A Social Network Analysis of Information Diffusion for Anti-Corruption Cooperation in Thailand

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Abstract

Systematic and efficient collaboration are key contributing factors to efficiency in anti-corruption efforts. Research shows Thailand's anti-corruption networks are decentralised. There are no formal central nodes responsible for coordinating between them. This makes the network not as efficient as it should be. Nevertheless, the work had its limitations. They only studied static relationships and analysed only missions. Thus, this study employs experimental networking to design surveys on information communication within networks, with social network analysis as a tool to analyse data and study dynamics of communication in the network. The results confirm the scattered communication pattern. The advantage is economies of scale in information distribution. However, such a pattern obstructs the efficient flow of information in the network. Information would flow slowly, leading to the risk of losing important information. This poses a significant challenge to collaboration in the network. Thus, Thailand's anti-corruption networks should be structured systematically, with a focus on efficiency in information communication, based on the findings from this paper.

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1. Introduction

A collaborative network is essential to successful anti-corruption efforts. This claim can be clearly observed from the fact that the word 'collaboration' is incorporated into the visions, missions, strategies, agendas, measures, and policies of most public, private, and civil society organisations directly and indirectly involved in anti-corruption work in Thailand (Yomnak, 2020). This is mainly because corruption is a complex phenomenon and thus a challenge that one organisation or sector cannot tackle alone. Therefore, anti-corruption is a responsibility shared by all citizens (Phanthasen, 2007).

This argument has not only been proposed from the practitioner's side but also from the academic realm. Organisational and institutional economists have been vocal in recommending that systematic collaboration is a key factor that contributes to efficiency and effectiveness in anti-corruption efforts (Yomnak et al., 2021; Anti-Corruption Organization of Thailand, 2016; Office of the National Anti-Corruption Commission, 2016; Pantasane, 2007).

However, previous research has shown that the actual collaboration amongst Thailand's anti-corruption organisations is still far from being efficient and sustainable. Most anti-corruption projects are initiated and operated by individual organisations without much collaboration. Some so-called 'joint projects' are mostly ad hoc and usually dominated by single organisations. Even meetings and workshops are on a voluntary and non-committal basis. On many occasions, events are left with only a few participants, which could hardly lead to strong and effective collaborative efforts (Sumano et al., 2015). Consequently, a systematic network has yet to be developed, and trust amongst these organisations has yet to be forged. This makes individual anti-corruption efforts weak, especially when compared to the strong collaboration in collusion rings in many corruption cases (Yomnak, 2020).

To clearly illustrate the situation, Yomnak, and Ruckchart (2021) studied levels and patterns of collaboration between Thailand's anti-corruption networks using Social Network Analysis Theory (SNA). The research shows that the network is highly decentralised. There is no central node to act as a collaborator or an intermediary in the network. Each node may also connect to other smaller networks, which arguably weakens the collaboration in the main network. This is because if the nodes that bridge other smaller networks become inactive, those smaller networks could be cut entirely out of the main network. When the network is weak, their efforts to fight corruption are thus weakened (Yomnak & Ruckchart., 2021).

However, the research reveals an interesting fact that, despite the lack of a central node, there are some organisations that claim to play the role of connecting and managing the network although they are still inefficient, such as the Anti-Corruption Organisation of Thailand and HAND Social Enterprise. It was then recommended that these connecting organisations should be supported and more should be introduced in order to strengthen and enhance the efficiency of collaboration in the network.

This previous research on Thailand's anti-corruption network, although important in shedding light on the next step of improving Thailand's anti-corruption work, is limited by the data used for its analysis, which is static data on the perception of closeness each organisation had with each other. To overcome this limitation and to verify the network's pattern so that recommended policies are more specific, this research employs experimental networking methodology to design a survey on dynamic information communication within Thailand's anti-corruption networks. Data drawn from email correspondence is then analysed by the Social Network Analysis tool to generate models of anti-corruption

information communication. The results could be used as a guideline to enhance the efficiency of collaboration amongst organisations in Thailand's anti-corruption network, which will in turn lead to the development of efficient anti-corruption systems and mechanisms.

2. Related studies

Social Network Analysis (SNA), developed in the 1970s, has been widely used in various disciplines to study how people share information and knowledge and to evaluate the performances of individuals, groups, or entire societies (Borgatti et al., 2009; Abbasi & Altmann, 2010). On practical contribution, the methodology is often applied to find out how problems are solved, organisations are run, markets evolve, and to what degree individuals succeed in achieving their goals (Bazerman & Schoorman, 1983; Battiston & Catanzaro, 2004; Abbasi & Altmann, 2010; Kim et al,2011).

One of the areas where SNA is often applied   in studies is the enhancement of public participation, which is an important factor in the success of public policy. Often, if a public policy is opposed by the vast majority, implementation of such a policy is unlikely to succeed (Sung & Chu, 200). In a case study in Thailand, it was found that the participation of the public sector can reduce the challenges of policy implementation controlled by the authorities. For example, the aggregation of local communities was a solution to mangrove encroachment in Phuket. This indicates that the collaboration of the people is indeed essential to finding solutions to social and collective problems.

Encouraging public participation requires public awareness and efficient and effective information dissemination. They are important factors in creating public awareness. Here is where SNA comes into play, as it can analyse the spread of information in each network. On this particular issue, Hambrick (2012) studied information spread in advertising for a cycling competition between an influential organisation and a local one. The study analysed the number of followers on their Twitter accounts. The result showed that the famous organisation with significantly more followers had more retweets than the ordinary organisations with relatively smaller numbers of followers. By applying SNA analysis, the result suggests that, if prominent organisations are followed by influencers, their information can spread more quickly and comprehensively. This study then points out the fact that influential people in a network can encourage and build public awareness at a more rapid pace. Therefore, applying a similar idea to the study of Thailand's anti-corruption network with the SNA tool to analyse the dynamic information communication in the network can help us identify influencers in the network who should then be supported.

Consequently, to understand information communication between anti-corruption networks, we need to study the general conditions of existing networks – the structures of organisations as well as cultures that could be linked. The study of Yomnak and Ruckchart (2021) reviews 30 Thai anti-corruption organisations by looking at their missions via 11 aspects that could connect them. The Bipartite Network Projection technique is employed to compare differences and similarities between the missions of paired organisations. Connections between each pair are then established based on similarities in missions. After that, Modularity Class is employed to complete cluster analysis on Social Network Analysis. (Lambiotte et al., 2008)

The results showed that there are 3 categories of anti-corruption organisations in Thailand. They are: 1) civil society organisations, or those with missions on technology and bodies of knowledge; 2) private organisations, or those communicating with the citizens as well as exposing, investigating, and monitoring; and 3) public organisations,

or those promoting and curbing, with the authority to manage policies. Each category has its advantages and disadvantages. For example, civil society organisations have a high level of anti-corruption knowledge and tools, but they lack financial and personnel resources, as well as enforcing authority. Meanwhile, public organisations have good resources and the authority to manage policies, but they lack sufficient tools. Lastly, most private organisations have resources and communication expertise. However, they lack tools and the authority to manage policies. Therefore, if these organisations are linked in a systematic and strategic way, the collaboration would be sustainable, and thus the effectiveness of each of their efforts would be enhanced.

