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A ResearchGate-way to an international academic community?

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Abstract

Academic Social Networks (ASNs) are becoming an important tool in the professional lives of researchers, providing an online space for international academic discourse. At the micro-level, ASNs serve to facilitate, (a) knowledge sharing, (b) networking, and (c) identity-building. ASNs such as ResearchGate (RG) may support entry into scholarly communities by researchers who are otherwise marginalized in a modern academic environment that privileges research conducted by established researchers in well-resourced institutions in mostly western countries. This national study follows a recently published case study of Japan, and surveys the use of RG by more than 500 researchers across the country. The authors investigate participants' awareness and regularity of use of the 3 micro-level components of RG, and the benefits and challenges of their adoption. The study finds that while RG is largely perceived as valuable for participants, use is unbalanced toward knowledge sharing, which is further limited to posting English-language outputs and accessing literature for personal consumption. Thus, RG may be positioned as a tool rather than a community, the latter requiring a more balanced engagement with the platform, particularly in the networking area. Some practical ideas for achieving this are offered in the discussion.

Keywords Academic social networks · Researcher development · Altmetrics · Knowledge sharing · Networking · Collaboration · Japan

Introduction

Online social networks have drastically changed the ways in which people interact with each other over the past 2 decades. Social networking sites (SNSs) such as Facebook and Twitter now have registered numbers of users in the billions of people, extending all around the world. They are an increasingly important channel of both interpersonal communication, as well as mass communication and information exchange (Fang 2015). Reflecting the

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increasing presence of social networks in our personal lives, social networking platforms that have been designed specifically for use within academia, known as Academic Social Networks (ASNs), are reshaping the professional lives of researchers, playing an increasingly prominent and important role in their research activities (Manca and Ranieri 2017; Weller 2011). A variety of ASNs are available to researchers each with its own distinct focus, although common to all is that they "give each member a profile and allow them to connect to each other in some way and to share information about their publications" (Thelwall and Kousha 2013:721). In reviewing the literature, Meishar-Tal and Pieterse (2017) identify 5 affordances of ASNs: Management of an online persona, diffusion of studies, collaboration, information management, and measurement of impact. Major benefits of adoption as offered by active users include the ability to disseminate one's research and build one's profile, sourcing information and staying up-to-date on current research trends and knowledge, finding potential collaborators, and engaging in discussions with other researchers (Jordan and Weller 2018). ASNs are seen as particularly valuable for early career researchers (ECRs) who are looking to maximize the impact of their research (Nicholas et al. 2018).

As networks of individuals who "interact around a shared interest, where the interaction is at least partially supported and/or mediated by technology and guided by some protocols or norms" (Porter 2006), ASNs can be classed as online communities. Academia itself is a community, albeit one that is highly exclusive. While it may often be positioned as a meritocracy, with membership granted based on merit, there are many social processes that privilege some groups over others, regardless of academic achievement (Zivony 2019). As a free and open network, ASNs may provide access to research and knowledge in places where it may be impeded by social biases and economic and material factors, allowing researchers from diverse contexts to "remain abreast with evolving disciplinary conversations" (Buckhingham 2014:8). Further, as the strength of social network ties has been found to predict future research performance (Cimenler et al. 2014), they may also provide an opportunity to access academic networks of individuals and groups where traditional forms of networking may otherwise prove difficult. Arguably the most prestigious and visible space for networking among scholars is the academic conference, and prohibitive costs serve to exclude those from outside of the Global North, and those from less well-resourced institutions (Parker and Weik 2014). The costs of registration, accommodation, and travel can add up to thousands of dollars, and even in cases where institutional funding covers these costs, it can take months to be reimbursed, making the choice between paying the rent or attending a conference one that many doctoral, post-doctoral and other early career researchers will have to contend with (Tsang 2019). While global mobility is valued highly as a strong (but flawed) indicator of status within academia, it "clearly ignores any social responsibilities researchers may have and articulates them as detached monads" (Parker and Weik 2014:174). The lack of measures by conference organizers to meet the needs of researchers with family responsibilities makes attendance at such networking opportunities challenging, and this is a burden that especially disadvantages women (Bos et al. 2019).

ASNs may also serve to give visibility to research which may be less privileged in traditional dissemination channels, such as peer-reviewed international journals which remain highly prestigious. There is a plethora of research that examines the biases inherent in academic publishing, which reflect existing hierarchies in society. As an exclusive group, academia tends to be highly insular, with Reingewertz and Lutmar (2017) revealing the existence of "bias within some journals towards publishing papers by faculty from their home institution, at the expense of paper quality, as measured by citations" (74). Gender biases are also prevalent, with a large study of over 85,000 articles in science and medical

journals finding that while women are more likely to conduct experiments, it is men who are more likely to have authorship roles (Macaluso 2016). Further, international scholarship in most fields is dominated by research in anglophone countries (Bański and Ferenc 2013; Faraldo-Cabana and Lamela 2019), reflecting the privileged position of English as the main language of scientific communication (Lillis and Curry 2010). While English as a *lingua franca* serves an important role as a facilitator of international knowledge sharing, it also serves as a gatekeeper to engagement in international research communities by those with limited or no English proficiency.

ASNs may serve to circumvent some of the obstacles researchers may otherwise face in becoming an integrated member of an academic community, providing "a critical gateway to collaborative and career opportunities" (Prabhu et al. 2019:132), particularly for those in less privileged positions. It is important to note, however, that their potential to serve as an equalizer is limited as they will invariably reflect existing academic hierarchies (Thelwall and Kousha 2015). Most obviously is the continued centering of English—the major international platforms have been developed exclusively in English, with no multilingual functionality or support (Mason 2020). Further, as shown by Yan and Zhang (2018) in a study of researchers from 61 universities in the United States, online connections between researchers tended to be insular within highly productive institutions, thus replicating the elite 'academic club' online. Several studies have also shown that ASN uptake appears to be more prevalent in Science, Technology, Engineering and Mathematics (STEM) fields than in the Humanities and Social Sciences (HASS) (Elsayed 2015), again mirroring an existing hierarchy and reflecting general funding trends across the world (e.g. Ahlburg 2020; Moahi 2011). Despite these limitations, ASNs may provide an important online space to facilitate inclusion of a wider scope of researchers into academic communities.

