



Work Package 1

Task 1.2

Supplementary report: Social Network Analysis

Report by: Mid Sweden University (Evangelia Petridou, Jörgen Sparf, Ellen Horbach, and Simone

Grännsjö) in Collaboration with Per Becker (Lund University and North-West University)

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Co-funded by the
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Strengthening University- Collaboration for Resilient Communities in Asia (SECRA): Social Network Analysis

Introduction

The overarching aim of the Erasmus+ funded project Strengthening University-Enterprise Collaboration for Resilient Communities in Asia (SECRA) is to contribute to the disaster resilience in Asia by foregrounding university-enterprise collaborations (UECs). SECRA aims at understanding the mechanisms of how these collaborations are formed and by doing so, develop practical and relevant tools in helping to enhance and maintain them. SECRA's consortium consists of 13 partners, including nine universities in Thailand, Sri Lanka, and The Philippines. This supplemental report is a component of the output of WP1, which aimed at mapping the institutional landscape of the partner countries in terms of external relations and collaboration with external partners. The working definition of “industry” in the project includes the public, private, and third sectors.

Background: Social Networks

Collaborative arrangements can be conceptualized as networks. Networks are analytical constructions that facilitate our understanding of interdependencies among actors. Moreover, networks are “an intuitively comprehensible metaphor: regular communication and frequent exchange of information lead to the establishment of stable relationships between actors and to the coordination of their mutual interests” (Adam and Kriesi, 2007, p 129). Networks are composed of nodes, which can be individual or collective actors (here HEIs or faculty members and students, enterprises, and their key personnel) and the links that connect the nodes, expressing social relations, transactions, exchange of material and immaterial resources such as information or services.

In summary, in WP1, we investigated collaboration from a network perspective, both formally and in narrative form as well as triangulated with quantitative data in order to gain a more comprehensive understanding of any collaborations, their activities and scope. This relational analysis was designed to reveal issues of practical utility. It aimed at showing whether the connections between the university and the private sector were formalized or informal in nature. This is important, because if the connection is based on the person and not the function, it disappears if the person moves away or changes jobs.

Additionally, the analysis was designed to reveal any structural barriers to collaboration. The main report of WP1 discusses barriers and enablers of institutional support in all three partner countries. Here we would like to note that it is important to highlight that social relations, trust, and the ability to rely on a network of stakeholders has been recognized as an important factor of crisis management, including the response in disasters caused by climate change (Jones and Faas, 2017).

Research Design

The study was based on a personal network design. This design focuses on a node, called an *ego*, and the relationships they have with others, called *alters*. The resultant networks are called *ego networks* (Borgatti, Everett, and Johnson, 2018). Our unit of observation was faculty members at all partner universities. The sample for this study was purposeful; we reached out to the SECRA partners at each university and asked them to identify faculty members with university enterprise connections. The reason for this is that the focus was to understand collaborations, so it was necessary that the respondents reported on them so that they could be analyzed.

The survey was modulated. Module A1 collected personal attribute information of the respondent such as age, gender, position, etc, while module A2 was aimed at questions of institutional nature, such as the degree of institutionalization of UECs in the partner university. The final module concerned the purely relational aspect of this survey. First, the respondents were asked to name 25 external contacts with which they had collaborated during the previous 5 years, followed by a series of questions regarding the nature of that relationship—how it started, whether it was formal or informal, and how strong it was. To answer the last two questions, respondents were asked to place their contacts in a bulls-eye visualization of their relationships with external partners (Figure 1). The respondent (*ego*), labeled 0 in the figure below, was able to move their alters (numbered to the left) in the main set of concentric circles. This allowed them to think of all the relationships as a whole and facilitate accurate reporting. We also asked respondents to report on any known ties between their alters, which is a necessary step in the construction of the ego network. For this, we instructed them to draw lines between their alters. The questionnaire was constructed by UCLan on Qualtrics. The original guidelines stipulated that the question be given face-to-face to minimize lack of response by the respondents.

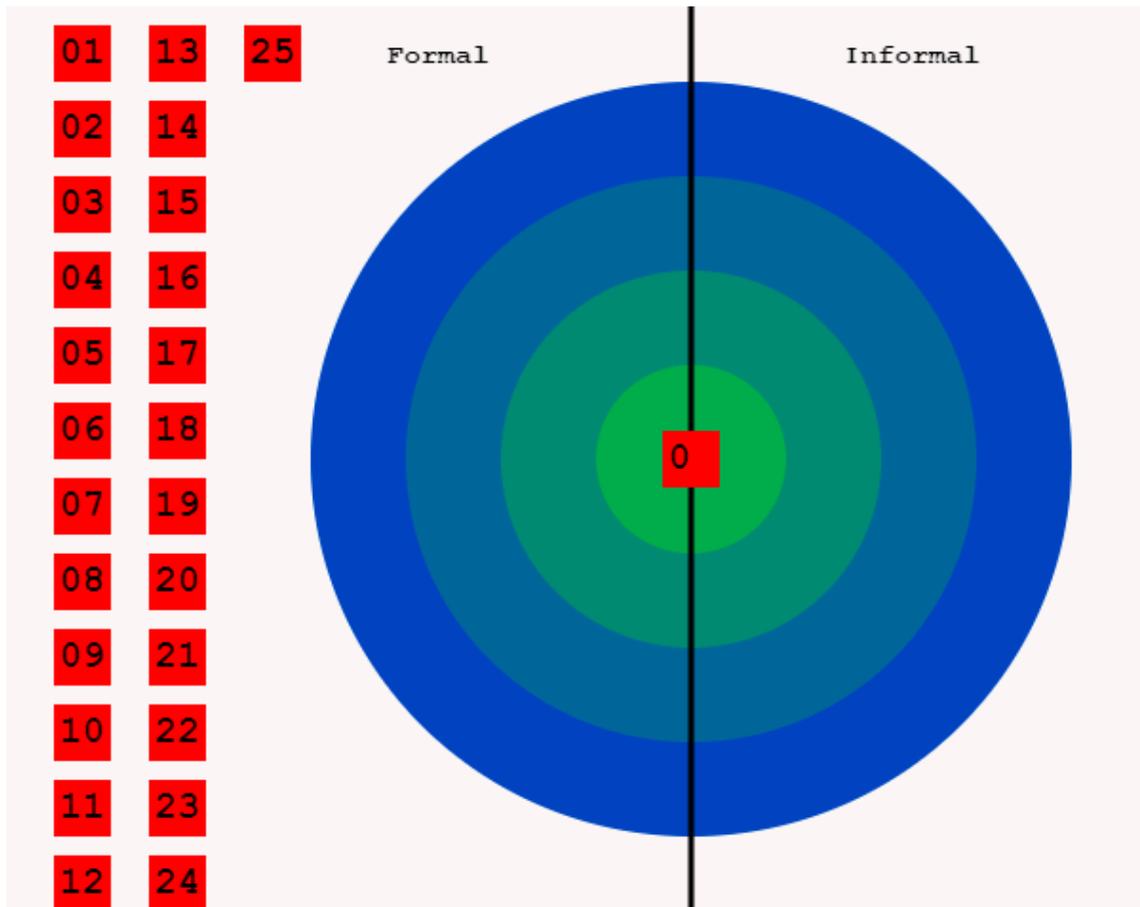


Figure 1: Strength and formality of tie

Additionally, the instrument was lengthy, and we foresaw that some items would require further explanation by the person administering it. Because of pandemic restrictions, it was not possible to conduct the questionnaire face-to-face. However, SECRA trained individuals at the partner universities during the Q2 of 2021, and the survey was administered online with the help of trained interviewers. Data collection ended in August 2021.