As mentioned earlier, the limitation of this study lies in its analysis of static observed and surveyed data. This study, which employs an experimental networking methodology to design a survey on dynamic information communication within the network, could help identify influencers who can most efficiently and effectively raise public awareness. Its result could also be used as a benchmark or measurement to determine improvement or decline in collaboration within the network and thus provide a guideline to enhance the efficiency of collaboration amongst organisations in Thailand's anti-corruption network.

3. Research Methods

This research employs experimental networking methodology to study the dynamic information communication within the network by asking HAND Social Enterprise, as suggested by previous research on Thailand's anti-corruption network as an organisation assuming the role of connecting and managing the network, to send out 3 different types of messages related to anti-corruption work to other organisations within the network. These messages were spread out through channels of communication normally used in the network, which are emails, telephone calls, and posts. Then, the data on which organisations replied or forwarded, which types of messages, and how long they took to respond were collected and analysed by the Social Network Analysis (SNA) tool.

The advantage of this technique is that it can observe actual decision-making, which can reflect the actual behaviour of each organisation in the network. However, the disadvantage of experimental networking is the difficulty in identifying conditions for nodes that should distribute the messages to other nodes. If the selected node was not the central node that acts as a coordinator in the network, messages might not reach the entire network. That would jeopardise the experiment's result. This paper, therefore, selected HAND Social Enterprise as it was suggested by a previous study on Thailand's anti-corruption network as one of the best representatives of a central node of this network. Then, after all messages were sent and responses received, the data were statistically analysed to identify response rates and inter-organisational communication patterns. The research methods are as follows:

3.1 Social Network of Anti-Corruption Organisations

The Social Network Analysis (SNA) tool was employed to study anti-corruption organisation's collaborative networks. Data is shown in a diagram depicting relationships between nodes representing anti-corruption organisations in Thailand. Those relationships are based on the communication of information on factors or resources crucial to successful anti-corruption work. There are 2 key components in the social network diagram.

Represents nodes, or anti-corruption organisations in Thailand

Represents directed edge, or one-way relationship of anti-corruption organisation's communication.

We studied 3 predefined patterns of collaborative networks based on the agendas of the messages being communicated.

Pattern 1 is an information network which focuses on information about funding for anti-corruption projects. We assumed that anti-corruption organisations would be interested in such information because funding is often limited and lacking, especially in the private and civil society sectors. Lack of funding disrupts their ongoing work and thus reduces their effectiveness (Chaiwat et al., 2020). When an organisation received news on funding, the data on how long it took for them to reply and to whom each organisation passed the information on was observed and collected.

Pattern 2 is an information network which focuses on the use of technology to fight corruption. We assumed that anti-corruption organisations would be interested in such information because, as knowledge on anti-corruption technology has become more important in anti-corruption work, many organisations, especially public ones, still lack sufficient tools and technologies (Yomnak, 2020). When an organisation received news on new technological tools or bodies of knowledge that can help fight corruption, the data of how long it took for them to reply and to whom each organisation passed the information on was observed and collected.

Pattern 3 is an information network which focuses on activities promoting anti-corruption work. We assumed that anti-corruption organisations would be interested in such information because, as mentioned earlier, collaboration is in the visions and missions of most anti-corruption organisations (Yomnak, 2020). When an organisation received news on the joint activities of other anti-corruption organisations, the data on how long it took for them to reply and to whom each organisation passed the information on was observed and collected.

E-mails containing these messages were sent out from HAND Social Enterprise's domain. As mentioned, a previous study by Yomnak (2020) found that HAND is one of the organisations with a high score in every centrality measure.

3.2 Social Network Analysis

Analysing networks with complex relationships is a challenging task. Thus, nodes inside networks need to be grouped using modularity. This reveals anti-corruption organisation's groups that have close relationships or are working together. Then, we study each node using HITS and PageRank algorithms to identify authorities within networks. This also helps identify anti-corruption organisations that have influence over sending and receiving information. The analyses include:

3.2.1 Grouping of nodes within networks (Modularity)

Nodes within networks can be grouped using modularity, a measure of network structure that studies relationships between modules broken down into bigger or more complicated groups. Modules can be called groups or communities (Newman, 2006). Modularity in this research groups anti-corruption organisations with close relationships, or those communicating with each other, as shown in Figure 1.

Figure 1: Grouping within Networks (Modularity)
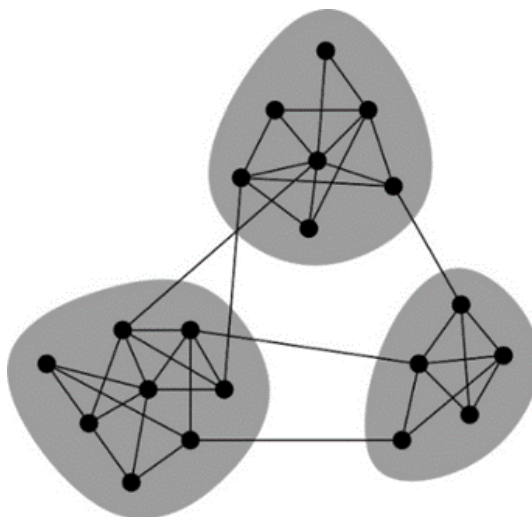
Source: Newman (2006)

3.2.2 Authorities within networks (HITs)

With modularity, we can now identify groups or relationships between anti-corruption organisations within networks. Then, we study nodes representing anti-corruption organisations within networks using Hyperlink-Induced Topic Search (HITs; also known as hubs and authorities) to reveal anti-corruption organisation's influence on receiving and distributing information (Hoppe & Reinelt, 2010). There are 2 patterns as follows:

Nodes with influence on receiving information can be identified by authority scores, which are scores of nodes with only incoming edges in a directed link. For example, Organisation A receives information from many other organisations. Thus, Organisation A possesses a high authority score, as depicted in Figure 2.