Being part of an online community is dependent on participation and the extent to which individuals participate is dependent on a variety of factors. Self-efficacy in technology use and perceptions of the benefits of community participation are both individual factors that have been linked to higher levels of adoption (Wang et al. 2012). Social support is also necessary to develop stronger and more trusting ties between community members, with emotional connections facilitating more contribution from members (Zhou 2019). Social processes may also play a role, with group norms and self-perceptions of an individual's position within a group influencing participation (Zhou 2011). As online communities are likely to involve members from various geographic contexts, there may be cultural differences that influence the use and perceptions of online communities. In one study that investigated the use of online networks (both SNSs and ASNs) by researchers in four countries (Germany, Singapore, UK, USA), there were national differences seen in the frequency of checking and updating profiles (Greifeneder et al. 2018), suggesting that researchers should be cognizant of differences across social groups when investigating ASN participation. Several models have been proposed to describe the different ways in which members engage in online communities. While there is variety in the methods employed to develop these topographies, in the number of categories, and the terminology adopted (See Akar and Mardikyan 2018 for a comprehensive review), they are generally presented as hierarchies from passive up to active users, although recent research has questioned the largely negative positioning of less visibly active users, sometimes known as 'lurkers', and shown that these participants may be gaining important benefits from their peripheral engagement in online communities (Bozkurt et al. 2020).

With the ubiquitous presence of social networks in our personal lives, and the increasingly important role they play in the professional lives of researchers, it is imperative that they are used effectively for maximum benefit. While some may see ASNs as time wasters,

the growing body of knowledge shows that they can serve as vital spaces that connect academics with their various communities. This is important not only for the potential professional benefits we have already outlined, but also to help combat the pervasive problem of academic isolation, "an involuntary perceived separation from the academic field to which one aspires to belong, associated with a perceived lack of agency in terms of one's engagement with the field" (Belkhir et al. 2019, p. 261). ASNs may be seen as a way for scholars to take the reins, so to speak, and harness the various functions in order to enter an academic community, and control their position and role within that community. This is only possible, however, if researchers have an understanding of the various ways in which ASNs can be used, and actively apply this knowledge to become fully engaged members of the online researcher community. A recent review of the extant literature found very few studies that focus on individual and collective practices of scholars and their participation in online networks (Manca 2018). Thus in our study, described in the next section, we offer an analysis of a nationally-bound, heterogeneous group of researchers, focusing on their perceptions, awareness, and adoption of the various features of a popular ASN in their professional lives.

Study context and framework

This study presents the second phase of investigation of ASN usage in Japan, a country that otherwise has high levels of social media adoption (Guyot 2010), but where ASNs have yet to play a prominent role in the lives of researchers (Mason 2020). With decreasing research quality and productivity impacting the international standing of its higher education sector (Armitage 2018; Phillips 2017a, b), the Japanese government has introduced explicit policies to address the "inward tendency" of its researchers and to promote increased international visibility and collaboration (Ministry of Education, Culture, Sports, Science and Technology [MEXT] 2019). As illustrated, ASNs may be one potential tool to aide in this goal. The first phase of investigation involved an exploratory study to determine the uptake of the major social media platforms in a representative sample of researchers in one region of the country, using public-facing bibliometric data. One finding of that study, recently published in *Scientometrics* (Mason 2020), showed that of the two major international ASNs, ResearchGate (RG) was much more popular than Academia.edu, reflecting trends in other cohort studies (Ali and Richardson 2017; Elsayed 2015; Swanepoel and Scott 2018), and as such, RG was chosen for specific focus in the continued investigation.

This study is guided by Manca's (2017) framework for analyzing ASNs, and is particularly focused on the micro-level, which concerns "individual use of social platforms and ways single users exploit these sites for specific purposes" (23). ASNs at the micro-level are composed of 3 components: knowledge sharing related to disseminating and accessing knowledge, networking related to building a personal network, and identity related to building reputation, trust and visibility (Manca 2017). Each of these areas may be exploited using the features available on ASN platforms, and in doing so researchers may find for themselves a community through which to enhance their professional activities.

RG is perhaps the most widely internationally recognized ASN (Van Noorden 2014). Founded in 2008 by two scientists, as of writing it cites a membership of around 17 million users (ResearchGate n.d.). RG is a for-profit platform that relies mainly on corporate investors for funding, and unlike some other platforms, all elements of the network are available at no financial cost to users. The platform includes features that facilitate knowledge

sharing, networking, and identity-building as per the framework adopted, and these can be seen in Table 1, although the features generally fit across more than one category. RG users develop a personal profile page where they can add details of their professional interests, activities, and outputs, and if copyright allows can upload a full-text version of their published works, or they can post a pre-print which they can invite researchers to view and provide feedback on. Thus, knowledge sharing works in two ways as users can both disseminate as well as access knowledge. Users can 'follow' each other, and 'recommend' each other's projects and publications. A unique feature of RG is the Q&A section where researchers can post questions to each other and elicit responses from researchers with similar research interests. In addition, RG automatically displays a number of individual metrics on each profile page, which can help build an online reputation. This includes counts of the number of times a publication has been read on the platform, and the number of times it has been cited (Thelwall and Kousha 2017). RG also offers an RG-score and Research Interest Score, and although the methods for calculating the in-house metrics remains largely a mystery (Orduna-Malea et al. 2017), as measurements of activity within the platform they may provide a useful indication of a users' level of activity within the online community.

