 - + What has happened to the majority of scientists who are not participating in AE?
 - + AE might have not only deterred sharing, but also changed the forms of sharing?

RESEARCH SETTING & DATA: JAPANESE UNIVERSITIES

- ✘ Policy reform toward AE regime
 - + Attempt to copy US system in response to the economic stagnation in the 1990s (Nagaoka 2009)
 - + Change in legal framework
 - ✘ Technology Transfer Law (1998)
 - ✘ Japanese Bayh-Dole Act (1999)
 - ✘ Relaxation of National Public Service Law (2000)
 - ✘ Patent system reform (2002-)
 - ✘ Incorporation of national universities (2004)
 - + Result was greater policy emphasis and actual rates of AE (Walsh, et al., 2008)

- ✘ Japanese scientist sample
 - + Relatively recent rise in AE
 - ✘ Still heterogeneity in the stance toward AE
 - + Focus on the impact of field-level AE
 - ✘ Measured by AE activities averaged in each scientific field

RESEARCH SETTING & DATA: SURVEY

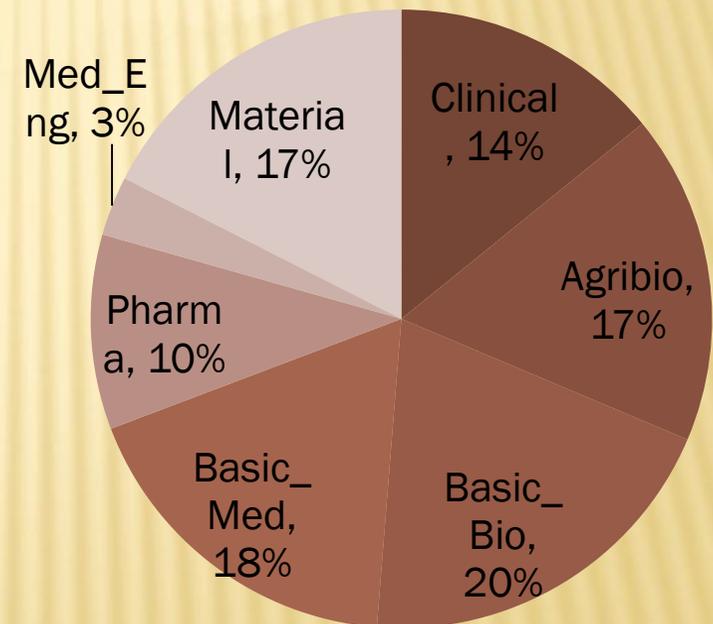
- ✘ Survey data of Japanese scientists
 - + 698 professors (full & associate) in Japanese universities
 - + 42% response rate (out of 1,674 scientists)
 - + Life science & Material science (16 fields)
 - + Research active (National grantees within 5 years)
 - + Feb-Apr 2009

- ✘ Focus on a specific form of sharing
 - + Material transfer
 - e.g., reagents, cell lines, chemical compounds, model animals

SAMPLE DESCRIPTION

Private university	9%
PRO	16%
The year when the 1 st degree was given	1988
#Labs previously experienced	2.81
#Years in the current lab	13.0
#PhD in the lab	5.74
#Publication/year	5.77
#Patent/year	0.62

