

Qualitative Core-periphery Approach on Information Sharing in Multicultural Communities Ecosystem

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ABSTRACT

Within interconnected multicultural communities, information sharing plays a pivotal role in shaping social dynamics and cross-cultural exchange. This study employs a qualitative core-periphery approach to explore information sharing patterns within such ecosystems. Focusing on the core nodes and peripheral nodes, we investigate the dynamics of information flow, influential actors, and community cohesion. A case study involving 75 individuals from 11 nationalities reveals central figures' vital role in facilitating communication. Through in-depth interviews and analysis of online and offline interactions, the research identifies the key actors within the communities' core-periphery structure. The research continues with qualitative network mapping and explores how information sharing occurs within different cultural groups. The core-periphery structure fosters diversity but can also reinforce information inequality. This research is relevant to approach and apply targeted interventions to a new multicultural communities ecosystem and study the patterns of how they share information to each other.

Keywords: Core-periphery structure; multicultural communities; network mapping; community cohesion; targeted interventions

ABSTRAK

Dalam komunitas multikultural yang saling terhubung, penyebaran informasi memiliki peran penting dalam membentuk dinamika sosial dan pertukaran lintas budaya. Studi ini menggunakan pendekatan kualitatif pusat pinggiran (*core-periphery*) untuk mengeksplorasi pola pertukaran informasi dalam ekosistem tersebut. Berfokus pada titik pusat dan titik pinggiran, penelitian ini menyelidiki dinamika arus informasi, aktor yang berpengaruh, dan kohesi komunitas. Sebuah studi kasus yang melibatkan 75 orang dari 11 negara mengungkapkan peran penting aktor kunci dalam memfasilitasi komunikasi. Melalui metode wawancara mendalam (*in-depth interview*) dan analisis interaksi daring dan luring, penelitian ini mengidentifikasi aktor-aktor kunci dalam ekosistem komunitas. Penelitian dilanjutkan dengan pemetaan jaringan secara kualitatif dan mengeksplorasi bagaimana pertukaran informasi terjadi dalam komunitas dengan budaya yang berbeda. Struktur pusat pinggiran menumbuhkan keberagaman namun juga memperkuat kesenjangan informasi. Penelitian ini relevan untuk melakukan pendekatan dan menerapkan intervensi yang ditargetkan pada ekosistem komunitas multikultural baru dan mempelajari pola bagaimana mereka berbagi informasi satu sama lain.

Kata Kunci: Struktur pusat pinggiran; komunitas multikultural; pemetaan jaringan; kohesi komunitas; intervensi tertarget

INTRODUCTION

Core-periphery structure refers to a meso-scale network pattern characterized by a well-connected core and a sparsely connected periphery [1-2]. The core nodes typically have a higher degree of connectivity and play a central role in information flow, influence diffusion, and resource allocation

within the network [3]. On the other hand, the peripheral nodes have limited connections and may rely on the core for information and resources [4]. The study of core-periphery structure in social networks has been facilitated by advances in network analysis techniques and methodologies. Social networks, in general terms, refer to the webs of interrelationships among individuals or entities. These networks can be studied and analyzed using social network theory, which examines the specific dynamics and structures within these webs [7]. Relationships can be represented as nodes (individuals or organizations) and edges (connections between them) in a network graph. Researchers have developed measures and algorithms to identify and analyze the core-periphery structure in networks [5]. These methods allow for the detection of central nodes, the assessment of network centralization, and the exploration of the relationships between the core and the periphery [6].

In the field of systemic design, the concept of core-periphery structure in social network can be relevant in understanding and designing complex systems. The interplay between the core and periphery is important in designing effective and resilient systems [8]. Systemic design aims to address complex problems by considering the interconnectedness and interdependencies within a system. Core-periphery structures can provide insights into the organization and dynamics of these systems. By understanding the roles and interactions between the core and periphery, systemic designers can identify key components and relationships that drive system behavior.

Multicultural communities are characterized by the coexistence of diverse cultural groups, and information sharing plays a crucial role in facilitating communication and interaction among these groups [9]. To understand the core-periphery structure in information sharing within multicultural communities, it is important to consider factors such as social cognitive factors, social network factors, trust, perceived benefit, and information sharing attitude [9]. The core nodes in the network may consist of individuals who have extensive social networks, high levels of trust, and a positive attitude towards information sharing. On the other hand, peripheral nodes may have limited access to information and may rely on the core nodes for information dissemination and may have less influence on the overall information sharing process [9].

