Structures of THE, QS and ARWU Top 100 universities' websites in different languages and social media accounts: Binary matrix approach

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ABSTRACT

The aim of the study is to understand how the diversity of university language websites and social networks influence the universities' reputation in the World University Rankings and how this diversity can be described. Combining the union of sets of university names in Times Higher Education (THE), QS World University Ranking (QS), and Academic Ranking of World Universities (ARWU) 2018, the World's Top 100 Universities Rankings enabled us to obtain a set of 146 universities. From October 18, 2018, through November 1, 2018, the availability of website versions in different languages and social media applications was checked. The study enabled a 146x15 binary matrix to be built in the first case, and a 146x21 one in the second, with 15 meaning the number of website versions in foreign languages, and 21 standing for respective number of various social media accounts. The binary matrices were clustered with a view to obtaining dense submatrices consisting of units only. The study shows that approximately 47 percent of the universities surveyed have their websites in more than one language. All the 146 universities have websites in English, those in Chinese coming second and equalling to 21. Most popular social networking sites have been revealed, with over 84 percent of universities having Facebook, Twitter, YouTube and Instagram accounts. On the whole, 18 universities form a dense binary submatrix for 6 social media, including four of the above, as well as LinkedIn and Google+. The binary matrices are proved to be effective for higher education managers and experts focusing on specific regions and social media. Correlational dependence calculations on comparative analysis of traditional and altmetrics rankings are also performed.

Keywords: *Website languages; Social networking sites; Social media presence; Top 100 Universities, Binary Matrix Approach.*

INTRODUCTION

The globalized nature of educational and research markets has increased the importance of national cultural values in online students and researchers. As noted in the study (Alcantera-Pilar, Del Barrio-García and Rodríguez-López 2018), here it is generally important to know the cultural differences that exist among Internet users and endeavor to understand the effect of the language they use on how they process information. These cultural differences are studied on the basis of the classic cultural framework developed by Hofstede (2001) using the example of English and Spanish Internet users.

The Internet World Stats web site (https://www.internetworldstats.com/) conducts regular monitoring of language preferences on the Internet. From this web site, an important distribution table by Argaez (2020) shows the Top Ten Languages Used in the Web - March 31, 2020, (Number of Internet Users by Language) and we can see a great potential internet users growth for the former French colonies in North and West Africa and Madagascar, the former Portuguese colonies (Brazil, Angola, Mozambique), as well as for the Arab countries, which have the lowest Internet Penetration indicator value. And since high school graduates and students are active Internet users in all these countries, it will be natural to develop university websites in these languages and related social networks not only in these countries, but also in all countries where young people from these countries are sent to study (North America, Europe, Russia, and Ukraine). It is assumed that the exclusivity of Anglo-Saxon view on the higher education may be undermined by the "unquestionable growth of Asian universities performance and, thus, arise of publications in other languages, in other cultural formats may be witnessed on a not-too-distant horizon" (Koblížková and Leeming 2016, p. 397)

Universities develop their websites in foreign languages in order to attract students from respective countries and world regions. For instance, many world universities develop their websites in Spanish language in order to attract prospective students from Latin America. However, failing a link to social networks, such websites lose much of their efficiency. That is why the majority of scientific articles are devoted to the students' activities focus on students' use of Social Networking Sites (SNS). The sociological methods applied in such works include questionnaire surveys and interviewing.

Given the Internet penetration into all spheres of our lives, all universities take effort to develop their own websites and create SNS accounts connected to their official web pages. With each passing year, official websites become less and less significant in promoting universities, as social media grow in popularity.

Thus, globalization has increased the demands placed on higher education among universities. In response, universities have started to consider their online presence as a potential competitive advantage (Maresova et al. 2020). This online presence may include the above-mentioned university websites and SNS. They may be described as universities' intangible assets (Moskovkin and Yavej 2019). What we refer to as "intangible assets" may be compared with "social media capital" as described by Saxton and Guo (2020). The benefits such intangible assets provide for the universities include higher WUR rankings, which may result in financial profit and image improvement, for instance, due to an increase in the number of international students. At the same time, "universities are becoming aware of the importance of social networking sites for the reinforcement of their institutional brands" (Valerio-Ureña et al. 2020, p. 1). Figueria (2018) also says that social

networks represent an important communication tool with a potential to increase brand awareness for institutions.

In present time, universities see their presence and visibility on the Web as central to their reputation. For this purpose, Webometrics Ranking of World Universities was launched in 2014. Hence, information content on the academic Web is viewed as a reflection of the overall organization and performance of the university (Aguillo et al. 2008; McCoy et al. 2018). At the same time, social media has become mainstream in organizational communication (Lovejoy and Saxton 2012; Badea 2014; Holmberg 2015).

As we have already mentioned that the role of social media is becoming increasingly important in the university Web presentation, we should describe the essence of this concept. So far, there is no established terminology in this sphere. The same social media resources are described as social media sites, social media services, social networking services, social network sites, social networking sites, and social media platforms. Boyd and Ellison (2007) provide a classical definition of social media sites, as a "web-based service that allow individuals to (a) construct a public or semi-public profile within a bounded system, (b) articulate a list of other users with whom they share a connection, and (c) view and traverse their list of connections and those made by others within the system. The nature and nomenclature of these connections may vary from site to site" (p.211). Obar and Wildman (2015) list the following characteristics of social media: (a) services that are on Web 2.0 Internet-based applications, (b) having user-generated content; and (c) having individuals and groups to create user-specific profiles for a site or application designed and maintained by a social media service (p. 746-747).

Mayfield (2008) proposes seven kind of social media services: social network, blogs, wikis, podcasts, forum, content communities (media sharing services), and microbloging; but Aicher and Jacob (2015) propose 13 types of social media services: blogs, business networks, collaborative projects, enterprise social networking, forums, microblogs, photo sharing, product/services review, social bookmarking, social gaming, social networks, video sharing, and virtual worlds. As of late October, 2020, the Make a Websitehub.com (makeawebsitehub.com/social-media-sites/) resource contains a brief description of 97 social networking (media) sites. Regular monitoring of the coverage of the world's population by social networks is carried out on statista.com. The latest data from this site are shown in Global social networks ranked by numbers of users 2019 (Clement 2020). It is clear that the lion's share of the users of these networks are students, young researchers and university lecturers.

LITERATURE REVIEW

Quite few academic papers have been devoted to diversity language versions of universities' websites. Their topics cover either issues within separate universities, or comparative research of the use of two languages at the university websites of respective countries. For instance, a search for the term "university websites" (provided we choose the "search for an exact phrase" option) in Advanced Search of Google Scholar yields 17,000 results, and a search for "language university websites" and "university language websites" yields 11 and 0 results, respectively (27.12.2020). Only three of the 11 results were relevant. For example, Pluta and Olearnik (2015) study ten Polish universities which had the leading positions in the "internationalization" category in Perspektywy University Ranking 2015. It is shown that they all had websites in English, two of them had a website

in Russian and one had a website in Ukrainian. Tomášková (2015) suggests a comparative analysis of Anglo-American and Chezh university websites in the linguistic aspect, and Venuti and Nasti (2015) provide a comparative analysis of communicative strategies of Italian and UK university websites.

In the search for articles containing the distribution of language university websites for universities included in National and World University Rankings, Google Scholar yields only three results (Kane et al. 2007; Moskovkin and Chzhan 2019; Moskovkin and Yavej 2019).

The first work reveals that as of 2006, all the World's Top 100 Universities had website versions in English, while 39 of them had additional websites in other foreign languages. Among North American universities, McGill University, National Autonomous University of Mexico and The University of Michigan had additional website versions in French, Spanish and Spanish, respectively. Quite a big number of universities in China, Japan, Korea and other countries had website versions in Chinese, Japanese and Korean languages (Kane et al. 2007). The two other papers are devoted to the distribution of language versions of websites and social media accounts for leading Russian universities.