Figure 2: A Node as Authority
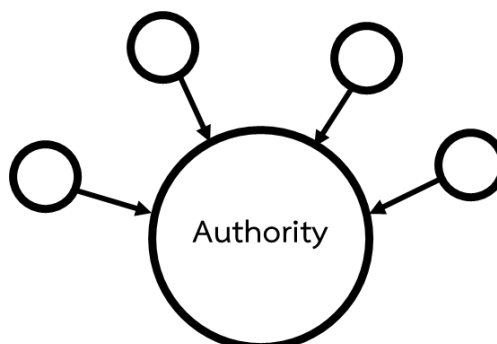
Source: Authors' preparation

Nodes with influence on information distribution are identified by hub scores, which are scores of nodes with only outgoing edges in a directed link. For example, Organisation B distributes information to many organisations. Thus, Organisation B possesses a high hub score, as depicted in Figure 3.

Figure 3: A Node as Hub
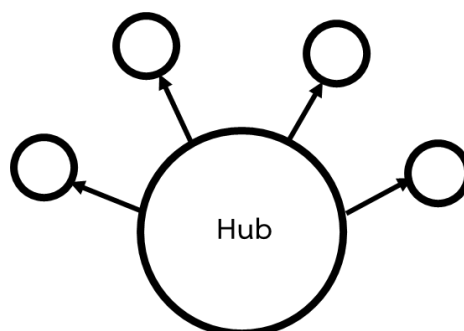
Source: Authors' preparation

3.2.3 Ranking the importance of nodes within networks (PageRank)

Using PageRank in network analysis refers to the ranking of nodes within networks to identify important nodes, or nodes that receive and distribute information to other nodes more frequently (Page et al., 1999). PageRank algorithms allow us to know which nodes are the most appropriate for sending out messages. In this case, it refers to the distribution of information important to the operations of anti-corruption organisations in Thailand from the selected node, HAND Social Enterprise. Knowing the importance of organisations helps spread information more efficiently with limited resources. A High PageRank score means organisations are very important to the networks.

4. Results

We divided the result analysis into 2 parts. (1) A study of collaborative networks based on inter-organisational communication. We analysed the observed and collected data on whom each organisation chose to pass different types of messages to. This was to identify the response rate and the interpersonal communication networks. (2) An analysis of networks sharing anti-corruption information. We identified the closeness and the collaboration between organisations, which included authorities and hubs within the networks.

4.1 Collaborative Networks Based on Inter-Organisational Communication

We sent out 135 e-mails to personnel working at 39 organisations from HAND Social Enterprise's domain. We received 37 responses from 27 organisations, totalling 27.4%. Out of 37 responses, 17 were instant, totalling 12.6%. There were additional 7 responses after reminder e-mails were sent out, which accounts for 5.2%. We also received 9 more responses after we made telephone calls to remind them, which accounts for 6.7%. Finally, we received 4 responses after both reminder calls and reminder e-mails, totalling 3%. The numbers are shown in Table 1.

Table 1: Response Rates by Reminder Methods (n = 135)

Reminder Methods	Responses	Percentage
No reminders	17	12.6
Reminder e-mails	7	5.2
Reminder calls	9	6.7
Reminder calls and e-mails	4	3.0
Total	**37**	**27.4**

Source: Author's preparation

After analysing the data, the response time was between 1-34 days. Reminder calls produced the quickest response, with an average response time of 8.67 days. It was followed by calls and e-mails for an average of 14 days. Reminder e-mails yielded the slowest result, with an average of 21 days. Overall, the average response time took 10.06 days, as shown in Table 2.

Table 2: Average Response Time

Reminder Methods	Average Response Time (Days)
No reminders	4.37
Reminder e-mails	21.00
Reminder calls	8.67
Reminder calls and e-mails	14.00
Average	**10.06**

Source: Author's preparation

To ensure data completeness, we also sent out physical copies of each message type by post to those who did not reply even after reminder calls and e-mails. There were

18 letters to personnel in 16 organisations. We received 6 responses, totalling 33.34%. The average response time was 15.67 days based on a 14–17-day window.[1]

4.2 Analysis of Networks Sharing Anti-Corruption Information
        Next, we used Social Network Analysis to analyse information on response rates. 4 networks were analysed, including networks on anti-corruption funding, networks sharing information on anti-corruption technology, networks sharing information on activities promoting anti-corruption, and an overview of networks sharing information, which derives from the analyses of the previous 3 networks. The results are as follows:

        4.2.1 Networks Sending and Receiving Information on Anti-Corruption Funding
        When grouped by modularity, there are 8 sub-groups in this information network on Anti-Corruption Fundings. Three of them include personnel from more than 5 organisations. The most active organisations are Isra News Agency and Anti-Corruption Organization of Thailand (ACT) (7 times). The organisations receiving the highest amount of information are HAND and ACT (12 and 11 times, respectively).
        Using HITs, the 3 organisations with higher authority scores are HAND, ACT, and Thailand Development Research Institute (TDRI). Their respective scores are 0.64, 0.54, and 0.37. This means these organisations are more likely to receive information on anti-corruption funds. Three organisations with higher hub scores include the Office of the Auditor General of Thailand (OAG), Isra News, and Khonthai Foundation (KTF). Their respective scores are 0.38, 0.35, and 0.32. This reveals that these organisations play an important role in sending information to others within the networks, especially those with high authority scores.
        PageRank reveals ACT, HAND, and Isra News (0.07, 0.07, and 0.04, respectively) are more likely to receive information from important hubs within their networks, as shown in Figure 4 and Table 4.

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[1] Please be cautious when you refer to this analysis. We do not compare response times between different means of response. There could be some deviations because respondents could prioritise each meaning differently.

Figure 4: Anti-Corruption Fund Information Networks

*Remark: Circle sizes indicate authority scores whilst colours indicate groups from modularity
Source: Author's preparation