The research of core-periphery structures in social network analysis is primarily conducted through quantitative methods. For example, Kojaku & Matsuda (2017) proposed a scalable algorithm to detect multiple nonoverlapping core-periphery pairs in networks [8]. Similarly, Zhang et al. (2015) developed a method based on generative network models for identifying core-periphery structure [10]. In a related study, research developed a generalized framework for studying community structure in time-dependent, multiscale, and multiplex networks [11]. This framework allowed for the algorithmic detection of tightly connected groups of nodes, known as communities, in arbitrary multislice networks. These studies highlight the significance of quantitative approaches in understanding and characterizing core-periphery relationships in various types of networks.

While numerous quantitative techniques have been proposed and applied to analyze core-periphery configurations in various types of networks, the research of qualitative subtleties and contextual insights within these structures has yet to be fully explored. Qualitative notions of core-periphery structure have been explored in various fields such as international relations, sociology, and economics; however, the study of core-periphery structure remains less developed compared to the study of community structure [12]. Community as a standalone structure has a different meso-scale structure of networks [8], however, the focus of this paper is specifically directed towards a collection of communities with different cultural origins instead of analyzing the network within the community itself.

This paper focuses on identifying the opportunities and risks of using core-periphery network for information sharing, using social network mapping tools in experiment of multicultural communities ecosystem in an educational institution consists of 75 students from 11 different countries. Understanding the core-periphery approach in information sharing between multicultural communities ecosystem structure can help identify potential barriers to information sharing and develop strategies to promote more inclusive and equitable information flow within multicultural communities. In business settings, it can inform strategies for marketing, collaboration, and innovation by identifying influential actors and potential bottlenecks in information flow [13]. In community development, it can help identify key individuals or organizations that can facilitate social cohesion and resource distribution [14]. In policymaking, it can provide insights into power dynamics and the distribution of influence within a network [15].

Multicultural Communities Ecosystem

Multicultural communities can be defined as social and educational environments that reflect the particular characteristics of cultural diversity and promote natural sociocultural interaction among participants [16]. These communities aim to meet the needs of individuals from various ethnic backgrounds, support dialogue, mutual enrichment, and cultural interaction. Multicultural communities encompass diverse aspects such as ethnicity, language, religion, social class, and sexual orientation [17]. They are characterized by the coexistence and interaction of multiple cultural groups within a shared space [18].

Multicultural education interventions have been associated with positive outcomes across a wide variety of participant and study characteristics [19]. The effectiveness of multicultural education has been debated, but meta-analytic studies have been conducted to estimate the typical magnitude of the effects of multicultural education interventions [19].

Communities ecosystem in this paper refers to the dynamics of communities within a system. Ecosystem, in the context of complex networks or interconnected systems, refers to a structure or dynamics that involves the interactions and relationships among various entities or actors. It can be modeled as a network or graph, where nodes represent the entities and links represent the interactions between them [20]. The concept of an ecosystem emphasizes the interconnectedness and interdependence of the entities within the system, and the study of ecosystems aims to understand their structure, dynamics, and resilience [21-23]. The ecosystem perspective provides insights into the complex systems and forces that shape the behavior and outcomes of the entities involved [24-25].

METHOD

Study Case: Communities Ecosystem in an Educational Institution

The focus of this study case lies within a unique setting: communities within a laboratory in educational institution, distinguish by the name SPL. Unlike typical community-based activities, the individuals in these communities are motivated primarily by their pursuit of knowledge and educational goals. However, what sets this ecosystem apart is the spontaneous formation of communities, not originally initiated by the educational institution itself. In this study, we aim to explore the motivations behind the establishment of this communities ecosystem and investigate the connection between members within the context of a shared national identity.

It is important to note that the members of SPL did not enter the communities voluntarily based on a specific motivation, but rather as a natural progression within the educational institution. Despite this, it is intriguing to observe that the communities emerged organically as a result of a shared cultural heritage or national background. In some cases, the ties that bind the members of these communities are rooted in a common ancestry, which has fostered a sense of kinship and solidarity among them.