We would like to suggest a review of SNS study on personal and institutional levels. A large cluster of academic papers is devoted to the use of SNS by young people, with college and university students prevailing.

Pew Internet and American Life Project in (Lenhart et al. 2010; Madden and Zickuhr 2011) found that 82 percent of teenagers between the ages of 14 and 17 and 83 percent of adults between the ages of 18 and 29 use at least one SNS. More specifically, 52 percent of Facebook users, 33 percent of Twitter users, and six percent of LinkedIn users engage daily. Greenwood's (2012) findings enable us to establish three significant facts:

(a) 77 percent of all page visits last less than 10 seconds. Thus, presenting social media on the homepage is the most effective way to reach users in this time frame (Weinriech and Obendorf 2008).

(b) Only 23 percent of individuals use the scroll bars on a homepage to read text, making the space above the fold the most valuable real estate. Along with content, ease of navigation is also highly valued by teens and young adults visiting university Web pages (Neilson 2006; 2010).

(c) Teens and young adults expect to find desired information on the university sites within three mouse clicks.

Based on the above findings, Greenwood (2012) concludes that a university's social media information and SNS should be located on the homepage, toward the top, viewable without the use of scroll bars, or at the very maximum, within three mouse clicks from the homepage.

Apart from the above-mentioned works by US scholars based on questionnaire survey and interviewing, we would like to mention research conducted in Turkey and involving 203 Sakarya University graduates in 2010-2011 academic year (Isbulan 2011), as well as that in Spain, namely, at the Universities of Cordoba, Sevilla, Muelva and the Basque Country (Almenara and Diaz 2014). We have also identified the findings of 150 University of Nigeria (Nsukka) undergraduate students' survey (Eke and Odoh 2014). In the University of Cape Town (South Africa), systematic data collection included semi-structured interviewing of first-year IT students (Mwanza 2011). In Spain, using the data collected through a structured questionnaire involving 236 social science students enabled scholars to reveal

three clusters significantly different-labeled as "total scepties", "dual moderates" and "pro-digitals" (Gavilan et al. 2017). In Pakistan (Faculty of Education of the University of Bahawalpar Islamia) 600 students were interviewed using a convenient sampling technique (Hussain 2012). In all of these studies, students preferred Facebook.

The most fundamental review of the study of social media in higher education was done by Manca (2020). Out of about 130 publications reviewed, she selected 46 in-depth studies analyzing four relatively new social media platforms (Instagram, Pinterest, Snapchat, WhatsApp) to understand how these new platforms have become an integral component of teaching and learning in higher education. In addition, this study demonstrates the ability to search of Scopus and the Web of Science-indexed articles using these four platforms.

We will now provide a brief analysis of the academic papers concerning the university scholars questionnaire surveys. In Fauzi et al. (2019) a pilot study is conducted among academics in Malaysian public universities. Responses are obtained from 45 academics out of 399 survey questionnaires sent via e-mail. The analysed data showed that "social, attitude, management support, social media, and perceived behavioral control are significant factors for academics' intention to share while commitment, trust and subjective norms are not significant'" (Fauzi et al. 2019, p. 123). Shah and Cox (2017) explore how academics use Twitter in their scientific activities. Data gathered through 28 semi-structured interviews from researchers of a British University. Their analysis uncovers the great benefits that academics gain from use of Twitter as an information source for scientific communication in context of creation, usage and sharing of scientific information. Though Twitter is globally the second most popular, after Facebook (Wright 2010), scholars choose it as the most popular of all general social media platforms (Lupton 2014).

Mazurek et al. (2020) explore the relationship between researcher's social media presence on ResearchGate, LinkedIn, Facebook, and Twitter and the level of Google Scholar citation. They analysed 1604 papers published in 10 listed by Financial Times top 45 journals in management (7) and marketing (3) over three years (2013 – 2015), whereas the data collection on the social media presence was conducted in 2016. The study enables to obtain three significant results: (a) Academia social media (ResearchGate) and professional social media (LinkedIn) are positively associated with Google Scholar citations; (b) There is a significant relationship between the general social media (Facebook) presence and Google Scholar citations; (c) Microbloging social media (Twitter) presence is expected raise the Google Scholar citation rate (Mazurek et al. 2020).

We would like to describe the way social media platforms are used at the institutional level. Based on the TOP - 100 of 2010 - 2011 U.S. News Best Colleges National Rankings, Greenwood (2012) showed that 92 percent of American colleges (i.e. 92 colleges) linking at least one SNS and also that large majority of these institutions were providing Facebook (98.7%), Twitter (94.8%) and YouTube (85.7%) links on their homepages. Linvill et al. (2012) studied the same ranking for 2012 and explored how colleges and universities were employing Twitter. In their study, they chose 10 latest tweets for each of the 113 American institutions surveyed (60 national universities and 51 liberal arts colleges). As it turned out, 1007 (89.1%) tweets were directed a general audience, 790 tweets (69.9%) contained links, 587 tweets (51.9%) of these were links to other parts of institutions. It was revealed that institutions did not use Twitter in the dialogic mode, but rather as an institutional news feed to a general audience.

Comparing Greenwood (2012) data from 18 years ago with the latest data presented by Clement (2020), we see that Facebook and YouTube have not lost their positions, unlike Twitter. But this does not mean that Twitter has become less popular in the university environment, as shown in previous studies (Linvill et al. 2012; Lupton 2014; Shah and Cox 2017; Mazurek et al. 2020).

Chatterjee and Maity (2014) showed a survey of 100 universities based on the QS University Rankings: Asia 2013, regarding their presence in Facebook. The paper suggests official Facebook pages distribution for Asian countries, depending on their years when their accounts were created (2008 – 2013). The study reveals that China and Japan are the leaders in the number of such web-pages. Besides, 79 people out of 100 use Facebook.

Otto and Williams (2014) collected data of 20 November 2013 – 27 November 2013 concerning the official web-pages at Facebook, Twitter, LinkedIn, YouTube, Flickr and Google+ for 24 Africa universities from Top 200 Webometric Ranking (July 2013). The study found that 42 percent (10 universities) of the universities were officially present on Facebook, Twitter, LinkedIn and YouTube, 17 percent (3 universities) of the universities have no official presence on any SNS. Only one university – Rwanda University was officially presents in all six SNS.

Freire et al. (2014) studied the presence of 164 universities of the Andean countries (Colombia, Peru, Ecuador and Bolivia) on the six general (Facebook, Twitter, Google+, YouTube) and scientific (ResearchGate, Academia.edu) social network sites. The data collected from February to May 2014 and early July, 2014, revealed 20, 250 professors and researchers in the ResearchGate, including 13, 862 from Colombia. The authors specify there are 107, 100 professors and researchers and almost two million students these four countries. The scholars conclude that in their official accounts, Andean universities prefer general social networks rather than scientific networks (Freire et al. 2014).

Permatasari et al. (2013) conducted a study with the objectives to examine the academic use of social media by 264 Indonesian universities and measure the popularity and visibility of social media owned by universities. All universities reviewed are included both in Webometrics and 4ICU in July 2012 edition. The social media which was examined included Facebook, Twitter, Flickr, LinkedIn, YouTube, Wikipedia, Blogs, social network community owned by the university and open Couse Ware. The study founded that majority of the social media users used Facebook then followed by Twitter.

Taecharungroj (2017) investigates how universities in the USA (MIT, Harvard, and Stanford) and Thailand (Mahidol, Chulalongkorn, and Thammasat) use Facebook (1394 Facebook posts by the six universities in 2014 were analysed). This study established 12 post types: research, faculty, curriculum, campus, students, alumni, industry, events, products, image and reputation, announcements, and other. The most common post type by USA universities is research, whereas the most common post type by Thai universities are events and announcements (Taecharungroj 2017, p.111)

All of the above studies conducted in 2011 – 2014 in various parts of the world enable us to understand how general social networks are used on institutional levels, with preferences given to Facebook and Twitter.