4.2.2 Networks Sending and Receiving Information on Anti-Corruption Technology
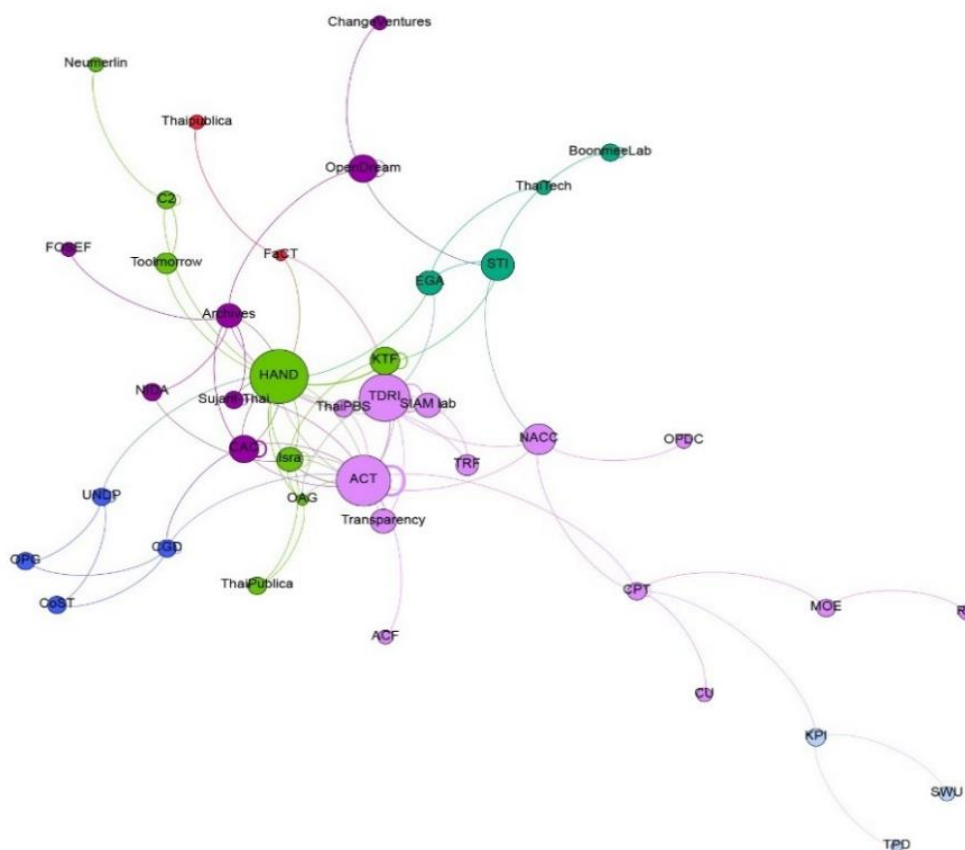
When grouped by modularity, there are 7 sub-groups in this information network on Anti-Corruption technology. Five of them include personnel from more than 5 organisations. The organisation sending out the highest amount of information is UNDP, at 6 times, followed by TDRI, Isra News, CGD, and HAND at 5 times. The organisations receiving the highest volume of information are HAND and ACT. They receive these messages 10 and 7 times, respectively.

Using HITs, the 3 organisations with the highest authority scores are HAND, ACT, and TDRI. The respective scores are 0.77, 0.49, and 0.18. This means these 3 organisations are most likely to receive news about anti-corruption technology. Organisations with the highest hub scores are Sujarit-Thai, Isra News, CAC, and KTF. Their respective scores are 0.41, 0.39, 0.33, and 0.33. This means these 4 organisations play an important role in sending information to others, especially those with high authority scores.

PageRank reveals that HAND and ThaiTech are more likely to receive information from important hubs in their networks. Their respective scores are 0.05 and 0.04, as shown in Figure 5 and Table 5.

Figure 5: Anti-Corruption Technology Information Networks
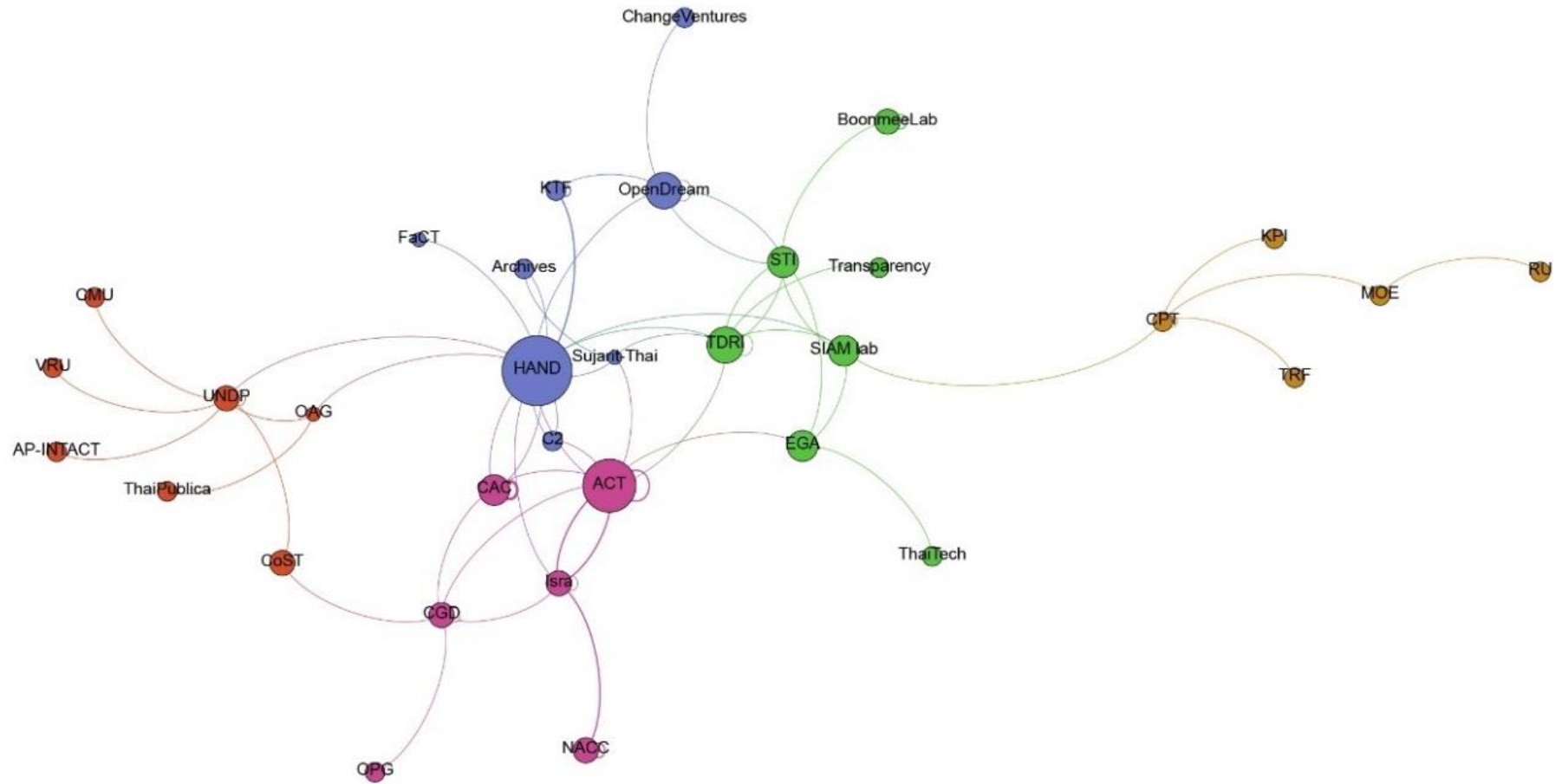
Remark: Circle sizes indicate authority scores whilst colours indicate groups from modularity.
Source: Author's preparation

4.2.3 Networks Sending and Receiving Information on Anti-Corruption Activities

When grouped by modularity, there are 8 sub-groups in this information network on Anti-Corruption Activities. Four of them include personnel from more than 5 organisations. Organisations sending out information the most are ACT (8 times) and KTF (7 times). Organisations receiving the highest volume of information are HAND (6 times), followed by TDRI, NACC, and ACT (5 times each).

