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Adoption and usage of Academic Social Networks: a Japan case study

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Abstract
Engaging in the international academic environment is now facilitated by a range of Academic Social Networks (ASNs) that are being used by an increasing number of early career and established researchers, in order to build their international profile and to connect with researchers across the globe. A range of studies have noted the benefits of ASNs for individual researchers and institutions, particularly those in emerging academic systems looking to build their international reputation. Missing from the research body are studies of ASN use in Japan, which although has an established higher education system, is experiencing considerable decline in international standing, in part due to a lack of engagement with international researchers. Thus, ASNs provide a potential tool to build international visibility and connections. This case study investigates the adoption and usage of Academia.edu and ResearchGate, the two most popular ASNs in the world today, by 1771 researchers from eight universities in Japan. The findings show that Academia.edu adoption and activity is very low, with ResearchGate adoption at thirty per cent of the sample, indicating moderate knowledge and adoption of the platform. Altmetric analysis shows that use of ResearchGate is largely passive, and the interactive features that might facilitate engagement with international researchers are not being exploited. Language and cultural barriers provide one potential explanation for trends in usage, and there is also a need for further training in the various features available to researchers in Japan.

Keywords Academic Social Networks · Altmetrics · Researchers · Internationalisation · Collaboration · Japan

Introduction

In recent times, Academic Social Networks (ASNs) have become an important tool for researchers around the world to disseminate their work and to interact with each other (Van Noorden 2014), an extension of the rapid expansion of online social networking that has become a ubiquitous part of our personal and professional lives. Unlike other online social media platforms such as Twitter and Facebook, which may also be used by researchers for

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academic purposes (Jordan 2014b), ASNs are specifically designed for academic discourse (Guyot 2010), and unlike static institutional research repositories which have long been used by researchers to promote their research activities, an ASN is specifically designed to facilitate interaction between individuals within the academic space.

While there are a number of platforms available with slightly different features, 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, p. 721). At present, the most popular ASNs are Academia.edu and ResearchGate, with 94 million and 15 million members according to their respective websites. While the exact number of active users is difficult to determine—for example, a number of studies in different contexts have shown ResearchGate to be more popular than Academia.edu (Ali and Richardson 2017; Swanepoel and Scott 2018)—there has been exponential growth over the past 10 years in the uptake of ASNs (Jordan 2019). Reflecting this, there has also been a growing interest in ASNs and their usage, as evidenced in a review of the literature conducted by Jordan (2019). That review showed that "the best characterized and most widely used benefits (related) to the role of platforms for dissemination of academic publications" (Jordan 2019, p. 11). Further, the social aspects of ASNs are also valued, as well as their provision of "access to academic knowledge and legitimacy to participants who are in less privileged positions in their 'offline' academic positions" (Jordan 2019, p. 11).

The ability to share information about ones research and to interact with academic audiences across the world brings a potential for increased international visibility (Jordan 2019). This increased exposure may result in increased engagement with ones research, with one study finding a 58% increase in citations for papers uploaded to the Academia.edu platform (Niyazov et al. 2016), a trend that was also seen in another, albeit smaller study (Sababi et al. 2017). ASNs allow researchers to 'follow' other users, and in doing so (by the click of a button), they will see updates about the publications of and other contributions of that user in a more prominent position. In the same way, an individual may be 'followed' by others. A wider professional profile may also lead to increased potential for international collaboration. International research collaborations have been shown to foster global innovation and competitiveness (Hwang 2007), as well as improved research quality (Erfanmanesh 2017; Tang 2011). Collaboration allows the transfer of knowledge and expertise, increases efficiency, extends researchers' networks, and facilitates the development of social and management skills (Carroll et al. 2010). The relationship between visibility and collaboration is reciprocal; studies in several national contexts have shown that international collaboration can have a positive influence on research visibility (Hayati and Didegah 2010; Khor and Yu 2016; Persson 2010). Thus, the ability to engage with researchers from around the world is a key skill for academics, one that has been given increasing attention in academic development, particularly for early career researchers (Carroll et al. 2010; Flanagan et al. 2015).

In addition to providing a space in which connection and sharing can occur, ASNs also provide a range of alternative metric measures, or altmetrics, that complement traditional and frequently relied upon metrics, such as citation counts and journal impact factors (Ashok et al. 2016). Thus, researchers can determine the number of other researchers who 'follow', or 'recommend' their work, and how many times particular research outputs have been downloaded or viewed. ResearchGate also provides two in-house altmetric scores known as the RG score and the Research Interest score, although in both cases serious questions have been raised about the legitimacy of the altmetric, due to a lack of transparency surrounding its calculation (Copiello 2019). Strong caution has been expressed by researchers regarding the use of the RG-score as a measure

of researcher productivity or reputation, as it is more likely to be reflective of ones "activities within the site rather than their wider scholarly reputation" (Orduna-Malea et al. 2017, p. 456). While the role and weight that altmetrics (should) have in academia is still up for intense debate (Bornmann 2014), they allow a complementary view of the impact of scholarly outputs, providing researchers an early indication of impact, which is not true of peer-review due to inherent biases (Haffar et al. 2019) and sometimes prohibitively long turnaround times (Powell 2016), nor of citation counts, with an often considerable time lag between publication and citations (McGillivray and Astell 2019).

