SciVal SPOTLIGHT

Perspectives

Identifying Organizational Inefficiencies in Research Institutions

ELSEVIER

Abstract

In today's lean times, academic and government decision-makers continually face challenges to efficiently and effectively organize their research organizations and conduct research activities.

Objective quantitative information is required to evaluate whether the right people are in the right place, whether those with certain skill sets are assigned to research groups that stand to benefit the most, and whether research centers are structured in the most optimal way. Using SciVal Spotlight to analyze the research projects of 106 life science researchers within an elite Japanese research center, decision-makers could clarify structural and resource issues in both their established and newly created research centers and, hopefully, use the results to initiate constructive changes and improve overall organizational efficiencies.

Introduction

Decision makers face new challenges in leading their research organizations, and these challenges are brought about in part by the changing landscape of research.

Today, research is more interdisciplinary, which blurs the distinct lines between departments and subject areas. This trend can transform and enhance a researcher's skill set as project collaborations are created and become productive, and a researcher's experience and knowledge can then alter the way his or her research center performs. Decision-makers may find it difficult to identify organizational inefficiencies due to the sheer size of their institutions and the density of processes or because they have an abundance of qualitative information and a lack of quantitative metrics. Alas, the cost of organizational inefficiency is substantial for research institutions when it comes to questions of performance, reputation, and budgeting.

Since there are clear advantages to identifying organizational inefficiencies within an academic or government research institution, decision-makers need to pinpoint these areas in order to develop structures and strategies that best solve the issues. SciVal Spotlight can be used as a tool to provide a more insightful and accurate perspective on research activities conducted by members comprising the research organization; it is particularly effective due to its granular grouping of selected research areas.
Elsevier created SciVal Spotlight based on a highly detailed model of the current structure of science. The Wheel of Science was built on a meta-analysis of over 20 existing maps of science,[1] and SciVal Spotlight creates a map upon the Wheel of Science that illustrates for which specific research areas an institution has unique competencies.
In addition, SciVal Spotlight reveals not only the research strengths, but also the researchers responsible for that work, whether that work is considered to be multidisciplinary or from a single discipline. To ensure that an institution's map represents the broadest coverage of research output, SciVal Spotlight uses abstracts and citations from over 18,000

peer-reviewed journals.[2] The precision of author and affiliation matching ensures that SciVal Spotlight accurately assesses an institution's research output and identifies a researcher's specific strengths.[3]

Using the methods followed in this analysis, an academic or government research institution leader might use SciVal Spotlight to identify organizational inefficiencies across a number of research centers and determine the performance level of individual researchers in relation to that of the research centers overall. This analysis draws upon actual data from an elite Japanese research center, though fictitious center and researcher names are used for privacy purposes. Once our model institution was chosen, five of their research centers were selected as our focus for identifying organizational inefficiencies. From those five centers, a list of 106 individuals' names and the center or group to which they belong was developed.[4] Each name was entered into a search in SciVal Spotlight, and the results were aggregated and mapped out in a spreadsheet.