SECRA complied with research ethics requirements in all partner countries. UCLan applied for, and received, ethics approval for this study. All respondents were anonymized and the data are stored and curated by the coordinator of SECRA, Mid Sweden University. SECRA partners have access to the data by request.

Data were analyzed using R. The data were designed to be used for inferential statistics, correlating relations with attribute data. In the section that follows we report the results of the analysis focusing on statistically significant differences.

Results

Size of ego networks

The respondents' personal networks varied in size, from one to 29 alters. While the size of the ego nets did not vary by country, there were statistically significant differences in the number of alters in the personal networks of respondents in some partner universities (Figure 2).

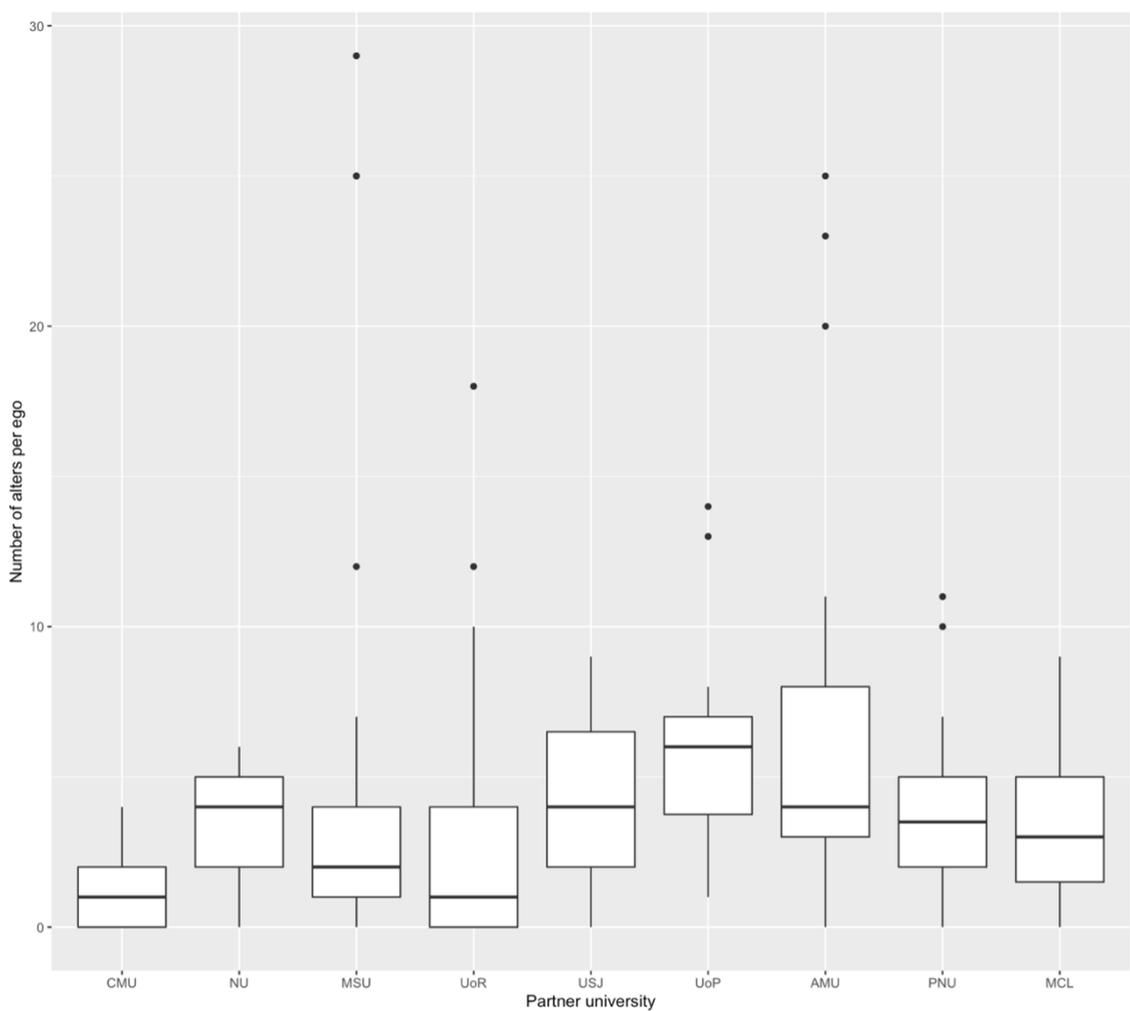


Figure 2: Network size among partner universities

More specifically, there is a statistically significant difference in mean number of external contacts between particular partner universities (one-way ANOVA, $p = 0.00667$). Tukey HSD test indicates only statistically significant difference between CMU and AMU, where the staff at AMU has significantly more external contacts than CMU ($p = 0.0122$). A pairwise t-test using the Bonferroni method for p-value adjustment concurs ($p = 0.015$).

Network Density

Density is here the proportion of possible ties between alters in the network that are actually present, ranging from no alter-alter ties (0) to all alters being connected to each other (1) (Figure 3)

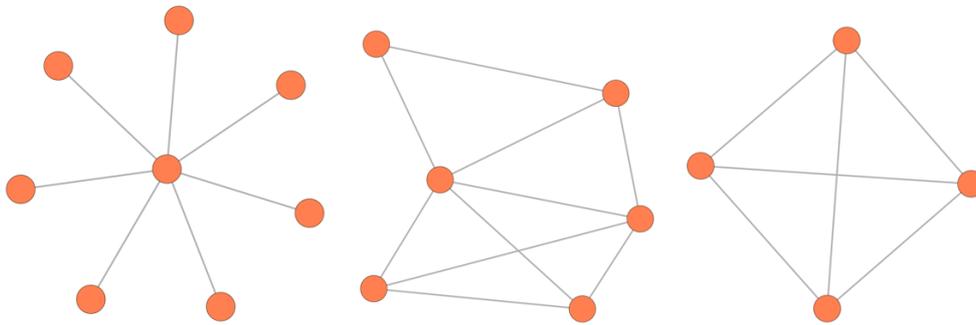


Figure 3. Varying density of personal networks, ranging from 0 (left), 0.5 (middle), to 1 (right).

