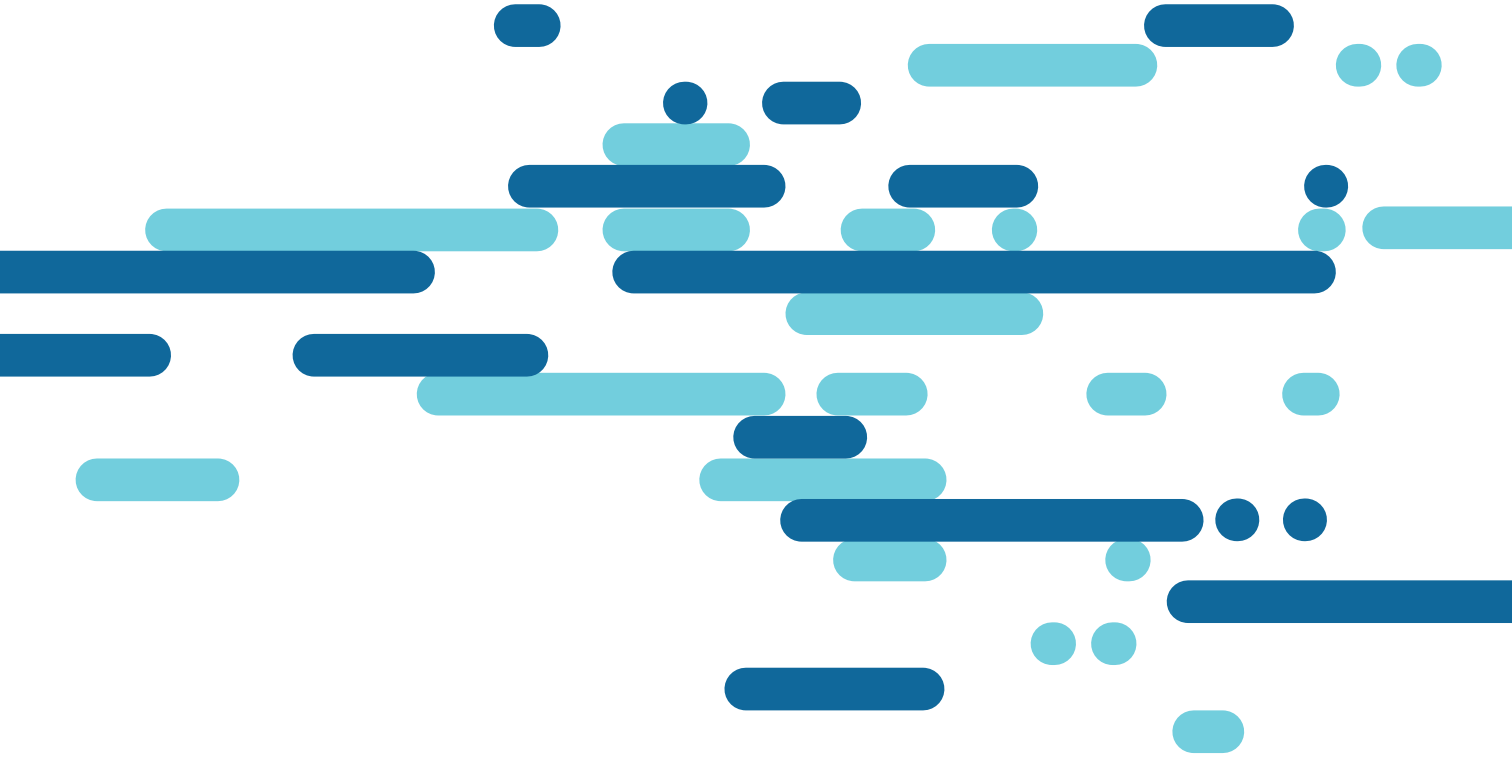
SciVal SPOTLIGHT

Perspectives

Verifying the Effectiveness of Existing Collaborations



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Abstract

Scientific collaborations come in the forms of co-authorships, consortia, co-locations, and alliances. This paper examines the effectiveness of one example of collaboration: an alliance of three Taiwanese institutions formed to capitalize on their collective research strengths to advance their respective positions within the global research community.