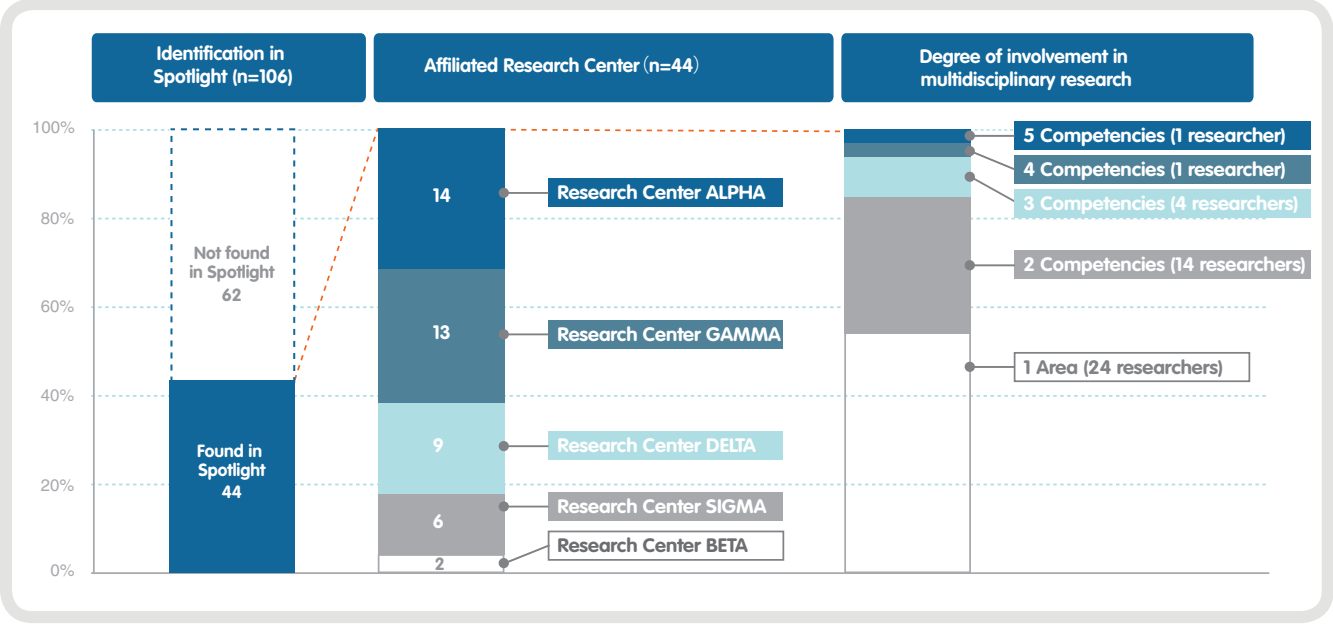
The results of the mapping and the subsequent analysis clarified structural and resource issues within the institution's established research centers and its newly founded multidisciplinary centers. Though it is common for decision-makers to have a good overview of underlying organizational issues, it is important to initiate changes to systems and processes based on evidence and data rather than instinct alone. By formally evaluating research organizations from a structural and resource point of view, institutional decision-makers can not only better determine the nature of the inefficiencies but also gain the information they need to better allocate or realign their resources to minimize or eliminate them.

Methods

We began the assessment by looking at the institution's SciVal Spotlight map for 2007. We then selected five of the institution's research centers in life science-related fields on which to focus our analysis and labeled them **Alpha, Beta, Gamma, Delta,** and **Sigma**. A list of the authors conducting research in those five centers was developed based on the information available on the institution's and each individual research center's official Web sites. In total, 106 researchers were included in this list.