This study investigates the ways in which researchers in Japan use RG at the micro-level in order to better understand if and how the platform is being harnessed as a gateway into academic communities. Specifically, the following research questions are investigated:

To what extent are researchers in Japan aware of, and utilize:

- the knowledge sharing components related to one's own research,
- the knowledge sharing components related to the research of others,
- the networking components, and
- the identity-building components of RG?

Methods

Survey methodology was adopted as the most effective approach for meeting the research aims of the study. An online questionnaire was developed and piloted by the researchers for the purpose of the study, with both quantitative and qualitative data collected as necessitated by each of the research questions. The questionnaire began with the collection of demographic and employment-related questions to enable contextualization of the sample and comparison among in-sample groups. Table 1 shows the questions posed to participants in English, although in the official version of the survey all questions were presented in both Japanese and English, which is a novel aspect of this study. While the reporting in other studies of ASN usage is not explicit on this point, it does appear that surveys and interviews are conducted in English, and as such users who may have limited English skills may be further excluded from such research. For our study, all questions were presented in both English and Japanese, and in the case of the open-ended questions, participants had the option of responding in either language. The survey was developed by the two authors, one native speaker of English and one native speaker of Japanese, each with proficiency in both languages.

Our target population included any researcher currently working in a university or research institution in Japan. The higher education system in Japan is broadly divided into three sectors: national (funded federally), public (funded by prefectures or cities), and

Table 1 Questionnaire items

Focus	Details/questions	Question type
Social media use	Do you use any other social networks for academic purposes?	Checkbox
	Is social media important to you as a researcher?	5-point Likert scale[a]
ResearchGate use	How long have you been using ResearchGate?	Multiple choice
	How often do you check your ResearchGate account?	5-point Likert scale[b]
	Is ResearchGate important for you as a researcher?	5-point Likert scale[a]
Knowledge sharing (own research)	How often do you use these dissemination-related features?	6-point Likert scale[c]
	Post information about your own research outputs	
	Post a full-text copy of your own research outputs	
	Post information or outputs in Japanese	
	Post information or outputs in English	
	Post a preprint of your work	
	Create a project page	
Knowledge sharing (others)	How often do you use these engagement related features?	6-point Likert scale[c]
	Read another researcher's publication	
	Download another researcher's publication	
	Recommend another researcher's publication	
	Follow another researcher's publication	
	Share another researcher's publication	
	Request a copy of another researcher's publication	

Table 1 (continued)

Focus	Details/questions	Question type
Networking	How often do you use these interaction-related features?	6-point Likert scale[c]
	Look at another researcher's profile	
	Follow another researcher	
	Ask a question in the Q&A section	
	Answer a question in the Q&A section	
	Recommend a question in the Q&A section	
	Follow a question in the Q&A section	
	Send a private message to a researcher	
	Approach a researcher you know through RG for collaboration	
Identity-building	How much do you care about the following RG statistics?	5-point Likert scale[d]
	RG Score	
	Total Research Interest Score	
	Number of citations	
	Number of recommendations	
	Number of reads	
	Number of followers	
Benefits	What benefits do researchers perceive in participating in the RG community?	Open ended
Challenges	What challenges are faced that impede further or effective participation in the RG community?	Open ended

[a]Strongly agree, agree, neither agree nor disagree, disagree, strongly disagree

[b]At least once a day, at least once a week, at least once a month, at least once every 6 months, rarely

[c]Often, sometimes, occasionally, at least once, never, I don't know this feature

[d]Very much, quite a lot, a little, not at all, I don't know this metric

private institutions, including universities, 2-year colleges, and research centers. According to the Ministry of Internal Affairs and Communications (MIAC 2019), there were 874,800 researchers in Japan at the time of data collection. While more detailed information is limited, it is known that only 16.6% researchers are female (MIAC 2019), and while attempts have been made to address the gender imbalance and inequality in academia, Japan continues to be among the least gender-diverse higher education systems in the world (Osumi 2018). We also know that higher education in Japan is largely dominated by a domestic workforce. The most recent data shows in 2019 there were 22,693 non-Japanese researchers in full-time, part-time and casual positions in Japanese universities (the data excludes those in research institutes), constituting around 6% of the researcher workforce, but when looking only at permanent faculty that drops to less than 5% (MEXT 2019). While our multi-pronged recruitment procedures (discussed in the next section) did not result in a truly random sample, and the lack of more comprehensive baseline data precludes a stratified sampling approach, we used the total population of researchers to calculate a minimal sample size for a 95% confidence interval and a 5% margin of error, and found that to meet the desired statistical constraints, we would need a sample size of at least 384 participants, and we used this number as an initial target for recruitment.

To identify as diverse a range of researchers across the country as possible, the authors adopted both active and passive measures for participant recruitment, an approach that the authors have successfully applied to recruit researchers in other studies where the absence of national databases precludes stratified sampling (Mason et al. 2020). For each of the 47 prefectures in Japan, one national, one public, and one private university was selected using a random number generator. From each of these universities, 20 RG users were identified. Where more than 20 RG users were found, random number generators were used to select the required number of researchers, and where less than 20 users were found, another institution was selected from the same sector. Selected RG users were cross-checked against the *J-Global* database, a national database of researchers in Japan managed by the Japan Science and Technology Agency, and contact was made via the *J-Global* online messaging system, with requests arriving at the recipient's institutional email address. While not all researchers use this database, registration is increasingly becoming a requirement by institutions and funders, and this was chosen as the most effective method as initial attempts to use RG messaging function proved ineffective, due to a prevalence of inactive accounts and daily message limits. Following this method, 3087 researchers were directly contacted between November 2019 and February 2020. During this same time period, information about the study was shared with the professional contacts of the 2 authors, and posted on RG, Researchmap (a domestic Japanese ASN), and Twitter. Japanese language searches were conducted on each platform to locate posts mentioning RG, and messages were sent directly to identified users. Finally, all attempts at recruitment included a request to share information about the study with colleagues, adding snowball sampling to the repertoire of approaches.