We found statistically significant differences regarding density correlating with gender and partner universities.

First, there was a statistically significant difference in network density between men and women (independent sample t-test, $p = 0.0457$). This meant that the external contacts of women are more often connected to each other. It can also be interpreted as women being more knowledgeable of the social relations of the people they interact with (Figure 4).

What is more, there were statistically significant differences in network density between partner universities (one-way ANOVA, $p = 4.3e-09$) (Figure 5). A Tukey HSD test indicates a number of statistically significant differences: CMU has less dense networks than NU ($p = 0.0000430$) and USJ ($p = 0.00170$); MSU has less dense networks than NU ($p = 0.0000951$) and USJ ($p = 0.00540$); UoR has less than NU ($p = 0.0000019$), USJ ($p = 0.000181$) and AMU ($p = 0.0171$); UoP has less dense networks than NU ($p = 0.000974$) and USJ ($p = 0.0320$); and PNU has less dense than NU ($p = 0.000274$) and USJ ($p = 0.0145$). A pairwise t-test using the Bonferroni method for p-value adjustment concurs.

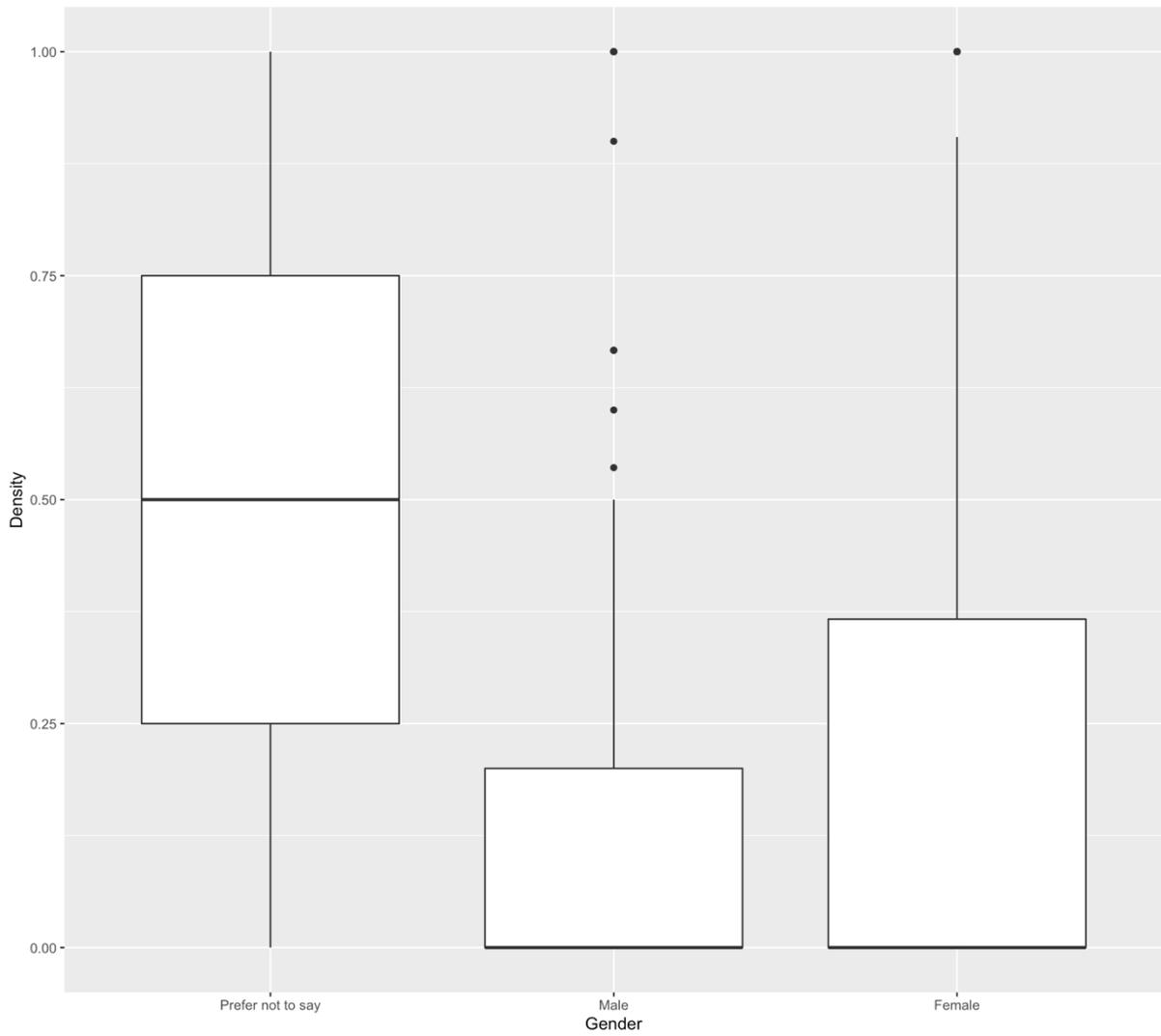


Figure 4: Density between genders.