Considering the fierce competition for funding and the growing interdisciplinary nature of research today, research executives from the alliance needed to determine whether collaboration at an institutional level is worth actively supporting via future research strategy and policies, and this required a structured, quantitative way to determine the individual strengths that hold the most value for the collective as well as an impartial way to evaluate overall collaborative performance. Understanding the current state of their collaboration efforts requires the identification of each university s research competencies[1] and the location of existing collaborative networks. Utilizing data from SciVal Spotlight, our analysis revealed two important aspects about the current state of their collaboration and research performance; we confirmed that the research strengths of the member institutions complemented and strengthened each other, but as of 2008, the collaborative research was not evenly distributed amongst the three member institutions.

Relying upon the results of this analysis, alliance research executives were confident that continuing the alliance was in the group s best interest. Furthermore, they agreed that supplemental action must be taken at the management level to leverage their strengths and considered SciVal Spotlight to be one of the best solutions available to continually monitor the effectiveness of their collaboration efforts.

1. A competency is a network of article clusters that are grouped together based on the unique publication profile of an institution. Article clusters are linked by current papers from the institution that were assigned to two or more article clusters in the co-citation analysis. Thus, a competency is a set of topics that are linked together by an institution in an institution-specific manner.

Introduction

One driving force behind many institutional alliances is the increasing competition for funding.

Research funding can be influenced by several factors, including university rankings, as governments and funding bodies tend to award grants to researchers at institutions with a successful reputation (e.g., the sponsors consider these researchers more likely to produce strong results). University rankings may also affect an institution s ability to recruit strong researchers as well as attract future collaboration partners for interdisciplinary projects. Though historically it has been challenging for smaller universities to compete nationally or globally, the recent proliferation of university alliances, added to a general increase in competition for research funding, has further concentrated funding for a smaller number of research institutions.

Leveraging their collective research strengths in hopes of improving their performance and ability to compete with leading global research-focused institutions, three Taiwanese universities - in close proximity in the southern part of Taiwan - formed an alliance. The three Taiwanese universities in the Alliance[2] are National Cheng Kung University (NCKU) in Tainan, National Chung Hsing University (NCHU) in Taichung, and National Sun Yat-Sen University (NSYSU) in Kaohsiung.

After establishing the partnership, Alliance executives wanted to determine the efficacy of the group s ability to attain their principle objectives (e.g., being more prominently and competitively placed in the global research community). The three universities questioned whether the Alliance was improving their cumulative research performance, and they wondered what steps should be taken, if any, to strengthen the partnership and further improve performance in designated research disciplines and, specifically, in which research disciplines. **Without a structured, quantitative way to determine the individual strengths that hold the most value for the collective as well as an impartial way to evaluate overall collaborative performance, the Alliance executives found it difficult to answering these questions objectively.**

One of the executives familiar with SciVal Spotlight suggested using it as a tool to evaluate their output and, ultimately, the alliance. Elsevier created SciVal Spotlight based on a more detailed model of the current structure of science (the Wheel of Science)[3] as an alternative to traditional methods that may not fully identify an institution s research strengths (particularly in the increasing number of interdisciplinary research areas) and thus the performance of collaborations. Spotlight creates a map upon the Wheel of Science that illustrates the specific research topics in which an institution exhibits unique competencies (both interdisciplinary and mono-disciplinary). For each competency, we can identify the prominent researchers and institutions working in the field, their relative leadership positions, and the respective growth of the research area.[4] An institution s performance can then be compared to that of a collaborative partner to evaluate the viability of an alliance.

This new Elsevier solution inspired me from an intellectual point of view. At the same time, I thought the data could help us to further strengthen our three-university alliance. We should not base these discussions solely on instinct, explained an NCKU research executive. Reviewing the results from SciVal Spotlight, the Alliance was able to confirm that the research strengths were complementary and continuing the partnership would be beneficial for each institution.