In light of the potential benefits that ASNs may afford researchers engaging in a technology-driven world, there is increasing research interest in their use. As a relatively new phenomenon, the research investigating the adoption and use of ASNs across different disciplinary and geographic contexts is still limited. However, there is a growing body of international studies that are collectively helping to address this gap. Through exploratory research of institutions and regions looking to improve their global position in international research engagement, such studies help to build foundation knowledge on which to build further research, as well as informing local strategies for promoting effective ASN usage. Recent examples include a study of 200 research scholars in Central Universities in Delhi by Asmi and Margam (2017), a survey of 81 researchers at three academic institutions in Israel (Meishar-Tall and Pieterse 2017), and a study of 68 social science researchers at five public sector universities in Karachi, Pakistan (Ali et al. 2017).

Currently missing from the research body are studies looking at the adoption and use of ASNs in the context of Japan. Such a study is of interest because despite having a well-established academic system, there are serious concerns about the declining prestige and competitiveness of its higher education sector, both domestically but particularly internationally (Sawa 2019). Specifically, there has been a marked decrease in research productivity among researchers in Japan over the last decade. In 2000, Japanese researchers contributed more than ten per cent of the world's research publications. While global research output doubles every 9 years (Bornmann and Mutz 2015), Japanese researchers in eleven of fourteen research fields published fewer articles in 2015 than in 2005 (Phillips 2017). In a study of research outputs in the field of microbiology, Japan's productivity was found to be lower than Western Europe and the USA, despite its higher gross national income per capita (Vergidis et al. 2005). Furthermore, the quality of research outputs has also been called into question, with Japanese researchers publishing in lower quality publications which have less international impact and have fewer subsequent citations (Sawa 2019). The country performed "worse than 29 other developed economies in the amount of high-quality research it produces per [research and development] dollar invested" (Armitage 2018, para 4).

In general, researchers in Japan tend to have comparatively less global mobility, with only 38% of researchers publishing outside of their home country, compared to 72% in both the United Kingdom and Canada [American Association for the Advancement of Science (AAAS) 2019, p. 35]. Strategic policy in Japan to increase the global mobility of both students and researchers has led to a slight increase in international collaborations in the past 5 years (AAAS 2019), although the level is still low compared to many other developed countries, and is not yet enough to make an impact on the overall decline in research outputs (AAAS 2019; Kakuchi 2015). Japan's Ministry of Education, Culture, Sports, Science and Technology (MEXT 2016) has expressed a need for Japan to overcome its "'inward tendency' and to foster human resources who can positively meet the challenges and succeed in the global field" (MEXT n.d., para 3).

Due to the potential of ASNs to facilitate increased international visibility and connectedness, the author investigates the adoption, non-adoption, and usage of ASNs in Japan, focusing on a total population sample of researchers from one of Japan's 47 prefectures. To date, there have been no previously published studies on ASN use by researchers in Japan, despite the considerable political push for researchers to engage more with their international colleagues (MEXT 2016), and the high level of adoption of social media more broadly among the Japanese population (Guyot 2010). While MEXT is making efforts in this space, there is a need "for autonomous initiatives on the part of universities and academics themselves for the internationalization of higher education" (Yonezawa 2009, p. 199). Thus, ASNs have a potentially significant role to play in this effort toward increasing international engagement. In this context, the study poses the following research questions:

I. What is the rate of uptake of the two major Academic Social Networks by researchers in Japan?
II. What are the trends in adoption and non-adoption in terms of discipline and academic ranking?
III. What do altmetric data reveal in terms of users' sharing, connecting, and interacting with other researchers on these networks?

The answers to these questions will help in our understanding of the use of ASNs and their role and prominence in the professional lives of researchers in Japan, and adds to our international understanding of ASN use in different contexts. The answers have implications for the effective use of international academic networks, by identifying groups that may be under-represented, and features that may be underutilised, which may inform the development of individual strategies and institutional training, which in turn has implications for internationalisation processes of institutions and individual researchers. The results may also aide ASN platforms to identify strategies for better capturing the needs of diverse users of their platforms, and to potentially meet the needs of more researchers in Japan, which is a competitive market, and one that western technology companies have had trouble breaking into in the past due to a lack of understanding of users' needs (Tabuchi 2011).