Quantitative data analysis began with descriptive statistics to calculate frequencies, ranges, and means for each item. Cronbach's alpha coefficient was calculated for each of the four Likert scales, in all cases $a \geq 0.80$ indicated 'good' internal consistency. Non-parametric tests were conducted to investigate the difference in mean rank between groups, using Mann–Whitney U for binary groups and Kruskal–Wallis *(H)* when independent variables are categorized in three or more groups, which is a common practice in social science research (Mat Roni et al. 2020a). For significant findings at $p \leq 0.05$, effect sizes were calculated using Z or X^2 scores respectively to calculate an eta-squared (η^2) effect size estimate (Gignac 2019). In order to investigate the relationship of the scales to each other,

Spearman's ρ was used to calculate a non-parametric correlation coefficient. In reporting our statistical findings, due to word count limitations, we only report those results for which significance was determined. We also do not report results that are logically explained and have no practical significance, such as an increase in length of RG use with age.

Qualitative results were subject to a manifest content analysis whereby the researcher "describes *what* the informants actually say (or in this case, write), stays very close to the text, uses the words themselves, and describes the visible and obvious in the text" (Bengtsson 2016:10). The benefits and challenges reported in the participants' responses constituted the unit of analysis, and codes recurring more than once were reported as the most salient. Participants were also given an opportunity to provide additional comments, and where these reported benefits or challenges they were also added to the data set. To enhance reliability, the manual coding involved both authors. To begin the process, the first author inductively developed codes, which were named in English as the final report was to be written in English. The codes were applied to the original data as they were provided by the participants (in Japanese or English or occasionally a mix of both). Then, the second author reviewed all codes and noted agreement or disagreement for each coded response. Through an asynchronous dialogue using a shared online document there was a back-and-forth process to refine the codes and their application across entries until agreement was reached. In this way, as much as possible threats that may be introduced when translating from one language to another could be minimized (Birbili 2000), and the only stage at which translation of participant data occurred was if it was used as an illustrative quote in the final English report, in which case the two bilingual researchers discussed the translation to ensure that the original meaning and nuance was retained as much as possible.

Results

In total, 508 researchers across all areas of Japan completed the survey, reaching well over our minimum sample target. The response rate of 16% is high for a cold-call email recruitment method (although this was not our only recruitment method), with a recent study of response rates in Japan using a similar method reaching only 6% despite the use of incentives (So et al. 2018). We note that the majority of participants in this sample are male and Japanese-born, reflective of the wider population of academics in the country. Table 2 provides an overview of the participants, and these characteristics are used as independent variables for testing differences within the sample.

Importance, length, and frequency of RG use

Among the participants, the majority (72%, $n = 366$) believed that online networks in general were important to their role as researcher (responding agree or strongly agree), and most (94%, $n = 478$) used at least one social network other than RG for academic purposes, with an average of three. The most commonly adopted networks are shown in Table 3.

In regards specifically to RG, a majority of participants (59%, $n = 301$) agreed that the platform was important for them as a researcher, with a relatively smaller number (11%, $n = 61$) disagreeing, and the remaining one third (29%, $n = 146$) giving a neutral response. Non-parametric tests showed that both early career researchers, $U = 75{,}104$, $p = 0.012$, $\eta^2 = 0.01$, and researchers born outside of Japan, $U = 7508$, $p = 0.007$, $\eta^2 0 = 0.01$, rated RG as more important, significantly more so than their counterparts, although with relatively

Table 2 Participant personal and employment characteristics, $N = 508$

Characteristic	In sample	
Gender		
Male	435	86%
Female	72	14%
Other	1	<1%
Region of birth		
Japan	466	92%
Outside Japan	42	9%
Age group (s)		
20	18	4%
30	132	26%
40	194	38%
50	118	23%
60	38	8%
70	8	2%
Languages of research outputs[a]		
English	485	96%
Japanese	407	80%
Other	7	1%
Workplace		
Private university/institution	196	39%
National university/institution	180	35%
Public university/institution	105	21%
Other	27	5%
Early Career Researcher		
Yes	198	39%
No	310	61%
Broad field		
STEM and medical fields[b]	374	73%
HASS	133	27%
Unknown	1	<1%
Position		
Professor	158	31%
Associate Professor	141	28%
Assistant Professor	84	17%
Lecturer	56	11%
Post-doctoral researcher	23	5%
Doctoral researcher	7	1%
Other, undefined researcher	27	5%
Other[c]	12	2%

[a]Multiple responses possible

[b]Medical fields include medicine, dentistry, nursing, pharmacy, and health sciences

[c]Includes research assistants, independent researchers, and job seekers

Table 3 Online network services other than RG used by participants, $n=478$

Network	In sample	
Researchmap	385	81%
Google Scholar	362	76%
Facebook	176	37%
Mendeley	165	35%
LinkedIn	139	29%
Twitter	129	27%
Academia.edu	106	22%
Zotero	13	3%

small effect sizes, with $\eta^2=0.01$ indicating that early career status and nationality each account for 1% of the variance.

The length and regularity of RG use is shown in Table 4, showing that most respondents have been RG users for at least two years, and the majority are weekly or monthly users, although a sizeable number of participants rarely use the platform. In this sample those who reported more frequent RG use were men, $U=10{,}917$, $p=0.000$, $\eta^2=0.03$, early career researchers, $U=26{,}340$, $p=0.022$, $\eta^2=0.01$, non-Japanese researchers, $U=7366$, $p=0.016$, $\eta^2=0.01$, and those who publish in English, $U=3677$, $p=0.005$, $\eta^2=0.015$.