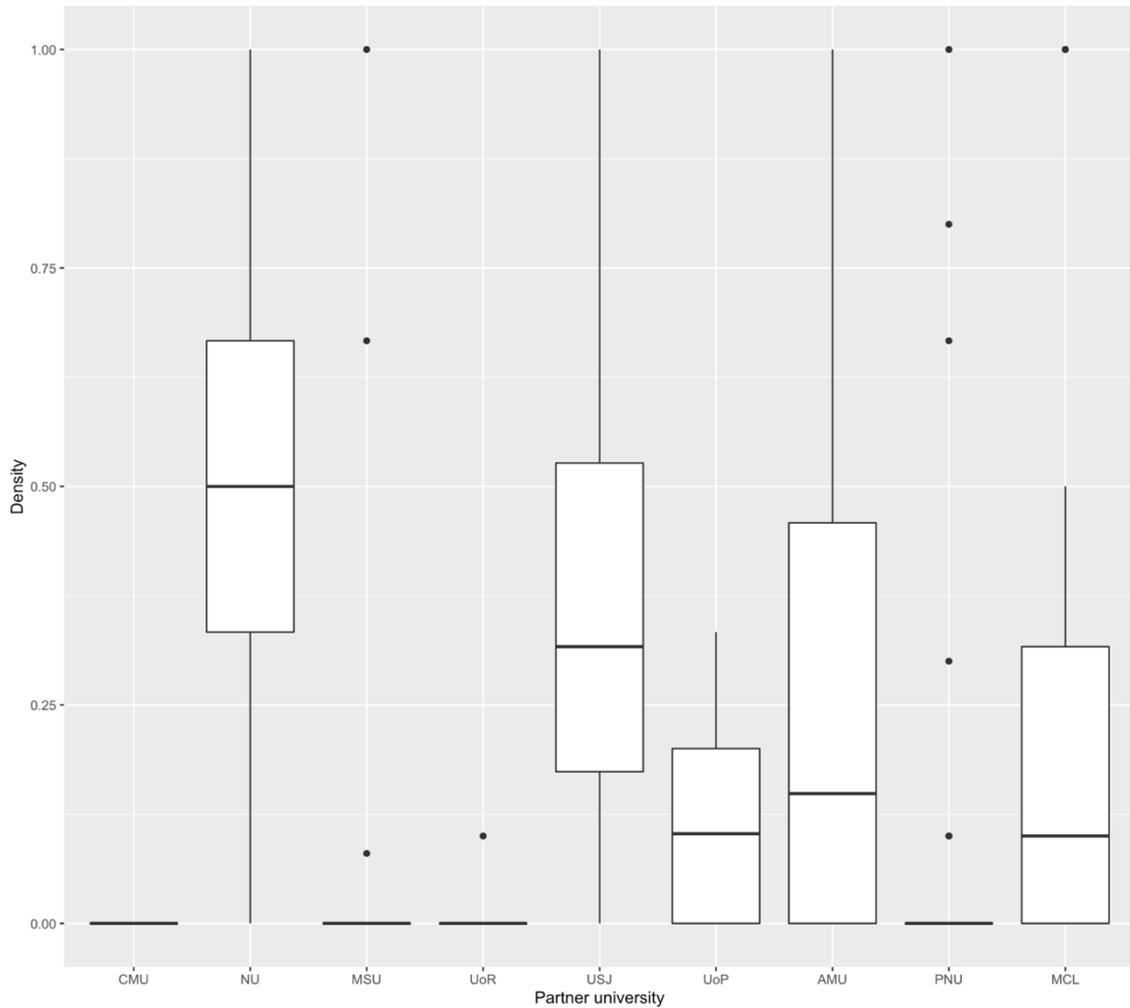


Figure 5: Density among partner universities

Organizational Diversity of External Contacts

Organizational diversity here concerns the diversity of the types of organizations the external contacts represent. It is operationalized as Shannon entropy, where zero means only one type of organization or no external contacts at all and the higher number the better balance in representation of the three different types of organizations in the study (highest is 1.52, which is found with egos with five alters, two representing one type, two representing another type and one representing a third type of organization) (Figure 6). Organizational diversity is context dependent. While one would assume that diversity of actors creates redundancy and hence a more resilient network, the appropriateness of diversity is a matter for the partner university.

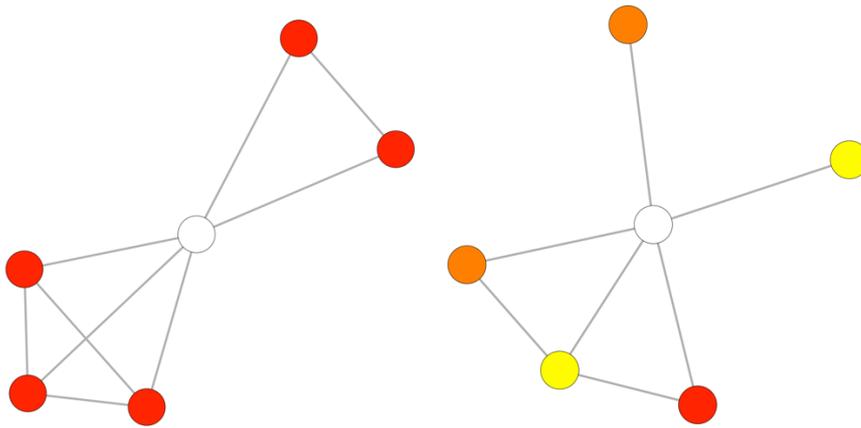


Figure 6. Varying organizational diversity of alters, ranging from 0 (left), to 1.52 (right, e.g. two, two, one alters from the different types of organization).

There are statistically significant differences in organizational diversity of external contacts between partner universities (one-way ANOVA, $p = 0.023$). A Tukey HSD test indicates a number of statistically significant differences: CMU has less organizationally diverse networks than NU ($p = 0.0000430$) and USJ ($p = 0.00170$); MSU has less than NU ($p = 0.0000951$) and USJ ($p = 0.00540$); UoR has less than NU ($p = 0.0000019$), USJ ($p = 0.000181$) and AMU ($p = 0.0171$); UoP has less than NU ($p = 0.000974$) and USJ ($p = 0.0320$); and PNU has less than NU ($p = 0.000274$) and USJ ($p = 0.0145$). A pairwise t-test using the Bonferroni method for p-value adjustment concurs (Figure 7).

A Tukey HSD test indicates that the Philippines has significantly higher organizational diversity than Thailand ($p = 0.00345$). Other differences are not statistically significant. A pairwise t-test using the Bonferroni method for p-value adjustment concurs. (Figure 8).

