

# Comparative Analysis of High and Low Performers' Behavior from Research Topic Exploration to Research Outreach

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## Abstract

This study presents findings from an exploration into the practices of active researchers, encompassing the entire process from collecting research information to presenting their findings. Participants were researchers from universities, national research and development corporations, and independent administrative agency research institutes in Japan. We asked 486 organizations and received 1442 responses. The findings indicate that high-performing researchers prioritize sharing their work widely. Additionally, the way they gathered information differed highly among different fields of study.

*Keywords:* research information retrieval, research outreach, questionnaires, institutional research

## 1 Introduction

Recent years have seen a diversification in research-related activities, with many components of the research process, including collaboration and dissemination, moving online. Researchers now face the challenge of navigating tools and methods to discover new information, organize their work, and share their findings. This study explores the strategic choices that high-performing researchers in Japan make to navigate this landscape. It aims to understand how these researchers collect information, select research topics, conduct their studies, publish their findings, and how their work is referenced by others through different stages. This study is a further development of the work presented in [1].

## 2 Survey

### 2.1 Questionnaires

The survey was administered through an online questionnaire, which included questions on how researchers select their research topics, conduct their studies, and publish their findings. A summary of the questions asked was as follows:

- Attributes of the respondents (organization, position, job level, age, and field of study)
- Information collection (search objects, collection, and management methods)
- Methods of information acquisition (financial)
- Methods of publication (open access and research publicity)
- Frequency of paper submissions, research presentations, and book publications.

This survey was partly designed to align with PlumX metrics [2], facilitating analysis in conjunction with the altmetrics survey initiated two years prior [1][3]. The research fields of

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respondents were classified according to the All Science Journal Classification (ASJC) [4] by Elsevier. Other attributes were defined based on the criteria used in researchmap.

## 2.2 Targets

A list was compiled of Japanese universities with more than 90 faculty members, and in addition, public and private research institutions and museums that have received Grants-in-Aid for Scientific Research in the past 10 years were also listed. Responses were requested by mail. Since the responses must be made by researchers, we addressed the letter to the person in charge of general affairs at the administrative office, enclosed a document explaining the purpose of the questionnaire and the URL for responses, and asked them to disseminate the information within their organizations. Responses were collected anonymously using Google Forms. A total of 486 letters were sent out in June 2023, resulting in 1442 responses during the two-month collection period. After excluding two invalid responses, 1440 responses were analyzed. Table 1 shows the attributes of the respondents.

Table 1: Attributes of survey respondents

Academic field		No.	%	Organization		No.	%	Age	No.	%
Multidisciplinary		24	1.7	National universities	623	43.3	20s	72	5.0	
Physical Sciences		512	35.6	R&D Agency, Public Research Institutions, etc.	365	25.3	30s	397	27.6	
Health Sciences		250	17.4	Private universities	302	21.0	40s	433	30.1	
Life Sciences		257	17.8	Public universities	139	9.7	50s	374	26.0	
Social Sciences & Humanities		397	27.6	Junior colleges, technical colleges, etc.	6	0.4	60s	161	11.2	
				Corporation	4	0.3	70s	3	0.2	
				Others	1	0.1				
				Total	1440	100.0	Total	1440	100.0	

Note that the response rate cannot be calculated because the survey was requested through the general affairs departments of each organization and not directly from the respondents.

## 2.3 Methods

The respondents were categorized as either high performers or low performers based on their academic field, and we analyzed the differences between these groups. The criteria for classifying someone as a high performer included their frequency of submitting papers, presenting research, and publishing books. Specifically, individuals in the top 20% for these activities within their field were considered high performers. We excluded the Multidisciplinary field from our analysis due to its limited number of respondents (24) and focused on the four remaining fields. The results are shown in Table 2. High performers are highlighted in green and low performers in orange.