Knowledge sharing in the RG community (own research)

Figure 1 provides an overview of participant responses regarding RG features related to knowledge sharing through dissemination of one's own research. Awareness of each feature is given as a percentage, and the stacked bar graphs show the regularity of use of each feature, reflecting responses only from those with awareness, as a lack of awareness precludes usage. There was awareness by more than 90% of respondents across all related features, and while participation was seen most regularly through posting publications, posting of English-language publications was more common than posting of Japanese-language outputs. In testing group differences, both males, $U=12{,}321$,

Table 4 Length and frequency of RG usage, $N=508$

| Length of usage	In sample	(%)	Frequency of usage	In sample	(%)
More than 10 years	46	9	At least once a day	27	5
More than 5 years	238	46	At least once a week	136	27
More than 2 years	140	28	At least once a month	171	34
More than 1 year	24	5	At least every 6 months	66	13
More than 6 months	10	2	Rarely	101	20
Less than 6 months	8	2	Upon receiving notification[a]	6	1
Don't recall	40	8	No response	1	<1
No response	2	<1			

[a]Derived from 'other' option
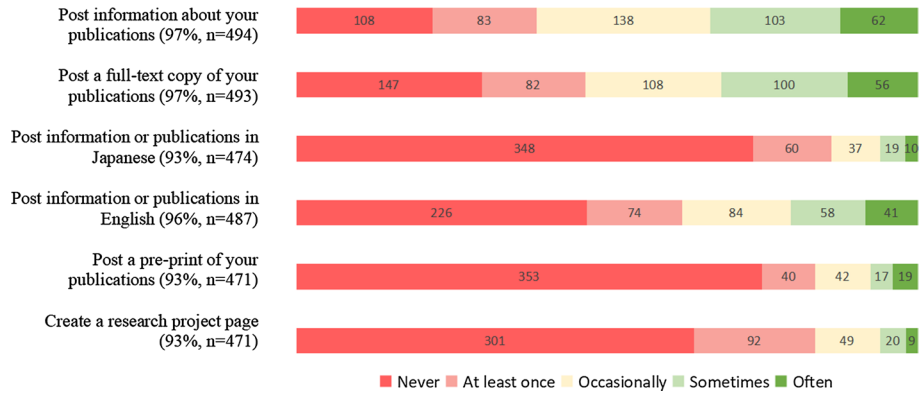
Fig. 1 Awareness (in parentheses) and frequency of use of knowledge sharing (dissemination) RG features

$p = 0.025$, $\eta^2 = 0.01$, and non-Japanese researchers, $U = 5084$, $p = 0.000$, $\eta^2 = 0.05$, were more likely to engage in dissemination activities.

Knowledge sharing in the RG community (others research)

Figure 2 shows the awareness and regularity of knowledge sharing through accessing and sharing the research of others. It shows that overall, users more regularly read, download, and request the research of others for their own consumption, but are less frequent in bringing attention to others' research, such as through recommending or sharing, although there is a high level of awareness of such features. Significantly higher mean ranks were seen by early career researchers, $U = 26,225$, $p = 0.025$, $\eta^2 = 0.01$, those in HASS fields, $U = 19,445$, $p = 0.002$, $\eta^2 = 0.02$, and non-Japanese researchers, $U = 5972$, $p = 0.000$, $\eta^2 = 0.03$.
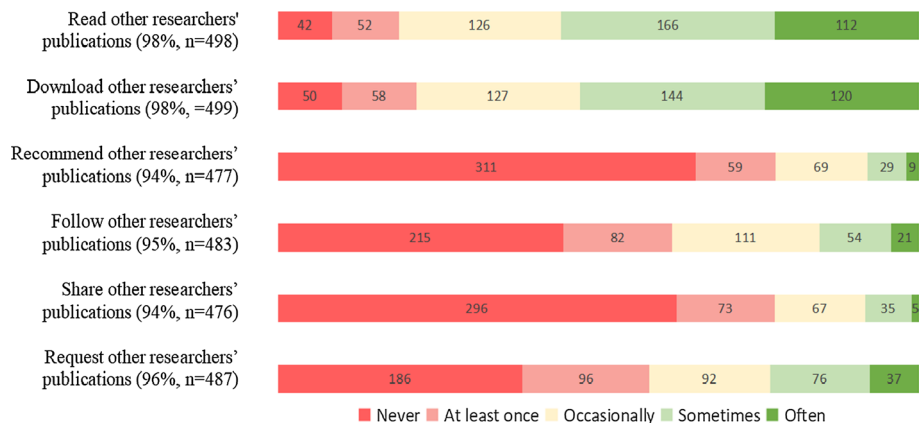

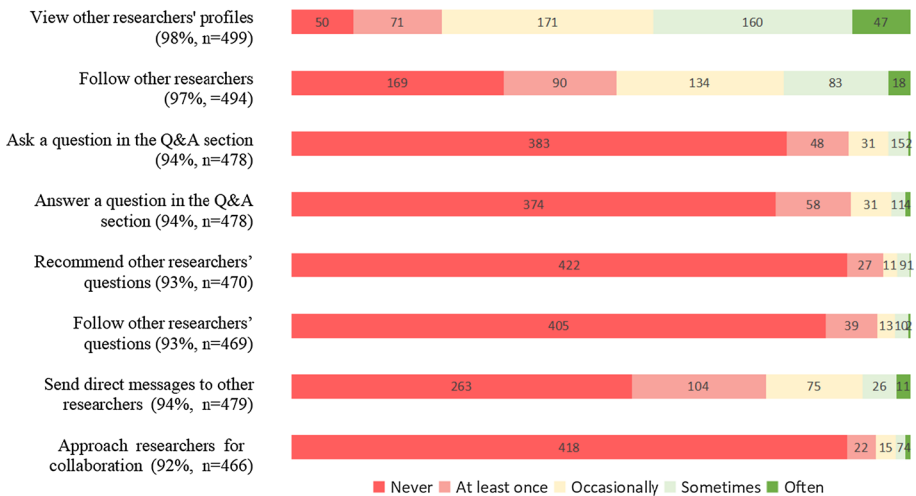**Fig. 2** Awareness (in parentheses) and frequency of use of knowledge sharing (access) RG features

Fig. 3 Awareness (in parentheses) and frequency of use of networking features

Networking in the RG community

Figure 3 shows the awareness and regularity of the use of 8 features related to networking with other users within the RG community. Once again, there was a high level of awareness of the features available, but participation was mostly limited to several passive activities (viewing and 'following' which involves simply clicking a button), and most participants had never engaged in the other more interactive activities, particularly in relation to the Q&A discussion boards. Only one group was found to be statistically more likely to engage in the networking component of RG, that being researchers born outside of Japan, $U = 5055$, $p = 0.000$, $\eta^2 = 0.09$, which showed a medium effect size of 9% (Cohen 1988).