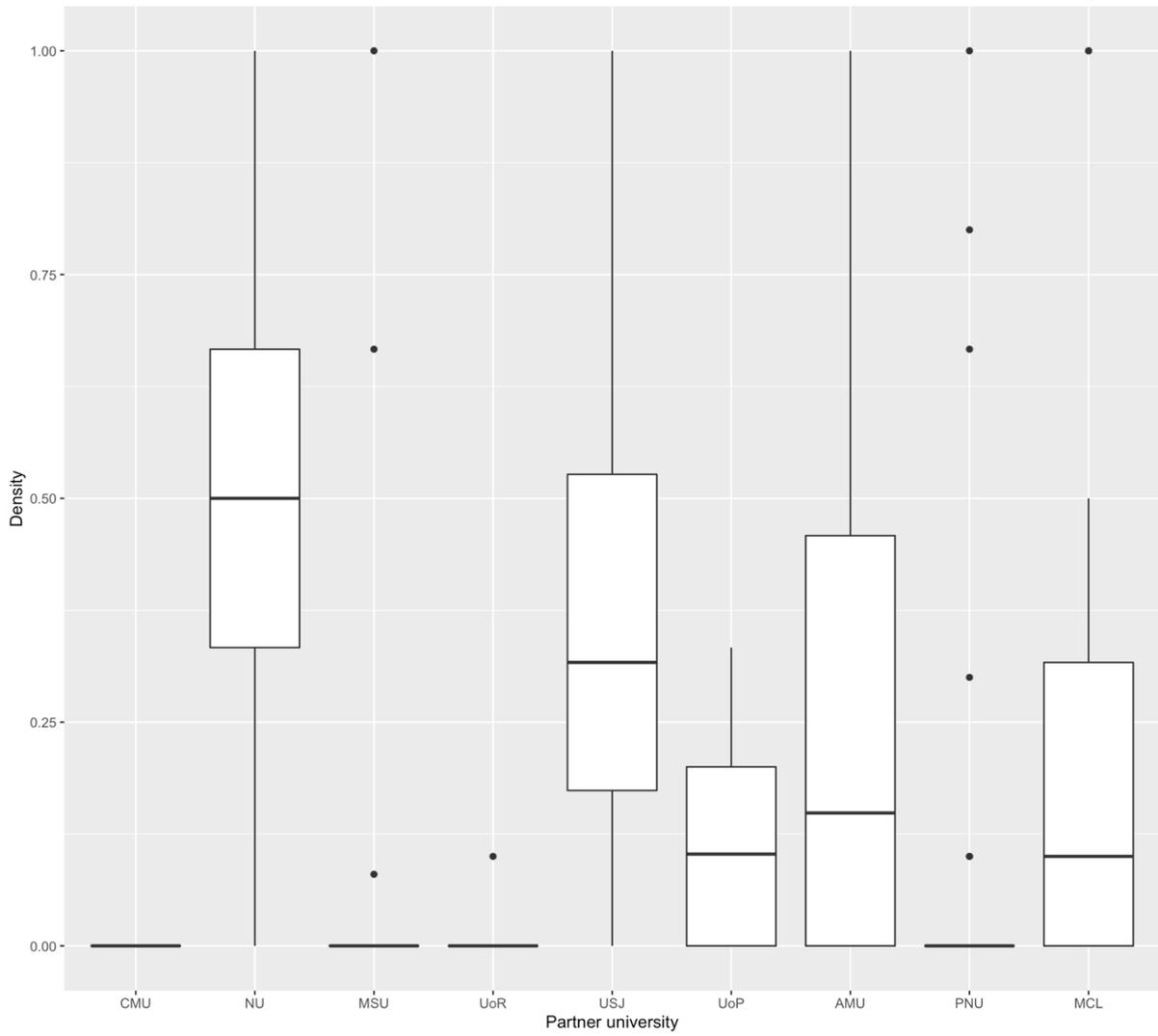


Figure 7: Organizational diversity among partner universities

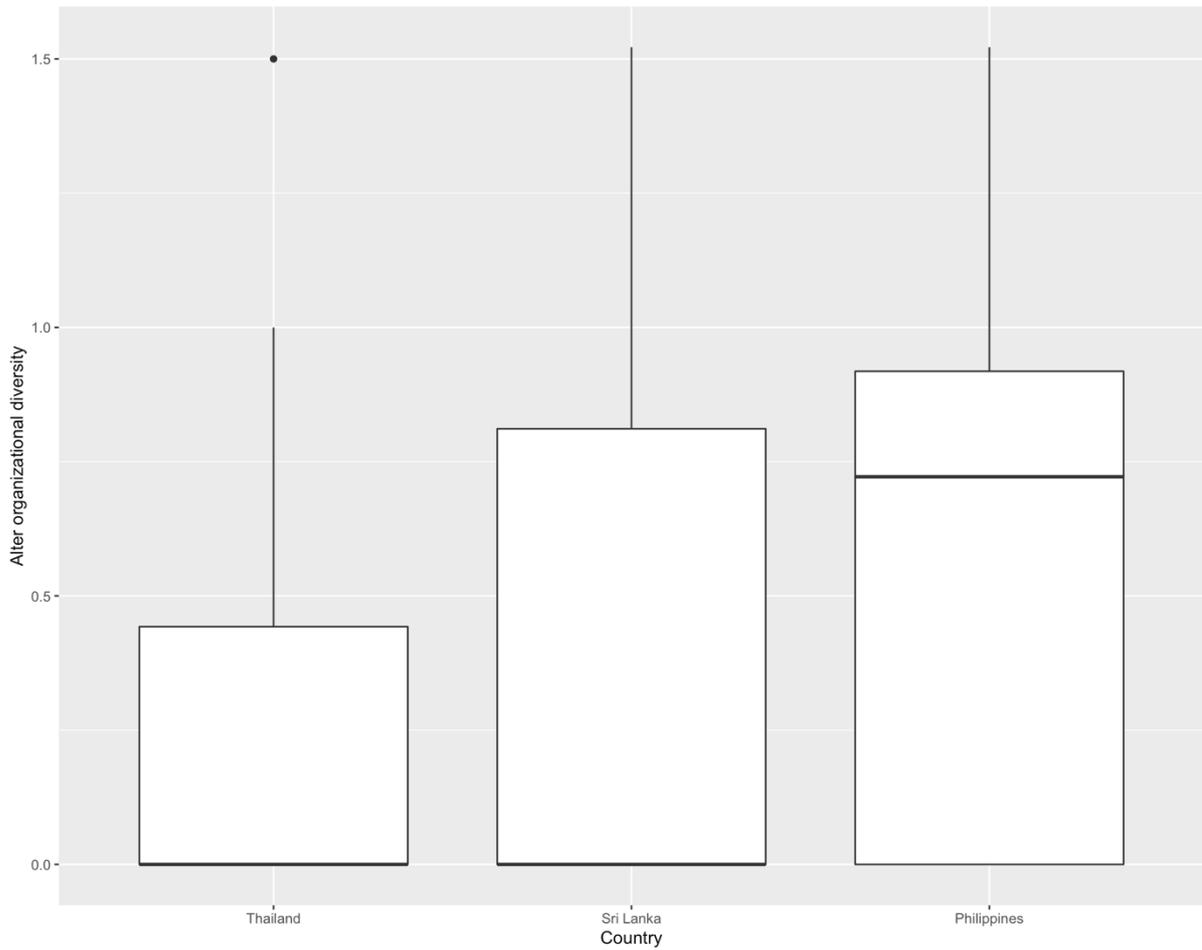


Figure 8: Organizational diversity among partner countries

Constraint of personal networks on partner university staff

Burt's constraint is a measure of the extent to which the alters are connected to each other, forming clusters of connected alters that constrain the freedom of action of the partner university staff, reduce their non-redundant sources of input, but provide social support.

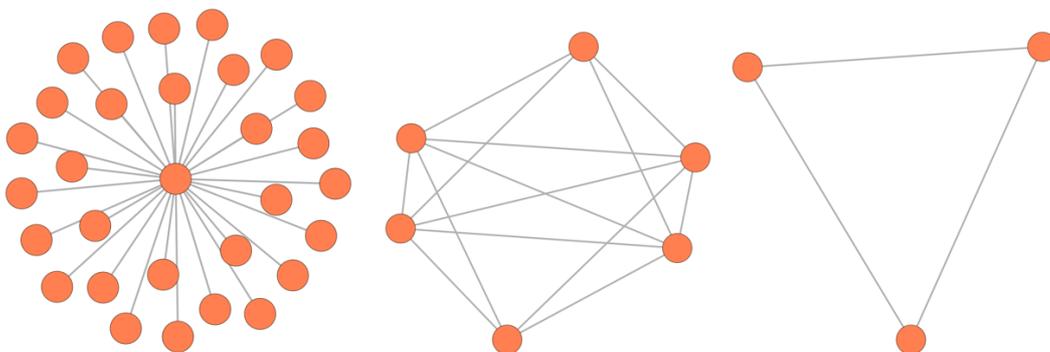


Figure 9. Varying constraint on ego, ranging from extremely low (0.034, left), to rather substantial (0.638, middle), to high (1.125, right)

There are statistically significant differences in constraint between the three countries (one-way ANOVA, $p = 0.0218$). A Tukey HSD test indicates two statistically significant differences, with Thailand having higher constraint than Sri Lanka ($p = 0.0441$) and Philippines (0.0346) (Figure 9).