Using HITs, the 3 organisations with the highest authority scores are HAND, TDRI, and CAC. Their respective scores are 0.57, 0.48, and 0.25. This means they are more likely to receive information on anti-corruption activities. Organisations with the highest hub scores are Sujarit-Thai, KTF, and Siam Lab. Their respective scores are 0.53, 0.53, and 0.36. These three organisations play an important role in sending information on anti-corruption activities to other organisations, especially those with high authority scores.

PageRank reveals similar scores. HAND's score is the highest at 0.04, meaning it is more likely to receive information from important hubs. The information is shown in Figure 6 and Table 6.

Figure 6: Anti-Corruption Activity Information Networks

Remark: Circle sizes indicate authority scores whilst colours indicate groups from modularity.
Source: Author's preparation

4.2.4 Overview of Anti-Corruption Information Networks

This part is the analysis of all the information networks. The results show that, with modularity, there are 6 sub-groups. Four of which include personnel from more than 5 organisations. Organisations that sent out the highest volume of information was ACT (15 times), UNDP (11 times), and HAND (10 times). Organisations that received the highest volume of information were HAND, ACT, and TDRI (13, 12, and 11 times, respectively).

Using HITs, the 3 organisations with the highest authority scores are HAND, ACT, and TDRI. Their respective scores are 0.51, 0.45, and 0.40. This means they are more likely to receive any information related to anti-corruption work. Organisations with the highest hub scores are HAND, KTF, and Isra News. Their respective scores are 0.34, 0.33, and 0.31. These 3 organisations play an important role in sending information to other organisations, especially those with high authority scores.

PageRank reveals that ACT and HAND are more likely to receive information from important hubs in their networks. They both receive a score of 0.06, as shown in Figure 7 and Table 7. However, there is an observation. HAND Social Enterprise's high authority and hub score as both an efficient sender and receiver of information in all information networks could be because HAND is the original sender of the first messages. Still, the analysis of authority and hub scores of other organisations in the network is useful in understanding the flow of information and potential collaboration in Thailand's anti-corruption network.

Figure 7: Overview of Anti-Corruption Information Networks

Remark: Circle sizes indicate authority scores whilst colours indicate groups from modularity
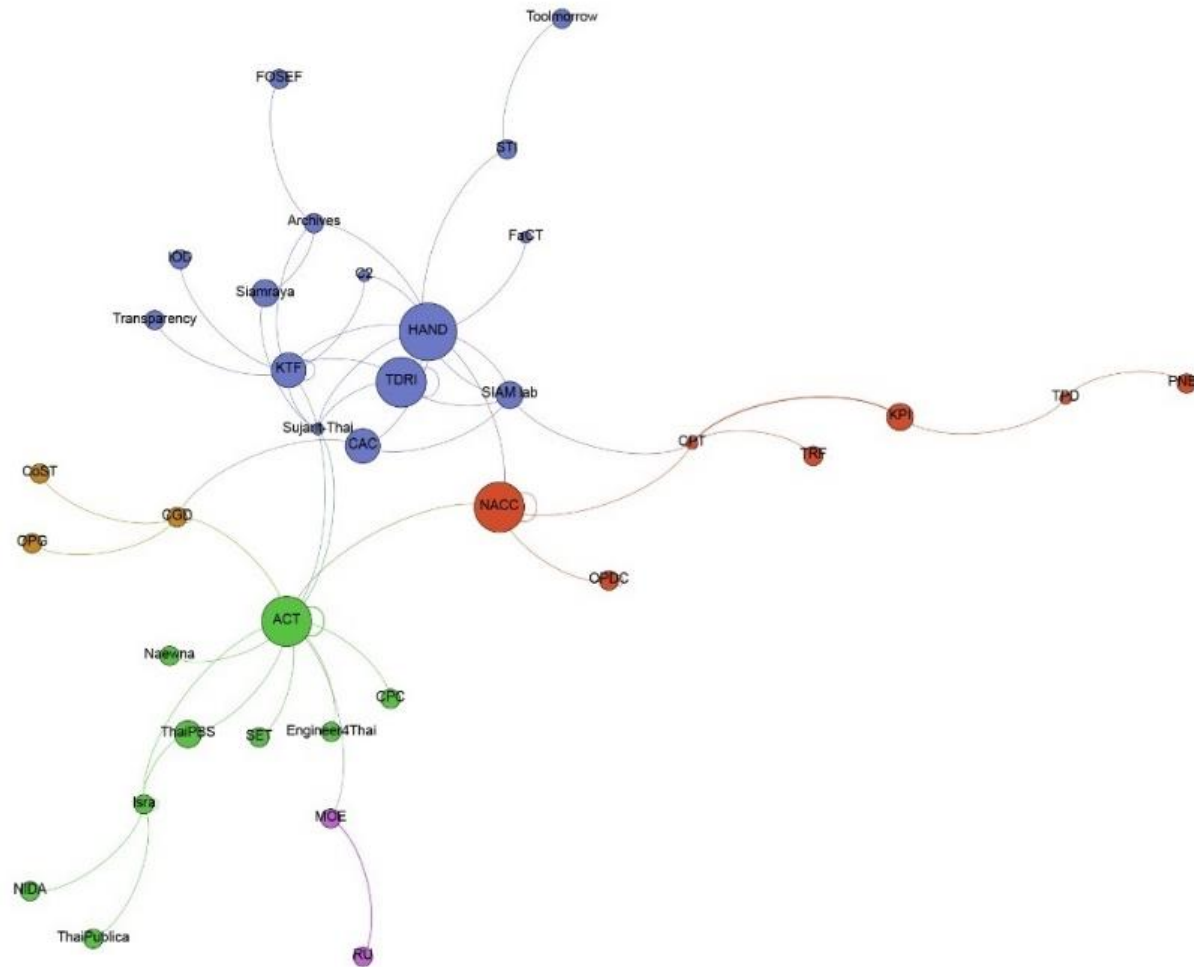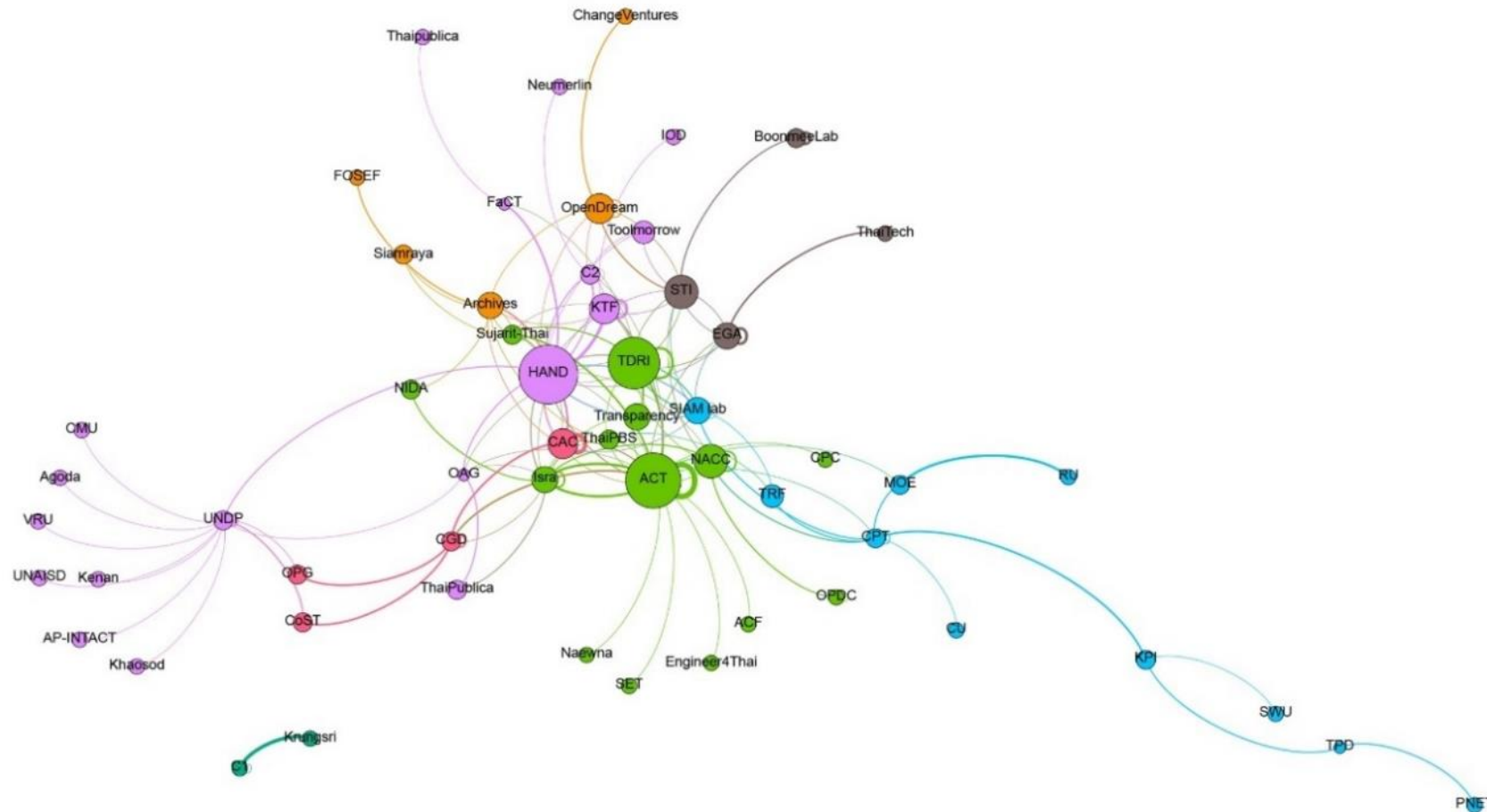Source: Author's preparation