Table 2: Categorized high and low performer groups

Academic field	Physical Sciences				Health Sciences				Life Sciences				Social Sciences & Humanities											
	Paper submissions		Research presentations		Book publications		Paper submissions		Research presentations		Book publications		Paper submissions		Research presentations		Book publications							
Answer	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%						
Less than 1	98	19.1	36	7.0	258	50.4	74	29.7	27	10.8	109	44.3	67	26.4	40	15.7	114	44.7	75	18.9	81	20.5	100	25.3
1	121	23.6	83	16.2	75	14.6	63	25.3	64	25.7	25	10.2	73	28.7	53	20.8	32	12.5	153	38.6	129	32.6	51	12.9
2	128	25.0	151	29.5	46	9.0	42	16.9	66	26.5	29	11.8	60	23.6	86	33.7	29	11.4	113	28.5	106	26.8	31	7.8
3	58	11.3	69	13.5	41	8.0	25	10.0	31	12.4	18	7.3	26	10.2	40	15.7	21	8.2	32	8.1	43	10.9	41	10.4
4	24	4.7	56	10.9	28	5.5	12	4.8	15	6.0	11	4.5	8	3.1	15	5.9	13	5.1	11	2.8	21	5.3	35	8.8
5	43	8.4	37	7.2	23	4.5	15	6.0	24	9.6	17	6.9	9	3.5	9	3.5	17	6.7	10	2.5	10	2.5	29	7.3
6	11	2.1	24	4.7	11	2.1	3	1.2	4	1.6	5	2.0	3	1.2	2	0.8	3	1.2	4	1.0	4	1.0	21	5.3
7	3	0.6	3	0.6	1	0.2	1	0.4	2	0.8	3	1.2	1	0.4	2	0.8	2	0.8	1	0.3	2	0.5	14	3.5
8	3	0.6	13	2.5	2	0.4	1	0.4	1	0.4	3	1.2	1	0.4			3	1.2					11	2.8
9			2	0.4	1	0.2	1	0.4	1	0.4	1	0.4											4	1.0
10 or more	23	4.5	38	7.4	26	5.1	12	4.8	15	6.0	25	10.2	6	2.4	10	3.9	21	8.2	1	0.3			59	14.9
Total	512	100.0	512	100.0	512	100.0	249	100.0	249	100.0	246	100.0	254	100.0	255	100.0	255	100.0	396	100.0	396	100.0	396	100.0

\* No. of "Paper submissions" and "Research presentations" are indicate the number of submissions and presents per year.

\* No. of "Book publications" is indicate the total number of books published to date.

We used IBM SPSS v.29 for the analysis, and applied T-tests and Chi-square tests across three indicators—paper submissions, research presentations, and book publications—for each of the academic fields. Among these three indicators, paper submissions and research presentations were based on the average annual count, whereas book publications refer to the total number of publications over a researcher's lifetime. It is important to note that indicators based on the total number of book publications may favor older researchers.

### 3 Results

In this chapter, the results are presented in chronological order based on the questionnaires. First, from the perspective of information acquisition: "objects of information search, methods of information collection, and methods of information acquisition." Then, from the perspective of information dissemination: "open access and methods of information dissemination."

#### 3.1 Information acquisition

Table 3 shows the results of comparing the objects of information search. The questions were asked using a 4-point scale, and an asterisk (\*) indicates items where the T-test showed a significant difference in mean values. Items with higher values are underlined. Those with positive implications (frequently selected by high performers) are highlighted in green, and those with negative implications (frequently selected by low performers) are highlighted in orange. Overall, "(1) Search for research" and "(2) Search for researchers" were commonly positive, however there are no significant differences common to all fields, indicating that the trends vary widely by field.

Table 4 shows the results of comparing the methods of information collection. The respondents were allowed to select multiple methods they use, and the results were cross-tabulated. An asterisk (\*) indicates items where the Chi-square test showed a significant difference. Items with positive implications (frequently selected by high performers) are highlighted in green, while those with negative implications (frequently selected by low performers) are highlighted in orange. There were no items that showed significant differences across all academic fields, indicating that trends vary greatly by field. Focusing only on items with significant differences, in Physical Sciences, only negative items are present, while in Social Sciences & Humanities, only positive items existed. In Life Sciences, few items are significantly different, and the few are negative. In Health Sciences, there are negative items related to book publications, but otherwise, many items are positive. Since the book publication index asks about the number of publications over a lifetime, it favors older researchers and may have a different trend than the article submission and research publication index, which asks about the number of publications per year.

Table 5 shows the results of comparing methods of information acquisition in financial terms. The approach to interpreting these results mirrors that of Table 4. There are significant differences in the Health Sciences and Social Sciences & Humanities fields, with two specific aspects showing marked disparities, particularly in the research presentations within Social Sciences & Humanities. However, the overall number of items with significant differences remains small.

Table 3: Objects of information search (T-tests)

Table with columns: Academic field, Question, Group (High/Low), Physical Sciences (Paper submissions, Research presentations, Book publications), Health Sciences (Paper submissions, Research presentations, Book publications), Life Sciences (Paper submissions, Research presentations, Book publications), Social Sciences & Humanities (Paper submissions, Research presentations, Book publications).