Research field



DESCRIPTION: MATERIAL TRANSFER

**%Received at least one request
(in 2 years)**

61%

Requests (received) / year

2.6

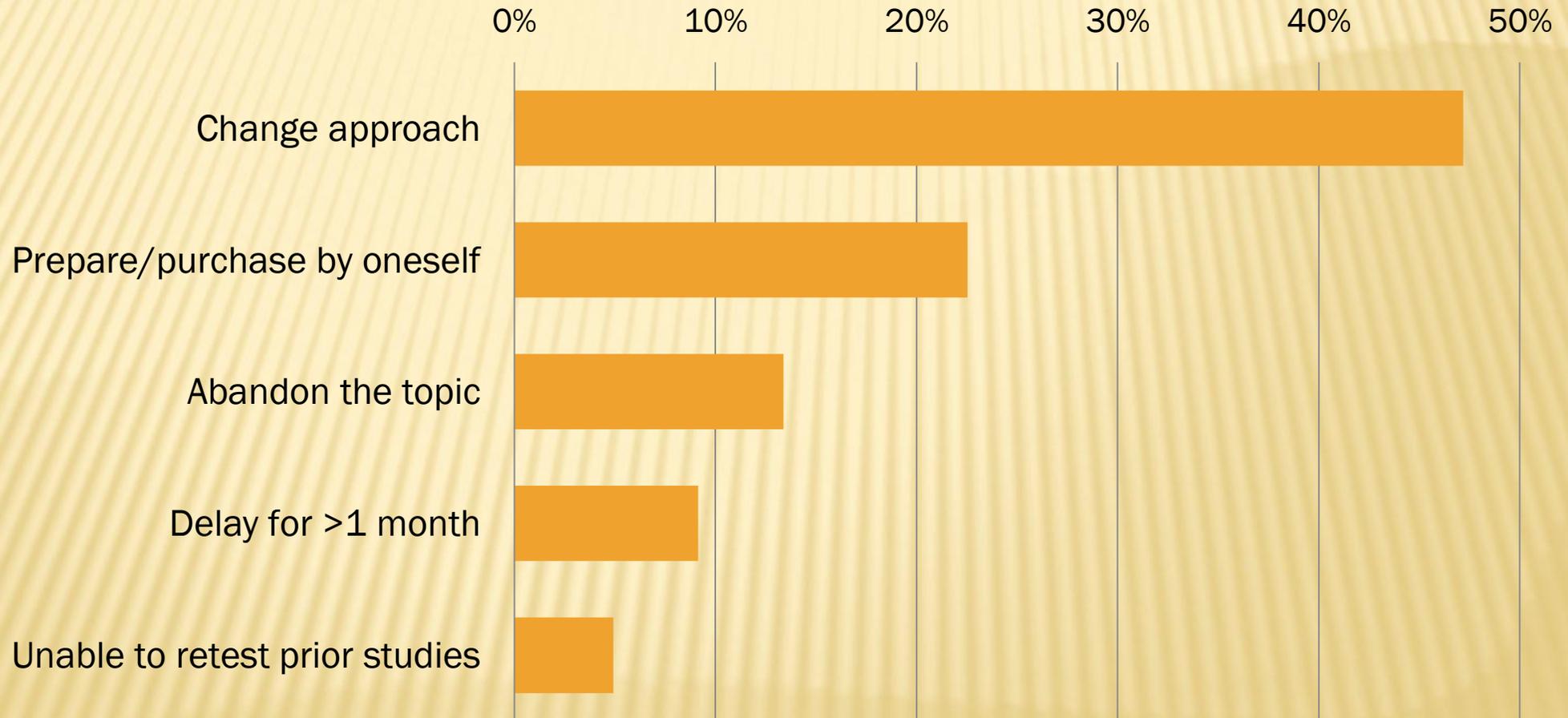
% Denial for the latest request

8.7%

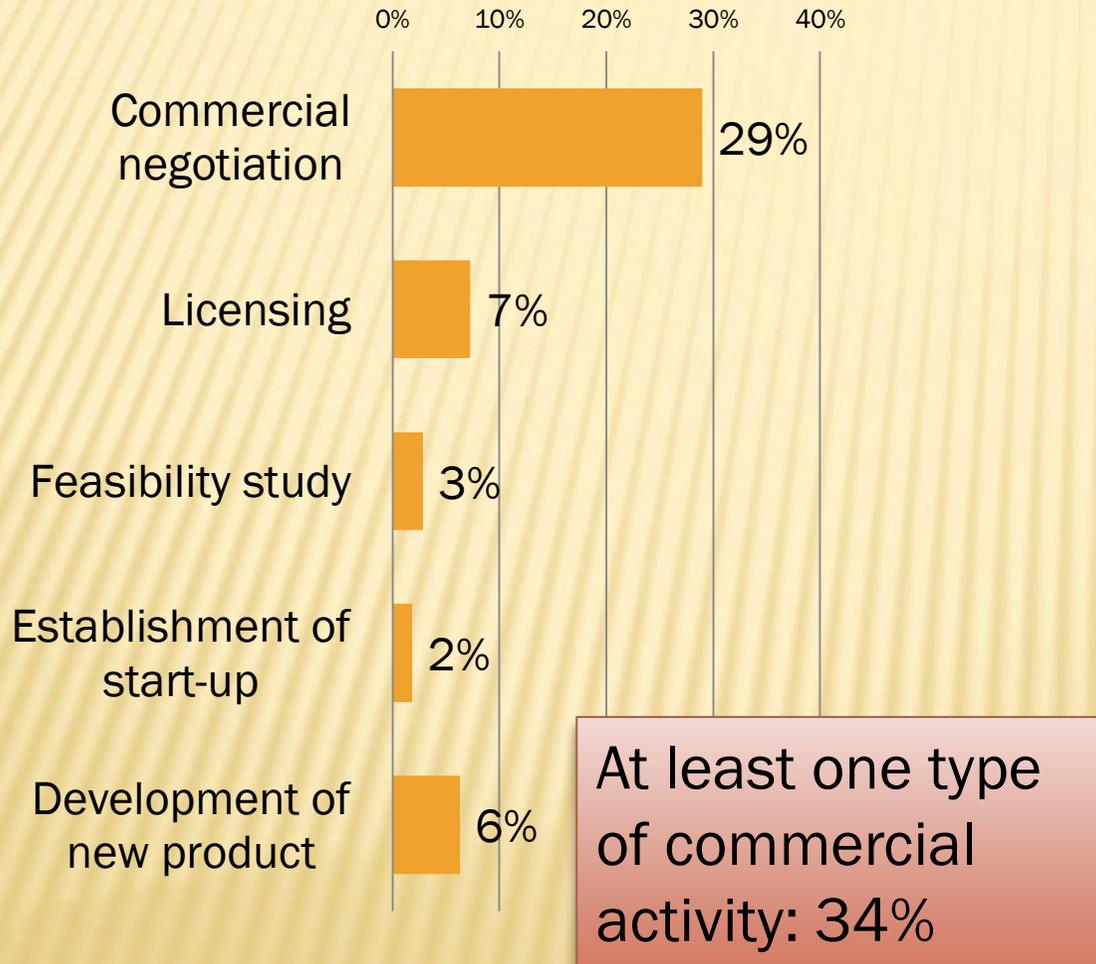
% Co-authorship offered

50%

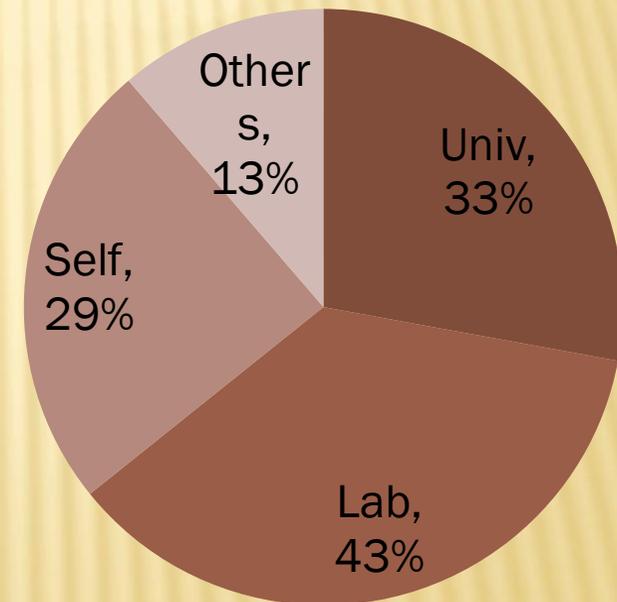
CONSEQUENCE OF BEING DENIED



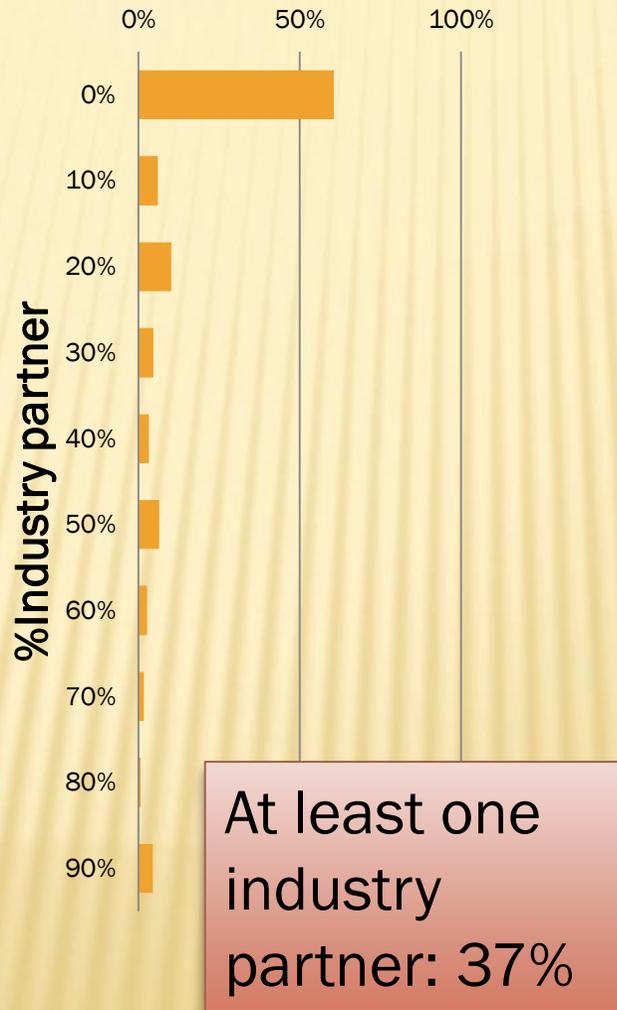
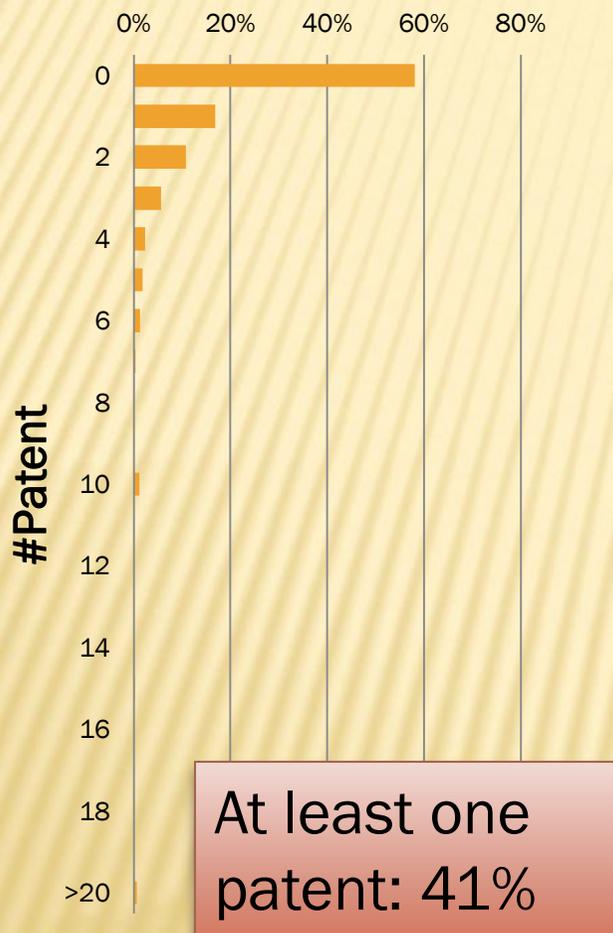
DE-MOTIVATING FACTOR ENTREPRENEURIAL ACTIVITY (1)



Distribution of commercial income



DE-MOTIVATING FACTOR ENTREPRENEURIAL ACTIVITY (2)