Methodology

Because of the lack of national data regarding researchers in Japan, this study adopts a case study approach, with a focus on the adoption and usage of Academic Social Networks by researchers in Nagasaki prefecture in the southern part of Japan where the researcher is based, facilitating an intimate understanding of the higher education system in the region. The study follows the methodology adopted by Stachowiak (2014) who unlike most other researchers who have used a purposive sample to study ASN usage, investigated the adoption and usage of a total population of researchers, in their case 2090 researchers at Nicolaus Copernicus University in Poland. Thus, data collection began with the gathering of data on all researchers across the eight institutions in the prefecture, with each university providing public lists of researchers (Table 1). These databases do not include those employed on a casual basis, nor those in visiting or post-doctoral positions. The sample thus is representative of all fixed-term and tenured researchers in the region, but due to a lack of baseline national data, its representativeness of the wider population of researchers

Table 1 Researchers at institutions in Nagasaki prefecture, Japan

	Type	*n*	Broad fields as determined by faculty association
A	Public national university	1214	Science, Technology, Engineering and Mathematics [STEM] ($n=564$) Health and medicine ($n=433$) Humanities and Social sciences [HASS] ($n=217$)
B	Public prefectural university	148	HASS ($n=88$) Health and medicine ($n=41$) STEM ($n=19$)
C	Private international university	129	Health and medicine ($n=74$) HASS ($n=55$)
D	Private Catholic women's university	95	HASS ($n=70$) Health and medicine ($n=25$)
E	Private science university	58	STEM ($n=58$)
F	Private Catholic university	56	HASS ($n=56$)
G	Private liberal arts university	40	HASS ($n=40$)
H	Private Wesleyan university	31	HASS ($n=31$)
Total number of researchers		1771	

N.B. Religious affiliation is not a condition of employment or study at denominational universities in Japan

across the country cannot be determined. Thus, the findings present a microcosm of ASN usage by researchers, and by not focusing merely on prestigious universities in metropolitan areas that usually garner more research interest, the study explores the of uptake of 'everyday researchers' working across national, prefectural, and private institutions across a broad range of fields.

To determine the uptake of ASN use of each researcher, their name, faculty, and position were noted, and this information was used to cross-check the profiles of researchers using the search features on Academia.edu and ResearchGate.

Manual searches were conducted to identify ASN profiles that matched the identified user information, with searches conducted using the researchers name in Japanese, as well as its romanized equivalent. For each matching profile identified, interaction and publication metric data were collected and recorded in a spreadsheet, based on the data available on each platform, as shown in Table 2. In terms of interaction metrics, the number of 'followers' and 'following' was noted. ResearchGate additionally provides a 'discussion board' feature where individuals may post questions, and answer questions posed by others, as well as an opportunity for researchers to 'recommend each other', although public data is one-directional, so data is only available on who has recommended an individual (but not who they themselves have recommended).

For publication metrics, both platforms allow individuals to post information about their research, including a copy of the publication itself, if copyright allows. Information is provided on the number of times that information is accessed, known as 'views' in Academia, and 'reads' in ResearchGate. Finally, ResearchGate provides information on article citations, and while it appears that the platform is slow in detecting citation indicators, it has "indexed impressively many citations for a single website and has become a major source of academic papers, perhaps even starting to challenge Google Scholar in this regard" (Thelwall and Kousha 2017, p. 1130). Due to the lack of transparency in

Table 2 Data collected from two Academic Social Networks

	Academia	ResearchGate
Interaction metrics	Number following[a] Number followed by	Number following[a] Number followed by Number of questions asked[a] Number of answers given[a] Number of recommendations
Publication metrics	Number of publications shared[a] Number of total views	Number of research items shared[a] Number of full-text items shared[a] Number of citations Number of total reads
Other		RG-Score

[a]Items over which users have active control

its calculation as discussed earlier, the RG-score for each user was collected, but is categorised separately as a measure of activity within the site, as recommended (Orduna-Malea et al. 2017).

Data were collected at two stages in September and November 2019, and while the data were correct as of the time of collection, the nature of social networks is that they are dynamic, and this data is not likely to have remained static since that time. Initial data analysis involved descriptive analysis to provide an understanding of the sample as a whole, with measures of central tendency and dispersion calculated for each variable. Chi-square tests were conducted to seek the nature of the relationship between users and non-users of the two ASNs, and of users and the nature of their connections to other researchers.