Identity-building in the RG community

Because the identity-building features of RG are not actively used, slightly different questioning was needed and participants were asked to rate their value of each of the individual metrics available. In this component of RG we see several instances where feature awareness goes below 90% but remains above 83%. The highest level of importance is placed on citation counts, followed by the number of reads. No significant differences in mean rank were found, meaning that the importance of RG identity-building metrics are independent of characteristics such as gender, field, position, etc. (Fig. 4).

Relationship between the scales

Correlation tests showed a high level of relatedness between the different characteristics and types of usage of RG. As shown in Table 5, the 4 components of RG (d–g) showed strong and positive correlation to each other. Although it was not the case regarding the length of use, both the frequency of use and the importance placed on RG were correlated to use of the four
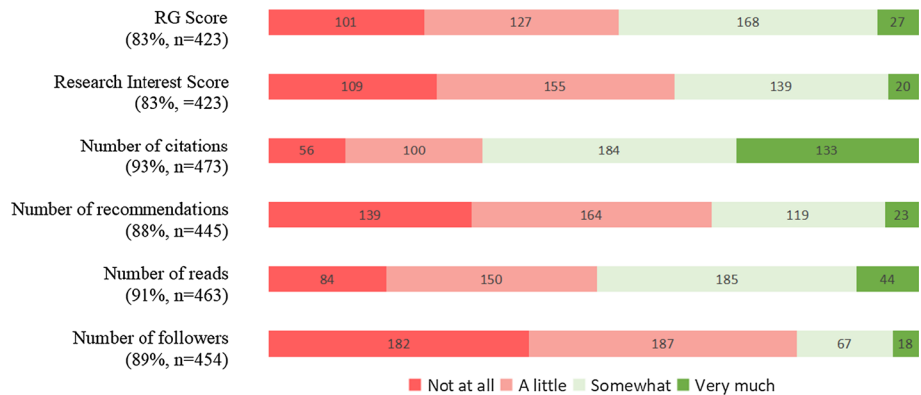
Fig. 4 Awareness (in parentheses) of and importance placed on identity-building features

Table 5 Correlations between characteristics and types of RG usage

	a	b	c	d	e	f	g
a. Length of RG use	–						
b. Frequency of RG use	.035	–					
c. Importance placed on RG	.127**	.547**	–				
d. RG for knowledge sharing (own)	.102*	.433**	.322**	–			
e. RG for knowledge sharing (others)	.053	.363**	.413**	.526**	–		
f. RG for networking	.141**	.232**	.207**	.354**	.373**	–	
g. RG for identity-building	.011	.273**	.273**	.315**	.239**	.137**	–

Significant at the 0.01 level** or 0.05 level* (2-tailed)

components of RG in the same direction. This means, for example, that as importance placed on RG increases so does usage, and as usage of RG increases so does the importance placed on it, taking care to note that there is no assumption of a causal relationship.

Benefits of participation

Just under 60% of participants offered one or more benefit that they have experienced as a result of engaging in the RG community. From the collective responses, 11 key benefits were identified. The most commonly cited benefits were the ease of access to literature, as well as access to knowledge about relevant research and researchers. Table 6 summarizes the responses in a joint table, which allows codes identified from qualitative data to be expressed both numerically and textually to aide interpretation and contextualization (Guetterman et al. 2015).

Challenges to participation

In terms of challenges, a smaller percentage of participants offered at least one challenge to participating in RG, at just under 30%, but a slightly larger array of 15 themes were identified, as listed in Table 7. The most common challenge related to copyright concerns,

Table 6 Recurring benefits of RG use as reported by participants, $n = 287$

Benefit	Count	Text example[a]
Gain access to publications	113	*My institution has limited contracts with electronic journals, so it has helped me to find papers*
Gain knowledge about research/ers	79	I found some interesting reports in (the) recommendation pages. It helped me to collect knowledge related to my study
Disseminate research and build a researcher profile	50	*I think it's important to have as many people read your paper as soon as you publish it, so I want to make it as appealing as possible. I use RG as one of the tools to do that*
Communicate with other researchers	35	I have connected with researchers both domestically and internationally through RG's private message function
Receive feedback and improve motivation	29	*It gives me encouragement to know through concrete numbers that other researchers have read or cited one of my papers written in English*
Assess the impact/Impact of one's research[b]	27	It is nice to see people are reading my old publications and they seem to enjoy them and can use them for their present research *Through links and evaluation metrics, and researchers, as well as impact score, it's great to be able to know easily how your research is thought of*
Gain opportunities for collaboration	10	*Before attending an international conference, I was able to communicate with other delegates, which led to joint research*
Organize research outputs	8	*Research results automatically accumulate in ResearchGate, so it is very useful as an information source when reporting your research results to your university*
Find researchers	8	When I am an editor of (a) journal, I find candidates of reviewers using RG
Receive offers (job, editor, reviewer, etc.)	5	*I had requests from guest editors, and I've received more invitations from international conferences*
Job search	2	*I am using it now to search for a job*

[a]Text in italics is a translation from a response in Japanese

[b]'impact' in this case refers to a general and unquantified impact, while 'Impact' refers to quantifiable measures, such as impact factor or H-Index