Replicating the following methodology would allow an institution to evaluate their collaborative research activity, to identify with which partners and in what research areas the institution is working effectively, and to understand the growth potential of these corresponding research areas. Research executives and administrators may then use this data to develop evidence-based policies and programs that will hopefully help them to improve their ranking and their ability to attract prestigious faculty as well as strengthen their overall capacity to compete for funding at the national and global levels.

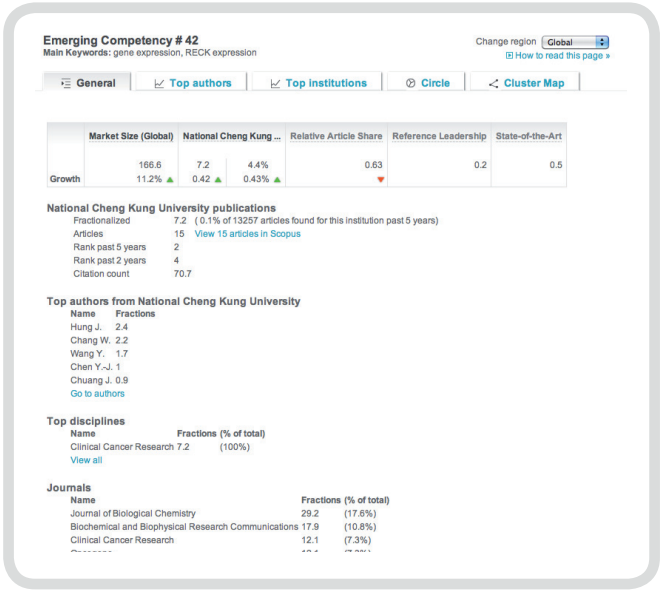
2. The alliance between the three universities will hereby be referred to as the "Alliance".
3. This model was developed through a meta-analysis of over 20 existing maps of science. (Klavans, R., & Boyack, K. W. (2009). Toward a consensus map of science. Journal of the American Society for Information Science and Technology 60(3), 455-476.)
4. Spotlight relies on abstracts and citations from over 18,000 peer-reviewed journals to ensure that an institution's map represents the broadest coverage of research output. The data for SciVal Spotlight is derived from Scopus, which is the world's largest abstract and citation database.

Methods

To assist the research executives from the Alliance in monitoring their research effectiveness, we created each university's SciVal Spotlight map for 2008,[5] investigated the details of their research competencies, and then reviewed the findings with Alliance executives.

We looked at each university s map to investigate the details of each of their research competencies. Taking one of NCKU s competencies within the Medical Specialties[6] (Emerging Competency[7] 42, Figure1) as our example, we found that this research area relies on literature from the discipline *Clinical Cancer Research*. It is a relatively small research area for the university with 166.6 papers published globally between 2004 and 2008, compared to an average of 692.2 papers across their 125 competencies published over the same five year period. Globally, this area of research is growing by 11.2% per year, whereas NCKU, who contributed 7.2 articles (or approximately 4.4% of all literature in this area), is increasing their number of published papers by 0.43% per year.

Figure 1: Emerging Competency #42, NCKU



NCKU is not currently a leader in this area (i.e., they do not publish the most, do not have the greatest share of highly-cited references,[8] and they are not citing the most recent work), but they have strong potential to be. This potential comes from the fact that it is still a small research field that is growing quickly, and although they are ranked second in this research competency behind a prestigious Japanese university, NCKU s contribution to the field is increasing. With a Relative Article Share of 0.63, they publish approximately three papers for every five that the Japanese university publishes. Their Relative Reference Share is 0.2, as indicated under Reference Leadership, meaning their share of the highly-cited reference articles is approximately one for every five that the Reference Leader has published.