5. Discussion and Conclusion

This paper aims to analyse the information networks of anti-corruption organisations in Thailand using a dataset from the experimental networking method, with social network analysis as a tool. The main finding is that there are a large quantity and variations of anti-corruption networks in Thailand. Many of them have central nodes, or an organisation playing an important role in receiving (Authority) and sending (Hub) information on anti-corruption funds, technology, activities, and other related information.

The study confirms the operating patterns of Thailand's anti-corruption networks –decentralized or dispersed networks with many small central nodes that act as collaborators in sub-networks, but without a main central node in the main network. Such networks have the advantages of economies of scale in information distribution, quicker information access, and efficient communications between sub-nodes in each sub-network.

Studies of collaborative networks of anti-corruption organisations in Thailand show that the communication of different types of messages related to anti-corruption work has similar patterns. This indicates that there is no specialisation for each anti-corruption organisations. Each specific type of information may be perceived as general information, which can be spread throughout the network by any organisations that have a high authority and hub score.

As previously mentioned, despite several small central nodes within each sub-network, the network is still highly decentralised with no main central nodes in the main network to act as collaborators or administrators of collaboration. This disadvantage obstructs the efficient flow of information throughout the entire network. Information has to pass from one point to another in several layers. Provided that each layer takes 1 week or more to pass on the information, the amount of time it takes for information to reach organisations in the deeper layers will keep multiplying. The flow of information is not efficient although information is eventually spread out comprehensively.

Random relationships between organisations that often work together can occur within this dispersed network because they would need to communicate directly with each other. This helps create small, efficient sub-networks. However, such characteristics do not lead to an efficient network as a whole. When looking at deeper layers, secondary-layered organisations, or organisations that receive information in the second layer, often do not have means to communicate back to those in the first layer. This means each anti-corruption organisation has its own collaborative network, and each of the networks does not intertwine. When an organisation receives news, they only distribute it within their sub-networks, making networks even more dispersed. The longer time required to communicate between different dispersed networks poses a challenge to effective and efficient collaboration in the main anti-corruption network.

Conceptually, corruption is a kind of private goods, whilst anti-corruption is a kind of public goods. Collaborative networks of anti-corruption organisations are considered pathways to collective action. Therefore, strengthening these collaborative networks can increase the quality of public goods, i.e., faster information communication and reduced activity costs. These would lead to more effective and efficient anti-corruption efforts for each organisation and as a whole. It can be concluded that understanding and overviewing collaborative networks of anti-corruption organisations are significant starting points that contribute to the literature in this field. Measurable results from this paper could also be used as a guideline to evaluate the impact of policies

designed to enhance collaboration or to measure and benchmark the development of collaboration amongst organisations in Thailand's anti-corruption network. This will in turn lead to the development of efficient and effective anti-corruption systems and mechanisms.

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Appendix

Table 3: List of Organizations that Are Studied in this Paper.