Results

The results show that of the 1771 researchers in our sample, around one third ($n=542$, 31%) had a profile on at least one of the two major ASNs. Uptake was higher at Institution A to a significant degree ($X^2(7, N=1771)=100.901$, $p<.05$). Users of ASNs were Assistant Professors ($n=172$), followed by Professors ($n=168$), Associate Professors ($n=134$), and Lecturers ($n=53$), with four 'other' titles, and 11 unknown, with academic title showing a significant relationship to ASN adoption ($X^2(5, N=1771)=32.070$, $p<.05$). To better understand this relationship, titles were given hierarchical numbers, and a Pearson Correlation test showed a strong negative correlation ($r=-.065$, $n=1771$, $p\leq.05$), meaning that as researchers moved up in ranking, their likelihood of adopting an ASN decreased. The fields of ASN adopters were, in order of frequency, STEM ($n=286$), Health and Medicine ($n=178$), and HASS ($n=78$). These categories are purposely broad in order to identify differences in ASN use by researchers working in disciplinary fields that, in Japan and around the world, experience different funding priorities. Again, a significant relationship was found, with those in STEM fields more likely to have a ResearchGate profile, and those in HASS fields less likely ($X^2(4, N=1771)=164.333$, $p<.05$).

Of the ASN adopters in this sample, most had profiles on ResearchGate ($n=519$), with a smaller number on Academia.edu ($n=51$), including 28 researchers with profiles on both. The following provides a breakdown of user and metric data for each of the networks.

ResearchGate

Searches of ResearchGate found that 518 researchers had a profile on the network, around one third of the total sample. Profiles were most held by Assistant Professors ($n=167$), followed by Professors ($n=156$), Associate Professors ($n=128$), and Lecturers ($n=51$), with four 'other' titles, and 12 unknown. The fields were, in order of frequency, STEM ($n=280$), Health and Medicine ($n=175$), and HASS ($n=63$). Because most of the ASN adopters use ResearchGate, the results follow a similar pattern to uptake across the platforms, with increasing academic ranking related to decreasing ResearchGate adoption ($r=-.060$, $n=1771$, $p\leq.05$), and significantly higher numbers of researchers from STEM fields ($X^2(2, N=1771)=188.610$, $p<.05$), and from Institution A ($X^2(7, N=1771)=107.806$, $p<.05$).

The analysis of the data identified 20 user profiles (<4%) that were considered inactive, meaning that the user had not uploaded any publications, and had not followed other users. However, these profiles were still included in the data analysis, because their inactivity did not preclude engagement from other researchers. For example, one of the inactive profiles was viewed by other users more than 500 times. Table 3 provides a summary of the engagement with the ResearchGate profiles by the participants.

ResearchGate allows users to group their research items into different categories, such as journal articles, book chapters and conference presentations, but as not all researchers use this feature, and to be consistent with Academia.edu data, the total number of research items was used. For a small number of users, their most recent publication shared on the network was published before 2010, but there is a considerable increase in new uploads as the data period continues, as shown in Fig. 1.

ResearchGate users in Nagasaki prefecture follow an average of 23 other users, and are followed by an average of 33 users, with total numbers in both directions exceeding 12,000 connections. The results show that the majority of connections initiated by Nagasaki researchers are with other researchers in Japan, while connections from others are almost equally domestic and international (Fig. 2).

In terms of participants' 17,008 followers, for which individuals do not have direct control over, almost half are internationally based outside of Japan. These international connections were more likely to be found to Institution D, a science-focused university ($X^2(18, N=17{,}008)=96.966$, $p<.01$), and by researchers in Health and Medicine

Table 3 Metric data for ResearchGate profile holders in Nagasaki prefecture, $n=518$

	Percentage (number) of users with at least one	Total	Lowest	Highest	Average
Following	97 ($n=504$)	12,104	0	311	23
Followers	99 ($n=512$)	17,008	0	399	33
Questions	1 ($n=6$)	10	0	4	<1
Answers	2 ($n=12$)	40	0	18	<1
Recommendations	60 ($n=311$)	2405	0	172	5
Research items	91 ($n=472$)	34,558	0	788	67
Full-text	86 ($n=443$)	9237	0	383	18
Citations	88 ($n=458$)	544,961	0	29,568	1052
Reads	91 ($n=472$)	1,644,655	0	95,709	3175
RG-Score	88 ($n=455$)	–	0	50.55	22

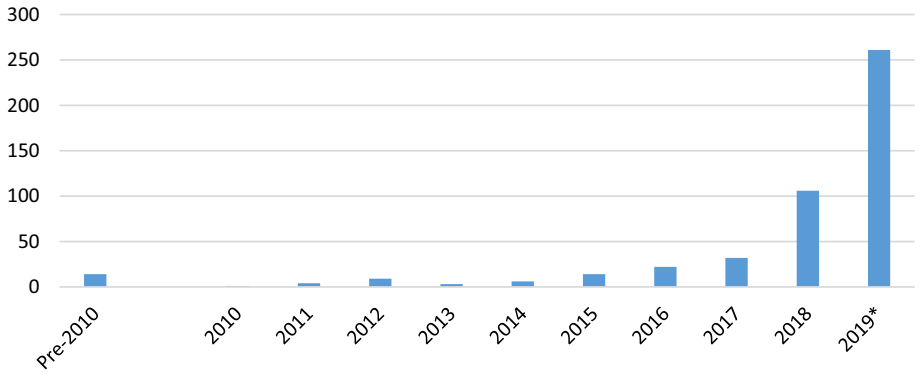

Fig. 1 Year of publication of most recent publication uploaded to ResearchGate, $n = 473$. *2019 data is part-year only