For our purpose of monitoring the effectiveness of the alliance, we filtered the list of top institutions in this competency to only collaborating institutions to determine whether researchers from NCKU had co-authored any papers with researchers from National Sun Yat-Sen University or National Chung Hsing University. While NCHU was not among the list of top institutions in this competency, we identified NSYSU as the third-ranked university in this competency (see Figures 2 and 3). Although NCKU publishes slightly more in this area (higher RAS), NSYSU wrote a larger share of the highly-cited references (RL = 0.5) and tend to cite relatively younger work (SotA = 1.3). With the partnership in place between NCKU and NSYSU, verifying that their authors had worked together and were strong in different ways meant that the collaborative efforts between the two institutions is effective and has contributed to the existence of one of NCKU s global research strengths.

5. Only article clusters in which the institution has a Relative Article Share that meets the Relative Article Share threshold are considered. The Relative Article Share threshold varies depending on the publication output of the institution. (refer to note 1)
6. Each article cluster is assigned to one of more than 550 disciplines; each discipline is mapped to one of 13 subject areas around the Wheel of Science: Math & Physics; Chemistry; Engineering; Earth Sciences; Biology; Biotechnology; Infectious Diseases; Medical Specialties; Health Sciences; Brain Research; Humanities; Social Sciences; and Computer Science.
7. Each institution's map will include some combination of Emerging Competencies and Distinctive Competencies. An Emerging Competency is defined as a strength for the institution where either the research area is emerging (small number of publications in the region) or the institution is emerging within the research area (not currently exhibiting leadership in publication output (Relative Article Share (RAS), share of highly-cited references (Relative Reference Share (RRS), or innovation (State-of-the-Art (SotA) leadership)). Once the research area is large enough and the institution meets one of the three leadership criteria, the competency will be considered a Distinctive Competency.
8. The 'highly-cited' reference articles used in the model are those that have been most highly cited during the map year (i.e., 2008).

Results

Based on the results of the analysis, the three universities in the alliance all have research competencies that complement and strengthen one another's.

National Cheng Kung University s 2008 map has a total of 125 competencies with many of the competencies within the following subject areas: Medical Specialties, Health Sciences, Math & Physics, Chemistry, and Engineering. In addition, we recognized that they do a fair amount of interdisciplinary research, as indicated by the presence of competencies situated closer to the center of the Wheel of Science. National Chung Hsing University has a total of 58 competencies concentrated mostly in Biology, Biotechnology, and Earth Sciences, and a total of 48 competencies were mapped for National Sun Yat-Sen University, mostly in Computer Science, Math & Physics, Chemistry, and Social Sciences.

By comparing the three maps, as seen below in Figure 4, we can see that the universities share strengths in some of the same subject areas, indicating that they are aligned in Computer Science, Math & Physics, Engineering, and Chemistry, and we can also see that the remaining competencies are complementary. For example, NCKU has many Medical Specialties and Health Science competencies and exhibits strength in interdisciplinary research whereas neither medical and health sciences nor interdisciplinary competencies are very prevalent in the maps of the other universities. If we did not see this analysis, we probably would not be aware of our great fit, stated a NSYSU dean.

