PATLISYS-J
An analysis of the Achievements of JST Operations through Linkage between Patents and Papers

Japan Science and Technology Agency
Mari Jibu

Collaborated with
M. Kawasaki, M. Kuniya
A review of current Federal efforts related to the science of science policy

- Examination of the data that are available for analysis
- Development of a literature synthesis that brings together academic research from many different disciplines
- Development of a roadmap that would chart a path forward for the Federal government to build a community of practice as well as tools in the science of science policy
Background
日本の状況

Political Leadership
Two Prescriptions for boosting effectiveness of the growth strategy
1. Thoroughly analyze goals and policies, adding new measures as needed
2. Craft and ensure the roll-out of the “Growth Strategy Implementation Plan”
   - Determine a timetable for the “Growth Strategy Implementation Plan”
   - Institute a system for examining and evaluating the progress of each measure

「政治的なリーダシップ」～成長戦略を実行をあげるための2つの処方箋～
1. 目標・施策の深掘り、新たな施策の追加
2. 「成長戦略実行計画」策定とその実行確保
   - 「成長戦略実行計画」（工程表）を策定
   - 各政策の達成状況を評価・検証する仕組みの採用

September 16, 2009
Yukio Hatoyama Administration
(The 93rd Prime Minister)
鳩山幸夫内閣誕生

November 11-27, 2009
The Japanese Government Revitalization Unit (GRR) reviewed the Science and Technology Budget Requests
行政刷新会議による事業仕分け

December 30, 2009
New Growth Strategy (Basic Policies) Toward a Radiant Japan
新成長戦略（基本方針）～輝きのある日本へ～
Innovativeness of a society for sustainable products depends on the structure of four autonomous entities: observing scientists, engineering scientists, actors and society (nature). When they make a relevant loop, innovative knowledge emerges in the loop providing those four entities with useful guides to act. Therefore, innovation is developed by not only scientists but also by actors and receptors in society.

持続性科学とは、それぞれ自立的である存在である観察型科学者、構成型科学者、行動者、社会（自然）が作るループの静的構造とその上を流れる物質と情報の動的挙動に関する科学であり、それぞれの知識が静的構造と動的挙動に対する制御の可能性を与えるものである。したがって持続性科学は、科学者だけでなく、行動者とその行動の受け容者（社会、自然）との参加のもとに進展し続ける。
There is a real opportunity to develop new tools and data sets that could be used to quantify the impact of the scientific enterprise thus far on innovation and competitiveness. These impacts could include the generation of knowledge, the health of the universities receiving funding, the growth of the STEM (Science, Technology, Engineering, and Mathematics) workforce, or the growth and survival of those businesses and their workforces most closely linked to the scientific enterprises.
The 2009 Plan for the Promotion of Intellectual Property (June 24, 2009)
With regard to patents and academic papers of universities, studies will be made in the fiscal year 2009 to draw some conclusions on the establishment of a method to count the number of times they are cited in the applications or notifications of reasons for refusal of other patents. These need to be counted per patent, academic paper, inventor, and author. The data will be utilized to evaluate the quality of patents and academic papers as well as to assess researchers.

The Japanese Government Revitalization Unit (GRR) reviewed the Science and Technology Budget Requests. (November 11-27, 2009)
-review selected projects/programs in the budget request for the next fiscal year (JFY2010: April 2010 – March 2-11) with the goal of securing sufficient funds in the next year’s fiscal year’s budget, to enable implementation of policies the Democratic Party of Japan Pledged in its campaign platform last August.
-tagged 447 out of 3,000 projects/programs for review.

Japan Science and Technology Agency (JST)’s Mission:
-promote science and technology in Japan by conducting a broad range of activities, including the following:
* Promotion of consistent research and development from basic research to commercialization with particular emphasis on the creation of new technological seeds
* Upgrading the infrastructure for the promotion of science and technology, including dissemination of scientific and technological information
-developed evaluation system to analyze the linkage between scientific papers and patents for the purpose of assessing the investment effects of its operations.
ANALYSIS METHOD

Database:
Papers: Web of Science, Thomson Reuters
Patents: Derwent Innovation Index (DII), Thomson Reuters
FY1981-FY2008
Total papers: 26,110 (1981-2008)

- exceeded 1,000 in 1999 during the period of the First Science and Technology Basic Plan (FY1996-FY2000)
- surpassed 2,000 papers in 2002 during the Second Science and Technology Basic Plan period (FY2001-FY2005)
- the number peaked in 2007, at 2,915 during the Third Science and Technology Basic Plan (FY2006-FY2010)
- decreased somewhat to 2,765 in 2008

The Second Plan, which advocated the “strategic prioritization of science and technology”, resulted in increased science and technology investments in the field of life sciences, and also led to the greater number of academic papers by JST-funded researchers in life sciences such as molecular biology, genetics, and immunology.
Together with molecular biology and genetics, the JST papers in these fields accounted for about 30% of the total number of times the JST papers were cited.

The number of times cited per academic paper is by far the highest in immunology, accounting to about four times that of molecular biology and genetics.

Sources: Calculated by JST based on data from Thomson Reuters’s Web of Science
596 papers are ranked in the top 1%
90 papers are ranked in the top 0.1%

The number of papers in physics is the highest at 29%, followed by those in molecular biology and genetics, and chemistry.
The number of papers in immunology, the highest at 24%, followed by those in physics.