We have found a recent research in this publication cluster (Valerio-Ureña et al. 2020) concerning the most popular SNS distribution (Facebook, Twitter, YouTube, LinkedIn,

Google+, Instagram and SnapChat) in Top 400 QS World University Ranking 2018, including the distribution based on university size, their management model (public, private), position in the QS ranking (Top 1-100, Top 101-200 and other) and region (8 large regions of the world). It was found out that 398 out of 400 universities had at least one account in the SNS under study. Universities display the highest presence at LinkedIn, Facebook, YouTube and Twitter (over 90% for each account), and the average number of universities' followers changed from 11, 556 (for 352 universities in YouTube) to 145, 058 (for 382 universities in Facebook).

We would like to analyse the publication cluster which compares traditional university rankings and Altmetrics rankings. The majority of relevant articles suggest a correlation between these rankings.

Veletsianos et al. (2017) have identified that Canada's top ten public universities use Twitter. On average, the accounts have been in operation for 6 years, beginning in fall 2009. It was found out that the majority of accounts were in English (84.4%) and the rest in French (18.6%). We have identified 9 out of these 10 universities, which are listed in current Webometric Ranking (July 2020). As we have calculated, Pearson's correlation coefficient between the university Webometric rank and tweet per year is equal 0.242.

Figueira (2018) studied Top10 university ranking from Centre for World University Ranking (CWUR) 2016 which included 8 USA and 2 UK universities. Using Facebook's API, the author collected all posts from each of the 10 universities (1 September 2015 – 31 August 2016). The structure of these posts was analysed to reveal that links, photos and videos prevailed. Total posts were compared with the CWUR Score. In studying these data, we noticed an absence of correlation between the Score and Total posts. For instance, Colombia University had a maximum number of posts (6, 514), ranking sixth in CWUR, while Stanford University had a minimum number of posts (2, 354) and ranked second in the same ranking.

In Maresova et al. (2020) the number of Facebook fans was calculated for TOP-10 universities according to QS World University Ranking. The data for 365 days were collected (July 2017 – July 2018). For the first ten, we chose Overall Score for QS Ranking 2017 – 2018 and calculated Pearson's correlation coefficient which was equal to 0.399. When we chose current ranks of the Webometric Ranking (July 2020) instead of QS Ranking 2017 – 2018, the correlation coefficient increased to 0.491.

We will now analyse the articles which specify the correlation coefficients calculated.

Woźniak and Buchnowska (2013) argue that, according to Sociagility report, there is a strong correlation between PRINT IndexTM of the university and its place in the Times Higher Education World University Ranking. This Index depends on "how each school attracted attention to its social media pages – based on site traffic, followers, views and engagement – as well as receptiveness to listening to comments, interaction, network reach and trust" (Wozniak and Buchnowska, 2013 p. 324, 325; https://www.sociagility.com/universities/).

In his paper, Holmberg (2015) builds a cross-correlation matrix for Spearman rank correlation between the social media metrics (9 metrics) and offline metrics (4 metrics) of the 14 universities in Finland (2012 year). This matrix reveals that the highest correlation coefficients (above 0.9) were between ResearchGate score and all offline metrics (PhD's awarded, Faculty, Research funding and Peer – reviewed publications in 2012). Good

correlation coefficients (above 0.5) were revealed between Tweets and Facebook likes, on the one hand, and most of offline metrics, on the other.

Iskender and Bati (2015) compared the ranking of Turkish Universities obtained by The Scientific and Technological Research Council of Turkey's (TUBITAK) Entrepreneur and Innovative University Index (EIUI) with rankings obtained by Sentiment Analysis (SA) of the related university's students or graduate student's social media messages. They used 13, 007 tweets that contain "entrepreneur" keyword and 14, 579 tweets that contain "Innovation" keyword. As a result, Spearman's correlation coefficient between SA Rank and TUBITAK's EIUI Rank is equal 0.413.

McCoy et al. (2018) identified 264 American universities included in Academic Ranking of World Universities (ARWU) 2016, Times Higher Education (THE) 2015 – 2016, USNEWS 2015, and USNEWS 2016. Based on the University's rank in these five rankings, the Adjusted Reputation Rank (ARR) was calculated. Additionally, the University Twitter Engagement (UTE) was calculated, which is the total number of affiliated users the university promotes on its home pages plus the followers of any Twitter friends. Finally, Kendall's correlation coefficient between ARR and UTE Rank was equal 0.6018.

Goncalves (2018) explores the correlating the relationship between U.S. News & World Report Rankings and Social Media Efficiency of the Top 10 Ranked (U.S. News 2019) universities at the state level (Massachusetts), U.S. national, and the world. We would like to stress that Social Media Efficiency was calculated as follows: Cost per Follower = Total Operating Expense/Gross Followers, with Facebook, Twitter and Instagram followers taken into consideration. In this paper, correlation was calculated based on the miscorrelation factor, which is the difference between U.S. News and Cost per Follower ranks. This factor proved to be the best one in considering TOP – 10 U.S. News ranking for the global assessment and equal is 26 +/_ (52% miscorrelation, maximum miscorrelation factor for 10 universities equal to 50+/-_ is assumed to constitute 100%).

In Meseguer-Martinez et al. (2019) two different metrics are proposed as a measure of online university video impact: (a) Views accounts for the total number of views of the videos published on a university YouTube account; (b) H1000 score of a university is defined as the highest number H of videos with at least Hx1000 views. According to the authors, Spearman's correlation coefficients between ranking of ARWU (N=416) and these two indices as equal to 0.398 (for H1000) and 0.372 (for Views). Similar correlation coefficients for THE (N=352) proved equal to 0.435 and 0.413, respectively. N here denotes the number of universities in the rankings.

OBJECTIVES

The literature review has enabled us to define our research objective. The objective is aimed at understanding how the diversity of university language websites and social networks influence the universities' reputation in the World University Rankings and how this diversity can be described. Based on the objective, we have set the following five research questions:

RQ1. Is there a correlation between the user activity in university social networks and university ranks in the World University Rankings?

RQ2. How big is the language diversity of the world's leading universities' websites and how can it be described?

RQ3. Does the language diversity of the world's leading universities' websites influence their positions in the World University Rankings?
RQ4. How big the diversity of SNS is accounts of the world's leading universities' and how can it be described?
RQ5. Does the diversity of the world's leading universities' SNS accounts influence their positions in the World University Rankings?

METHODS

Combining the union of sets of university names in THE, QS, and ARWU 2018 Top 100 Rankings enabled us to obtain a set of 146 universities. From October 18, 2018, through November 1, 2018, we checked the availability of website versions and social media apps in different languages. As a result, in the first case we obtained a 146x15 binary matrix, where 146 stands for the number of universities, and 15 means the number of website versions in different languages. In the second case we obtained a 146x21 binary matrix, where 21 denotes the number of various accounts in social media, messengers and applications. Both matrices are shown in Appendices 1 and 2.

Such binary matrices can be clustered by rearranging rows and columns in the initial sparse matrix. The idea of such clustering and the corresponding machine algorithm was first proposed in the work (Qyanadi, Kubota, Nakase 2001). In our case, for sparse matrices of relatively small dimensions, such clustering was carried out manually by rearranging rows and columns in the initial matrices, as noted above. Such problems, using the example of foreign-language sites and social networks of Russian universities, were solved in the works (Moskovkin and Chzhan 2019; Moskovkin and Yavej 2019).

RESULTS

Appendix A shows that all the 146 universities have websites in English. Those provided in Chinese come second. They include 21 websites. Apart from universities of China, all Japanese and Singapore universities have websites in Chinese, as well as some universities in the Netherlands, the UK, Argentina and Russia. It means that all of these educational establishments, including Moscow State University, seek to attract students from China. Surprisingly, neither of the four universities of South Korea has any website version in Chinese or Japanese. Websites in German come third in popularity. These include 15 sites of German and Swiss universities.