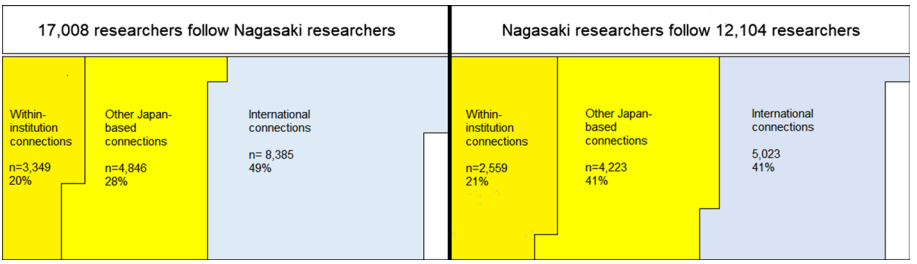

Fig. 2 Connections to and from Nagasaki researchers on ResearchGate. N.B. White indicates unknown location, around 2.5% of cases for both followers and following

fields ($X^2(6, N = 17{,}008) = 16.998$, $p < .01$). Nagasaki researchers who are at the level of Professor were more likely to have international followers, with those with lower academic ranking less likely ($X^2(15, N = 17{,}008) = 233.721$, $p < .05$).

The location of the 12,104 researchers that participants choose to follow was related to institution, field, and academic ranking. In relation to connections to researchers outside of Japan, those from Institution C, an internationally-focused university ($X^2(15, N = 12{,}104) = 335.341$, $p < .05$), and those in STEM and HASS disciplines ($X^2(2, N = 12{,}104) = 146.596$, $p < .05$) were more likely to have international connections. International connections were seen more in higher ranking academics, and more within-institution connections were seen among Assistant Professors and Lecturers ($X^2(2, N = 12{,}104) = 126.132$ $p < .05$).

Analysis of the profiles of each connected researcher found that NU researchers were connected to more than 150 countries, with most connections in both directions being with researchers in the United States. Table 4 shows the top 10 countries in terms of the number of connections, with countries beyond this accounting for one per cent or less of all connections.

Table 4 ResearchGate users' international connections, by top 10 countries

Location of followers ($n=17{,}008$ researchers in 155 countries)			Location of following ($n=12{,}104$ researchers in 122 countries)		
Country	Number	% total	Country	Number	% total
United States	1344	7.1	United States	1341	11.1
China	682	3.8	United Kingdom	414	3.4
United Kingdom	416	2.4	Australia	261	2.2
India	404	2.4	China	225	1.9
Egypt	301	1.8	Germany	212	1.8
Australia	279	1.6	France	183	1.5
Germany	239	1.4	Italy	169	1.4
Brazil	232	1.4	Canada	148	1.2
Italy	202	1.2	Netherlands	133	1.1
France	198	1.2	South Korea	112	< 1%

Academia.edu

In total, 51 researchers had a corresponding profile on Academia.edu, a rate of just under three per cent of the total population of researchers. The users were ranked at the academic position of Professor ($n=22$), followed by Associate Professor ($n=15$), Assistant Professor ($n=9$), and Lecturer ($n=5$) Researchers came from HASS ($n=26$), STEM ($n=17$), and Health and Medicine ($n=8$) fields. There was no relationship found between researchers' use of Academia.edu and their academic position, field, or institution.

The analysis of the data identified six of the 51 Academia.edu user profiles (12%) that were not actively used by the researcher, using the previously mentioned criteria.

As summarised in Table 5, the altmetric data for users varied greatly, showing that some users had limited engagement with the network, with others sharing relatively large numbers of publications and following relatively large numbers of other researchers. Passive engagement was on average higher than the active measures, with Nagasaki researchers followed by more than 600 other researchers, and their profiles viewed more than 9000 times in total.

For the 21 users who shared at least one publication on their Academia.edu profile, the most recently uploaded publications were from between 2014 and 2017 ($n=14$), although five users had not uploaded any outputs published since 2009, the year after the ASN was launched. No new publications were added by users in 2018 or in 2019 up to the period between September and November when data collection took place. It was noted that

Table 5 Metric data for Academia profile holders in Nagasaki prefecture, $n=51$

	Percentage (number) of users with at least one	Total	Lowest number	Highest number	Average
Following	78 ($n=40$)	638	0	119	13
Followers	69 ($n=35$)	849	0	156	17
Publications	41 ($n=21$)	387	0	71	8
Views	86 ($n=44$)	9549	0	1502	187

analysis of the location of each connection to the Academia.edu users would not bring any useful findings, not only due to the small sample size, but also the high level of inactivity meaning that connections are likely not active.