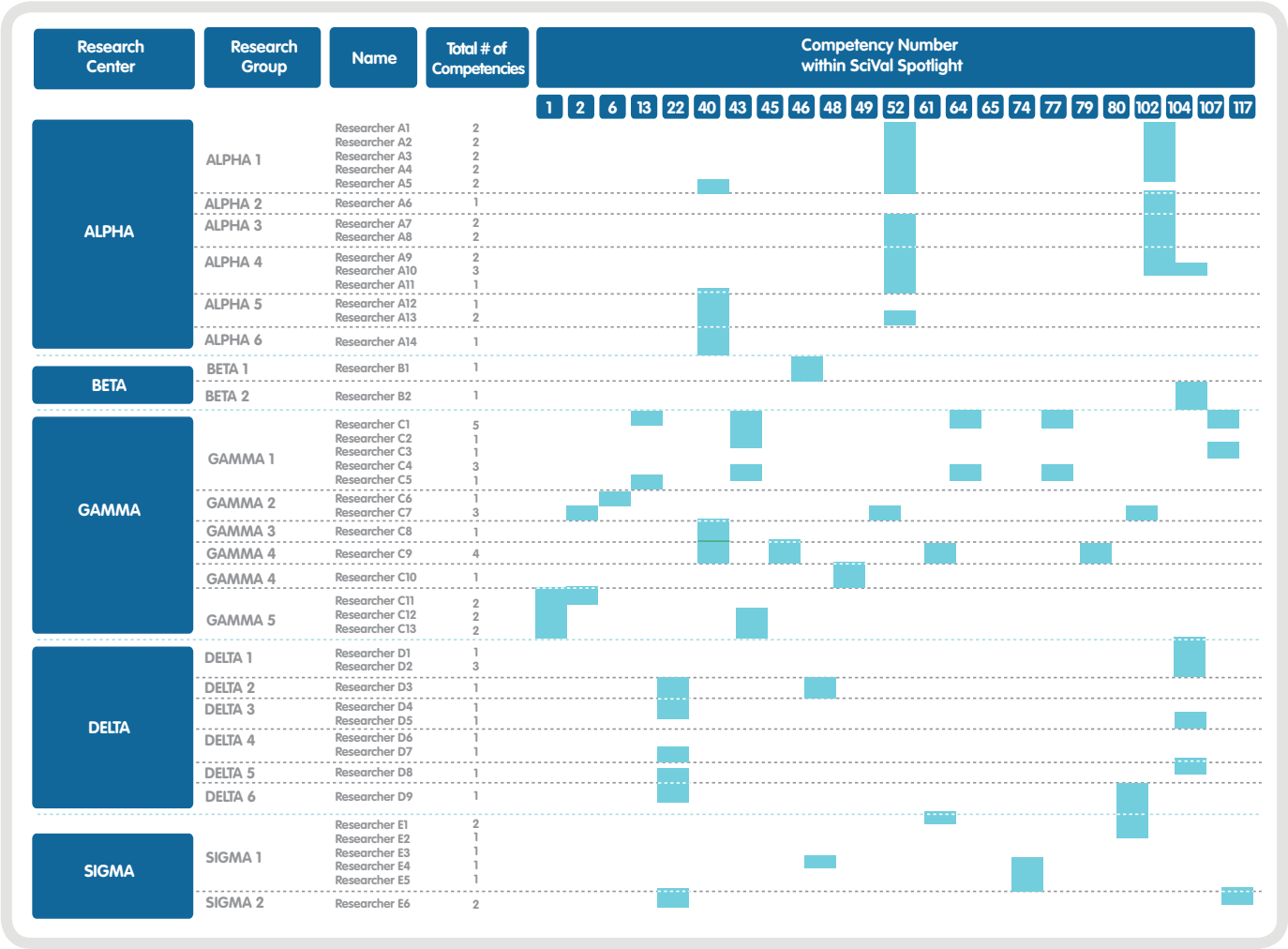
In order to identify their research strengths, we performed a search for each researcher's last name and first initial in SciVal Spotlight. Within Spotlight it is possible to search by researcher's name (all authors on a paper are indexed) or keyword phrase (extracted from the title and abstract of the corresponding articles). There are two possible outcomes with this search function: one outcome is "No Result" and the other is "with Results." It is important to note that if "No Result" is found, it is still possible that the researcher may be fully engaged in valuable research activity; however, that research is not related to the institution's distinctive or emerging competencies[5] (research strengths) for the year 2007. Furthermore, an outcome of "Results" also has implications. If only one competency is found, it may indicate that the researcher's strength is concentrated in a specific research area. Multiple "Results" likely imply that the researcher is doing more multidisciplinary research. At the conclusion of the author search, we found 44 out of the 106 researchers (40%) on our list.

1. Klavens, R., & Boyack, K. W. (2009). Toward a consensus map of science. *Journal of the American Society for Information Science and Technology*, 60(3), 455-476.
2. Scopus, the world's largest abstract and citation database, was used as the underlying data source.
3. Elsevier, *Co-Citation Analysis: The Methodology of SciVal Spotlight*, June 2009.
4. Individual names and corresponding research centers were collected from the institution's official Web site and each research center's official Web site.
5. A distinctive competency is a research strength that is relatively large and where the institution is a leader in at least one of three ways: publications (Relative Article Share), references (Reference Leadership), or recency of references (State of the Art).



To determine how many researchers were involved with multidisciplinary or discipline-specific research areas, we looked at the number of strengths related to each researcher. While 44 researchers were identified as having research output related to at least one of the institution's strengths, there were a total of 23 competencies represented. This results in an average of 1.9 competencies per researcher and possibly indicates that the majority of the institution's researchers in these five centers are focusing on discipline-specific research areas rather than on multidisciplinary work.