We have virtually failed to find any universities aimed at Spanish- and Portuguese-speaking countries of Latin America and Africa.

Wageningen University & Research displays the best linguistic diversification of its website, offering a choice of 7 languages. Within 2019, the University of Michigan provided versions of its website in Chinese, Hindu and Portuguese.

Unlike the University of Michigan (USA), The University of Nottingham (UK) and McGill University (Canada), all other universities of English-speaking countries have websites in English only. Apart from Moscow State University, neither of the 146 universities has a website in Russian.

Appendix A shows that as little as about 47 percent of universities provide their websites in more than one language.

Appendix C contains dense submatrices for four-, three- and two- language websites. It reveals the fact that the world's leading universities do not have a sufficient language diversification of their web pages. Besides, they tend to provide additional website versions in Asian languages. At the same time, it is evident that if these universities had their websites in other languages, they might be able to attract more students from respective areas of the world and improve their Webometric Ranking indices significantly.

Appendix B enables us to calculate the percentage of most popular social media and compare it with Greenwood's (2012) data. The results are displayed in Table 1, containing seven most popular social networks, according to our findings (Appendix B, 2018) and those by Greenwood (2012). Both studies yield similar results in terms of SNS popularity, with Facebook, Twitter and YouTube being top three. Similar results were also obtained by Valerio-Ureña (2020) for Top 400 QS World University Ranking: Facebook – 95.5 percent, Twitter – 90.8 percent, YouTube – 92.0 percent, Instagram – 78.3 percent, LinkedIn – 97.5 percent.

Table 1: Six Most Popular Social Networks

Appendix B (2018)			**Greenwood (2012)**		
SNS	**Number**	**%**	**SNS**	**Number**	**%**
Facebook	143	98.0	Facebook	91	98.9
Twitter	138	94.5	Twitter	88	95.7
YouTube	133	91.1	YouTube	79	85.9
Instagram	124	84.9	iTunes	47	51.1
Linkedin	93	63.7	Flickr	31	33.7
Google+	25	17.1	Linkedin	18	19.6
Flickr	16	11.0	Foursquare	9	9.8

Appendix B enables us to conclude that each of the universities under study has 755/146≈5.2 SNS, messenger and application accounts on average, with social media prevailing.

It should be noted that, apart from Moscow State University, The University of Nottingam (UK) also has a Vkontakte account.

As we can see in Appendix D, eighteen universities form a dense submatrix for six SNS which are most popular among all social media (Facebook, Twitter, YouTube, Instagram, LinkedIn, Google+). Sixty-three universities form a dense submatrix for five SNS (the same ones, excluding Google+), while forty-one universities form a dense submatrix for four SNS (the same ones excluding LinkedIn). Appendix B has enabled us to construct Table 2, similar to Greenwood's (2012) data.

As in the previous case (Greenwood 2012), we have a unimodal distribution of the universities number over SNS accounts, with 5 maximum number of accounts. (In Greenwood (2012) this maximum value was achieved at SNS number equal to 4).

Table 2: Number of SNS Linked by Universities

Number of SNS Linked by Universities	Number of Universities	%
1	3	2.1
2	2	1.4
3	9	6.2
4	34	23.3
5	47	32.2
6	25	17.1
7	11	7.5
8	12	8.2
9	3	2.1
Total	146	100

Figure 1 shows Pearson's correlation and regression relationship between Webometric Rank (July 2020) and university social media accounts.

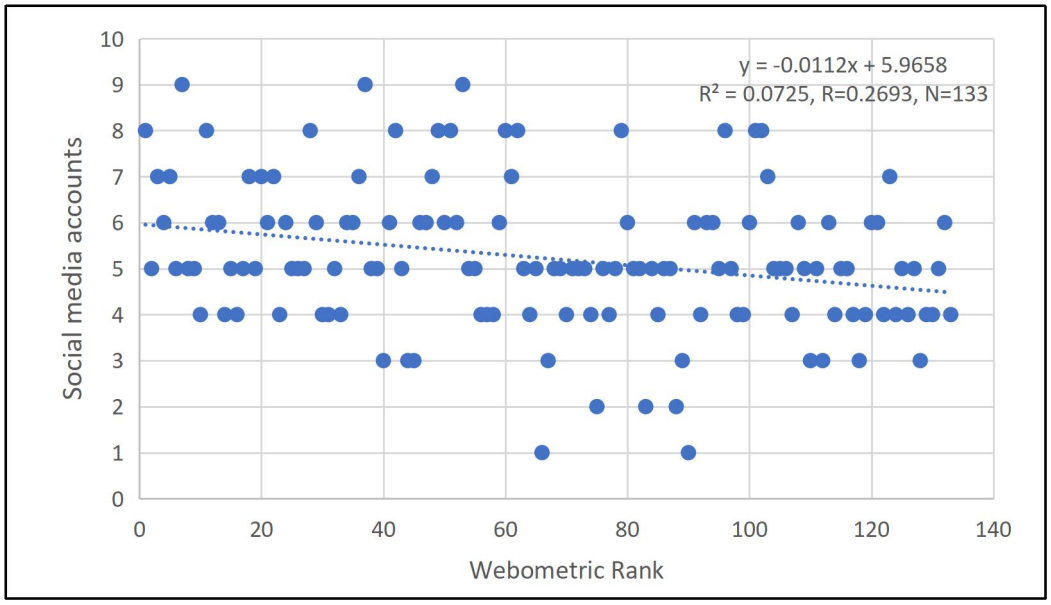

Figure 1: Pearson's Correlation and Regression Relationship between Webometric Rank (July 2020) and University Media Accounts

As we can see in Figure 1, there is a little correlation between the indices under study (Pearson's correlation coefficient is equal to 0.2693). We have analysed 133 universities instead of 146, as no Webometric Ranks have been found for 13 universities. In our calculations, such correlation with the Overall (Total) Score equaled to 0.2224 for Top 100 QS ranking, 0.2014 for Top 100 ARWU, and to 0.3000 for Top 100 THE. It may mean that for Top 100 World University Rankings, the number of social media accounts has little influence on Overall (Total) Score World University Rankings, as it is scientometric indices rather than Altmetric ones that play a big role in this band. We can suggest that in the low-ranking World University Rankings band the role of social media accounts diversity will increase.

DISCUSSION AND CONCLUSIONS

This study has shown that of all the 146 universities included in Times Higher Education (THE), Quacquarelli Symonds (QS), and Academic Ranking of World Universities (ARWU) TOP – 100 rankings in 2018, as little as 47 percent had more than one language version of their websites. Dense submatrices analysis has revealed that the world's leading universities display an insufficient language diversification of their web pages. They tend to provide additional versions of their websites in Asian languages (namely, in Chinese, Japanese and Korean).

Eighteen universities form a dense submatrix for six major SNS. The top three social media revealed in our study coincide with Greenwood's major US colleges survey findings in 2012, our percentage distribution approximately the same as in the latter.

We can now answer the 5 research questions we have set.

RQ1. The literature review, including our correlation calculation based on the data of two published papers, reveals a correlational dependence between users' activity in university social networks and universities' positions in National and World University Rankings. We will choose all Pearson's, Spearman's and Kendall's correlation coefficients of this review excluding correlations between online and offline metrics: 0.413; 0.6018; 0.399; 0.491; 0.242; 0.398; 0.372; 0.435; 0.413. Their average value is 0.418.

RQ2. The language diversity of the websites of the world's major universities is insignificant. Anglo- Saxon universities prefer to have their websites only in English, while they might attract more international students and improve their Webometric Ranking indices if they offered their webpages in other languages. The best way to represent the diversity of language websites is to use binary matrices and to single out dense submatrices using the matrix clustering procedure.