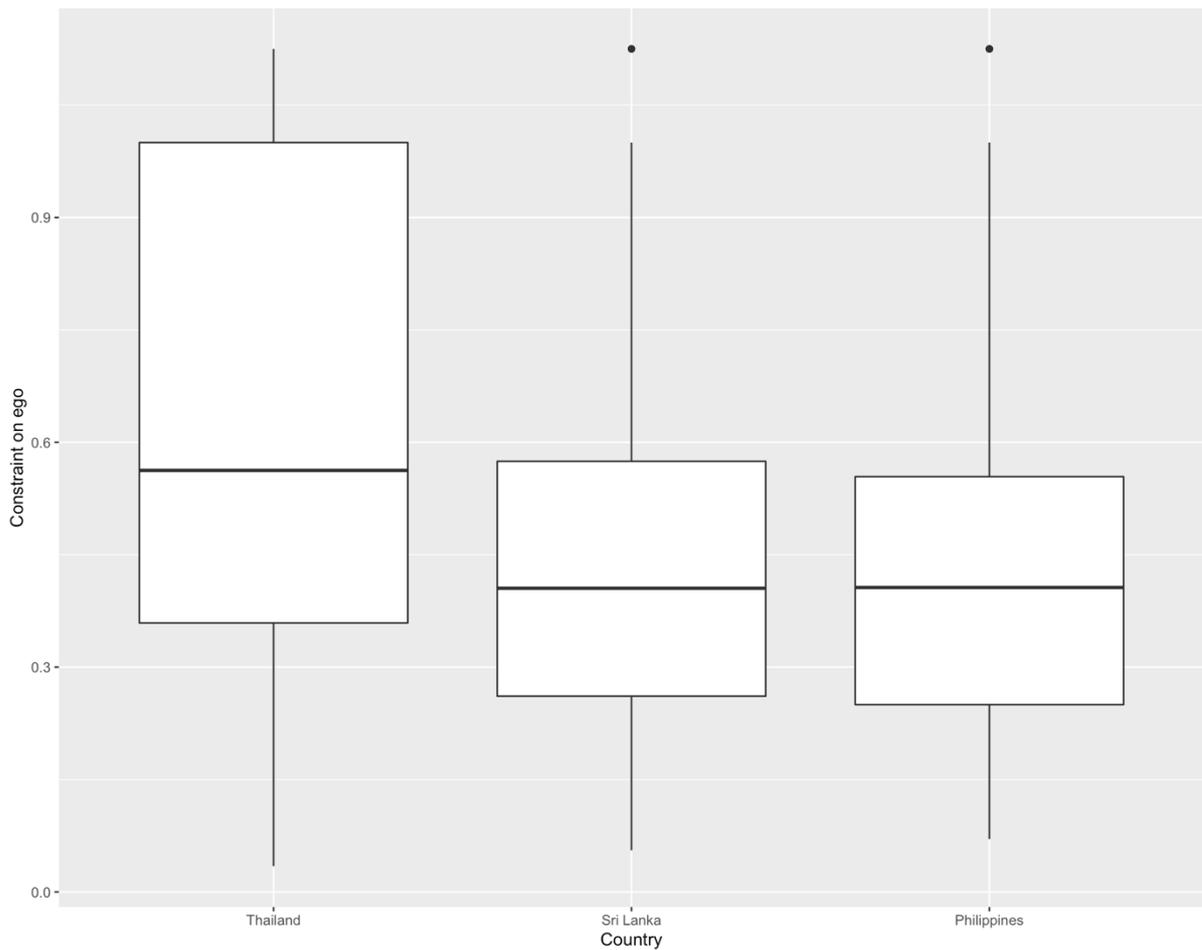


Figure 9: Constraint among countries

There is a statistically significant difference in constraint between men and women (independent sample t-test, $p = 0.0377$). This meant that the external contacts of women are more often connected to each other, forming clusters of connected alters that constrain egos' freedom of action, limit their non-redundant sources

of input, but provides social support. It can also be interpreted as women being more knowledgeable of the social relations of the people they interact with (Figure 10).

