

Social Network Analysis of Knowledge Sharing Across Disciplines and Regions in a Multinational Engineering Consultancy

Mwamba Mwila

Department of Business Management and Commerce, Dmi-St-Eugene University, Lusaka Province, Zambia.
mwilamwamba71@gmail.com

Correspondence should be addressed to Mwamba Mwila : mwilamwamba71@gmail.com

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Abstract – In the current global environment characterized by knowledge-intensive work, it is crucial to foster knowledge sharing (KS) across geographically distributed work teams within multinational corporations (MNCs). This research aims at finding out the level of knowledge sharing connections (KSC) in a dispersed community of practice (CoP) among employees in a multinational engineering consultancy. Specifically, we investigate the flow of knowledge within a sustainability-focused CoP using social networking analysis (SNA) and semi-structured interviews with open-ended questions. The survey sample included 37 employees from 32 offices across 19 countries and was conducted using an ego-centric survey with follow-up interviews. Inter-disciplinary relationships were more common than inter-regional ones, as professionals within regions frequently collaborated and shared knowledge due to geographical closeness. There was less frequent knowledge exchange (KE), especially in the inter-regional networks, in which mostly were project-related. They were predominantly reciprocal, with an emphasis on mutuality based on social obligations. Respondents responded that they use inter-regional connections less often than inter-disciplinary ones probably because inter-disciplinary contacts are more frequent. These results point to the need for the provision of regular and effective cross-regional and cross-disciplinary communication to increase the level of KE and innovation in projects.

Keywords – Knowledge Sharing, Knowledge Exchange, Knowledge Sharing Connections, Social Networking Analysis, Community of Practice, Knowledge Resilience, Knowledge Frequency.

I. INTRODUCTION

Within an organization, knowledge is the paramount resource utilized to generate fundamental competitive advantages. Typically, an organization's knowledge and skills are documented in written materials such as papers, manuals, and reports, and stored in a knowledge database. An organization accumulates and circulates significant quantities of codified knowledge to assist knowledge workers involved in various jobs and activities. In order to safeguard, distribute, and utilize these resources, firms must implement suitable knowledge management techniques to effectively assist knowledge workers [1, 2]. Knowledge management, a widely used practice in businesses, plays a crucial role in effectively maintaining and disseminating knowledge [3, 4, 5]. In order to enhance productivity, workers who are engaged in comparable or collaborative jobs typically have similar information requirements connected to their tasks. They can establish a group to promote the sharing, cooperation, and reuse of knowledge. A group of workers can be clearly recognized by designating tasks that are comparable or cooperative, allowing knowledge workers performing those jobs to create a cohesive group. Alternatively, a group of workers can be implicitly identified based on their referencing behavior, as suggested in [6, 7].

Multi-national project-based firms, particularly those in the Architecture, Engineering, And Construction (AEC) industry, employ individuals with a wide range of expertise in many fields, and these personnel are spread out around the globe. These organizations are highly motivated to jointly share information, regardless of the usual boundaries of projects, geographic regions, and disciplines. Rolland and Kaminska-Labbé [8] define Knowledge Sharing (KS) as the process of disseminating knowledge to individuals inside an organization. KS is the act of transforming an individual's information into a format that can be comprehended, assimilated, and utilized by others. KS is considered a form of social interaction in which employees inside a company discuss their experiences, abilities, and information [9]. KS is the process of exchanging explicit and/or tacit knowledge with the view of creating in the workplace [10]. KS can be defined as the process, which takes place between the employees with an aim of enhancing the skills, overcoming the difficulties and enhancing the performance of the tasks at hand [11].

Knowledge Sharing (KS) can be described as the effective communication of knowledge that may be useful to other workers within an organization [12]. Members of an organization agree to knowledge acquisition, innovation and therefore the enhancement of competitiveness through this important mechanism [13]. According to Cabrera and Cabrera [14] KS is a process by which a group of people share both their and other peoples' knowledge and, in this process, they create novel knowledge. KS can be defined as the process of sharing task-related data, expertise, and advice for purpose of helping and working with other individuals to solve problems and do their work, as well as coming up with new ideas [15]. In addition, according to Blankenship and Ruona, [16], KS is realized when one deliberately transmits professional knowledge or experience for the purpose of enriching the others with new ideas or thoughts. Lastly, KS can be defined as the process of exchange of experience and organizational knowledge with the business processes by using communication media among the individuals, groups and organizations [17].