DE-MOTIVATING FACTOR ENTREPRENEURIAL ACTIVITY (3)

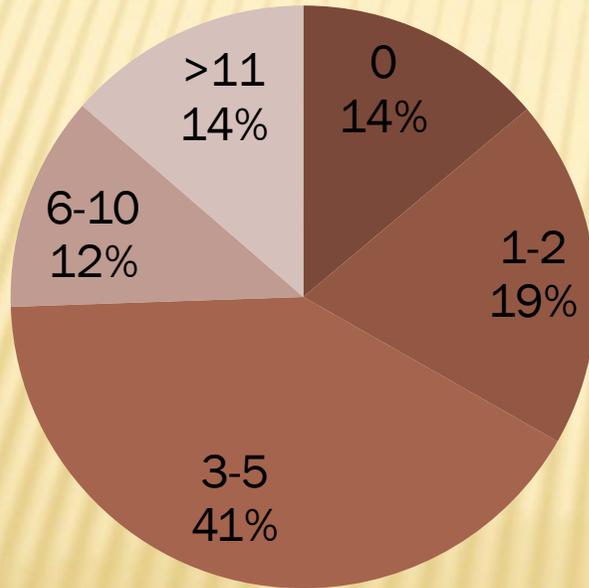
	Yes group		No group		T-test
	N	%Denial	N	%Denial	
Involved in commercial activities	192	10%	291	8%	n.s.
Early stage (negotiation & feasibility study) ^a	109	15%	291	8%	n.s.
Late stage (start-up & new technology on market) ^a	46	2%	291	8%	n.s.
Licensing income ^a	37	8%	291	8%	n.s.
Collaborated with industry	186	9%	316	9%	n.s.
Received industry fund	237	10%	254	8%	n.s.
Applied patents	224	11%	271	7%	n.s.
Requested material is patented	68	10%	309	8%	n.s.
Requested material is related to commercial activities	26	19%	476	8%	†