Figure 2: Emerging Competency #42, NCKU

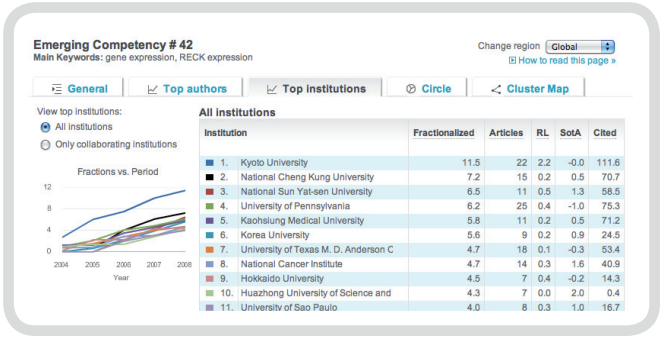


Figure 3: Emerging Competency #42, NCKU

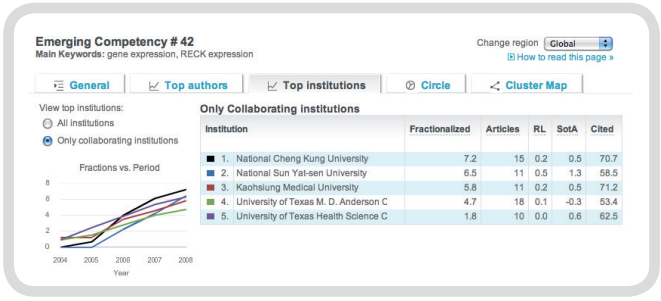
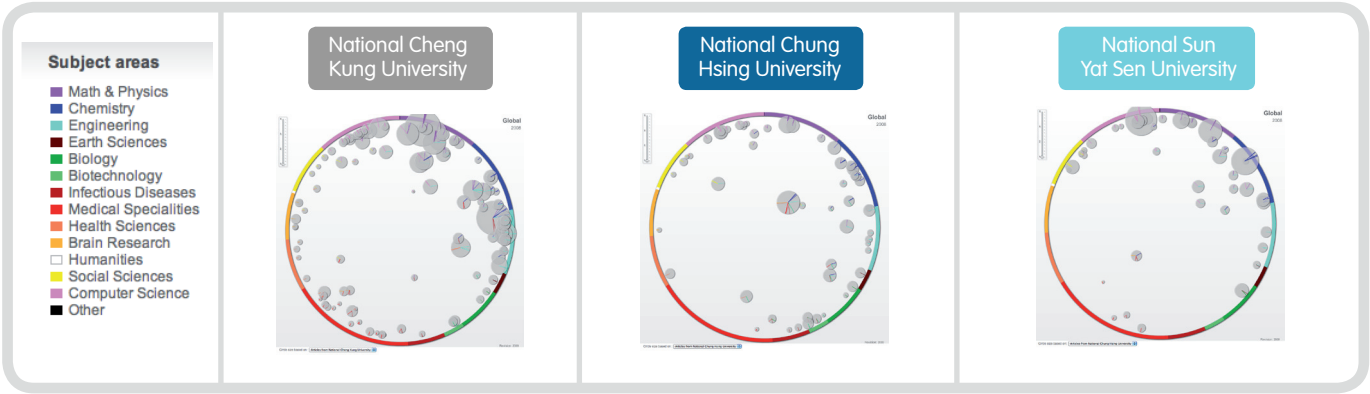


Figure 4: Comparative Competencies Across the Universities



To determine the strength of collaboration, we calculated the Collaboration Rate (CR) between the unique pairings of the three universities. We defined the CR with one university and another (e.g., University A collaborating with University B) as follows:

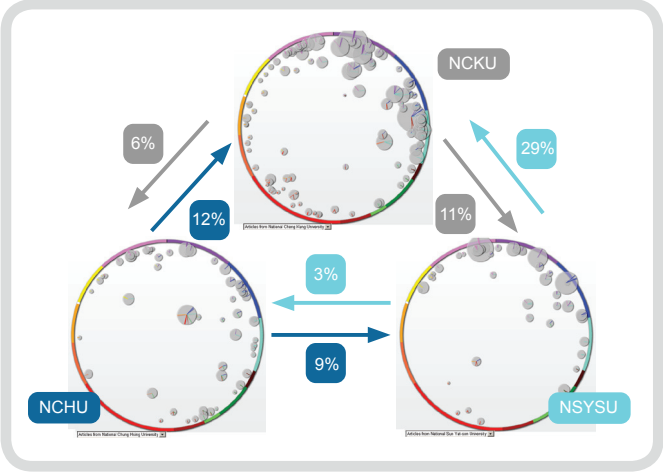
$$CR\ (A{:}B) = \frac{\text{\# of University A competencies with collaboration from University B}}{\text{Total \# of competencies for University A}}$$

Our analysis revealed strong collaborative work between the three universities and especially between NCKU and NSYSU.