Given that the communities ecosystem under case study originates within an educational institution, the author will employ the term "student" to refer to individuals within the broader student population. However, to specifically denote members within communities formed, the term "community member" will be used. Additionally, the term "participant" will be employed to refer to individuals who have been interviewed as part of this case study experiment. This nomenclature is intended to provide clarity and distinguish between the various roles and groups involved in the study.

Within SPL, recorded in June 2023, there was a diverse population of approximately 75 students with them being from doctoral, master year 1, master year 2, and bachelor students. There are also exchange students that stay for short periods of time, usually ranging from 6 to 12 months. To ensure the communities ecosystem structure, a casual interview was conducted with 14 participants to provide insights into the day-to-day interactions and informal networks that exist in the communities. This interview is also to find the key person of each cell community formed. Additionally, to delve deeper into the social network dynamics, 8 participants were chosen for in-depth interviews and information sharing experiment. These 8 participants were the key people of the communities, based on the initial casual interviews. Through these in-depth interviews, participants were able to share detailed information about their social ties, affiliations, and roles within the community.

DISCUSSION

How the Communities Were Formed

At first glance, the primary factor contributing to the formation of these communities appears to be the shared nationality among their members. This common national identity serves as a strong bond and facilitates the establishment of cohesive social groups. However, an equally significant aspect that distinguishes these communities is the students' class grade or academic year. It seems that individuals within the same class grade tend to form tighter-knit groups within the larger cell-structured communities. This could be attributed to shared experiences, similar academic goals, and a higher likelihood of interacting on a regular basis due to their enrollment in similar courses or programs.

Measuring closeness within a community can be a challenging task. In the context of this experiment, individuals are considered close enough if they engage in regular communication, either on a daily or weekly basis. The determination of this closeness was based on both observed interactions and information gathered through interviews conducted as part of the study. According to the casual interviews, four communities stood out as the most prominent within the ecosystem.

a. Southeast Asia + Mexico

Southeast Asia community consists of members from Indonesia, Thailand, and Malaysia. Indonesian members are alumni from the same university back in Indonesia, and Indonesia people have a quite strong student society community based on prefecture in Japan. On the other hand, Thai members are from various universities, but they bonded after arriving at Japan. There are only one Malaysian

member and Mexican member, but they are also included in the community of Southeast Asia. One of the factors that contribute to the closeness of this community is their cultural inclination towards gathering together. Additionally, language plays a role in their cohesion, as not everyone in SPL is proficient in English. However, proficiency in English is essential for non-Japanese speaker admission to SPL, enabling all members of the Southeast Asia and Mexico community to communicate fluently with one another. Major communication channels: WhatsApp group (Indonesian), Facebook Messenger (Thai), LINE group (everyone in the community, some also have their own group for projects or the same level of class).

b. China

The Chinese community within SPL represents a significant portion of the population, comprising approximately 60% of the total members, with a majority being doctoral students. That being said, there is no singular social media group that encompasses all Chinese members. Instead, the social network within the Chinese community exhibits a fragmented model, characterized by multiple smaller community meso-scale structure that contain overlapping members. This indicates that certain individuals are part of multiple groups of friends. These groups are formed based on various factors, including participation in the same project, sharing classes together, socializing outside of academic activities, or even gathering for cultural celebrations like Chinese New Year dinner. Additionally, some groups are formed due to romantic relationships among the members. Chinese are known for their strong cultural bond to each other and shared language. Some members may have limited proficiency in English or Japanese, leading them to avoid forming connections with individuals with whom they cannot communicate effectively. Nonetheless, there are Chinese members who are open to interacting with members of other communities, and they actively engage in socializing and frequent communication. Major communication channels: WeChat group, LINE group (if there are members from other country).

c. Japan

The motivation for many Japanese students to pursue advanced studies, particularly at the master's level, is driven by the desire to secure better job prospects. Additionally, it is mandatory for third-year bachelor's students to join a laboratory, which explains the presence of bachelor students in the SPL laboratory. Japanese students also have a cultural inclination to actively search for employment opportunities before their graduation, which often keeps them busy and limits their interactions with members from other communities. Moreover, some members face language barriers and have limited proficiency in English. Within the Japanese community, there is a division based on academic year, comprising first-year and second-year master's students, as well as bachelor students. These subgroups share a strong bond as they engage in the job-hunting process together, facing similar challenges and aspirations. Major communication channels: LINE, Slack (Master first year and Bachelor student members).