\* p < 0.05, \*\* p < 0.01

Options: 1.Never, 2.Rarely, 3.Sometimes, 4.Always

Table 4: Methods of information collection (Chi-square tests)

Table with columns: Academic field, Question, Yes/No, Physical Sciences (Paper submissions, Research presentations, Book publications), Health Sciences (Paper submissions, Research presentations, Book publications), Life Sciences (Paper submissions, Research presentations, Book publications), Social Sciences & Humanities (Paper submissions, Research presentations, Book publications).

\* p < 0.05, \*\* p < 0.01

Table 5: Methods of information acquisition (Chi-square tests)

Table with columns: Academic field, Question, Yes/No, Physical Sciences (Paper submissions, Research presentations, Book publications), Health Sciences (Paper submissions, Research presentations, Book publications), Life Sciences (Paper submissions, Research presentations, Book publications), Social Sciences & Humanities (Paper submissions, Research presentations, Book publications).

\* p < 0.05, \*\* p < 0.01

### 3.2 Information dissemination

Table 6 shows the results of responses to Open Access publishing. The approach to interpreting these results mirrors that of Table 4 or 5. While the item "(1) Open Access (no subscription or publication fees)" was received a negative response in Physical Sciences, all other items in all fields were answered positively. Notably, "(2) Gold OA (author pays publication fee)" emerged as the most prevalent practice. Furthermore, the fields of Health Sciences, and Social Sciences & Humanities were more likely to engage in "(7) Closed Access (readers pay a subscription fee)". There are no notable differences in the use of preprint servers, whose use has been increasing rapidly in recent years "(8) Pre-reviewed papers are published to a preprint server".

Table 7 shows the results related to the frequency of disseminating research information. The approach to interpreting these results mirrors that of Table 3. Significant differences are observed across numerous aspects of research dissemination, with nearly all outcomes being positive, except for one. Notably, practices such as "(1) Posting an introduction of your research on your own laboratory website, etc." and "(4) Your organization publishes a press release introducing your research" are prevalent across various fields.

Table 6: Use of open access (Chi-square tests)

Academic field	Question	Physical Sciences						Health Sciences						Life Sciences						Social Sciences & Humanities					
		Paper		Research		Book		Paper		Research		Book		Paper		Research		Book		Paper		Research		Book	
		High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low		
Yes	(1) Open Access (no subscription or publication fees are charged)	39	205	70	174*	64	180	32	115	59	88	33	114	33	98	39	92	37*	94	38	228	120	146	57	209
	No	44	224	103*	165	69	199	13	90	33	70	21	82	21	105	37	89	22	104*	17	114	66	65	31	100
Yes	(2) Gold OA (author pays publication fee)	59**	196	99*	156	76*	179	27*	86	50*	63	25	88	32	111	43	100	31	112	14	60	46**	28	14	60
	No	24	233**	74	183*	57	200*	18	119*	42	95*	29	108	22	92	33	81	28	86	41	282	140	183**	74	249
Yes	(3) Green OA (author's own publication in repository)	27**	81	51**	57	29	79	8	32	17	23	11	29	9	29	14	24	8	30	16	106	50	72	27	95
	No	56	348**	122	282**	104	300	37	173	75	135	43	167	45	174	62	157	51	168	39	236	136	139	61	214
Yes	(4) Hybrid OA (author chooses to pay, reader is free)	23*	75	38	60	24	74	13	34	18	29	7	40	10	46	17	39	14	42	9**	21	18	12	6	24
	No	60	354*	135	279	109	305	32	171	74	129	47	156	44	157	59	142	45	156	46	321**	168	199	82	285
Yes	(5) Bronze OA (free of charge at publisher's discretion)	3	11	4	10	3	11	3	8	7	4	3	8	0	2	1	1	1	1	1	6	5	2	2	5
	No	80	418	169	329	130	368	42	197	85	154	51	188	54	201	75	180	58	197	54	336	181	209	86	304
Yes	(6) Delayed OA (automatically released after a reserved)	29	136	50	115	51	114	13	41	23	31	16	38	29	87	42*	74	26	90	22	126	72	76	44**	104
	No	54	293	123	224	82	265	32	164	69	127	38	158	25	116	34	107*	33	108	33	216	114	135	44	205**
Yes	(7) Closed Access (readers pay a subscription fee)	51	246	96	201	83	214	24*	70	44*	50	25	69	27	91	36	82	25	93	21	125	69	77	42*	104
	No	32	183	77	138	50	165	21	135*	48	108*	29	127	27	112	40	99	34	105	34	217	117	134	46	205*
Yes	(8) Pre-reviewed papers are published to a preprint server	17	97	37	77	24	90	5	10	7	8	4	11	10	23	12	21	10	23	4	20	14	10	4	20
	No	66	332	136	262	109	289	40	195	85	150	50	185	44	180	64	160	49	175	51	322	172	201	84	289