† p<0.10; * p<0.05; ** p<0.01

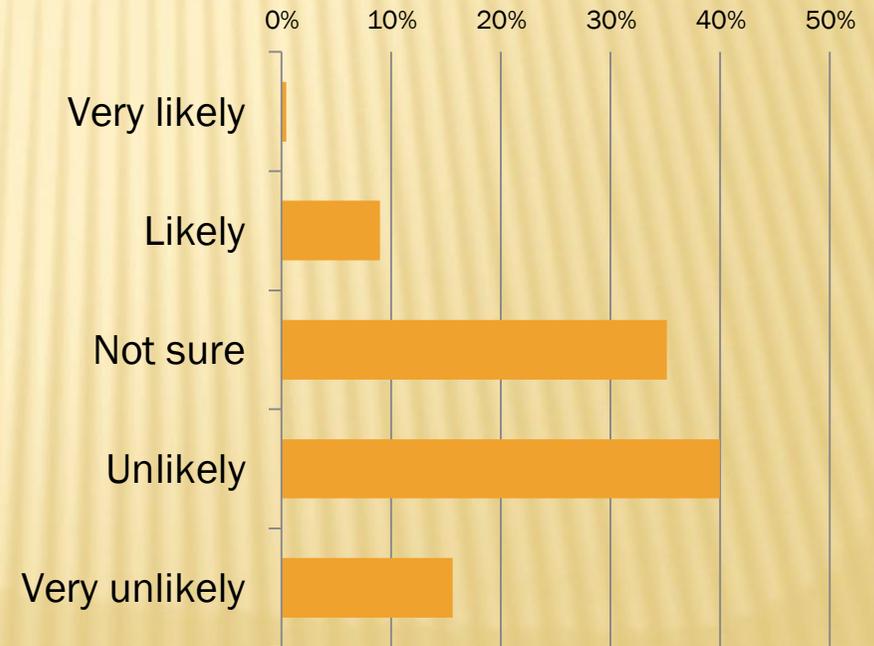
a. Comparison with non-commercially active scientists

DE-MOTIVATING FACTOR COMPETITION (1)

How many research groups could compete with your research group?



For the latest request you received, how likely did you think you will compete with the consumer?

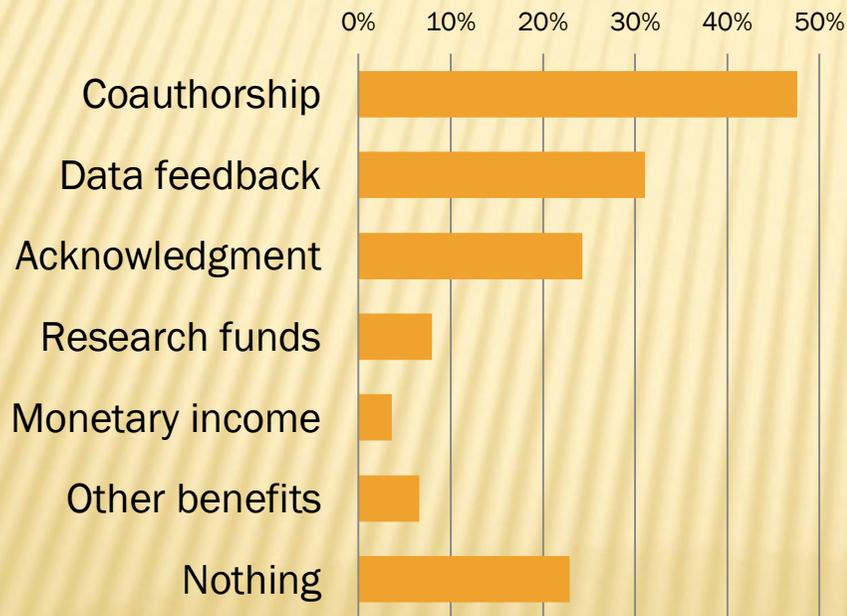


DE-MOTIVATING FACTOR COMPETITION (2)

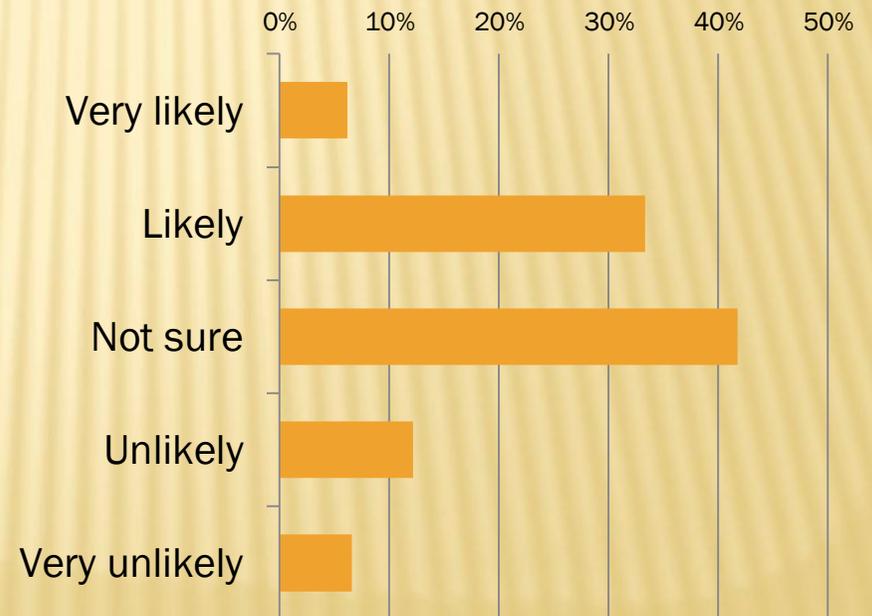
	Yes group		No group		T-test
	N	%Denial	N	%Denial	
Likely to compete with the consumer	47	15%	453	8%	n.s.
More than 6 competitor	135	11%	362	8%	n.s.