Multinational project-oriented companies interested in many markets are particularly eager to jointly acquire knowledge within projects and countries to gain a competitive advantage [18]. However, project-based organizations at the global level encounter a number of challenges when it comes to the formation of KSCs and KSNs. These include the lack of resources, corporate structures and culture, and individual self-interest but also geographical and related physical and cultural barriers. Although the benefits of KS across the global have been postulated there is scanty information on the creation and sustenance of KSCs and KSNs. In order to gain a better understanding of the network configuration and the creation of KSCs in global enterprises, Söderquist [19] studied the KSC framework in a KS network that is oriented towards sustainability in a large multinational engineering firm. Teece [20] found out that links that transcend physical barriers, including geographical location, can improve the capacity to acquire information and boost performance.

Teigland and Wasko [21] have suggested that task-oriented Knowledge Exchange (KE) between persons in various geographical locations results to enhanced performance at the project and at the individual level. Furthermore, the exchange of knowledge among individuals with diverse disciplinary backgrounds is anticipated to enhance performance, as it has resulted in significant breakthroughs. While there has been research on KS across different locations, our understanding of disciplinary boundary transcending and the relative difficulty of crossing different barriers is limited. An organization's comprehension of the effect of geographical and disciplinary barriers on KS relationships is crucial in understanding how these borders affect knowledge networks. Furthermore, analyzing the process of establishing and sustaining these relationships can assist firms and network administrators in devising effective solutions to combat them.

There are current and future challenges associated with engineering projects that require integration of work and Knowledge Exchange (KE) across different geographical and professional contexts. Organizational KS has the potential to improve performance, innovation and increase the competitiveness of an organization. However, it is surprising that there is still scarce theoretical insight into how knowledge is transferred across dispersed networks, especially in engineering consultancies. This research aims at addressing this research gap by offering a review of the KS practices within a vast Community of Practice (CoP) focused on sustainability. The remainder of this research has been arranged as follows: Section II discusses a theoretical framework concerning organization knowledge, KS across geographic regions, KS across inter-disciplinary boundaries, and networks. Section III describes the research data and methods, including the use of terms and KSC. Section IV provides a critical discussion of the results, which include frequency and connections of KE, knowledge flow, reciprocity, and reliance. Section V reviews and discusses four major objectives demonstrating the impact of crossing geographic and disciplinary boundaries on the development of KSC. Lastly, Section VI summarizes the findings obtained in this study.

II. THEORETICAL FRAMEWORK

This work is derived from organizational theory, particularly knowledge-centered perspective of firms, and the network theory. This section provides a theoretical foundation of organization knowledge, KS across geographic regions, KS across inter-disciplinary boundaries, and networks.

Organization Knowledge

According to Kelp [22], knowledge is defined as a justified belief, when beliefs are employed to justify one's own interests. This definition of knowing aligns with the "constructionist perspective". From this viewpoint, actors are regarded as individuals who perform and create realities using their cognitive frameworks, which are formed through interpretations and discussions among various participants [23]. Some knowledge becomes public and is constantly reviewed and reinterpreted by various members of society [24]. The remaining portion of the knowledge continues to be solely inside the realm of the individual. The understanding of this knowledge can only be grasped by the individual, rather than being effectively conveyed [25]. In order to effectively handle knowledge, a company requires an organizational structure that is both highly flexible and adaptable. Scarbrough [26] propose that organizations should adopt a structure based on "core competencies" in current environments. Such structures are inherently dynamic and flexible, allowing them to withstand high levels of environmental uncertainty and chaos.

Organizational knowledge is based on the firm itself and the industry it operates in [27]. Organizational knowledge is generated and transmitted within the framework of an organization, and is closely linked to the social environment in which it exists. It cannot be completely attributed to individual efforts alone [28]. The industry environment influences managers' perceptions of a company's ability to gain a competitive advantage. This is because it provides a crucial analytical framework for managers to deal with uncertainty [29]. The process of Organizational Knowledge Creation [30] consists of four distinct modalities, namely socialization, internalization, externalization, and combination. Socialization is the process of transferring an individual's implicit knowledge to the collective implicit knowledge of an organization [31]. Tacit knowledge

is challenging to express explicitly, but it does not necessarily have to be communicated through words. It is transmitted through team collaboration, the exchange of mental models, technical expertise, personal experiences, and different viewpoints [32]. Virtual teams utilize visual signals and rich media, such as animation, graphics, audio, videoconferencing, internet chat, and virtual reality, to enhance sociability in the absence of face-to-face contact [33].