Table 7 Recurring challenges of RG use as reported by participants, $n=137$

Challenge	Count	Text example[a]
Copyright concerns	29	Determining a paper uploadable or not is a difficult and time-consuming task
Difficult to use, unsure how to use	23	*There are many parts of ResearchGate where I do not know exactly what I can do, and I don't know what kind of usage is appropriate*
Frequent unwanted emails from RG	13	The service frequently asks me to upload my paper. It is somewhat annoying
Slow or no response to article requests	13	Many of the authors are inactive, and so sending a message to request an article does nothing
Unwanted or unnecessary contact from researchers	10	*It's annoying to be asked to send a paper without checking that it is already publicly available online*
Technical problems	9	It is hard to update publications and to unify duplicated articles (without losing the statistics)
Privacy concerns	8	*I'm worried about posting a profile photo of my face. I don't have one posted at the moment*
Concerns about metric scores	7	I also don't care so much about the citation count in RG as I'm not sure how accurate it is
Time-consuming, lack of time	7	Entering information is time consuming!
Difficulties uploading Japanese outputs (technically and psychologically)	6	*It's troublesome that for papers published in Japanese journals, the journal names cannot be registered in the system* *It's difficult to upload papers in Japanese because there are few people who read them*
Concerns about own research limits	4	*I'm embarrassed that I can only participate by 'read only' because I don't have much of a resume*
Researchers with similar names	3	*My surname is 'Tanaka', a very common name in Japan. So, without my knowledge articles written by other researchers with the same name are linked to me. I waste a lot of time responding to questions such as "Is this your paper?" As a result, my work registered on RG is quite inaccurate. I would like to delete my account*
Cost[b]	3	Limited functions to free users
English language proficiency	3	*I am worried about how to make appropriate requests to overseas researchers. I am worried about contacting them in English*
Limited use by other researchers in Japan	3	*Compared to the activities on Research map, Japanese universities are not using RG very much*

[a]Text in italics is a translation from a response in Japanese

[b]Use of the RG platform itself is free

making it difficult for some participants to determine what they are legally allowed to post on their profiles.

Discussion

This study has investigated the ways in which a random sample of 508 researchers across Japan use RG at the micro-level, to better understand if the platform is being harnessed as a potential gateway into academic communities. The findings should be read in light of several limitations, including the size and scope of the sample, and while attempts were made to recruit as large and diverse a sample of researchers as possible, representativeness cannot be determined. As such, our study identifies possible trends and we make no claim of generalizability beyond the sample. The sample is likely to be skewed toward those who are proficient technology users as this was the main channel of recruitment, and toward those who are regular RG users, as infrequent users may feel that they do not have anything to offer and thus decline to participate. The use of self-report surveys is open to several biases such as social desirability bias, which may influence participant responses in this study. Our study design included questions to elicit both quantitative and qualitative data, and in the latter case we used several strategies to try to elicit rich, descriptive data about the experiences of participants using RG, including requiring a response, allowing participants to respond in either English or Japanese, and encouraging participants to give as much detail as possible. Ultimately, the data collected was largely descriptive in nature. In further research with participants in Japan, we recommend the use of interviews or other techniques that allow the development of rapport between participant and researcher, which may be necessary to collect more personal and in-depth qualitative responses.

This national study builds on a previous localized study in Japan that relied on public-facing bibliometric data. As might be expected, some of the conclusions are confirmed, including that 'sharing of research appears to be limited, and engagement with the interactive features of ASNs appears to be underutilised' (Mason 2020, p. 1764). By collecting data directly from RG users themselves, we are able to gain a more nuanced understanding of RG usage—what features are known, what features are used, to what extent, and the perceived benefits and challenges influencing usage. Following Manca's (2017) model, we focus on three components of RG: knowledge sharing (which we further divide into own and others' knowledge), networking, and identity-building. For the most part, the platform provides considerable benefit to many researchers for whom it is a regular part of their academic activities, and this appears to be particularly true of early career researchers, as beginning researchers in Japan, as in many countries, face considerable challenges in finding employment in an extremely competitive academic labour market (Murai 2016). Quantitative findings show high levels of awareness of the various features available to RG users, although its actual use is largely limited to several key features, specifically accessing the researchers of others, and disseminating research outputs. Application of the tripartite model reveals an unbalanced use of RG, and the open-ended responses provide some explanatory insights. The following discussion draws on the results of this study and the literature to offer ways to promote effective usage of RG at the micro-level across all components, with a view to enhancing participation and engagement in the community.

One of the major uses of RG for participants is access to knowledge, particularly through posted research outputs. In recent years there have been considerable cuts to government funding of universities (Armitage 2018; Phillips 2017a), and this often impacts

institutional subscriptions to major international databases, which can cost millions of dollars per year (Wilson 2017). This might explain the significantly higher use of knowledge access features by researchers in HASS, where cuts are felt more strongly (Grove 2015). Indeed, for those 113 who reported access to literature as a benefit, around one-third ($n = 33$) explicitly noted that RG provides access to articles not otherwise available to them due to financial or resource limitations at their institution. Without access to a wide range of recent and relevant international literature, researchers may struggle to get their work published in quality outlets. Knowledge access may also be enhanced by adding the other less adopted but relatively simple features, such as recommending, following, and sharing other researchers' publications. Not only does this help to build (albeit initially weak) ties to other members of the RG community, it serves to refine the results of algorithms that are used to suggest new research and researchers based on previous activity.

Participants also use RG as a platform to disseminate their own research, which is noted as a major benefit. While most participants produce both English and Japanese outputs, they are more likely to post their English-language publications. The predominance of English-language research on the platform may impact researchers' decisions about what information they can post, with one researcher noting that 'compared to the information I post on my own website, the information on RG is much less; because most of my papers are in Japanese I don't update my profile'. While it appears that some participants may feel discouraged from posting outputs in Japanese, researchers from diverse linguistic backgrounds do use RG to disseminate non-English research, and in the field of social representations, papers in ten different languages were identified on RG, including French, Spanish, Portuguese and Italian (Silvana de Rosa et al. 2016). Thus, posting Japanese-language research may enhance international visibility, particularly if an abstract or key findings are provided, and inclusion of a reference in English may encourage citation of non-English research. Nevertheless there are technical challenges for disseminating research in Japanese. For example, the names of domestic Japanese journals and conferences are often not registered on the platform, and thus researchers are unable to post in the usual 'publication' section, and this is an area where RG should ensure that their platform is responsive to the needs of their multilingual users.