d. Exchange Student

Exchange students refer to students who are pursuing their education at an overseas university but have come to SPL to gain additional experience studying abroad. Typically, exchange students have a relatively short duration of stay, ranging from 6 to 12 months. Due to the temporary nature of their presence, exchange students often find it challenging to form deep connections with other students. Additionally, exchange students are typically engaged in their own project work, which requires them to collaborate within their respective groups. As a result, they tend to form close bonds primarily with

fellow exchange students, while not actively seeking to develop extensive relationships with other members. Since their purpose for joining SPL is not primarily focused on research theses, exchange students often exhibit a more playful and youthful disposition. Within this community, members are highly replaceable, and their presence is transient, as exchange students continuously come and go. Furthermore, exchange students frequently establish friendships with other exchange students or international students from various departments within the institution. Major communication channel: LINE.

Information Sharing Mapping

In addition to the in-depth interviews conducted with eight participants as the key people of the communities ecosystem, the author implemented an information sharing experiment. Information sharing mapping, a visual representation of their connections, aided in further understanding the structure and interconnectedness of the communities ecosystem and how the core-periphery structure was formed. Table 1 explains the status of eight key people in the ecosystem. These individuals were selected for interviews due to their prominence in the minds of other participants during casual interviews. A "key person" denotes an individual with substantial connections both within and outside their community. The findings of key person can determine the core nodes in the ecosystem. An "observed leader" signifies someone whose opinions resonate within the community, often resulting in other members following suit. Interestingly, one participant initially seemed to be a key person due to their frequent in-person presence at SPL. However, it transpired that this individual didn't foster profound connections with others, resulting in them categorized as periphery person.

Table 1 In-Depth Interview and Experiment Participant

Participant Nationality	Status in SPL	Status in Community
Indonesian	Master (first year)	SE Asia + Mexico community key person
Indonesian	Doctoral	SE Asia + Mexico community observed leader
Mexican	Exchange Student	Exchange Student community key person
Japanese	Bachelor Student	Japanese community key person
Chinese	Doctoral	Chinese community observed leader
Chinese	Master (second year)	Chinese community key person
Iranian	Doctoral	Periphery person (was assumed as key person)
Chinese	Doctoral	Chinese community key person

The experiment revolves around the scenario where SPL's teacher imparts information to 'submit a design' to the participants, who then share it with others in SPL. Figure 1 (a) and (b) shows the form to be filled in by participant. The participants were tasked with mapping their personal journeys of sharing information with individuals they were acquainted with and who were part of their social network within SPL. Two sets of experiments were conducted: the first involved mapping their optimal scenarios, while the second focused on mapping their worst-case scenarios. The participants were entrusted with charting their information-sharing journeys with fellow SPL members within their social network. The information sharing could be in-person, online by personal chat, or online by group. Example of answers by participants shown in Figure 1 (c) and (d). By scrutinizing communication dynamics, the author aimed to uncover insights into how communication spreads within the ecosystem. This experiment served as a tool in understanding the communication patterns and channels employed by each community within the ecosystem.

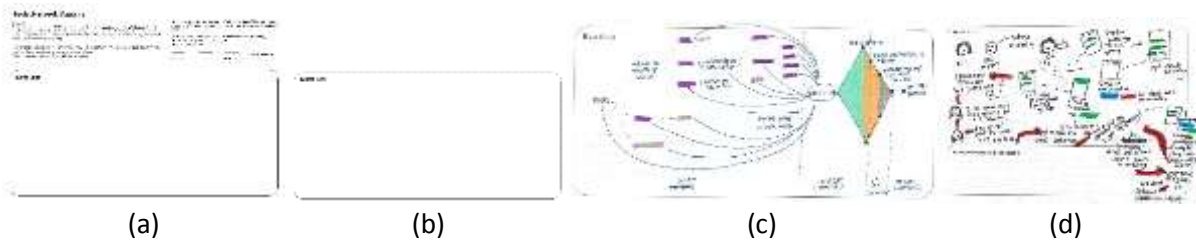


Figure 1. Social Network Mapping Experiment; (a) Page 1: instruction and best case scenario; (b) Page 2: worst case scenario; (c) Example of best case scenario answer; (d) Example of worst case scenario answer