KS Across Geographic Regions

Studies on knowledge flows have indicated that knowledge spillovers tend to be limited to specific geographic areas [34, 35, 36]. Nevertheless, Perri and Peruffo [37] raise the essential inquiry of whether there are any benefits for enterprises in close proximity or even within the same country, or if spillovers just dissipate and become accessible to anybody worldwide. Nathan et al. [38] propose that there has been a lack of thorough investigation on the movement of resources between different regions. The study conducted by Lepik and Krigul [39] offers valuable insights into the distinct process of transferring information across regional and national borders. Kotabe et al. [40] argue that geography has nonlinear impacts on knowledge flows, except for the innovativeness of the originating enterprise. The linear relationship between the innovativeness of the original firm and its impact implies that when there is a lack of closeness, the perceived ability of the firm to innovate becomes a valuable alternative to identifying and thoroughly evaluating its expertise. Acquiring technology from a reputable source is a cautious method of obtaining knowledge when there are no direct connections available.

The effect of geographical distance on the transfer of knowledge does not follow a linear pattern, as previously suggested by Gallaud and Torre [41] that is based on the idea of distance decay [42]. Comber et al. [43] provide evidence to support the idea that distance measures do not fully capture geographical considerations, which contradicts the notion that information flows decrease as the distance between locations increases. Our hypotheses were developed using a methodology that takes into account mitigating factors. While location may establish limits, the crucial factors for producing inventive activity and knowledge spillovers are the economic and institutional framework, as well as the microeconomic connections between enterprises. Examining the subgroup averages for previous connections among companies reveals a decrease in prior citations as the level of separation rises. This observation is reflected in the average number of citations from previous clusters or nations. Caragliu and Nijkamp [44] suggest that being physically close to others enhances the probability of exchanging knowledge, mostly by facilitating the formation of social networks that focus on technological advancements and innovation.

KS Across Inter-Disciplinary Boundaries

Encouraging cross-disciplinary information interchange has previously been advocated due to its potential for revolutionary advancements in knowledge and its contribution to the development of significant domains, such as oceanography and cognitive science [45]. Nevertheless, the act of exchanging knowledge between different fields of study, although common in engineering disciplines, has not been well examined. The presence of disciplinary boundaries is anticipated to pose challenges as a result of disparities in institutional learning, a dearth of shared understanding and knowledge, as well as shared identity. Due to homophily, it is anticipated that individuals are more inclined to engage with those who possess comparable features or characteristics [46]. Therefore, we anticipate that providing the same education and training will result in frequent disciplinary KS and collaboration inside an organization, since it will foster shared knowledge and contextual practices. Nonetheless, this idea might not work out well in the project-oriented AEC business, where some individuals might have been prompted to go beyond such constraints due to project pressure and might bring in insights on how to overcome such limitations.

Networks

This research employs Social Network Analysis (SNA) [47] to evaluate the comparative occurrence of connectors that are geographically or disciplinarily diverse. SNA is not a theory in social sciences but a technique of identifying and mapping relationships between individuals or groups. This is why SNA is typically known as Structural Analysis (SA) [48]. The primary distinction between SNA and classic or traditional social research strategy lies in their respective emphasis. SNA emphasizes the contexts of the social actors and links between players, whereas the traditional approach emphasizes individual qualities. Social networks are a collection of businesses or individuals that collaborate and/or compete with one other and have a relationship. The representation of the collaboration or competition can take the form of graphs or multi-graphs. Every individual engaged in competition or collaboration is referred to as an actor and is visually signified as a node within the graphical theory. Valued relationships between different actors are represented as connections, known as ties or links that could be either be directed or undirected, linking the corresponding nodes. Actors encompass individuals, institutions, or collectives, representing any interconnected entities. SNA can be applied to several levels, including political parties, large organizations, small groups, families, web pages, individuals, and even countries.