Sources: Calculated by JST based on data from Thomson Reuters’s Web of Science
How much contribution academic papers of JST-funded researchers have made to technology, patent citing such papers were extracted from the Derwent Innovation Index:

1789 papers: about 6.9% of all papers by JST-funded researchers were cited by patent examiners.

The timing when these papers were cited by patent examiners most frequently was 3 years after their publication, with an average period of 5.28 years.

Sources: Calculated by JST based on data from Thomson Reuters’s Web of Science and Derwent Innovation Index
On a percentile basis, the number of JST-funded academic papers cited by patent examiners. The most frequently cited papers are those ranked in the Top 1%. There are 190 such papers, accounting for 31.88%.

A discipline-based analysis of the academic papers cited by patent examiners shows that the number of academic papers in molecular biology and genetics is the highest, followed by those in physics and then chemistry. In terms of the percentage of total academic papers, those in immunology had the largest share at 22.91%.

Sources: Calculated by JST based on data from Thomson Reuters’s Web of Science and Derwent Innovation Index.
When looking at countries in which patent applications citing the academic papers of JST-funded researchers were filed, the number of hose filed to the U.S. Patent and Trademark Office is the highest, followed by the World Intellectual Property Organization, Australia, and Europe.

Sources: Calculated by JST based on data from Thomson Reuters’s Web of Science and Derwent Innovation Index
IPC codes of patents in which patent examiners cited the academic papers of JST-funded researchers

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<tr>
<th>Rank</th>
<th>IPC Codes</th>
<th>Description</th>
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<tr>
<td>1</td>
<td>C12</td>
<td>Biochemistry</td>
</tr>
<tr>
<td>2</td>
<td>C07</td>
<td>Organic Chemistry</td>
</tr>
<tr>
<td>3</td>
<td>A61</td>
<td>Medical or Veterinary Science</td>
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C12Q-001/68
Measuring or testing processes involving enzymes or microorganisms; compositions or test papers therefor; processes or preparing such compositions; condition-responsive control in microbiological or enzymological processes; measuring or testing apparatus with condition measuring or sensing means; compositions therefore; processes of preparing such compositions, involving nucleic acid)

A61K-039/395
Medical preparations containing antigens or antibodies

Anderson, et al. (1996) pointed out that the strongest linkage between patented technology and science is found in the biotechnology field, and at the JST, too, academic papers related to biotechnology were most frequently cited in patents.

Sources: Calculated by JST based on data from Thomson Reuters’s Web of Science and Derwent Innovation Index
COMPARISON WITH THE WORLD OUTPUTS

Database:
Papers: Scopus Custom Data, Elsevier
Patents: PATSTAT(Worldwide Patent Statistical Database), European Patent Office(EPO)
FY1996-FY2007
Country shares of the number of academic papers and those of times academic papers were cited

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<th>JAPAN</th>
<th>US</th>
<th>JST</th>
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<tr>
<td>Country shares of the number of academic papers</td>
<td>8.03</td>
<td>5.44</td>
<td>0.04</td>
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<tr>
<td>Rank</td>
<td>Rank 2</td>
<td>Rank 5</td>
<td>Rank 1</td>
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<tr>
<td>Country shares of the times academic papers were cited</td>
<td>5.94</td>
<td>4.4</td>
<td>0.16</td>
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<td>Rank</td>
<td>Rank 4</td>
<td>Rank 5</td>
<td>Rank 1</td>
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Country shares of the number of academic papers and those of times academic paper were cited by patent examiners.

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<th>JAPAN</th>
<th>US</th>
<th>JST</th>
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<tr>
<td>FY1996</td>
<td>8.03</td>
<td>5.44</td>
<td>0.04</td>
</tr>
<tr>
<td>FY2007</td>
<td>29.4</td>
<td>21.65</td>
<td>0.22</td>
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<tr>
<td>Country shares of the number of academic papers</td>
<td>Rank 2</td>
<td>Rank 5</td>
<td>Rank 1</td>
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<tr>
<td>FY1996</td>
<td>8.57</td>
<td>45.18</td>
<td>0.11</td>
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<td>FY2007</td>
<td>34.4</td>
<td>0.83</td>
<td></td>
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<tr>
<td>Country Shares of the times academic paper were cited by patent examiners</td>
<td>Rank 2</td>
<td>Rank 2</td>
<td>Rank 1</td>
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</table>

Sources: Calculated by JST based on data from Elsevier Scopus Custom Data and PATSTAT

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Visualization
now on development!!

To describe the impact of Scientific discovery and Innovation, new tools such as network analysis, visual analytics, science mapping (correlating funding with research outputs), co-citation analysis are now on development.
View historiography showing the key papers and timeline of a research field

Dr. S. Akira

Sources: Calculated by JST based on data from Thomson Reuters’s Web of Science
View historiography showing the key papers and timeline of a research field

Dr. S. Yamanaka

Generated iPS cells from mouse somatic cells
August, 2006
マウス体細胞からiPS細胞を創ることに成功
Oct-3/4, SOX2, c-Myc, Klf4

generated human induced pluripotent stem cells from human adult fibroblasts taken
from skin cells
November, 2007
人IPS細胞を創ることに成功
発症発癌遺伝子c-Mycを使わずに成功

Sources: Calculated by JST based on data from Thomson Reuters’s Web of Science
Thank you!