RQ3. The language diversity of the world's leading universities' websites does not influence their positions in the World University Rankings.

RQ4. There is quite a big diversity of the world's leading universities' SNS accounts, ranging from 1 to 9 accounts. The best way to represent this diversity is to use binary matrices and to single out dense submatrices using the matrix clustering procedure.

RQ5. The diversity of the world's leading universities' SNS accounts has an insignificant influence on their positions in the TOP-100 World University Rankings. We expect this influence to be much stronger in the low-ranking bands, for instance, in TOP – 500-1000.

We believe that binary matrices showing the distribution of different language versions of websites and social media accounts of the world's leading universities may be useful for education managers and experts for the purpose of identifying universities targeted at one or another region or specific social networks. In the future, it we believe it will be reasonable to conduct similar research of low-ranking World University Rankings bands.

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Appendix A: Availability of Websites in Different Languages at Universities Included in THE, QS, ARWU TOP-100 Rankings (18.10-01.11.2018)

	University	Country	Language															Total
			En	Ch	De	Fr	Nl	Ko	Ja	Sv	Pt	Es	Da	Ar	Fi	Nb	Ru	
1.	Wageningen University & Research	Netherlands	1	1	1	1	1	0	0	0	1	1	0	0	0	0	0	7
2.	The University of Tokyo	Japan	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	4
3.	Kyoto University	Japan	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	4
4.	Osaka University	Japan	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	4
5.	Universidad de Buenos Aires (UBA)	Argentina	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	4
6.	Lomonosov Moscow State University	Russia	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	3
7.	Nagoya University	Japan	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	3
8.	National University of Singapore	Singapore	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
9.	Peking University	China	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
10.	Tsinghua University	China	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
11.	University of Hong Kong	Hong Kong, China	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
12.	Nanyang Technological University, Singapore	Singapore	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
13.	Hong Kong University of Science and Technology	Hong Kong, China	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
14.	Chinese University of Hong Kong	Hong Kong, China	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
15.	Shanghai Jiao Tong University	China	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
16.	National Taiwan University (NTU)	Taiwan	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
17.	University of Science and Technology of China	China	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
18.	Fudan University	China	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
19.	City University of Hong Kong	Hong Kong,China	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
20.	University of Nottingham	United Kingdom	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
21.	Zhejiang University	China	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
22.	ETH Zurich	Switzerland	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
23.	LMU Munich	Germany	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
24.	Technical University of Munich	Germany	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
25.	Heidelberg University	Germany	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
26.	Humboldt University of Berlin	Germany	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
27.	RWTH Aachen University	Germany	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
28.	University of Freiburg	Germany	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
29.	Free University of Berlin	Germany	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
30.	Technical University of Berlin	Germany	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2

	University	Country	Language															Total
			En	Ch	De	Fr	Nl	Ko	Ja	Sv	Pt	Es	Da	Ar	Fi	Nb	Ru	
31.	University of Tübingen	Germany	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
32.	University of Bonn	Germany	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
33.	University of Zurich	Switzerland	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
34.	University of Goettingen	Germany	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
35.	University of Basel	Switzerland	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2
36.	Ecole Normale Superieure - Paris	France	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
37.	Sorbonne University	France	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
38.	University of Paris-Sud (Paris 11)	France	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
39.	University of Geneva	Switzerland	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
40.	Ecole Polytechnique	France	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
41.	McGill University	Canada	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
42.	Paris Sciences et Lettres – PSL Research University Paris	France	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
43.	École Polytechnique Fédérale de Lausanne	Switzerland	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
44.	University of Amsterdam	Netherlands	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
45.	Delft University of Technology	Netherlands	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
46.	Leiden University	Netherlands	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
47.	Utrecht University	Netherlands	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
48.	Erasmus University Rotterdam	Netherlands	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
49.	University of Groningen	Netherlands	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
50.	Ghent University	Germany	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
51.	Eindhoven University of Technology	Netherlands	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
52.	Korea Advanced Institute of Science and Technology (KAIST)	South Korea	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2
53.	Seoul National University	South Korea	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2
54.	Pohang University of Science And Technology (POSTECH)	South Korea	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2
55.	Korea University	South Korea	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2
56.	Tokyo Institute of Technology	Japan	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2
57.	Tohoku University	Japan	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2
58.	Uppsala University	Sweden	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
59.	Lund University	Sweden	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
60.	University of Helsinki	Finland	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	3
61.	Aarhus University	Demark	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
62.	Stockholm University	Sweden	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
63.	Technion-Israel Institute of Technology	Israel	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2

	University	Country	Language															Total
			En	Ch	De	Fr	Nl	Ko	Ja	Sv	Pt	Es	Da	Ar	Fi	Nb	Ru	
64.	The Hebrew University of Jerusalem	Israel	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
65.	University of Copenhagen	Demark	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2
66.	Karolinska Institute	Sweden	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2
67.	KU Leuven	Belgium	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
68.	University of Oslo	Norway	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2
69.	University of Oxford	United Kingdom	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
70.	University of Cambridge	United Kingdom	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
71.	California Institute of Technology	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
72.	Stanford University	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
73.	Massachusetts Institute ofTechnology	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
74.	Harvard University	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
75.	Princeton University	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
76.	Imperial College London	United Kingdom	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
77.	University of Chicago	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
78.	University of Pennsylvania	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
79.	Yale University	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
80.	Johns Hopkins University	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
81.	Columbia University	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
82.	University of California, Los Angeles	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
83.	University College London (UCL)	United Kingdom	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
84.	Duke University	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
85.	University of California, Berkeley	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
86.	Cornell University	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
87.	Northwestern University	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
88.	University of Michigan	United States	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2
89.	University of Toronto	Canada	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
90.	Carnegie Mellon University	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
91.	London School of Economics and Political Science	United Kingdom	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
92.	University of Washington	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
93.	University of Edinburgh	United Kingdom	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
94.	New York University	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
95.	University of California, San Diego	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
96.	University of Melbourne	Australia	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

	University	Country	Language															Total
			En	Ch	De	Fr	Nl	Ko	Ja	Sv	Pt	Es	Da	Ar	Fi	Nb	Ru	
97.	Georgia Institute ofTechnology	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
98.	University of British Columbia	Canada	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
99.	King's College London	United Kingdom	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
100.	University of Illinois at Urbana-Champaign	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
101.	University of Wisconsin-Madison	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
102.	Australian National University	Australia	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
103.	University of Texas at Austin	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
104.	Brown University	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
105.	Washington University in St Louis	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
106.	University of California, Santa Barbara	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
107.	University of California, Davis	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
108.	University of Manchester	United Kingdom	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
109.	University of Minnesota Twin Cities	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
110.	University of North Carolina at Chapel Hill	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
111.	Purdue University	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
112.	University of Sydney	Australia	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
113.	University of Queensland	Australia	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
114.	University of Southern California	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
115.	University of Maryland, College Park	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
116.	Boston University	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
117.	Ohio State University	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
118.	University of Bristol	United Kingdom	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
119.	Pennsylvania State University	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
120.	McMaster University	Canada	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
121.	University of Glasgow	United Kingdom	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
122.	Monash University	Australia	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
123.	Michigan State University	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
124.	University of New South Wales	Australia	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
125.	Rice University	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
126.	Dartmouth College	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
127.	University of Warwick	United Kingdom	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
128.	Durham University	United Kingdom	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
129.	Emory University	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

	University	Country	Language															Total
			En	Ch	De	Fr	Nl	Ko	Ja	Sv	Pt	Es	Da	Ar	Fi	Nb	Ru	
130.	University of California, Irvine	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
131.	The University of Sheffield	United Kingdom	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
132.	University of Birmingham	United Kingdom	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
133.	TheUniversity of Auckland	NewZealand	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
134.	University of Malaya (UM)	Malaysia	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
135.	University of Leeds	United Kingdom	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
136.	University of Southampton	United Kingdom	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
137.	University of St. Andrews	United Kingdom	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
138.	Rockefeller University	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
139.	University of Colorado at Boulder	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
140.	The University of Texas Southwestern Medical Center at Dallas	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
141.	Vanderbilt University	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
142.	Mayo Medical School	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
143.	University of Florida	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
144.	University of Pittsburgh, Pittsburgh Campus	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
145.	The University of Western Australia	Australia	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
146.	The University of Texas M. D. Anderson Cancer Center	United States	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Total		146	21	15	9	9	7	6	4	2	3	2	2	1	1	1	229

Note: En-English, Ch-Chinese, De-German, Fr-French, Nl - Dutch (Dutch), Ko – Korean, Ja – Japanese, Sv - Swedish, Pt – Portuguese, Es – Spanish, Da – Danish, Ar – Arabic, Fi – Finnish, Nb - Norwegian, Ru - Russian.