One of the major barriers to RG use is in the area of knowledge sharing, and relates to copyright issues. Much confusion is expressed around whether or not a paper can be posted publicly on the platform. Indeed this is an area fraught with tension, with lawsuits launched against the platform from journal publishers accusing RG of violating copyright law by allowing free distribution of articles (Else 2018; Singh Chawla 2017). Jamali's (2017) study shows the complexity and diversity of policies and the challenges in understanding them among researchers. Their study of a random sample of 500 English journal articles posted on RG, found that around half of non-Open Access papers breached the publisher's copyright policy, although much of this related to posting an incorrect version, rather than posting itself. Navigating the complexities of copyright law and journal policy is a challenge for many researchers. What is needed is for ASN platforms and individual journals to provide guidelines that are easily accessible and not hidden in fine print or jargonistic language, so that authors are able to make a determination as to whether and what version of their work can be posted publicly.

While networking is noted by some participants as a benefit of RG, in some cases leading to international collaboration, for many this is an area which sees limited engagement. Few researchers use the Q&A section, or make contact with other researchers. With the strongest statistical relationship across the analysis, it is researchers who were born outside of Japan who are more likely to engage in the networking component of RG, suggesting

that sociocultural background may be a factor. While more research is needed to investigate the cultural influence on ASN usage, it is worthwhile to consider the context in which researcher development occurs. Unlike the United States which has a long history of applying pressure to their higher education systems to be internationally competitive, the current emphasis on developing more internationally-minded researchers in Japan is only a recent phenomenon. Historically, academic activities have been conducted domestically, and the majority of researchers at least until relatively recently seem "to be satisfied with local settings or much less able to adapt themselves to international settings" (Yonezawa 2009:203). Nevertheless, RG is an international network and as Japan does have its own well-populated domestic ASN, Researchmap, it may be assumed registration of an RG profile by Japanese researchers indicates a desire to engage in international academic discourse. For this to be achieved, however, there is arguably a need for more active outreach to other researchers beyond the viewing and following that is currently seen.

In terms of identity-building metrics, researchers are most interested in the number of citations their published works receive, and this is reflective of international and national measures of impact and quality common across the world that apply citation-based metrics. With slipping world university rankings, the Japanese government is placing pressure on universities to increase their research impact (MEXT 2019). Subsequently, many institutions are now using citation-based metrics to measure the 'quality' of their researchers, which can impact their employment and tenure prospects, annual reviews, grant applications, as well as often being linked to salary bonuses. As other platforms calculate citation scores in different ways (Thelwall and Kousha 2017), the limitations of RG citations should be acknowledged, and it may be worthy for researchers to investigate their citation counts on other platforms. While value is placed on quantitative measures, users are also interested in the extent to which their work is useful to their field more generally, and thus how their research is perceived within the (online) academic community. Participants place little importance on the in-house metrics, which may be a judicious position due to the lack of transparency in how the score is calculated, as discussed earlier (Ortega 2015; Copiello 2019). However, as the RG-Score reflects (among other things) activity within the platform itself, it may provide a useful tool to assess the RG activity of other researchers they may wish to contact, as some researchers expressed frustration in slow or no responses to requests.

There are some challenges raised that may impede adoption of the range of RG features, and second to copyright concerns is a general undefined difficulty in using RG. While current researcher training may involve training in new methods for research dissemination and networking, this may not be the case for some established researchers, with one participant noting that "it's a pity that during my young researcher days that (ASNs) were not yet well-established or widely used". Concerns expressed about 'frequent unwanted emails' from RG that can be solved by changing notification settings, and about costs when RG is free for users, suggest that there is a need for more training opportunities, particularly as ASNs become a more important site for international academic networking across the world.

Deviating from the trend seen in Jordan and Weller's (2018) study where participants offered more problems than benefits, in this study more codes are attributed to benefits. RG in particular, and ASNs more generally are valued by the participants in this study, although this may be a result of non-response bias. However, there are two other possible explanations that likely play a role. Firstly, it is likely that in countries such as the United States and the United Kingdom where ASNs are already well-adopted, and where English is a dominant language, researchers may be more compelled or readily able to join RG,

even if they don't have a clear objective for doing so. In the case of researchers in Japan, where ASNs are relatively unfamiliar, and where average English proficiency levels are internationally low (EF Education First 2010), registration requires careful thought and consideration, and it might be less likely for a user to join on impulse, or without a clear aim. Secondly, it may be the case that fewer challenges are faced by users because of the limited and generally passive way in which RG is used. As researchers broaden their use of RG, other challenges will likely arise, such as the logistics of collaborating with researchers solely online. These are areas that will need further research attention as the world, and academia, increasingly conducts more of its activities online.

In the title of this paper we ask if RG is a gateway to an international academic community, summarizing the goals of the study. Our findings show that for most of our Japan-based participants, RG is a regular part of their academic activities, and that benefits outweigh the challenges. Nevertheless, at the micro-level, use of RG is unbalanced, focused largely on knowledge sharing, and specifically on access to literature and dissemination of English-language outputs. While this provides a vital service to researchers that is clearly important and valued, this narrow use of RG means that it may be positioned more as a tool, rather than a community. While some researchers do indicate more engagement with the community, building relationships that may progress beyond the online, this is not common. The authors suggest that in order to truly be engaged in RG as a community, there is a need to engage in all aspects of the platform, and particularly in the networking features that are underutilized, and while some of these features are relatively small and perhaps seem benign, these actions indicate a desire for connection to other members, and it is through these small efforts to connect that integration into a community may incrementally occur.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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