MOTIVATION FACTOR EXCHANGE (1)

What kind of benefits did you expect provided that you gave your material?



For the latest request you received, how likely did you expect that the relationship with the consumer will benefit you



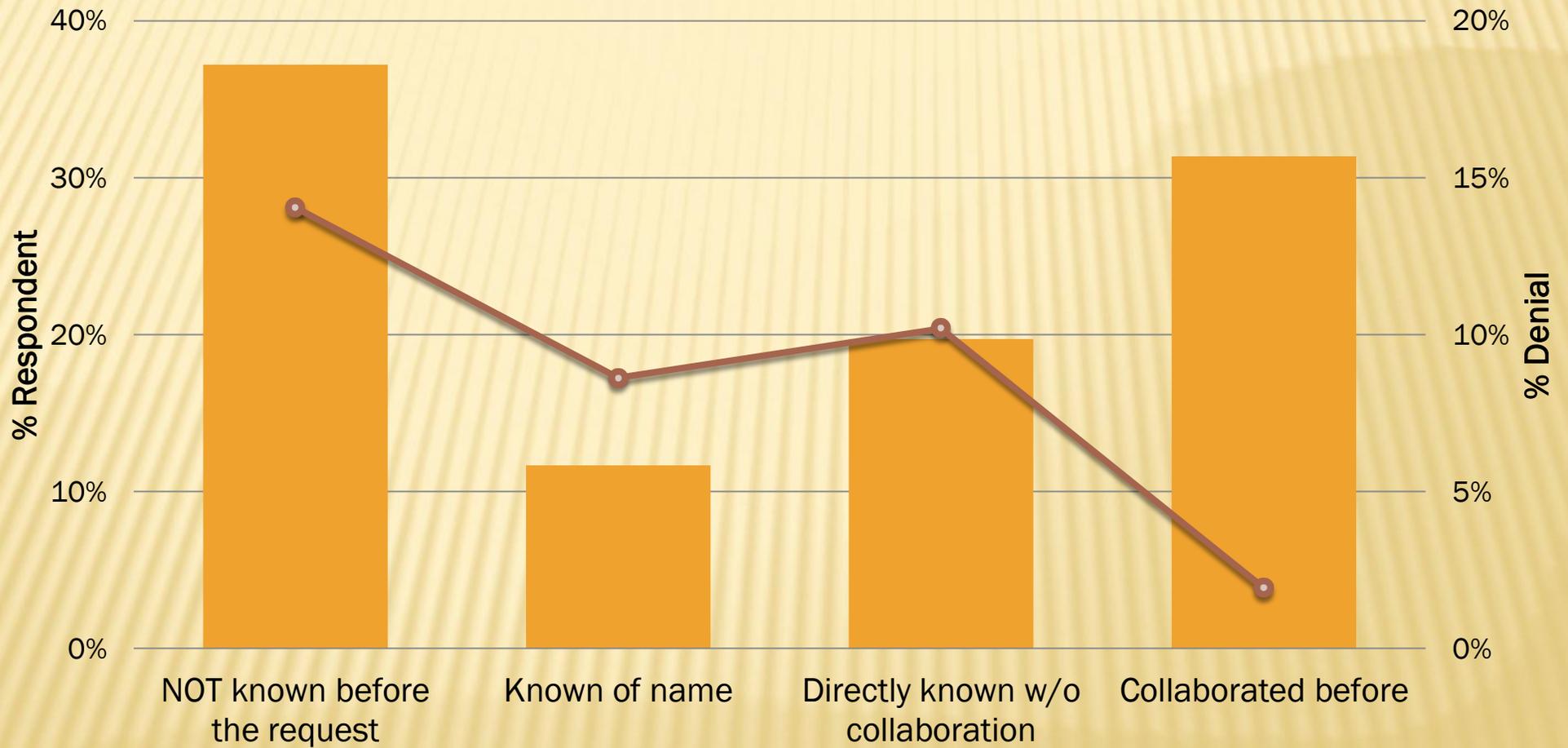
MOTIVATION FACTOR EXCHANGE (2)

	Yes group		No group		T-test
	N	%Denial	N	%Denial	
Material transfer leads to a certain form of return ^a	386	6%	115	17%	***
Coauthorship	238	5%	115	17%	***
Data feedback	155	6%	115	17%	**
Acknowledgement	122	7%	115	17%	*
Research funds	40	8%	115	17%	n.s.
Monetary income	18	11%	115	17%	n.s.
Relationship with the consumer is useful in the future	197	5%	303	12%	**

† p<0.10; * p<0.05; ** p<0.01

a. Comparison between requests with return in each form and requests without return.