Appendix B: Availability of Social Media Accounts, Messengers and Applications for Universities Included in THE, QS, ARWU TOP-100 Rankings (18.10-01.11.2018)

	University	Country	Facebook	Twitter	YouTube	Instagram	linkedin	Google+	Flickr	Weibo	Pinterest	iTunes	Snapchat	Wechat	Tumblr	XING	SoundCloud	Medium	Coursera	Conversation	Futurity	Vimeo	Vkontakte	Total
1.	Georgia Institute of Technology	United States	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	8
2.	Carnegie Mellon University	United States	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	9
3.	Harvard University	United States	1	1	1	1	1	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	8
4.	University of Pennsylvania	United States	1	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	8
5.	London School of Economics and Political Science	United Kingdom	1	1	1	1	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	8
6.	Brown University	United States	1	1	1	1	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	8
7.	Monash University	Australia	1	1	1	1	1	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	8
8.	University of New South Wales	Australia	1	1	1	1	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	8
9.	The University of Texas M. D. Anderson Cancer Center	United States	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	8
10.	University of Washington	United States	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	7
11.	Massachusetts Institute of Technology	United States	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
12.	University of Texas at Austin	United States	1	1	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	7
13.	The Univ. of Texas Southwestern Medical Center at Dallas	United States	1	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	7
14.	Free University of Berlin	Germany	1	1	1	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	7
15.	McGill University	Canada	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
16.	École Polytechnique Fédérale de Lausanne	Switzerland	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
17.	Leiden University	Netherlands	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
18.	McMaster University	Canada	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
19.	University of Illinois at Urbana-Champaign	United States	1	1	1	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	8
20.	Vanderbilt University	United States	1	1	1	1	1	0	1	0	1	0	1	0	1	0	0	0	0	0	0	0	0	9
21.	University of HongKong	Hong Kong, China	1	1	1	1	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	8
22.	University of Oxford	United Kingdom	1	1	1	1	1	0	0	1	0	1	0	0	0	0	0	1	0	1	0	0	0	9
23.	University of Nottingham	United Kingdom	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	8
24.	The University of Auckland	NewZealand	1	1	1	1	1	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0	8
25.	University of Geneva	Switzerland	1	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	7
26.	Peking University	China	1	1	1	1	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	7
27.	Purdue University	United States	1	1	1	1	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	7

	University	Country	Facebook	Twitter	YouTube	Instagram	linkedin	Google+	Flickr	Weibo	Pinterest	iTunes	Snapchat	Wechat	Tumblr	XING	SoundCloud	Medium	Coursera	Conversation	Futurity	Vimeo	Vkontakte	Total
28.	Pennsylvania State University	United States	1	1	1	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	7
29.	Princeton University	United States	1	1	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	6
30.	Imperial College London	United Kingdom	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	6
31.	ETH Zurich	Switzerland	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
32.	University of California, Los Angeles	United States	1	1	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	6
33.	University of Cambridge	United Kingdom	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	6
34.	National University of Singapore	Singapore	1	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	6
35.	New York University	United States	1	1	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	6
36.	Tsinghua University	China	1	1	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	6
37.	University of California, Santa Barbara	United States	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	6
38.	Karolinska Institute	Sweden	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
39.	University of Queensland	Australia	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
40.	University of Southern California	United States	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
41.	Paris Sciences et Lettres – PSL Research University Paris	France	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
42.	University of Freiburg	Germany	1	1	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	6
43.	University of Groningen	Netherlands	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
44.	Uppsala University	Sweden	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
45.	Lund University	Sweden	1	1	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	6
46.	Durham University	United Kingdom	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	6
47.	University of Bonn	Germany	1	1	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	6
48.	Ecole Polytechnique	France	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
49.	University of Colorado at Boulder	United States	1	1	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	6
50.	The University of Western Australia	Australia	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	6
51.	The University of Sheffield	United Kingdom	1	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	6
52.	Johns Hopkins University	United States	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
53.	Columbia University	United States	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
54.	University of Michigan	United States	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
55.	University of Toronto	Canada	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
56.	University of Edinburgh	United Kingdom	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
57.	University of British Columbia	Canada	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
58.	King's College London	United Kingdom	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5

	University	Country	Facebook	Twitter	YouTube	Instagram	linkedin	Google+	Flickr	Weibo	Pinterest	iTunes	Snapchat	Wechat	Tumblr	XING	SoundCloud	Medium	Coursera	Conversation	Futurity	Vimeo	Vkontakte	Total
59.	KU Leuven	Belgium	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
60.	University of Minnesota Twin Cities	United States	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
61.	Chinese University of Hong Kong	Hong Kong, China	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
62.	Delft University of Technology	Netherlands	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
63.	Utrecht University	Netherlands	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
64.	University of Wisconsin-Madison	United States	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
65.	Nanyang Technological University, Singapore	Singapore	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
66.	Michigan State University	United States	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
67.	Rice University	United States	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
68.	University of Helsinki	Finland	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
69.	Emory University	United States	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
70.	Tohoku University	Japan	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
71.	University of Leeds	United Kingdom	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
72.	University of Southampton	United Kingdom	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
73.	Eindhoven University of Technology	Netherlands	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
74.	Rockefeller University	United States	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
75.	University of Zurich	Switzerland	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
76.	Ghent University	Germany	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
77.	Ecole Normale Superieure - Paris	France	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
78.	Aarhus University	Demark	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
79.	Stockholm University	Sweden	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
80.	The Hebrew University of Jerusalem	Israel	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
81.	Sorbonne University	France	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
82.	University College London	United Kingdom	1	1	1	1	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	7
83.	California Institute of Technology	United States	1	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	6
84.	University of California, Berkeley	United States	1	1	1	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	6
85.	Northwestern University	United States	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	5
86.	City University of Hong Kong	Hong Kong,China	1	1	1	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	6
87.	Stanford University	United States	1	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	5
88.	LMU Munich	Germany	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
89.	Washington University in St Louis	United States	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5

	University	Country	Facebook	Twitter	YouTube	Instagram	linkedin	Google+	Flickr	Weibo	Pinterest	iTunes	Snapchat	Wechat	Tumblr	XING	SoundCloud	Medium	Coursera	Conversation	Futurity	Vimeo	Vkontakte	Total
90.	University of California, Davis	United States	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
91.	University of Manchester	United Kingdom	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
92.	University of North Carolina at Chapel Hill	United States	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	5
93.	Technical University of Munich	Germany	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
94.	Ohio State University	United States	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
95.	RWTH AachenUniversity	Germany	1	1	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	5
96.	University of California, Irvine	United States	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
97.	Duke University	United States	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
98.	Cornell University	United States	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
99.	University of Chicago	United States	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
100.	University of Sydney	Australia	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
101.	University of Maryland, College Park	UnitedStates	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
102.	Kyoto University	Japan	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
103.	University of Glasgow	United Kingdom	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
104.	Dartmouth College	United States	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
105.	University of Warwick	United Kingdom	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
106.	Technical University of Berlin	Germany	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
107.	University of Basel	Switzerland	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
108.	Korea Advanced Inst. of Science and Technology (KAIST)	South Korea	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
109.	Osaka University	Japan	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
110.	University of Birmingham	United Kingdom	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
111.	Pohang University of Science And Technology (POSTECH)	SouthKorea	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
112.	University of Malaya (UM)	Malaysia	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
113.	University of St.Andrews	United Kingdom	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
114.	University of Oslo	Norway	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
115.	University of Florida	United States	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
116.	University of Goettingen	Germany	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
117.	Mayo Medical School	United States	1	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	5
118.	University of Paris-Sud (Paris 11)	France	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
119.	University of Bristol	United Kingdom	1	1	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
120.	Australian National University	Australia	1	1	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	5

