

# Relationship between utilization of acquired technology by patent acquisition and subsequent patent production

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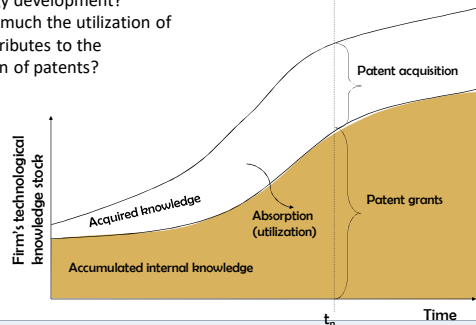
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## Introduction

### Research Question

- Does the acquisition of external technology lead to subsequent internal technology development?
- Can we verify the relationship between utilization of acquired technology and the subsequent technology development?
- Can we measure how much the utilization of acquired patents contributes to the subsequent production of patents?

- The citation of acquired patent by acquirer after an acquisition is considered to be evidence of the use of acquired patents.



## Data

- Data prepared by merging PATSTAT (EPO) and patent re-assignments (USPTO)
- Date collected for the patentees who have ever
  - acquired patents through the patent market or the tech M&A(2007-2011)
  - been granted patents in two period(2007-2011/2012-2016).
- The dataset covers only US patent grants.

Table 1. Variables: descriptions and summary statistics

Variable	Definition	Obs.	Mean	Std.dev	Min.	Max.
G1	The number of granted patents per patentee and technology field in 2007-2011	30,686	32.37	182.79	1	16,296
G2	The number of granted patents per patentee and technology field 2012-2016	30,686	44.78	266.86	1	25,966
A1	The number of patent acquired from outside per patentee and technology field in 2007-2011	30,686	14.11	85.83	1	7,810
GR_INC	Increase of the number of patents granted : G2/(G1+G2)	30,686	0.159	0.265	0	0.999
AbsR	The ratio of patents cited by acquirer to the acquired patents	30,686	0.216	0.331	0	1
ExtR	The ratio of acquired patents to the all the patents that assigned to the acquirer: A1/(G1+A1)	30,686	0.393	0.262	0.001	0.998

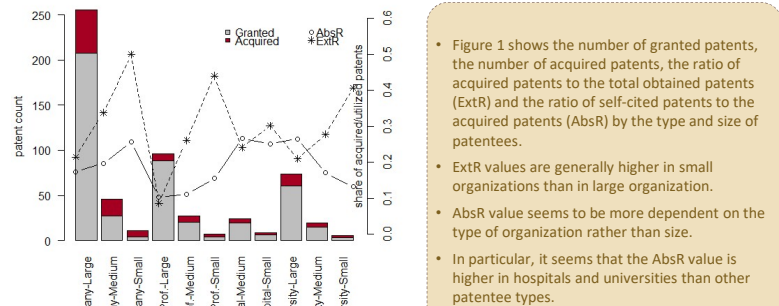
- The acquirers are categorized into four sector-groups according to the definition by EPO: company, government or non-profit organization (Gov./Non-Prof.), university and hospital.
- The acquirers are also categorized into three size-groups as suggested by Serrano (2010): small ( $\leq 5$  grants per year), medium ( $\leq 100$  grants per year) and large ( $> 100$  grants per year).
- The patents are assigned to one or more technology fields among 35 EPO technology classifications.

## Conclusion

- The utilization of technology acquired by patent acquisition affects subsequent patent production in the associated technology field of the organization.
- For more active organizations in self-citing, acquired patents produce more subsequent patents than less active organizations after controlling the organization type and the technology field of an acquired patent.
- Among the various ways to utilize technology acquired by patent acquisition, self-citation enhances the appropriability of innovation protected by acquired patent (Trajtenberg et al. 1997).
- The attempt to increase the appropriability of acquired technology by patent acquisition is believed to be the reason that self-citing an acquired patent is more active in the private sector, small-scale, and medical/pharmaceutical sectors as suggested in the results of the Scheffé test.
- An interesting follow-up study could be a comparative analysis on how the way of utilizing technology acquired by patent acquisitions varies depending on the sector and size of an organization and technology field.

## Results and Discussion

### Patent utilization differences in the type of buyers and technology field



- Figure 1 shows the number of granted patents, the number of acquired patents, the ratio of acquired patents to the total obtained patents (ExtR) and the ratio of self-cited patents to the acquired patents (AbsR) by the type and size of patentees.
- ExtR values are generally higher in small organizations than in large organization.
- AbsR value seems to be more dependent on the type of organization rather than size.
- In particular, it seems that the AbsR value is higher in hospitals and universities than other patentee types.

Figure 1: The mean value distribution of variables by the acquirer types and sizes

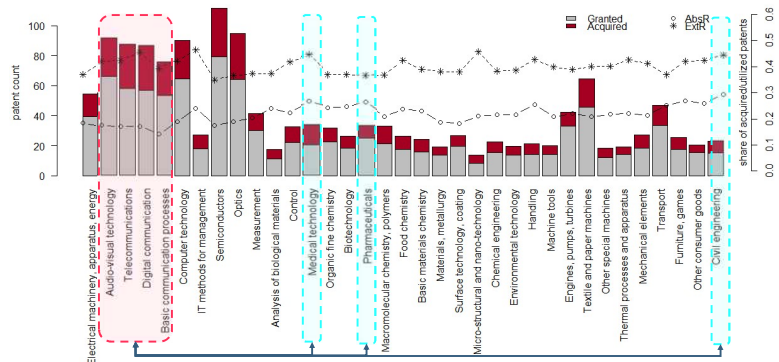


Figure 2: The mean value distribution of variables by the technology fields

- Figure 2 shows that the number of granted/acquired patents and ExtR/AbsR values varies by technology fields.
- The pairwise comparison test in the analysis of variance according to Scheffé method was performed to find out statistically significant differences among mean values of AbsR.
- The result of Scheffé test shows significant differences between
  - small size organizations and other size organizations
  - private companies and universities/governments/non-profit organizations
  - the specified pairs of groups described in Figure 2

### Relation between patent production and utilization of acquired patents

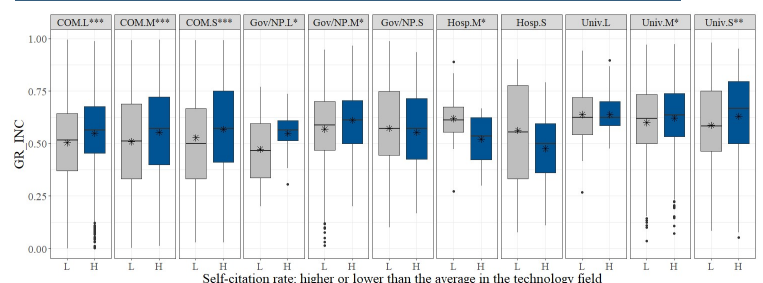


Figure 3: Differences in patent growth by self-citation rate and buyer types (with significance code)

- Figure 3 describes that there are differences in patent growth between the groups with higher and lower rate of self-citation (citations of acquired patent by acquirer after acquisition) than technology-average rate of self-citation.
- The patent growth is high when the self-citation rate is high in the all company groups, large/medium Gov./Non-Prof. groups and medium/small university groups.
- In other groups, the differences are in the opposite direction or not significant.
- The t-test results showed that the differences are significant except for small Gov./Non-Prof., small hospital and large university.

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