Even though both organizational influence and network structure play a role in KS, the actual sharing of knowledge, especially tacit knowledge, occur at the individual level. Consequently, our research centers on analyzing links as the foundational analysis unit and examining the features of individuals integrated in KSC. By analyzing the proportions of connections that cross borders, we may categorize connections based on their characteristics and obtain a comprehensive understanding of the network as a whole [49]. Our previous research only concentrated on KSC that encompass many geographical locations within a multinational engineering business [50]. During this investigation, it was recognized that there is a need to enhance our comprehension of interdisciplinary relationships. Hence, in this study, we investigated a cross-disciplinary, geographically dispersed work setting in a multinational engineering organization in an effort to understand:

- How often boundary-spanning KSC occur across specialties and geographies. It is concerned with knowing which of the various types of boundaries spanning connections are more prevalent and effective.
- The level of interaction of these boundary-spanning KSC. In particular, it looks at whether the nature of the boundary crossed has an impact on the rate at which information is transferred in a link.
- Different types of knowledge transfer across the boundaries of specialized fields, known as boundary spanning KSC, can be affected by the direction of the cross. This may impact the amount of one directional (given or received) or bidirectional (given as well as received) knowledge transfer.
- In case egos were increasingly dependent on inter-disciplinary or inter-regional KSCs.

III. METHODOLOGY

To examine the Knowledge Sharing Connections (KSC) [51] among employees in a geographically dispersed network within the same organization, we utilized Social Network Analysis (SNA) [52] and conducted semi-structured, open-ended interviews for analysis.

Research Setting

We conducted a study on a Community of Practice (CoP) [53], which specifically aimed at creating and exchanging tools related to sustainability within a multinational corporation that provides engineering consulting services. The organization is based in the United Kingdom and has different offices in 33 nations. Given the large CoP size that consisted of more than 1300 members, the organization carefully chose personnel to participate in the ego-centric questionnaire. They ensured that the personnel were representative of the various specialties and geographical regions within the overall CoP. More precisely, a total of 37 employees responded to a survey that was conducted using Network Genie. The staff were from 32 distinct offices located in 19 various nations. The questionnaires comprised 3 distinct groups of inquiries, which were centered around the mechanics (such as the presence of a link, the format and frequency of Knowledge Exchange (KE), and the directions of this KE within the link), the dynamics (including the assessment of the level of dependence on each KS Channel), and the features of the people engaged in the KS Channel and network.

Use of Terms

In order to enhance the exploration of data pertaining to Knowledge Exchange (KE) and stimulate a culture of introspection regarding the efficacy of KE in scientific endeavors, we urge practitioners and researchers alike to be cognizant of their vocabulary choices and strive towards adopting a common language. When researchers produce grey literature or peer-reviewed academic literature, they should choose one specific term of KE and integrate it in a keyword in the paper. The terms 'knowledge transfer', 'knowledge synthesis', and 'knowledge translation' have gained popularity among influential research organizations like granting agencies. However, it is important to use these terms only when referring to a one-way model where knowledge users and producers are distinct and separate. We urge scholars to contemplate a multidirectional foundation for the transfer of knowledge between users and producers. For individuals employed in the field of forest sciences, we recommend that English speakers utilize the term French speakers and 'KE' utilize the term 'échange de connaissances' to denote the transfer of scientific understanding between those who produce it and those who utilize it. These terms encompass the various directions in which knowledge can flow, making them inclusive of all four types of KE, which we have identified.

Knowledge Sharing Connections

In this study, KSC are defined as the participants' ability to recognize an individual with whom they share sustainability information in order to carry out sustainability duties linked to their employment. The respondents, who were either egos or workers, reported a total of 412 KSC throughout a network of 320 personnel. This network consisted of both egos and alters, which refers to the individuals with whom egos conveyed KSCs. Every ego is linked to a specific field of study and geographical area. The regional groups encompassed the UK, North America, Europe, Australia, Middle East, Eastern Europe, Asia, and Africa. The creation of these groupings was based on the inherent divisions of business activities within the corporation. The discipline groups encompassed in this list are Building Physics, Civil, Corporate Services, Environmental, MEP (Mechanical, Electrical, and Plumbing), Planning, Project Management, Structural Management and Sustainability. Every attribute was examined for characteristics related to the field of study and geographical location. The study was conducted using VBA code (macro) in Excel to ascertain the count of KSCs within the networks across various properties. We were able to identify both intra- and inter- attribute relationships for every survey question and feedback.