	University	Country	Facebook	Twitter	YouTube	Instagram	linkedin	Google+	Flickr	Weibo	Pinterest	iTunes	Snapchat	Wechat	Tumblr	XING	SoundCloud	Medium	Coursera	Conversation	Futurity	Vimeo	Vkontakte	Total
121.	Yale University	United States	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4
122.	The University of Tokyo	Japan	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
123.	Erasmus University Rotterdam	Netherlands	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
124.	Tokyo Institute of Technology	Japan	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
125.	Nagoya University	Japan	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
126.	Boston University	United States	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
127.	Seoul National University	South Korea	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
128.	University of Tübingen	Germany	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
129.	University of Pittsburgh, Pittsburgh Campus	United States	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
130.	University of Copenhagen	Denmark	1	1	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	7
131.	University of California, San Diego	United States	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
132.	Wageningen University & Research	Netherlands	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
133.	Technion-Israel Institute of Technology	Israel	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	4
134.	Universidad de Buenos Aires (UBA)	Argentina	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
135.	University of Melbourne	Australia	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
136.	Lomonosov Moscow State University	Russia	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	3
137.	Zhejiang University	China	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
138.	Heidelberg University	Germany	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
139.	Humboldt University of Berlin	Germany	1	0	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	6
140.	Hong Kong University of Science and Technology	Hong Kong, China	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
141.	Korea University	South Korea	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
142.	National Taiwan University (NTU)	Taiwan	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
143.	University of Amsterdam	Netherlands	1	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	4
144.	Fudan University	China	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
145.	Shanghai Jiao Tong University	China	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
146.	University of Science and Technology of China	China	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Total		143	138	133	124	93	25	16	16	14	11	8	6	5	4	3	3	3	3	3	2	2	765
	Percentage		98.0	94.5	91.1	84.9	63.7	17.1	11.0	11.0	9.6	7.5	5.5	4.1	3.4	2.7	2.1	2.1	2.1	2.1	2.1	1.4	1.4	

Appendix C: Dense Submatrices for Four, Three and Two Language Web Sites Obtained on the Basis of Initial Binary Matrix Clusterization (Appendix A)

N	University	Country	Language			
			En	Ch	Ko	Ja
1	The University of Tokyo	Japan	1	1	1	1
2	Kyoto University	Japan	1	1	1	1
3	Osaka University	Japan	1	1	1	1

N	University	Country	Language			
			En	Ch	Pt	Es
1	Wageningen University & Research	Netherlands	1	1	1	1
2	Universidad de Buenos Aires (UBA)	Argentina	1	1	1	1

N	University	Country	Language		
			En	Ko	Ja
1	The University of Tokyo	Japan	1	1	1
2	Kyoto University	Japan	1	1	1
3	Osaka University	Japan	1	1	1

N	University	Country	Language	
			En	Ch
1	Wageningen University & Research	Netherlands	1	1
2	The University of Tokyo	Japan	1	1
3	Kyoto University	Japan	1	1
4	Osaka University	Japan	1	1
5	Universidad de Buenos Aires (UBA)	Argentina	1	1
6	Lomonosov Moscow State University	Russia	1	1
7	Nagoya University	Japan	1	1
8	National University of Singapore	Singapore	1	1
9	Peking University	China	1	1
10	Tsinghua University	China	1	1
11	University of Hong Kong	Hong Kong, China	1	1
12	Nanyang Technological University, Singapore	Singapore	1	1
13	Hong Kong University of Science and Technology	Hong Kong, China	1	1
14	Chinese University of Hong Kong	Hong Kong, China	1	1
15	Shanghai Jiao Tong University	China	1	1
16	National Taiwan University (NTU)	Taiwan	1	1
17	University of Science and Technology of China	China	1	1
18	Fudan University	China	1	1
19	City University of Hong Kong	Hong Kong, China	1	1
20	University of Nottingham	United Kingdom	1	1
21	Zhejiang University	China	1	1

N	University	Country	Language	
			En	De
1	Wageningen University & Research	Netherlands	1	1
2	ETH Zurich	Switzerland	1	1
3	LMU Munich	Germany	1	1
4	Technical University of Munich	Germany	1	1

5	Heidelberg University	Germany	1	1
6	Humboldt University of Berlin	Germany	1	1
7	RWTH Aachen University	Germany	1	1
8	University of Freiburg	Germany	1	1
9	Free University of Berlin	Germany	1	1
10	Technical University of Berlin	Germany	1	1
11	University of Tubingen	Germany	1	1
12	University of Bonn	Germany	1	1
13	University of Zurich	Switzerland	1	1
14	University of Goettingen	Germany	1	1
15	University of Basel	Switzerland	1	1

N	**University**	**Country**	**Language**	
			En	**Fr**
1	Wageningen University & Research	Netherlands	1	1
2	Ecole NormaleSuperieure - Paris	France	1	1
3	Sorbonne University	France	1	1
4	University of Paris-Sud (Paris 11)	France	1	1
5	University of Geneva	Switzerland	1	1
6	Ecole Polytechnique	France	1	1
7	McGill University	Canada	1	1
8	Paris Sciences et Lettres - PSL Research University Paris	France	1	1
9	Ecole Polytechnique Federate de Lausanne	Switzerland	1	1

N	**University**	**Country**	**Language**	
			En	**Nl**
1	Wageningen University & Research	Netherlands	1	1
2	University of Amsterdam	Netherlands	1	1
3	Delft University of Technology	Netherlands	1	1
4	Leiden University	Netherlands	1	1
5	Utrecht University	Netherlands	1	1
6	Erasmus University Rotterdam	Netherlands	1	1
7	University of Groningen	Netherlands	1	1
8	Ghent University	Germany	1	1
9	Eindhoven University of Technology	Netherlands	1	1
10	KU Leuven	Belgium	1	1

N	**University**	**Country**	**Language**	
			En	**Ko**
1	The University of Tokyo	Japan	1	1
2	Kyoto University	Japan	1	1
3	Osaka University	Japan	1	1
4	Korea Advanced Institute of Science and Technology (KAIST)	South Korea	1	1
5	Seoul National University	South Korea	1	1
6	Pohang University of Science And Technology (POSTECH)	South Korea	1	1
7	Korea University	South Korea	1	1

N	University	Country	Language	
			En	Ja
1	The University of Tokyo	Japan	1	1
2	Kyoto University	Japan	1	1
3	Osaka University	Japan	1	1
4	Nagoya University	Japan	1	1
5	Tokyo Institute of Technology	Japan	1	1
6	Tohoku University	Japan	1	1

Note: en-English, ch-Chinese, de-German, fr-French, nl-Dutch(Dutch), Ko-Korean, ja-Japanese, sv-Swedish, pt-Portuguese, es-Spanish, da-Danish, AG-Arabic, fi-Finnish, nb - Norwegian, ru - Russian.