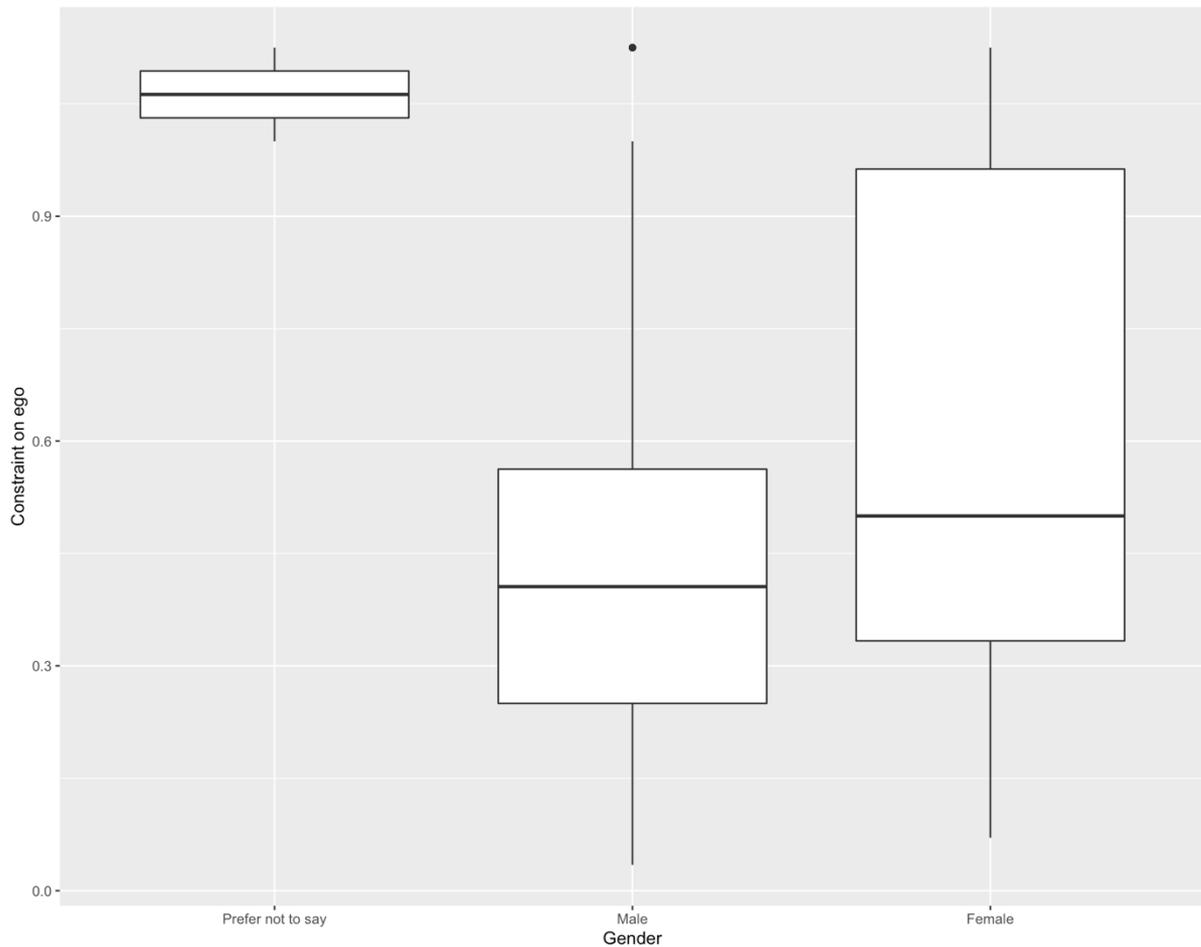


Figure 10: Constraint among genders.

Gender homophily between partner university staff and their external contacts

Gender homophily here is the tendency of a person to link with other people of the same gender. As it is operationalized, a score of -1 means that all external contacts are of the same gender as the partner university staff, while a score of 1 means that all external contacts are of different genders.

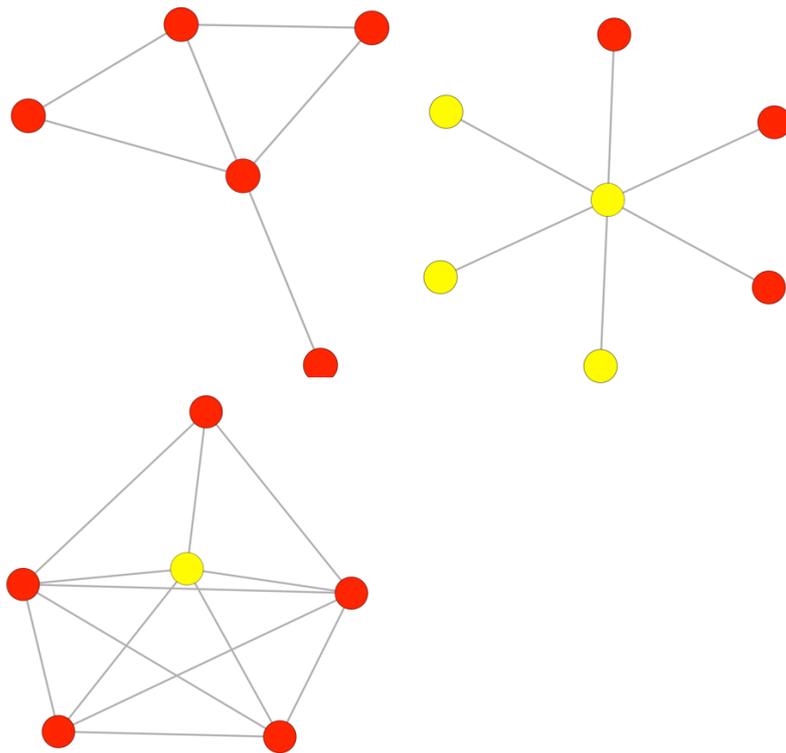


Figure 11. Ego-alter gender homophily ranging from full homophily (-1, left), mixed (0, middle), to full heterophily (1, right).

There was a statistically significant difference in ego-alter gender homophily between men and women (independent sample t-test, $p = 9.78e-10$). This meant that the women among the partner university staff are slightly more often connected to male than female external contacts, while men among the partner university staff are more often connected to male than female contacts. While the propensity for both the men and women to connect with male external contacts can be explained by there being more male than females working in relevant positions, it is still a result of interest that the women among the partner university staff have generally more gender balanced personal networks; meaning that they are more likely to connect to women than their male counterparts.