No.	Abbreviation	Full title	Sector
1	HAND	HAND Social Enterprise	Private
2	CAC	Collective Action Against Corruption	Civil society
3	Opendream	Opendream (Civic Tech Company)	Private
4	SIAM Lab	Thailand Anti-Corruption Research Project (collaboration between Thailand Science Research and Innovation and Faculty of Economics, Chulalongkorn University)	Public
5	TDRI	Thailand Development Research Institute	Civil Society
6	TRF	Thailand Science Research and Innovation	Public
7	UNDP	United Nation Development Programme	Civil Society
8	ACC	National Anti-Corruption Committee (Under the Prime Minister's supervision)	Public
9	ACF	Anti-Corruption Foundation	Civil Society
10	NACC	Office of the National Anti-Corruption Commission	Public
11	ACT	Anti-Corruption Organization of Thailand	Civil Society
12	FACT	*Foundation for a Clean* and Transparent *Thailand*	Civil Society
13	KTF	For KhonThai Foundation	Civil Society
14	PNET	Open Forum for Democracy Foundation	Civil Society
15	ThaiPublica	Thai Publica News Agency	Private
16	Transparency Thailand	Transparency International (Thailand's Chapter)	Civil Society
17	CGD	The Comptroller General's Department	Public
18	Isara	Isara News Agency	Private
19	FightAgainst Corruption Together	Fight Against Corruption Together Club	Civil Society
20	PACC	Office of the National Anti-Corruption Commission	Public
21	EGA	Digital Government Development Agency (Public Organization)	Public
22	OAG	Office of the Auditor General of Thailand	Public
23	OPDC	Office of the Public Sector Development Commission	Public
24	STI	Social Technology Institute	Civil Society
25	TPD	Thailand Political Database	Civil Society
26	BoonmeeLab	Boonmee Lab (Civic Tech Company)	Private
27	Thainocorrupt	Thai Honesty (Education Company)	Private

Source: Author's preparation

Table 4: Statistics of Transmission of Information about Anti-Corruption Project Funding by Social Network Analysis.

Organization	Degree	In degree	Out degree	Authority	Hub	Modularity class	pageranks
ACF	1	1	0	0.05	0.00	1	0.02
OPDC	1	0	1	0.00	0.00	1	0.01
RU	1	1	0	0.00	0.00	1	0.02
CU	1	1	0	0.00	0.00	1	0.01
MOE	2	1	1	0.00	0.00	1	0.01
TRF	2	2	0	0.09	0.00	1	0.02
Transparency	3	3	0	0.18	0.00	1	0.03
ThaiPBS	4	0	4	0.00	0.23	1	0.01
NACC	5	2	3	0.00	0.20	1	0.02
SIAM lab	6	2	4	0.06	0.23	1	0.01
CPT	7	2	5	0.05	0.00	1	0.02
TDRI	13	8	5	0.37	0.29	1	0.03
ACT	18	11	7	0.54	0.25	1	0.07
Neumerlin	1	1	0	0.00	0.00	2	0.02
Toolmorrow	2	2	0	0.04	0.00	2	0.03
ThaiPublica	2	2	0	0.15	0.00	2	0.02
C2	5	2	3	0.04	0.01	2	0.02
OAG	5	0	5	0.00	0.38	2	0.01
KTF	7	3	4	0.08	0.32	2	0.02
Isra	11	4	7	0.17	0.35	2	0.04
HAND	17	12	5	0.64	0.19	2	0.07
ThaiTech	1	1	0	0.05	0.00	3	0.01
BoonmeeLab	3	2	1	0.01	0.00	3	0.01
EGA	4	0	4	0.00	0.23	3	0.01
STI	5	2	3	0.09	0.03	3	0.02
ChangeVentures	1	1	0	0.00	0.00	4	0.02
FOSEF	1	1	0	0.04	0.00	4	0.01
NIDA	2	2	0	0.11	0.00	4	0.02
OpenDream	5	3	2	0.04	0.00	4	0.02
Sujarit-Thai	5	2	3	0.04	0.24	4	0.01
Archives	7	2	5	0.10	0.18	4	0.02
CAC	8	4	4	0.12	0.26	4	0.03
TPD	1	0	1	0.00	0.00	5	0.01
SWU	1	1	0	0.00	0.00	5	0.03
KPI	3	2	1	0.00	0.00	5	0.02
CoST	2	2	0	0.07	0.00	6	0.01
OPG	2	2	0	0.07	0.00	6	0.01
UNDP	5	1	4	0.00	0.16	6	0.01
CGD	6	1	5	0.00	0.16	6	0.01
Krungsri	1	1	0	0.00	0.00	7	0.02
C1	3	1	2	0.00	0.00	7	0.01
Thaipublica	1	1	0	0.04	0.00	8	0.01
FaCT	3	0	3	0.00	0.22	8	0.01

Source: Author's preparation

Table 5: Statistics of Transmission of Information about Technology for Anti-Corruption Project by Social Network Analysis

Organization	Degree	In degree	Out degree	Authority	Hub	Modularity class	pageranks
Transparency	1	1	0	0.05	0.00	1	0.01
ThaiTech	1	1	0	0.00	0.00	1	0.04
BoonmeeLab	3	2	1	0.03	0.00	1	0.01
EGA	4	3	1	0.11	0.00	1	0.03
SIAM lab	5	3	2	0.10	0.05	1	0.02
STI	7	3	4	0.07	0.12	1	0.03
TDRI	9	4	5	0.18	0.19	1	0.03
TRF	1	1	0	0.01	0.00	2	0.01
KPI	1	1	0	0.01	0.00	2	0.01
RU	1	1	0	0.00	0.00	2	0.02
MOE	2	1	1	0.01	0.00	2	0.01
CPT	6	1	5	0.00	0.03	2	0.01
OPG	1	1	0	0.05	0.00	3	0.01
NACC	3	2	1	0.10	0.00	3	0.01
CAC	6	3	3	0.09	0.33	3	0.02
Isra	7	2	5	0.07	0.39	3	0.02
CGD	7	2	5	0.10	0.20	3	0.01
ACT	11	7	4	0.49	0.25	3	0.03
TPD	1	0	1	0.00	0.00	4	0.01
PNET	1	1	0	0.00	0.00	4	0.01
ThaiPublica	1	1	0	0.06	0.00	5	0.01
AP-INTACT	1	1	0	0.08	0.00	5	0.01
VRU	1	1	0	0.08	0.00	5	0.01
CMU	1	1	0	0.08	0.00	5	0.01
CoST	2	2	0	0.13	0.00	5	0.01
OAG	3	0	3	0.00	0.24	5	0.01
UNDP	8	2	6	0.06	0.30	5	0.01
ChangeVentures	1	1	0	0.01	0.00	6	0.02
FaCT	1	0	1	0.00	0.20	6	0.01
Archives	2	1	1	0.11	0.20	6	0.01
C2	3	1	2	0.04	0.33	6	0.02
KTF	4	1	3	0.00	0.24	6	0.01
Sujarit-Thai	4	0	4	0.00	0.41	6	0.01
OpenDream	7	4	3	0.13	0.02	6	0.03
HAND	15	10	5	0.77	0.14	6	0.05
C1	1	0	1	0.00	0.00	7	0.01
Krungsri	1	1	0	0.00	0.00	7	0.01

Source: Author's preparation

Table 6: Statistics of Transmission of Information about Activities to Promote the Anti-Corruption Organization Network by Social Network Analysis