Discussion

The uptake of ASN use by researchers at universities in Nagasaki prefecture in Japan is around thirty per cent. Because there are no other studies of uptake in Japan, it is difficult to know whether this is a similar rate to other areas of the country. As already established, most studies of ASN usage begin with a sample of active users and so do not measure uptake and non-uptake of wider populations. Exceptions include a study of 811 researchers in the field of bibliometrics, which found an uptake of ResearchGate of 66% (Martín-Martína et al. 2018) and Stachowiak's (2014) study of 2090 researchers, which found an uptake of 14%. In this sample, uptake of 29% lies between these two previous studies. While this limited data does not allow for any comparative analysis, it does suggest that uptake is not particularly more or less than that seen in other populations, although more research is needed in this space.

What is clear from the findings of this study, however, is that ResearchGate is by far the more popular ASN, in keeping with other studies comparing uptake of multiple platforms (e.g. Ali and Richardson 2017; Swanepoel and Scott 2018). This raises questions about the number of active users of each of the ASNs as distinct from the number of member profiles. It appears that while Academia.edu may have gained some attention in earlier days, most researchers in the sample have merely created a profile page, and have not actively engaged with the network in recent years. The difference in uptake may be explained by a disparity in visibility of the two platforms in Japan. While neither ReseachGate nor Academia.edu have Japanese functionality or support features, only ResearchGate has a Japanese language page on Wikipedia, and its similar name to the Japanese national database *Researchmap* (https://researchmap.jp) may also help to build familiarity. The differences in uptake may also be related to the functionality of the platforms themselves. In a comparative analysis of the features of the various ASNs, Espinoza Vasquez and Caicedo Bastidas (2015) found that ResearchGate and Academia.edu shared most of the same features, although ResearchGate also provided discussion boards (allowing researchers to pose and answer questions) and citation counts for added publications. This finding opens up a further line of study, to understand the motivations behind the adoption of a particular ASN over another.

Before responding to the data itself, it is interesting to note one of the challenges the author faced during the data collection phase of the study. While searching for matching profiles on ResearchGate, it became obvious that a considerable number of researchers from Institution A were incorrectly listed as being affiliated with Institution B, the profile page of which using the wrong institutional logo. While the two universities share a similar name in English, their original names in Japanese clearly differentiate the two, one being a national university, and the other being a nearby prefectural university with a limited offering of disciplines, a much smaller population of students and staff, and lower prestige and domestic ranking. The author contacted ResearchGate to alert them to the issue, who subsequently updated the institutional profile to include the correct logo, but as of the writing of this paper, almost 20% of ResearchGate users from Institution A ($n=87$) were listed under the wrong institution. (The researcher cross-checked each user's institutional

and RG profiles to list them in the correct institution for data analysis, but in order to not influence researchers' usual use of the ASN, the author will notify individual authors of the error at the conclusion of this study). This experience is indicative of the disadvantages that researchers outside of Anglophone communities may face in engaging with ASNs, not only because English is the dominant discourse in science communication which functions as a gatekeeper to international research networks (Amano et al. 2016), but also because of the English functionality of the networks themselves, where language-related errors may arise and go unnoticed. Indeed, neither Academia.edu nor ResearchGate have multilingual functionality. This discovery is also further justification for the delimitation of the study to a single familiar region, as this error would not have been detected without inside knowledge of the different institutions and their relationship to each other.

Because one third of researchers have a profile on ResearchGate, it can be said that it is known to a considerable number of researchers in the region. Adoption was found to be dependent on academic ranking, with those at lower rankings more likely to create an ASN profile. Because of the hierarchical nature of academic rankings, particularly in Japan with its strict age-based social structures, those with lower rankings are more likely to be younger researchers. As such, they may be more familiar with online social networks in their daily lives than their colleagues of an older generation, making adoption of ASNs more seamless. Nández and Borrego (2013) found in their survey of 293 users of Academia.edu in Catalonia, that 60% of participants were under 40. Younger researchers also tend to be at an earlier stage in their careers, and with the difficulties that early career researchers face finding secure employment around the world, including in Japan (Murai 2016), ASNs may be used as a platform for developing networks and increasing visibility that may assist in future promotion and job opportunities, and this provides another possible explanation for the high uptake by researchers at lower academic rankings. This would also explain why in the previously mentioned Catalonian study, there was also a high uptake by doctoral students who generally face the same concerns about future employment (Nández and Borrego 2013).