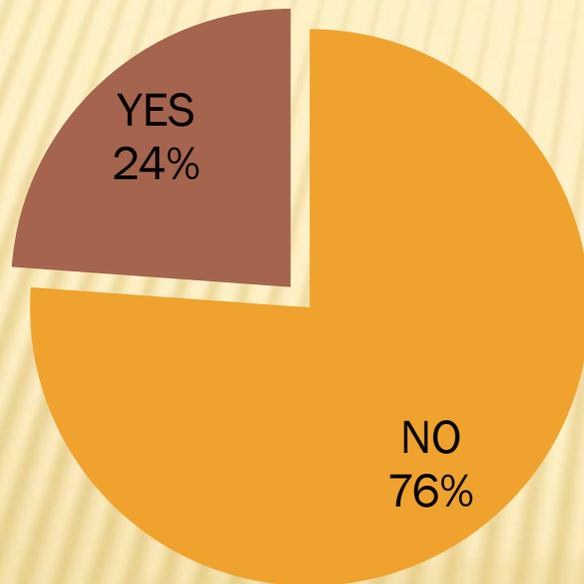
MOTIVATION FACTOR PREVIOUS RELATIONSHIP



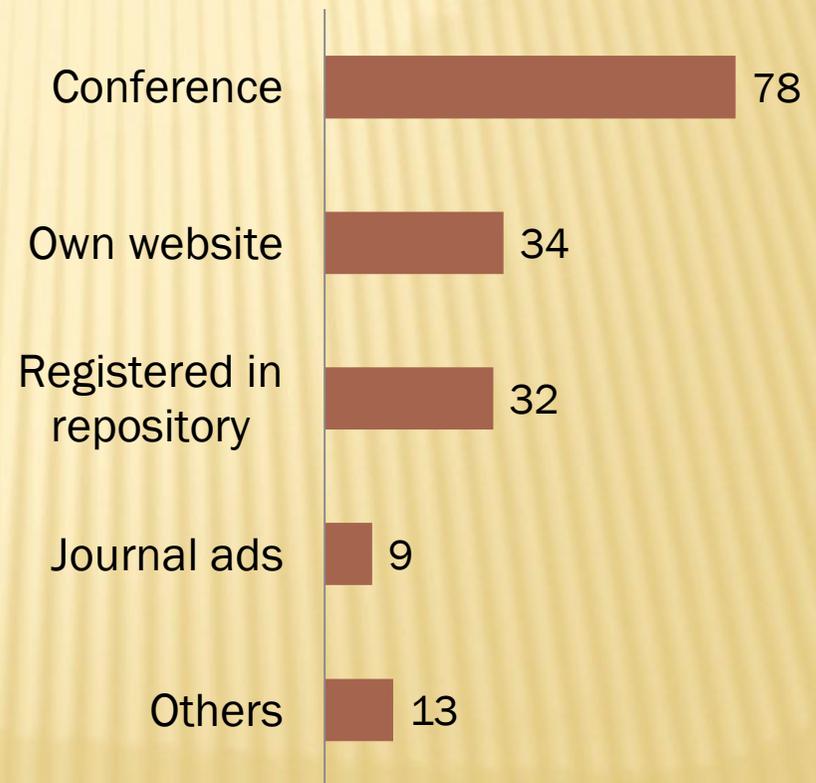
*ANOVA: $p < .01$

PUBLICLY SHARED MATERIAL

Do you have a research tool which is widely provided without charge through publicly accessible channel?

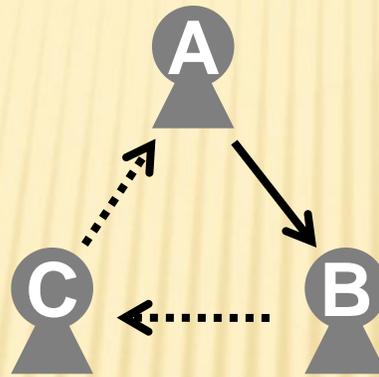


Media of Publication



THEORETICAL EXPLORATION: INTRODUCING SOCIAL EXCHANGE THEORY

Generalized exchange (GE)



-
- Unilateral transaction
 - Giver not reciprocated by recipient, but possibly by a third person
 - e.g., sharing in traditional academia (free and without conditions)

MECHANISMS TO SUSTAIN GE

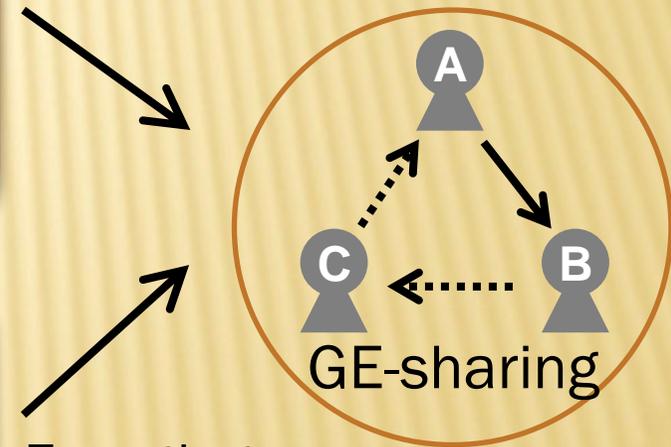
Collective mechanism

- Norm of reciprocity
(Gouldner 1960; Ekeh, 1974; Uehara, 1995)
- Sanctions to sustain collective actions
(Yamagishi 1986; Yamagishi 1988)