The results of the collaboration rates for each pairing are as follows:

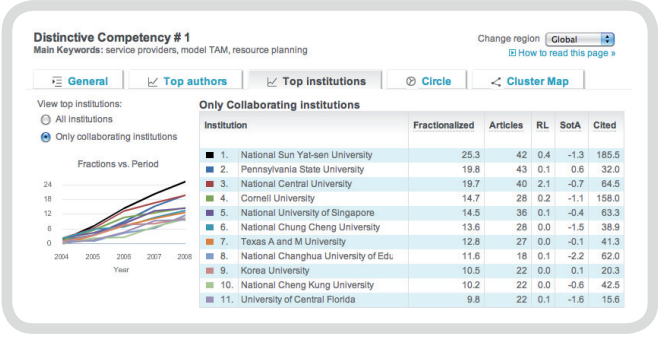
	Total # of Competencies	National Cheng Kung University		National Chung Hsing University		National Sun Yat-Sen University	
		Collaboration Rate	# of Collaborative Competencies	Collaboration Rate	# of Collaborative Competencies	Collaboration Rate	# of Collaborative Competencies
NCKU	125			6%	7	11%	14
NCHU	58	12%	7			9%	5
NSYSU	48	6%	3	29%	14		

Figure 5: Overview of Collaboration Activities



At present, many institutions are making an effort to encourage collaboration to expand their ability to conduct interdisciplinary research, especially in areas related to the natural and social sciences. NSYSU discovered through the analysis that their researchers are collaborating with NCKU and NCHU, and this collaboration is contributing to the creation of many of their Social Science competencies. This collaboration is not surprising considering NSYSU s strong College of Management and College of Social Sciences, and according to their 2008 map, NSYSU s largest competency (DC1, see Figure 6), which relies on literature mostly from the disciplines *Decision Support Systems* and *Human Management*, had papers co-authored with NCKU researchers.

Figure 6: Distinctive Competency #1, NSYSU



Distinctive Competency # 1
Main Keywords: service providers, model TAM, resource planning

Change region: Global
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View top institutions:
All institutions
Only collaborating institutions

Fractions vs. Period

Only Collaborating institutions

Institution	Fractionalized	Articles	RL	SotA	Cited
1. National Sun Yat-sen University	25.3	42	0.4	-1.3	185.5
2. Pennsylvania State University	19.8	43	0.1	0.6	32.0
3. National Central University	19.7	40	2.1	-0.7	64.5
4. Cornell University	14.7	28	0.2	-1.1	158.0
5. National University of Singapore	14.5	36	0.1	-0.4	63.3
6. National Chung Cheng University	13.6	28	0.0	-1.5	38.9
7. Texas A and M University	12.8	27	0.0	-0.1	41.3
8. National Changhua University of Edu	11.6	18	0.1	-2.2	62.0
9. Korea University	10.5	22	0.0	0.1	20.3
10. National Cheng Kung University	10.2	22	0.0	-0.6	42.5
11. University of Central Florida	9.8	22	0.1	-1.6	15.6

Additionally, NCHU s third (DC3, see Figure 7), and fourth (EC4, see Figure 8) largest competencies (which rely on literature mostly from the disciplines *Applied Economics* and *Solar & Wind Power* and *Business Ethics* and *Tourism*, respectively) have papers co-authored by NSYSU researchers, and this has likely contributed to reciprocal research strengths for the two universities.

Figure 7: Distinctive Competency #3, NCHU

Distinctive Competency # 3
Main Keywords: electricity consumption, energy consumption, economic growth

Change region: Global
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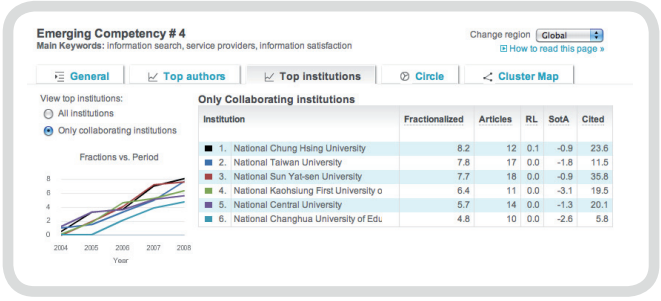
Fractions vs. Period