To better understand the organizational structures of each of the five research centers, we developed a detailed spreadsheet that provided a graphical representation of the groups that make up the center as well as each researcher's involvement in their groups, by determining their contribution to the institution's research competencies. There was a wide discrepancy in success rates in identifying the researchers associated with each center. For example, 14 out the 15 researchers (93%) working in the *Alpha* center were included in the 2007 map. Researchers within this group are involved in only one or two research areas and share



common strengths in competencies 40, 52, and 102, which are all related to protein science. In contrast, only 9 of the 35 researchers (26%) associated with the *Delta* center were identified. Similar to the *Alpha* center, *Delta's* researchers concentrate on one or two research areas concentrated in competencies 22 and 46, also related to protein science. The *Sigma* and *Beta* centers' results closely resemble that of *Delta's* with authors focusing on specific areas of research. In contrast, the *Gamma* center possibly has the highest number of researchers involved in a wide variety of research areas, and, therefore, the center may produce the most multidisciplinary research. *Gamma* researchers average 2.1 competencies compared to the institution's average of 1.9 per researcher. The *Gamma* 1 group's research portfolio illustrates that its researchers conduct a balanced combination of interdisciplinary and discipline-specific research.

By using SciVal Spotlight to provide information on the institution's researchers and five chosen research centers at a granular level, we were able to analyze the talent allocation within the groups. This allowed us to determine possible organizational inefficiencies within a few groups based on their researchers' output. We were also able to identify those researchers who contribute to multidisciplinary research and have potential to move laterally across centers or groups. Addressing inefficiency in research groups may reduce the institution's overhead costs while improving the quality of multidisciplinary research projects.

Competency	Related Disciplines	Top keyword phrases related to competency
1.	Carbon/ Semiconducting Materials / Chemistry and Material Science / Catalysis Electrochemistry	electron microscopy / mesoporous silica / X-ray diffraction
2.	Ceramics/ Electrochemistry / Filtration Membrane	electron microscopy / fuel cell / solid oxide
3.	Surface Coating Technology / Semiconducting Materials / Friction Lubrication and Wear	photoelectron spectroscopy / films deposited / chemical vapor
4.	Sensors and Actuators / Chromatography; Electrophoresis / Semiconducting Materials/ Clinical Chemistry	capillary electrophoresis / Poly(methyl)methacrylate / electro osmotic flow
22.	Protein Science / Genomics and Nucleic Acids	amino acids / protein folding / folding rates
40.	Systematics and Evolutionary Microbiology / Enzyme Microbiological Techniques / Molecular Cell Biology	cell wall / saccharomyces cerevisiae / S cerevisiae
43.	Nanotechnology / Electro Analytical Chemistry / Surface Science	quantum dots / quantium yield / dots QDs
45.	Clinical Cancer Research / Sleep / Neuroscience; Molecular and Cellular	circadian clock / clock genes / gene expression
46.	Molecular Physics / Protein Science	molecular dynamics / dynamics simulations/ free energy
48.	Cardiovascular / Clinical Rehabilitation / Circulation	receptor antagonist / endothelial cells / smooth muscle
49.	Macromolecules and Polymers / Semiconducting Materials	azobenzene polymer / polymer films / relief grating
52.	Mass Spectrometry / Protein Science/ Carbohydrate Research / Clinical Cancer Research	mass spectrometry / mass spectra/ ion trap / breast cancer
61.	Bacteriology / Macromolecules and Polymers / Microbiology Biotechnology	molecular weight / enzymatic degradation / rhodococcus sp
64.	Macromolecules and Polymers	electron microscopy / transmission electron / block copolymer
65.	Molecular Physics / Data Mining	molecular orbital / fragment molecular / perturbation theory
74.	Molecular Physics / Semiconducting Materials	raman scattering / surface-enhanced raman / raman spectroscopy
77.	Proteomics / Plant Physiology	mass spectrometry / protein spots / salt stress
79.	Protein Science	transcription factors / electron microscopy / feast/famine regulatory
80.	Computational Chemistry	two-photon absorption / nonlinear optical / cross section
102.	Protein Science / Carbohydrate Research	epithelial cells / site-directed mutagenesis / glycogen synthase
107.	Semiconducting Materials / Applied Optics	spectroscopy XPS / photoelectron spectroscopy / self-assembeled monolayers
117.	Clinical Cancer Research	saccharomyces cerevisiae / ribosomal protein/ RP genes

Conclusion

The results of our analysis clarified structural and resource allocation issues within the institution's established and newly created multidisciplinary research centers, as several researchers with similar strengths are allocated to multiple research groups.

Alpha center, divided into six groups, is one of the highest performing centers and has several veteran researchers in the protein science field. Considering that the researchers have similar strengths, there may be an opportunity to reduce overhead costs by integrating those research groups where researchers share strengths and reallocating several key researchers to under-resourced research centers or groups.