Individual benefit

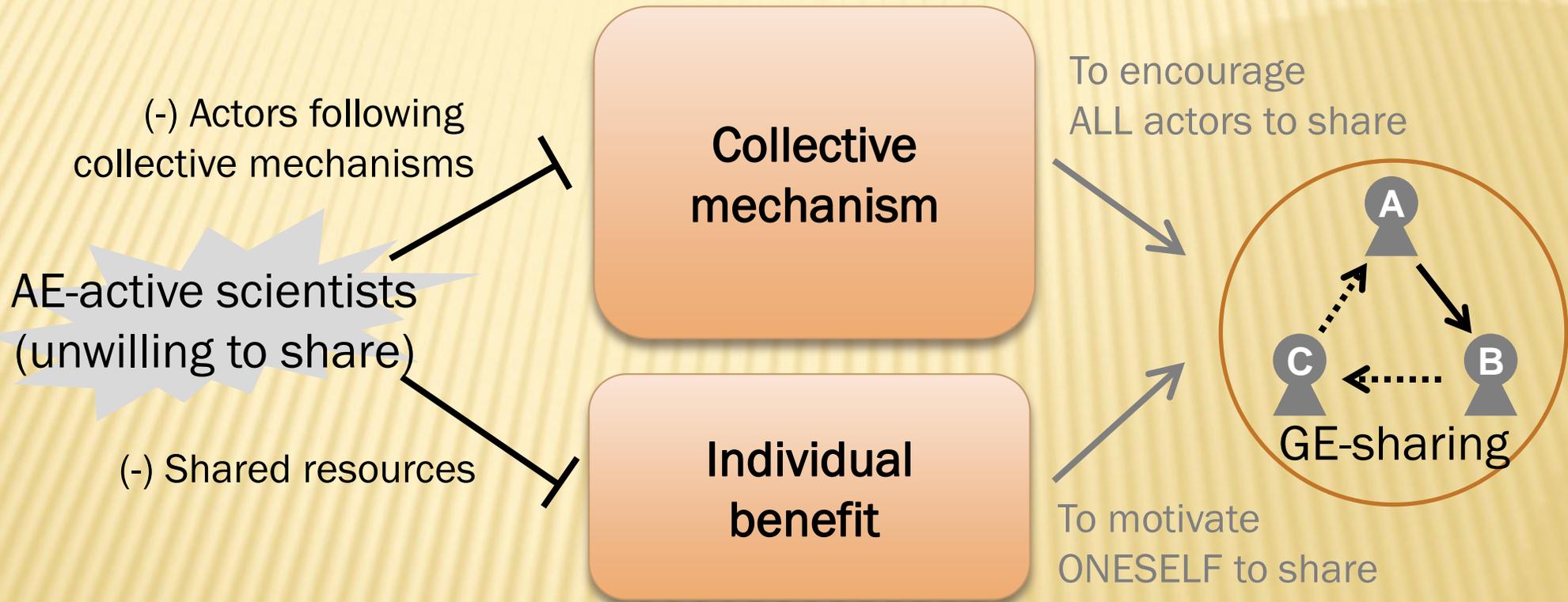
- Actors in exchange system are just benefit seekers (e.g., Emerson, 1987)

To encourage
ALL actors to share



To motivate
ONESELF to share

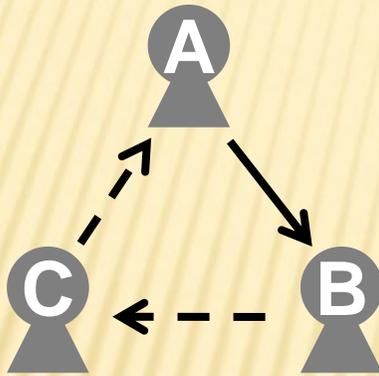
DETERIORATION OF GE-SHARING



H1: As AE prevails, GE-sharing is more likely to be denied.

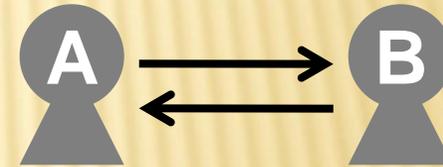
SHIFT IN SHARING FORMS: PREVAILING AE ENDS UP IN A DECREASE OF SHARING?

Generalized exchange (GE)



- Unilateral transaction
- Giver possibly reciprocated by a third person
- High risk of non-reciprocity (Takahashi, 2000; Yamagishi & Cook, 1993)
Innately, but more true in AE context

Direct exchange (DE)



- Direct contribution by 2 actors
- Based on promise or expectation of reciprocity from recipient
- Reduced risk of non-reciprocity (Molm, 1994; Molm et al., 2007)

SHIFT IN SHARING FORMS

- ✘ Secure reciprocity at the time of giving
 - + When requested for sharing, suppliers (who give) demand compensation from consumers (who receive) (a form of DE (*negotiated exchange*); Emerson 1981)
 - + e.g., sharing based on coauthorship, etc.

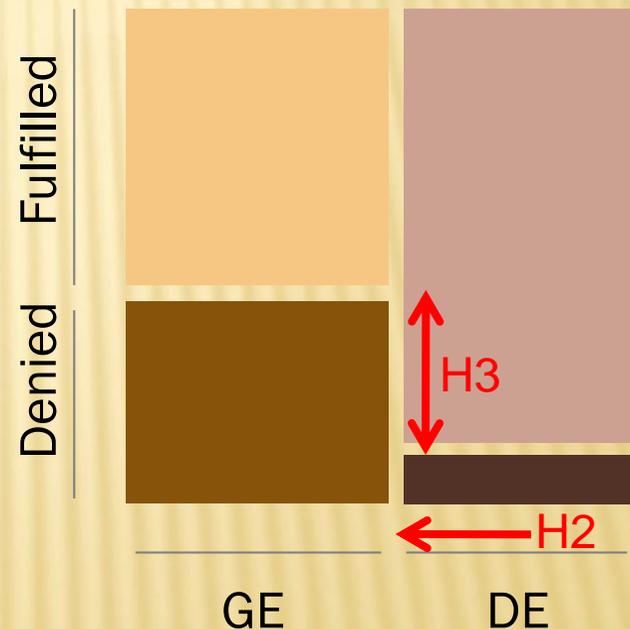
 - ✘ Restrict the network of generalized exchange
 - + In a small network, members can strictly monitor each other
Reduced to a 2-member unilateral reciprocity (another form of DE (*reciprocal exchange*); Emerson 1981)
 - + e.g., sharing based on expectation of future support, etc.
- Greater preference on direct exchange (DE) sharing

SHIFT IN SHARING FORMS

Low AE prevalence



High AE prevalence



H2: As AE prevails, %DE increases while %GE decreases

H3: As AE prevails, $(P[\text{denial for GE}] - P[\text{denial for DE}])$ increases