Only Collaborating institutions

Institution	Fractionalized	Articles	RL	SotA	Cited
1. National Chung Hsing University	23.9	34	1.5	2.0	103.6
2. U.S. Department of Agriculture	8.8	18	0.0	1.9	7.3
3. National Sun Yat-sen University	6.2	13	0.1	0.7	17.8
4. National Chi Nan University	5.9	7	0.0	1.0	0.8
5. Texas A and M University	5.0	11	0.0	-0.6	8.9
6. National Chengchi University	4.0	7	0.0	0.3	0.0

Figure 8: Emerging Competency #4, NCHU



Emerging Competency # 4
Main Keywords: information search, service providers, information satisfaction

Change region: Global
How to read this page »

General | Top authors | Top institutions | Circle | Cluster Map

View top institutions:
All institutions
Only collaborating institutions

Fractions vs. Period

Only Collaborating institutions

Institution	Fractionalized	Articles	RL	SotA	Cited
1. National Chung Hsing University	8.2	12	0.1	-0.9	23.6
2. National Taiwan University	7.8	17	0.0	-1.8	11.5
3. National Sun Yat-sen University	7.7	18	0.0	-0.9	35.8
4. National Kaohsiung First University o	6.4	11	0.0	-3.1	19.5
5. National Central University	5.7	14	0.0	-1.3	20.1
6. National Changhua University of Edu	4.8	10	0.0	-2.6	5.8

Discussion

Research institutions seek strategic partnerships with one another for many reasons, and these alliances are particularly desirable as they have the potential to improve an institution's quality of research via a broader and more diverse network of research talent, and consequently, they will increase their ability to compete for funding.

Improving research quality may have broader implications on their ranking and perceived prestige as well, and improving their reputation within the research community will enhance their ability to attract prestigious faculty and funding accordingly. Strategic alliances must benefit all members, so when forging these institutional partnerships, it is essential for university leaders to have a high-level as well as granular view of the group s research strengths. Combined with a thorough understanding of where their collaborative partners contribute to their mutual success, universities must measure and monitor the efficacy of the ongoing relationship.

Evaluating the current state of the Alliance using data from SciVal Spotlight, research executives from National Cheng Kung University, National Chung Hsing University, and National Sun Yat-Sen University confirmed that their partnership was effective. They determined that a continuation of the alliance would contribute to an elevated quality of research. If each institution takes a more informed approach to refining their research strategy by understanding which overlapping research areas to proactively support, the international exposure and rankings for each of the universities should increase. Collectively, the members of the Alliance will become increasingly well-positioned to compete for funding.

Actively supporting research collaboration, especially in growing fields, may have significant benefits for a research institution, but as one Alliance executive advised, At the end of the day, collaborative work is conducted on a researcher level. We cannot force a researcher to do research activity with someone we assign. From a management point of view, we need to create a scheme that will naturally facilitate researchers to get together and initiate working together.

One member proposed addressing this issue by creating a joint facility where researchers (exclusively from the Alliance) might network with new colleagues and converse about potential projects. Another suggested creating a pool of competitive funds that could only be allocated to joint research between Alliance researchers because they would likely require additional monetary incentives .

Initially, the university executives had been uncertain about whether to continue their alliance, but having established the strength of their mutual performance using an evidence-based evaluation, the university leaders confirmed their commitment to the alliance. They also agreed that it would be necessary to continuously monitor the effectiveness of the collaboration, and using Spotlight to evaluate the progress of their collaboration activities would allow them to determine whether their initiatives are helping them to fortify their alliance and achieve their research objectives. One university Vice President summarized the discussion by stating, We are a great match, and this collaboration really makes sense. In the near future, I look forward to seeing our maps integrated and having them compared with the world s top universities.

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