IV. RESULTS

This research focuses on Knowledge Sharing Connections (KSC), which encompass many locations and disciplines. Consequently, we provide our findings in the form of the RF (relative frequency) of different connections, which extend across every boundary. Furthermore, we applied normalization to survey question proportions with multiple feedbacks by considering the number of links discovered within a category. This enables us to directly compare the links between attributes. Raw RF represents the proportion of overall feedbacks for a given query whereas standardized RF represents the proportion of responses from a specific group (such as inter-regional KSC) for every individual feedback.

Frequency and Connections of KE

We conducted an analysis of the KSC, which engages in the exchange of knowledge on a yearly basis. Subsequently, we obtained the quantity and RF (relevance factor) of intra-attribute and inter-attribute KSC. For instance, KSCs between a worker located in Western Europe and a worker located in Africa was grouped as an inter-attribute link between two different physical engineers was classified as an intra-attribute link based on their specialty. **Fig 1** displays the proportions of KSCs that engage in KE on a yearly and quarterly basis.

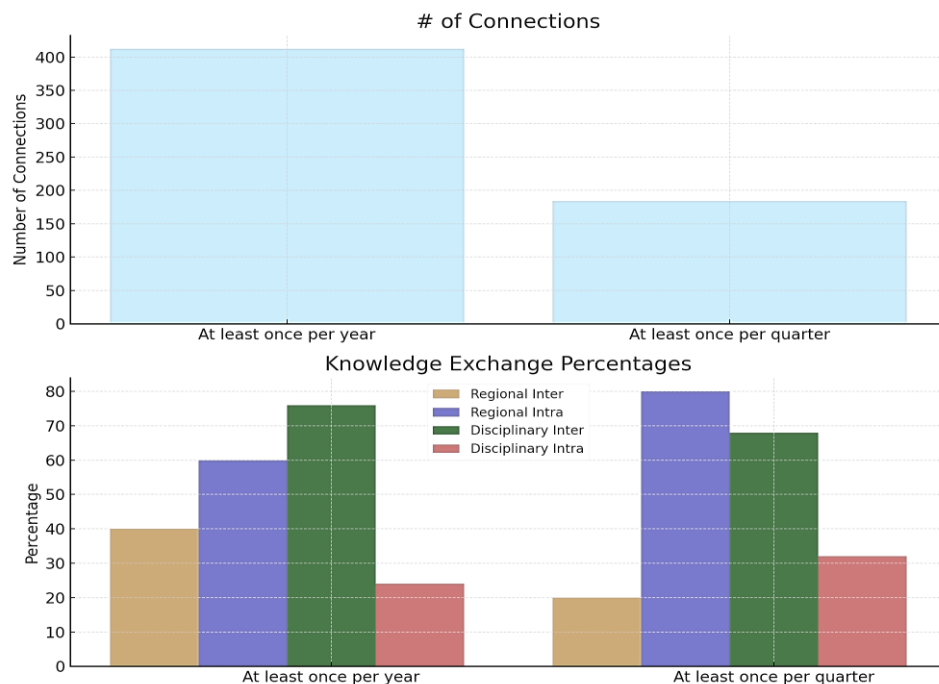


Fig 1. RF for Various Exchange Frequencies

We standardized the RFs of every group among the 181 KSCs that engaged in KE at least once a month, as shown in **Fig 2**. The percentage of interregional links that communicate knowledge less frequently than once a month is given to us as a normalized relative frequency.