MEASURES

Individual-level AE-activity

- Commercial activity
 - Industry collaboration
 - Industry funding
- (Yes=1/No=0 for each)

Denial for the latest request

- Denied=1, Fulfilled=0



Latest request received

Field-level AE prevalence

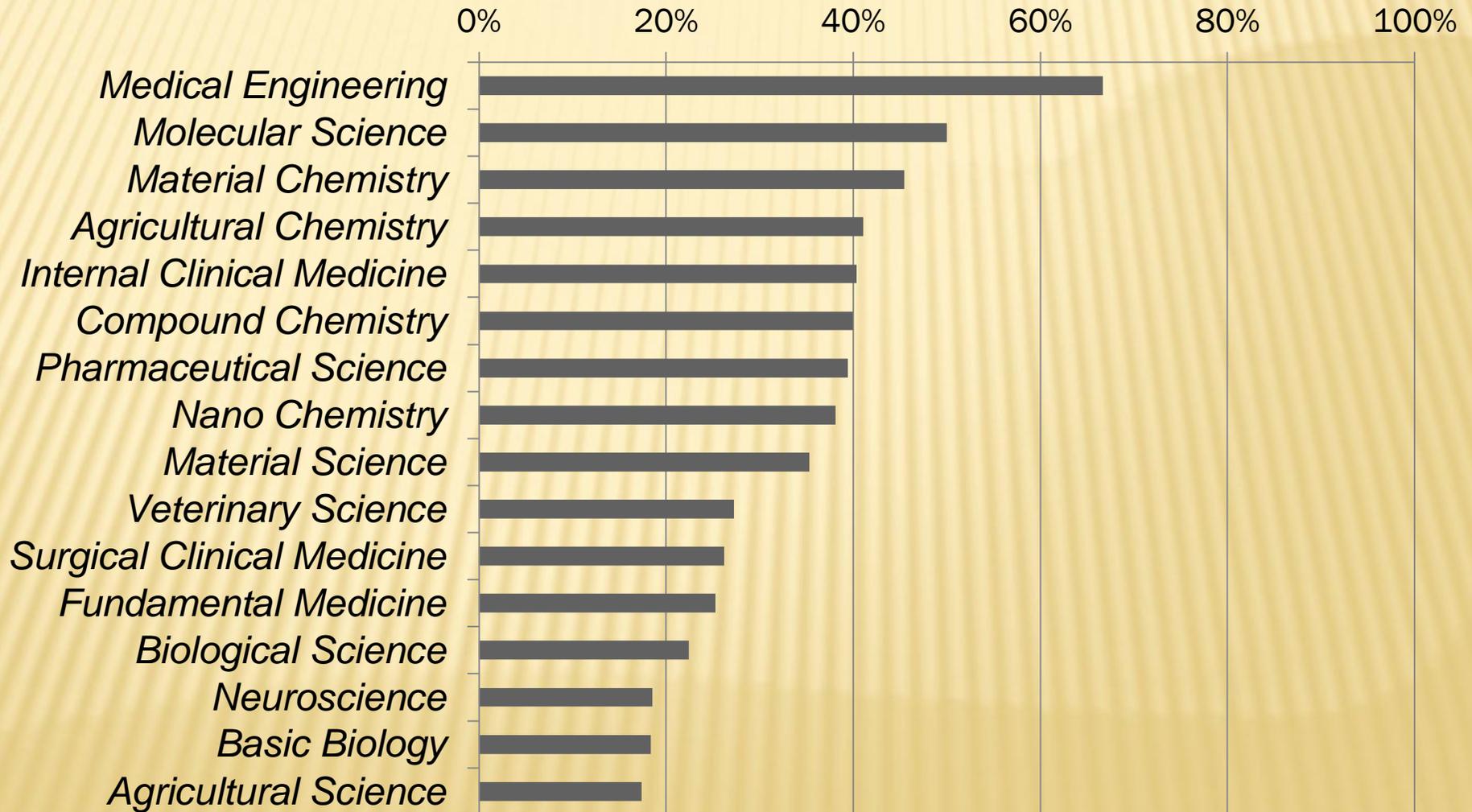
- %AE-active scientists at 16 field level

Forms of sharing

- Expect coauthorship (Yes=1)
- Expect future support (Yes=1)

DESCRIPTION: FIELD-LEVEL AE PREVALENCE

% SCIENTISTS INVOLVED IN COMMERCIAL ACTIVITIES



CONCLUSION : IMPACT OF PREVAILING AE

- ✘ Broader impact of entrepreneurship
 - + Not only AE-active scientists but any scientists in AE prevailing fields tend to withhold
 - ✘ Weakening norm for sharing in specific academic fields
- ✘ Shift in sharing forms
 - + From generalized exchange toward direct exchange
 - ✘ To secure reciprocity
- ✘ Decrease in total sharing
 - + Limitation of direct exchange
 - ✘ Suppliers may not be satisfied with the offered return
 - ✘ Consumers may not want to give authorship, etc.
 - ✘ Suppliers may demand unreasonably costly reciprocity

DISCUSSION

✘ Implication:

Shift to hybrid norms of industry and open science (e.g. Murray, 2010; Owen-Smith, 2003)

- + Need to encourage generalize exchange (GE) sharing
 - ✘ Secure the benefits for suppliers by community (e.g., Rome agenda for mouse lines)
 - ★ Guideline of acknowledgment, etc.
 - ★ System to increase the exposure of suppliers
 - ★ (Central repository of research tools, etc.)

✘ Limitation

- + Specificity of sample, research context
 - ✘ Japanese culture, material transfer
- + Endogeneity
 - ✘ Field-level AE may be caused by DE-oriented culture
- + Self-report measures
- + Social exchange: not completely controlled test