Adoption of ASNs was related to disciplinary field, with ResearchGate usage having the most traction in STEM fields. As in many other parts of the world, in Japan the 'hard sciences' are given funding priority over HASS disciplines (Grove 2015). The comparatively low level of funding and research priority may be responsible for lower levels of engagement in the international scholarly publication process, and in turn may be a factor in the lower levels of adoption of international ASNs. In a study of over 6000 researchers across four ASN platforms, including Academia.edu and ResearchGate, Ortega (2015) found "significant differences in the way in which the populations are distributed among the academic social sites … (with) the possibility that some social sites are being populated by researchers from specific disciplines" (p. 534). However, the tendency in that study of Social Science researchers to Academia.edu, and the tendency of Biomedical researchers to ResearchGate (Ortega 2015), was the opposite of what was seen in this study. The results may be reflective of departmental initiatives and/or norms, with regulation of Japanese national universities largely devolved to individual departments. There is a need for further investigation into the motivators for researchers in different fields adopting ASNs.

One of the major roles of ASNs is the sharing of research. Both ResearchGate and Academia.edu allow members to upload details of their publications, as well as, if copyright allows, a copy of the article itself, if not a pre-print version. Only one third of publications shared on ResearchGate included a full-text version of the publication. While there are obvious copyright issues involved that may prevent public dissemination, it may also be the case that some researchers have difficulty navigating the complex fine-print of the terms

and conditions of use of each ASN, or indeed of journals themselves, to understand their rights and responsibilities in terms of the wider dissemination of their work. They may also be reluctant to upload full versions of publications written in Japanese, due to the apparent Anglocentric focus of the major ASNs. While Academia.edu and ResearchGate functionality is in English, as discussed earlier, there is no restriction on the language of contributions that can be uploaded to ones profile. One study of publications uploaded to ASNs in the particular area of social representations, found papers in French, Spanish, Portuguese, Italian and six other languages (Silvana de Rosa et al. 2016). Thus, there is a potential for researchers in Japan to harness this tool and build their international visibility by sharing Japanese language publications. While difficult, engagement in international research discourse need not necessarily revolve around publishing in English. Wider engagement by international researchers may be facilitated by tagging publications with keywords in English, and adding an abstract or highlights in English, while still continuing to contribute to local knowledge by publishing in Japanese. Furthermore, making Japanese-language research more visible internationally opens up the possibility that it will be seen by Japanese-speaking researchers around the world, who may provide an important connection between domestic research and international collaboration opportunities. Building a network of researchers with shared interests may indeed bring potential opportunities for co-authorship with others with more confidence or ability in writing for English journals.

Researchers in this sample tend to use ASNs in a passive rather than active way. For example, researchers had higher rates of being followed (passively) than actively following others. Usage of discussion boards, one of the more interactive tools available, is rare. While some interactive features are hidden from public view, such as private messages, it is unlikely that this is occurring to a great extent considering the inactivity in public. This may indicate high levels of inactivity of usage of the ASN, perhaps due to differing motivations for usage, such as accessing papers from other researchers, or even a lack of specific motivation, with one study showing that 22% of 293 respondents had no specific goal when creating an Academia.edu profile (Nández and Borrego 2013). However, in this sample 90% of researchers had an RG Score, and more than 85% had an RG Score higher than five, which indicates at least some engagement with the platform. Japanese researchers will likely be familiar with the aforementioned domestic platform *Researchmap*, which is connected to the national funding grant system and in some institutions (including Institution A), registration is required. However, international ASNs such as ResearchGate offer a different experience in their engagement in international online academic discourse. It may be the case that the full functionality and potential of ASNs is unclear, particularly due to the aforementioned language barriers. Interaction is central to ASNs, and there is a need for further development in researchers' knowledge and skills in their use, to be able to exploit their full potential, a recommendation that has been made in other studies (Meishar-Tall and Pieterse 2017).

Examination of the connections found the majority to be based within Japan, including those within the same institution. Japanese researchers are often funded by government grants, and accountability to taxpayers is a strong motivator for researchers to publish in local publications and limit themselves to domestic science communication (Koso and Alvarez 2018). With recent increased international mobility among Japanese students, it may be expected that younger researchers are also more open to international online connections, also given the younger generation are likely to have had online tools as a ubiquitous part of their upbringing. However, the results of this study indicate that MEXT (n.d., 2016) needs to continue in its efforts to address the insularity of Japanese researchers, if rates of international collaboration are to be improved. The higher

percentage of connections initiated by international researchers also suggests that there are potential avenues for collaboration, with interest being shown in Japanese researchers' activities exhibited from various countries.