When information is complicated with many structural concepts and words, visualization can help untangle the complexity and untangle possible tangles of meaning [26]. Figure 2 shows the result of the experiment of information mapping in SPL. The solid line represents individuals who undoubtedly receive information and have close relationships within the community, emerging as top-of-mind key persons, meaning these individuals are mentioned by multiple key persons, or the people are belonged to smaller tight knit group that connects with key persons. The dashed line indicates closer periphery, meaning key persons are uncertain or take time before sharing information, or scenarios where assumed key persons have their information conveyed by others. Among 75 individuals, 16 didn't receive the information. The circles that didn't connected to any lines are the individuals that didn't receive the information, indicating the outer periphery. The dotted circle indicates the core of community. Each significant community possesses distinct characteristics in information distribution.

For Southeast Asia and Mexico community, one individual was unable to access information due to their absence in SPL (the individual is studying from Thailand). The community's key person is notably active and contemplates sharing with members of other communities. Information dissemination mainly occurs through SPL meetings or group chats. Indonesia and Thailand also maintain their separate group chats, fostering mutual reminders. Within this community, three individuals belong to the closer periphery, facing potential exclusion from primary information.

In China community, eight individuals, all doctoral students, lacked information due to factors like inactivity, remaining in their home country, or infrequent attendance at SPL. Information spread within this community is mostly shared in small groups, and most of the groups have overlapping members. Additionally, five individuals are part of the closer periphery here.

In Japan community, everyone received information due to personalized information dissemination by key persons based on academic levels, each class having its group chat. Key persons spread information to one representative per level, relying on them to further share with classmates. However, some remain at the closer periphery due to not being closely connected with those receiving information within their batch, posing a risk of exclusion.

Among exchange students community, their short-term collaboration makes them closely-knit, eliminating periphery distinctions. Still, seven individuals didn't receive information as they weren't involved in the same projects. Most of the individuals are from China and Taiwan, that means there are one more community that this experiment did not reach, which is the exchange student Chinese community.

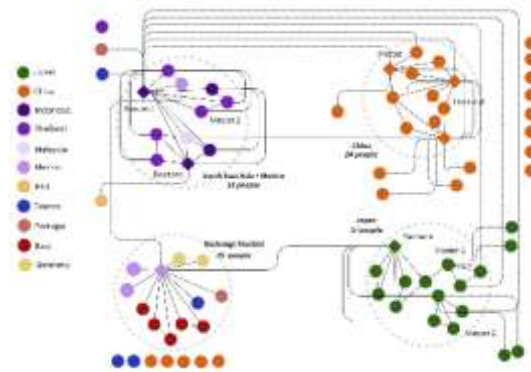


Figure 2. Information Sharing in SPL Map

This experiment indicates that core-periphery approach of information sharing can be done by finding key people in communities to share the information to the rest of the community they are in. This experiment failed to identify one more community, which is the Chinese exchange student community, that is why most of them did not receive the information. Accurate identification of key people is needed as it determines the recipients of information.

CONCLUSION

The core-periphery approach is particularly relevant in the current digital era, where a substantial portion of our communication and interactions occur online. This approach can be beneficial for individuals who are not very active in engaging in digital communication, as it provides a framework for understanding and facilitating communication within a network. This study suggests that in order to approach multicultural communities ecosystem, it is important to study and observe the key people that initiate cohesion among their community. By identifying the key people and approaching them, a sense of belonging and equal participation can be nurtured within the community. Further research is necessary to determine the specific efforts required for different stakeholders in various contexts, such as business settings, community development, and policymaking. It is crucial to recognize that different ecosystems may necessitate distinct approaches and strategies to effectively promote communication and collaboration. People's views and actions in dealing with an intervention application in their environment will depart from their socio-cultural background, and this is not necessarily the same as what is seen by outsider because the frame of reference can be different [27].

While the core plays a central role in a core-periphery network, it is important to avoid excessive centralization of power or decision-making. Applying a core-periphery network requires careful consideration of inclusivity, information sharing, adaptability, and avoiding excessive centralization. By striking the right balance, organizations or activities can benefit from the efficiency and specialization that core-periphery structures offer while ensuring equal participation and fostering a collaborative and dynamic network.

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