Organization	Degree	In degree	Out degree	Authority	Hub	Modularity class	pageranks
Transparency	1	1	0	0.15	0.00	1	0.01
Toolmorrow	1	1	0	0.00	0.00	1	0.03
FOSEF	1	1	0	0.07	0.00	1	0.01
IOD	1	1	0	0.15	0.00	1	0.01
FaCT	1	0	1	0.00	0.16	1	0.01
STI	2	1	1	0.08	0.00	1	0.02
C2	2	0	2	0.00	0.22	1	0.01
Siamraya	2	2	0	0.21	0.00	1	0.02
CAC	3	3	0	0.25	0.00	1	0.03
Archives	4	1	3	0.15	0.24	1	0.01
SIAM lab	5	2	3	0.11	0.36	1	0.02
Sujarit-Thai	5	0	5	0.00	0.53	1	0.01
TDRI	6	5	1	0.48	0.00	1	0.03
KTF	10	3	7	0.21	0.53	1	0.02
HAND	11	6	5	0.57	0.30	1	0.04
RU	1	1	0	0.00	0.00	2	0.02
MOE	2	1	1	0.03	0.00	2	0.01
SET	1	1	0	0.03	0.00	3	0.01
CPC	1	1	0	0.03	0.00	3	0.01
Naewna	1	1	0	0.03	0.00	3	0.01
Engineer4Thai	1	1	0	0.03	0.00	3	0.01
ThaiPublica	1	1	0	0.04	0.00	3	0.01
NIDA	1	1	0	0.04	0.00	3	0.01
ThaiPBS	2	2	0	0.07	0.00	3	0.02
Isra	6	1	5	0.00	0.16	3	0.01
ACT	13	5	8	0.40	0.10	3	0.02
BoonmeeLab	2	1	1	0.00	0.00	4	0.01
ThaiTech	1	1	0	0.00	0.00	5	0.02
EGA	3	1	2	0.00	0.00	5	0.01
Kenan	1	1	0	0.00	0.00	6	0.01
UNAISD	1	1	0	0.00	0.00	6	0.01
Khaosod	1	1	0	0.00	0.00	6	0.01
Agoda	1	1	0	0.00	0.00	6	0.01
UNDP	6	1	5	0.00	0.00	6	0.01
CoST	1	1	0	0.06	0.00	7	0.01
OPG	1	1	0	0.06	0.00	7	0.01
CGD	6	1	5	0.00	0.21	7	0.01
TRF	1	1	0	0.02	0.00	8	0.01
PNET	1	1	0	0.00	0.00	8	0.02
TPD	2	0	2	0.00	0.01	8	0.01
KPI	2	2	0	0.03	0.00	8	0.02
OPDC	3	1	2	0.00	0.04	8	0.01
CPT	4	0	4	0.00	0.09	8	0.01
NACC	6	5	1	0.15	0.00	8	0.03

Source: Author's preparation

Table 7: Statistics of Transmission of Information about Anti-Corruption Overview by social Network Analysis

Organization	Degree	In degree	Out degree	Authority	Hub	Modularity class	pageranks
ACT	27	12	15	0.45	0.30	2	0.06
CAC	9	5	4	0.17	0.19	5	0.03
Isra	14	4	10	0.15	0.31	2	0.02
SET	1	1	0	0.05	0.00	2	0.01
HAND	23	13	10	0.51	0.34	0	0.06
ThaiPBS	6	2	4	0.10	0.19	2	0.01
Transparency	4	4	0	0.20	0.00	2	0.02
CPT	9	2	7	0.05	0.08	1	0.01
CPC	1	1	0	0.05	0.00	2	0.01
NACC	10	6	4	0.18	0.18	2	0.03
Naewna	1	1	0	0.05	0.00	2	0.01
Engineer4Thai	1	1	0	0.05	0.00	2	0.01
EGA	9	4	5	0.12	0.19	3	0.02
MOE	3	2	1	0.06	0.00	1	0.01
ACF	1	1	0	0.05	0.00	2	0.01
BoonmeeLab	3	2	1	0.03	0.00	3	0.02
Archives	10	4	6	0.17	0.15	4	0.02
TDRI	17	11	6	0.40	0.25	2	0.04
ThaiTech	1	1	0	0.03	0.00	3	0.02
STI	12	6	6	0.21	0.17	3	0.04
OpenDream	8	5	3	0.16	0.04	4	0.02
SIAM lab	11	4	7	0.11	0.25	1	0.03
C2	8	2	6	0.06	0.22	0	0.02
Toolmorrow	3	3	0	0.12	0.00	0	0.02
ThaiPublica	2	2	0	0.10	0.00	0	0.01
CGD	7	2	5	0.05	0.12	5	0.01
KTF	13	5	8	0.17	0.33	0	0.02
NIDA	2	2	0	0.08	0.00	2	0.01
ChangeVentures	1	1	0	0.01	0.00	4	0.02
TRF	3	3	0	0.09	0.00	1	0.02
TPD	2	0	2	0.00	0.00	1	0.01
PNET	1	1	0	0.00	0.00	1	0.01
KPI	3	2	1	0.01	0.00	1	0.01
UNDP	13	2	11	0.05	0.12	0	0.01
CoST	2	2	0	0.04	0.00	5	0.01
OPG	2	2	0	0.04	0.00	5	0.01
AP-INTACT	1	1	0	0.02	0.00	0	0.01
Kenan	1	1	0	0.02	0.00	0	0.01
UNAISD	1	1	0	0.02	0.00	0	0.01
Khaosod	1	1	0	0.02	0.00	0	0.01
Agoda	1	1	0	0.02	0.00	0	0.01
VRU	1	1	0	0.02	0.00	0	0.01
CMU	1	1	0	0.02	0.00	0	0.01
OPDC	3	1	2	0.00	0.03	2	0.01
FOSEF	1	1	0	0.02	0.00	4	0.01
Siamraya	2	2	0	0.07	0.00	4	0.01
Sujarit-Thai	9	2	7	0.02	0.30	2	0.01
C1	3	1	2	0.00	0.00	6	0.01
Krungsri	1	1	0	0.00	0.00	6	0.02
IOD	1	1	0	0.05	0.00	0	0.01
SWU	1	1	0	0.00	0.00	1	0.02

Organization	Degree	In degree	Out degree	Authority	Hub	Modularity class	pageranks
Neumerlin	1	1	0	0.04	0.00	0	0.01
RU	1	1	0	0.00	0.00	1	0.02
FaCT	3	0	3	0.00	0.16	0	0.01
Thaipublica	1	1	0	0.03	0.00	0	0.01
OAG	6	0	6	0.00	0.28	0	0.01
CU	1	1	0	0.01	0.00	1	0.01

Source: Author's preparation