\* p < 0.05, \*\* p < 0.01

Table 7: Methods of information dissemination (T-tests)

Academic field	Question	Group	Physical Sciences						Health Sciences						Life Sciences						Social Sciences & Humanities					
			Paper		Research		Book		Paper		Research		Book		Paper		Research		Book		Paper		Research		Book	
			Mean	p	Mean	p	Mean	p	Mean	p	Mean	p	Mean	p	Mean	p	Mean	p	Mean	p	Mean	p	Mean	p		
High	(1) Posting an introduction of your research on your own laboratory website, etc.	2.95	**	2.87	**	2.76	**	2.72	**	2.36	*	2.26		3.02	**	2.84	**	2.60		2.11	*	1.91	**	1.87		
		2.47		2.39		2.48		2.04		2.05		2.13		2.24		2.22		2.35		1.72		1.66		1.75		
High	(2) Posting an introduction of your research on X, Facebook, and other SNS yourself	1.65	*	1.57	*	1.48		1.50		1.49		1.35		1.72	**	1.53		1.49		1.76		1.68	*	1.64		
		1.42		1.41		1.45		1.37		1.34		1.41		1.34		1.38		1.40		1.55		1.50		1.57		
High	(3) Your organization posts your research introduction on X, Facebook, and other SNS	1.68	*	1.57		1.59		1.84	**	1.60	**	1.62	*	1.65		1.66		1.68		1.46		1.47	*	1.54	*	
		1.50		1.51		1.51		1.35		1.34		1.39		1.61		1.60		1.60		1.38		1.33		1.35		
High	(4) Your organization publishes a press release introducing your research	2.01	**	1.85		1.93	*	2.24	**	1.92	*	2.12	**	2.27	*	2.17	*	2.21	*	1.74		1.62		1.76	**	
		1.75		1.77		1.75		1.64		1.65		1.66		1.95		1.95		1.96		1.55		1.54		1.52		
High	(5) Sending papers to your own colleagues	1.44	*	1.57		1.54		1.47		1.43		1.50		1.62		1.67		1.73		2.22		2.07		2.38	**	
		1.60		1.58		1.59		1.53		1.56		1.52		1.66		1.65		1.63		2.03		2.05		1.97		
High	(6) Sending papers to the people involved in your research	2.13		2.32		2.21		2.45		2.50		2.75		2.24		2.44		2.59		2.72		2.68		2.88	**	
		2.23		2.16		2.21		2.53		2.53		2.45		2.42		2.37		2.33		2.58		2.54		2.52		
High	(7) Sending papers to your sponsors of your research	1.58		1.77	**	1.73	**	1.42		1.42		1.66	*	1.52		1.70		1.54		1.44		1.47		1.52		
		1.53		1.42		1.48		1.39		1.38		1.33		1.57		1.51		1.57		1.41		1.37		1.39		
High	(8) Sending papers to researchers that you think might be relevant to your research	1.37		1.37		1.34		1.26		1.23		1.24		1.41		1.44		1.46		1.85		1.87		2.26	**	
		1.38		1.39		1.39		1.18		1.17		1.19		1.35		1.33		1.33		1.87		1.87		1.76		

\* p < 0.05, \*\* p < 0.01

Options: 1.Never, 2.Rarely, 3.Sometimes, 4.Always

## 4 Conclusion

This study presents a comparative analysis of high and low performers in terms of collecting research-related information to publishing papers. In the dissemination of research findings, most of the significant differences identified were positive. Regarding Open Access, the significant differences are also positive, especially in the Physical Sciences, Health Sciences, and Social Sciences & Humanities, where Gold OA has been favorably adopted. Conversely, the method of information acquisition showed almost no significant differences. Both positive and negative significant differences were observed in the methods of information collection, suggesting notable disciplinary variances. The findings indicate that high performing researchers place a high priority on research outreach. They preferentially select Gold OA for its paid Open Access options and show a keen interest in sharing their research online, leveraging both personal and organizational websites. However, significant disciplinary differences in information search strategies are observed. Physical Sciences displayed a negative trend in preferred search methods, whereas Social Sciences & Humanities exhibited a positive trend. This distinction may echo previous studies indicating that Social Sciences & Humanities employ diverse information collecting techniques [5].

It is important to note that while some correlations are suggested, these analysis results do not imply causality, so caution must be exercised in interpreting the findings. To enhance the validity of these results, future analyses should combine these indicators with other relevant metrics such as altmetrics and will be conducted using the latest data from [3].

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