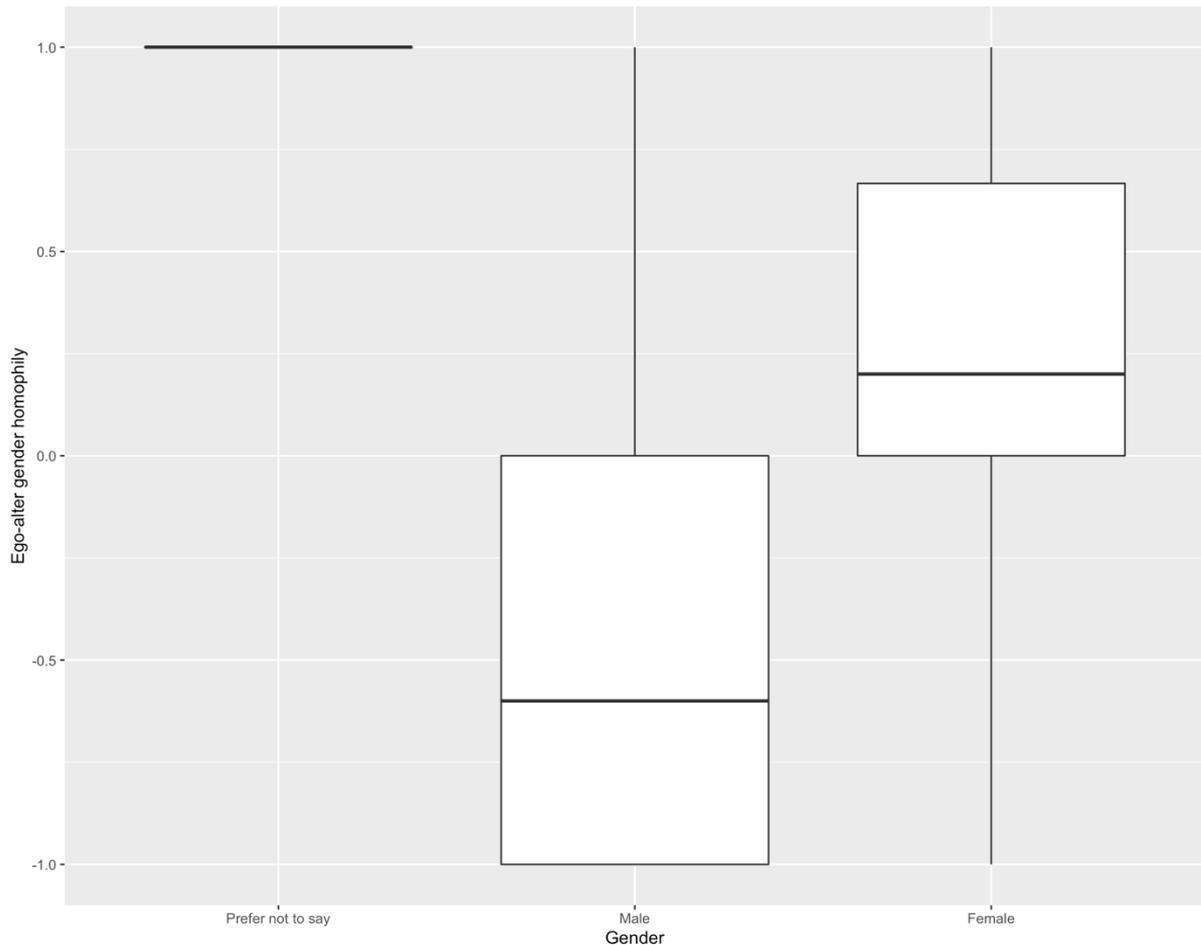


Figure 12: Gender homophily

Proportion of informal ties in the personal networks of partner university staff

Proportion of informal ties here is the proportion of ties to external contacts that the partner university staff self-report as informal in relation to ties that are formal, where zero indicated only formal ties or no ties, and one indicates only informal ties.

There are statistically significant differences in proportion of informal ties between academic disciplines (one-way ANOVA, $p = 0.00866$) (Figure 13). A Tukey HSD test indicates a statistically significant difference, with Humanities having a higher proportion of informal ties than Business, Economics and Management ($p = 0.0383$).

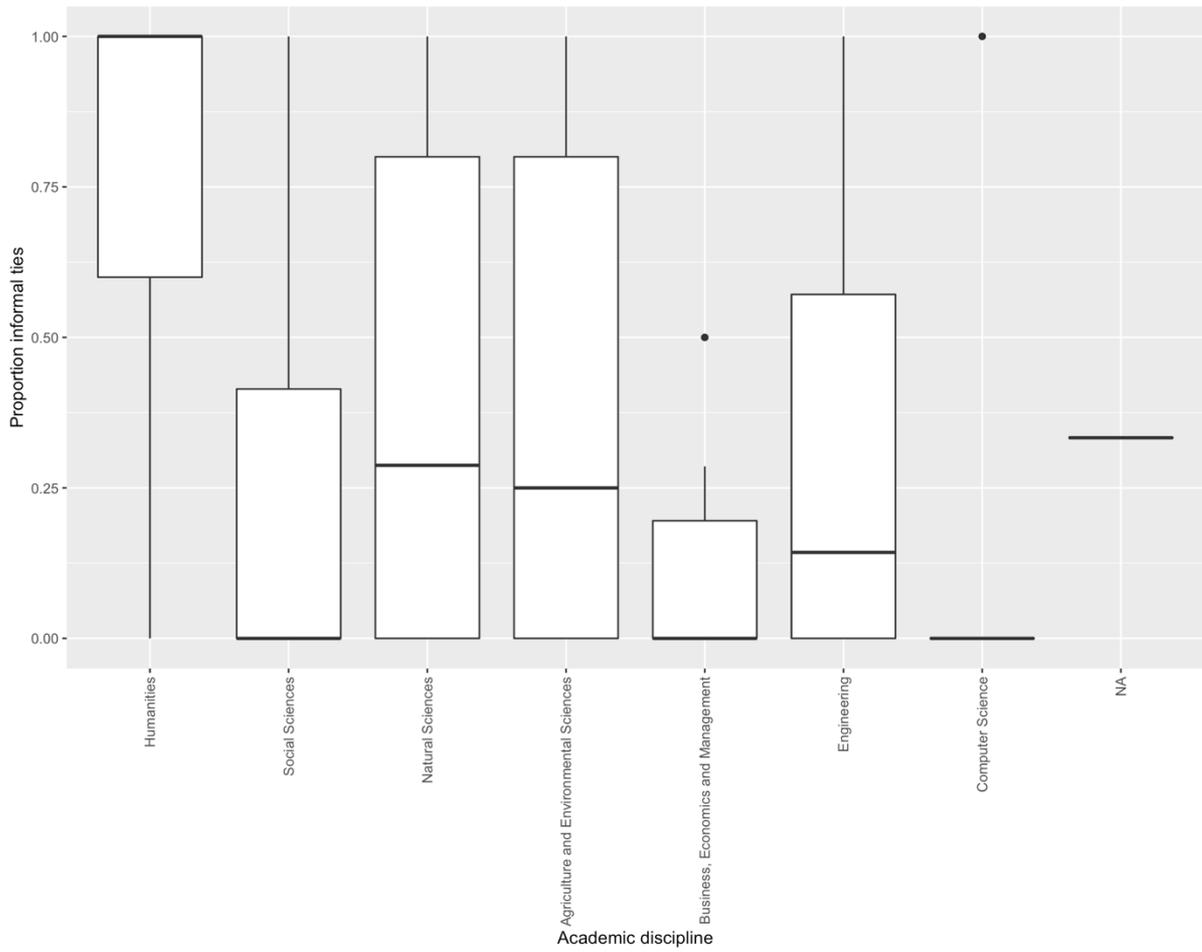


Figure 13: Proportion of informal ties per academic discipline.

Discussion and Conclusions

The formal social network analysis revealed a number of results that will form the basis for further research and inform the development of tools customized for each partner university. Some results were surprising— for example, one might expect that faculty members with more experience in their academic careers might have had more connections, but this was not the case. Seniority proved to not be statistically important in the formation of ego networks. We did not find significant differences among countries either, with the exception of the organizational diversity of alters and constraint of personal networks on partner staff. The Philippines having slightly higher organizational diversity than Thailand. This measurement is content specific and can serve as a basis for discussion among the partner universities: is organizational diversity desirable in their institutions? In terms of Burt's constraint, Thailand scored higher, meaning that the alters of the informants of the Thai partner universities were more tied to each other than in Sri Lanka and The Philippines. This implies a lack of redundancy of sources of input such as information, for example, but it also means more social support.

In terms of homophily, women tend to have more gender balanced networks and in turn they are more likely to connect to women than their male counterparts. Given gender equity being a goal of SECRA, the partner university may consider strategies for more gender balanced networks for the male egos as means to ameliorating the gender homophily. What is more, the networks of women were more dense than those of men, meaning that external contacts of women were more likely to be connected to each other. A possible interpretation of this is that women were more socially acute in their relations with others. Finally, and perhaps this was a surprising find, faculty members in humanities had a higher proportion of informal ties than business, economics, and management.

In summary, these findings will be incorporated in learning process of building better and stronger UECs.

References

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