Appendix D: Dense Submatrices for Six, Five and Four Social Networks Obtained on the Basis of Initial Binary Matrix Clusterization (Appendix B)

N	University	Country	Facebook	Twitter	YouTube	Instagram	Linkedin	Google+
1	Georgia Institute of Technology	United States	1	1	1	1	1	1
2	Carnegie Mellon University	United States	1	1	1	1	1	1
3	Harvard University	United States	1	1	1	1	1	1
4	University of Pennsylvania	United States	1	1	1	1	1	1
5	London School of Economics and Political Science	United Kingdom	1	1	1	1	1	1
6	Brown University	United States	1	1	1	1	1	1
7	Monash University	Australia	1	1	1	1	1	1
8	University of New South Wales	Australia	1	1	1	1	1	1
9	The University of Texas M. D. Anderson Cancer Center	United States	1	1	1	1	1	1
10	University of Washington	United States	1	1	1	1	1	1
11	Massachusetts Institute of Technology	United States	1	1	1	1	1	1
12	University of Texas at Austin	United States	1	1	1	1	1	1
13	The Univ. of Texas Southwestern Medical Center at Dallas	United States	1	1	1	1	1	1
14	Free University of Berlin	Germany	1	1	1	1	1	1
15	McGill University	Canada	1	1	1	1	1	1
16	Ecole Polytechnique Federale de Lausanne	Switzerland	1	1	1	1	1	1
17	Leiden University	Netherlands	1	1	1	1	1	1
18	McMaster University	Canada	1	1	1	1	1	1

N	University	Country	Facebook	Twitter	YouTube	Instagram	Linkedin
1	University of Illinois at Urbana-Champaign	United States	1	1	1	1	1
2	Vanderbilt University	United States	1	1	1	1	1
3	University of Hong Kong	Hong Kong, China	1	1	1	1	1
4	University of Oxford	United Kingdom	1	1	1	1	1
5	University of Nottingham	United Kingdom	1	1	1	1	1
6	The University of Auckland	New Zealand	1	1	1	1	1
7	University of Geneva	Switzerland	1	1	1	1	1
8	Peking University	China	1	1	I	1	1
9	Purdue University	United States	1	1	1	1	1
10	Pennsylvania State University	United States	1	1	1	1	1
11	Princeton University	United States	1	1	1	1	1
12	Imperial College London	United Kingdom	1	1	1	1	1

13	ETH Zurich	Switzerland	1	1	1	1	1
14	University of California, Los Angeles	United States	1	1	1	1	1
15	University of Cambridge	United Kingdom	1	1	1	1	1
16	National University of Singapore	Singapore	1	1	1	1	1
17	New York University	United States	1	1	1	1	1
18	Tsinghua University	China	1	1	1	1	1
19	University of California, Santa Barbara	United States	1	1	1	1	1
20	Karolinska Institute	Sweden	1	1	1	1	1
21	University of Queensland	Australia	1	1	1	1	1
22	University of Southern California	United States	1	1	1	1	1
23	Paris Sciences et Lettres - PSL Research University Paris	France	1	1	1	1	1
24	University of Freiburg	Germany	1	1	1	1	1
25	University of Groningen	Netherlands	1	1	1	1	1
26	Uppsala University	Sweden	1	1	1	1	1
27	Lund University	Sweden	1	1	1	1	1
28	Durham University	United Kingdom	1	1	1	1	1
29	University of Bonn	Germany	1	1	1	1	1
30	Ecole Polytechnique	France	1	1	1	1	1
31	University of Colorado at Boulder	United States	1	1	1	1	1
32	The University of Western Australia	Australia	1	1	1	1	1
33	The University of Sheffield	United Kingdom	1	1	1	1	1
34	Johns Hopkins University	United States	1	1	1	1	1
35	Columbia University	United States	1	1	1	1	1
36	University of Michigan	United States	1	1	1	1	1
37	University of Toronto	Canada	1	1	1	1	1
38	University of Edinburgh	United Kingdom	1	1	1	1	1
39	University of British Columbia [!]	Canada	1	1	1	1	1
40	King's College London	United Kingdom	1	1	1	1	1
41	KU Leuven	Belgium	1	1	1	1	1
42	University of Minnesota Twin Cities	United States	1	1	1	1	1
43	Chinese University of Hong Kong	Hong Kong, China	1	1	1	1	1
44	Delft University of Technology	Netherlands	1	1	1	1	1
45	Utrecht University	Netherlands	1	1	1	1	1
46	University of Wisconsin-Madison	United States	1	1	1	1	1
47	Nanyang Technological University, Singapore	Singapore	1	1	1	1	1
48	Michigan State University	United States	1	1	1	1	1
49	Rice University	United States	1	1	1	1	1
50	University of Helsinki	Finland	1	1	1	1	1
51	Emory University	United States	1	1	1	1	1
52	Tohoku University	Japan	1	1	1	1	1
53	University of Leeds	United Kingdom	1	1	1	1	1
54	University of Southampton	United Kingdom	1	1	1	1	1
55	Eindhoven University of Technology	Netherlands	1	1	1	1	1
56	Rockefeller University	United States	1	1	1	1	1
57	University of Zurich	Switzerland	1	1	1	1	1
58	Ghent University	Germany	1	1	1	1	1
59	Ecole Normale Superieure - Paris	France	1	1	1	1	1
60	Aarhus University	Demark	1	1	1	1	1
61	Stockholm University	Sweden	1	1	1	1	1
62	The Hebrew University of Jerusalem	Israel	1	1	1	1	1
63	Sorbonne University '	France	1	1	1	1	1

N	University	Country	Facebook	Twitter	YouTube	Instagram
1	UCL	United Kingdom	1	1	1	1
2	California Institute of Technology	United States	1	1	1	1
3	University of California, Berkeley	United States	1	1	1	1
4	Northwestern University	United States	1	1	1	1
5	City University of Hong Kong	Hong Kong,China	1	1	1	1
6	Stanford University	United States	1	1	1	
7	LMU Munich	Germany	1	1	1	1
8	Washington University in St Louis	United States	1	1	1	1
9	University of California, Davis	United States	1	1	1	1
10	University of Manchester	United Kingdom	1	1	1	1
11	University of North Carolina at Chapel Hill	United States	1	1	1	1
12	Technical University of Munich	Germany	1	1	1	1
13	Ohio State University	United States	1	1	1	1
14	RWTH Aachen University	Germany	1	1	1	1
15	University of California, Irvine	United States	1	1	1	1
16	Duke University	United States	1	1	1	1
17	Cornell University	United States	1	1	1	1
18	University of Chicago	United States	1	1	1	1
19	University of Sydney	Australia	1	1	1	1
20	University of Maiyland, College Park	United States	1	1	1	1
21	Kyoto University	Japan	1	1	1	I
22	University of Glasgow	United Kingdom	1	1	1	1
23	Dartmouth College	United States	1	1	1	1
24	University of Warwick	United Kingdom	1	1	1	1
25	Technical University of Berlin	Germany	1	1	1	1
26	University of Basel	Switzerland	1	1	1	1
27	Korea Advanced Institute of Science and Technology (KAIST)	South Korea	1	1	1	1
28	Osaka University	Japan	1	1	1	1
29	University of Birmingham	United Kingdom	1	1	1	1
30	Pohang University of Science And Technology (POSTECH)	South Korea	1	1	1	1
31	University of Malaya (UM)	Malaysia	1	1	1	1
32	University of St Andrews	United Kingdom	1	1	1	1
33	University of Oslo	Norway	1	1	1	1
34	University of Florida	United States	1	1	1	1
35	University of Goettingen	Germany	1	1	1	1
36	Pohang University of Science And Technology (POSTECH)	South Korea	1	1	1	1
37	University of Malaya (UM)	Malaysia	1	1	1	1
38	University of St Andrews	United Kingdom	1	1	1	1
39	University of Oslo	Norway	1	1	1	1
40	University of Florida	United States	1	1	1	1
41	University of Goettingen	Germany	1	1	1	1