One potential explanation for the passive use of ASNs by participants in this sample is cultural background, with research showing that online behaviours are reflective of national culture, with clear differences in social media usage patterns seen in individuals across individualistic-collectivist and high-context-low-context cultural orientations (Alarcón-del-Amo et al. 2015; Cho 2010; Qiu et al. 2013; Trepte and Masur 2016). While there are international researchers among our sample, the number is small, reflective of the high level of heterogeneity in the Japanese higher education system. The majority of our participants are Japanese, and thus likely have a collectivist mindset—where priority is given to maintaining group harmony—and a high-context approach to communication, which relies on non-verbal, indirect and implicit communication (Hofstede 2001). Thus, actions such as directly approaching unknown researchers—particularly those with higher hierarchical status, may be seen as breaking social norms. Self-promotion on social media was found to be less common in Japanese users compared to American users (Barker and Ota 2011; Omori 2014), and in a study of Korean users, who share a similar collectivist, high-context profile to Japanese users, were found to more likely to value privacy and limit themselves to in-group sharing than their American counterparts (Cho 2010). While other factors are inevitably at play, there is still a need for more comparative cultural studies to identify differences in use of ASNs across different cultural backgrounds.

In this sample, it is the higher ranked and (presumably) older generation of researchers who are connecting more with international researchers. This goes against what sociodemographic trends tell us about the increasing, albeit slightly, international outlook of younger people in Japan (Kuroda et al. 2018). This is also despite the higher uptake of ASN adoption by lower ranking and (often) younger researchers. This suggests that strict social norms regarding social hierarchical status that dictate behaviours in academia (and society more broadly) in Japan, may also be present in online environments. Thus, advice commonly given to early career researchers in western countries is that "networking, reaching out to those working beyond their immediate environment, including other institutions, countries, disciplines and career sector communities, is likely to be beneficial for their career success" (Blackford 2018, pp. 2–3). However, as Jordan (2014a) notes, rather than acting as a democratising space, ASNs may merely serve to preserve social hierarchies, and as such engaging in academic discourse, for example by initiating contact with a higher-ranking researcher, may be just as challenging for Japanese researchers in the online space as in the offline space.

While much literature is placed on the position of English as a gatekeeper to international academic discourse by Japanese researchers (e.g. Okamura 2006), this study suggests that cultural differences may also work as a barrier to increased engagement on ASNs, with implications for connections and potential collaborations with researchers outside of Japan. Indeed, this was a concern recently raised by Universities UK International (2018), who noted that impeding research collaborations between the UK and Japan is a "lack of familiarity between the two higher education systems … There are very low levels of Japanese knowledge among UK students and researchers, and Japanese researchers have relatively low levels of English proficiency by global standards" (p. 11). While international collaboration must be responsive to cultural diversity, the reality is that 'breaking in' to the international research discourse as it currently stands is facilitated at an individual level not only by a knowledge of English but also an ability

to engage with western communication styles, knowing how to approach and interact with other researchers and how connections are made within the international academic space, whether online or off.

Limitations and conclusions

This study has provided a case study of the adoption of two major Academic Social Networks by 1771 researchers in eight universities in one prefecture of southern Japan. While it provides important insights that contribute to our wider understanding of the use of ASNs, there are limitations that need to be acknowledged. First, the scope of the sample is limited to one geographic area, and is further limited by its non-inclusion of doctoral students, postdocs, and casual staff, who may use ASNs in different ways. Further research is needed to complement the quantitative findings of this study with more personalised qualitative studies which investigate the use of ASNs from the perspective of the researchers themselves. While ASNs may improve international visibility and online connections, whether this is a facilitator or predictor of international collaborations remains unclear, and further investigation is needed in this space. Finally, the author of the study is positioned as an 'inbetweener' researcher, an insider as a researcher in Japan with intimate knowledge of the language and culture, but ultimately an outsider as a native English speaker from a western background (Milligan 2014). The author has worked with objective data, but acknowledges that their cultural and linguistic privilege may influence the ways in which the data is understood and reported.

The results of this study show that for this sample of researchers, Academia.edu is not well-known or actively used, while ResearchGate has a solid uptake of 30%. Researchers of lower academic ranking, who are more likely to be younger researchers, have higher rates of uptake, as do those in the 'hard sciences', most likely reflective of broader funding priorities. Sharing of research appears to be limited, and engagement with the interactive features of ASNs appears to be underutilised. While multiple connections are made to other researchers, many are connections domestic, with participant-initiated international connections in the minority. Higher ranked researchers are more likely to connect to international researchers, and adherence to Japanese social norms regarding social hierarchy may prevent younger researchers from approaching international researchers. Thus, both cultural and language barriers exist that may impede Japanese researchers' ability to engage in international online environments.

These findings have implications for the development of training opportunities for researchers and institutions in Japan looking to increase their international visibility and connections. Specifically, as a tool with growing importance in research around the world, the existence and possible benefits of ASNs need to be better communicated to Japanese researchers, as well as the potential risks. Further, researchers would benefit from support in how to best harness the features of each ASN, particularly the more active measures that are not a feature of the current domestic academic platform, *Researchmap*. Finally, researchers need to be assured that within the linguistically diverse reality of academia, publications in their local language are valid and important, and engagement in international networks is possible, even for those who don't publish in English.

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