Though *Delta* center also conducts research in the protein science area, only 26% of its researchers were present in the 2007 map (compared to *Alpha's* 93%), and our analysis indicates that the center lacks a researcher with an expertise in Data Mining (*Computer Science*). This is a key distinction between the *Alpha* and *Delta* centers, and it could be a source of organizational inefficiency within the *Delta* group.

Newly established multidisciplinary research centers, such as the *Beta* and *Sigma* centers, have researchers with disciplinary-specific research projects and little consistency can be seen in the portfolio of research strengths among authors working within these centers. Very few of the researchers from *Beta* and *Sigma* centers' were contributing to institutional research strengths, as a low percentage of their authors were included in the 2007 map (28% and 35%, respectively). We conclude that *Beta* and *Sigma* centers could benefit from the addition of more experienced and multidisciplinary researchers. *Gamma* center's *Gamma* 1 group's diverse research portfolio stands in contrast to *Beta* and *Sigma's* portfolio; *Gamma* illustrates that having a balance of multidisciplinary and discipline-specific researchers increases output and supports multiple research strengths for the institution.

Discussion

Identifying and addressing organizational inefficiencies across research centers is critical for an institution's short and long-term success.

Decision-makers often speculate about where inefficiencies reside, however, many find it difficult to begin addressing issues without a clear understanding of how to improve the situation. There are strong benefits for institutional leaders who have a comprehensive view of their research centers' performance; research performance assessments will allow them to develop a more informed strategy to restructure and reallocate resources and improve research quality across their institution.

Given budgetary constraints, decreasing levels of research funding, and the interdisciplinary focus of research today, it is important to conduct assessments that accurately reveal opportunities for the reduction of overhead costs within established centers as well as the implementation of policies and processes that could support the formation of new centers. Creating new structures or revamping policies and reallocating funding necessitates a thorough understanding of how established research centers currently operate in addition to how research leaders form and add new personnel to newer centers.

To reduce an institution's overhead cost, one may identify which research centers or groups have a greater proportion of high performing researchers and then reallocate those researchers to groups with less seasoned researchers or ask them to take on mentoring activities. Also, centers with researchers performing work on similar research topics could be merged into one to reduce the cost of maintaining two centers, and by combining resources and skill sets in a new and more dynamic manner, the research quality for both individuals and their affiliated centers could improve.

Institutions without formal policies and processes in place regarding the structure of new multidisciplinary centers are heavily dependent upon the appointed head of the organization, and this individual has the liberty to select researchers based on personal preference rather than a measured potential for contribution. Creating guidelines for forming multidisciplinary centers or groups could ensure that researchers with multiple or discipline-specific strengths are brought into the group, as the group's performance will benefit from the addition of both types of researchers.

Conducting performance assessments across research centers is an excellent starting point for confirming or identifying organizational inefficiency and addressing those issues with research leaders. Institutions may use research evaluation as a way to reallocate resources, make organizational improvements, and establish firm policies and guidelines for recruitment or assignment. Overall, developing strategies and guidelines that improve current organizational inefficiencies and prevent the recurrence of future issues will encourage more effective research partnerships, decrease financial constraints, and secure lasting achievements for the institution.

SciVal delivers comprehensive and integrated workflow solutions to help you evaluate, establish and execute your research strategies and performance assessments.

For more information about our SciVal suite of products, please contact your nearest Elsevier Regional Sales Office.

Europe, Middle East and Africa

E-Customer Service
P.O. Box 211
1000 AE Amsterdam,
The Netherlands

Tel: +31 20 485 3767
Fax: +31 20 485 3432
Email: nlinfo@spotlight.scival.com

Asia and Australia

E-Customer Service
3 Killiney Road #08-01
Winsland House 1
Singapore 239519
Tel: +65 6 349 0222
Fax: +65 6 733 1050
Email: sginfo@spotlight.scival.com

Japan

E-Customer Service
1-9-15 Higashi-Azabu, Minato-ku
Tokyo 106-0044, Japan
Tel: +81 3 5561 5034
Fax: +81 3 5561 5047
Email: jpinfo@spotlight.scival.com

North, Central and South America

E-Customer Service Department
3251 Riverport Lane
Maryland Heights, MO 63043
Email: usinfo@spotlight.scival.com
Tel: 1 888 615 4500
(+1 314 523 4900, if calling from outside the USA and Canada)

www.scival.com

ELSEVIER