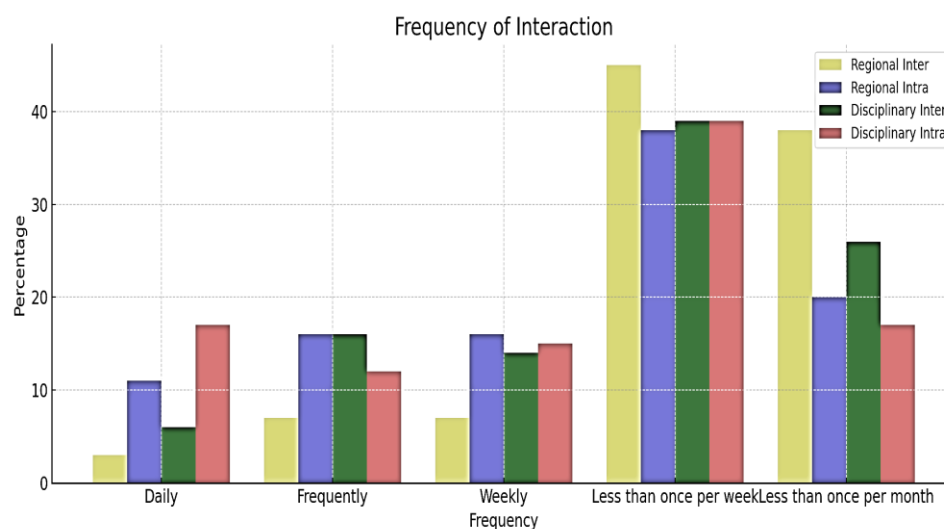


Fig 2. Normalized RF for Various Exchange Frequencies

Knowledge Reliance, Reciprocity, and Flow

To comprehend these connections, we additionally collected data on the transfer of knowledge and the level of dependence that individuals placed on every KSC they detected. The initial question asked individuals to assess whether they impart, and acquire knowledge. The RFs are presented in both their original and standardized forms in **Fig 3**.

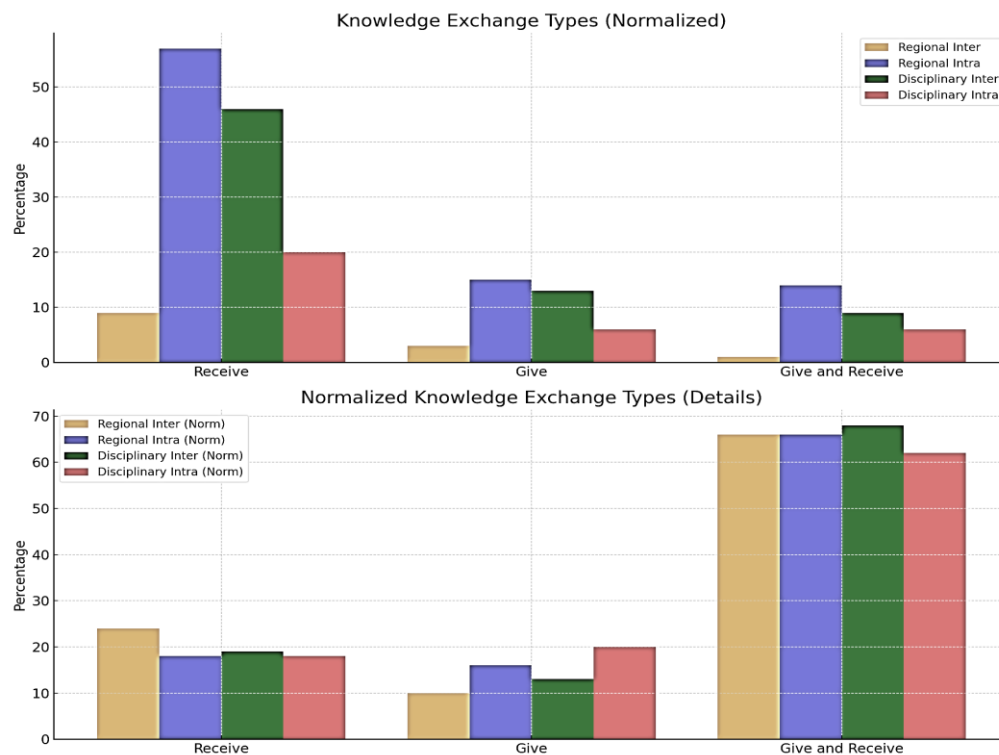


Fig 3. RFs and Standardized RF of Receiving and Giving KSC

The subsequent inquiry necessitated participants to evaluate the extent to which they depended on every KSC to carry out their job-based sustainability duties. As a result of a decrease in participants, only 375 KSCs had reported levels of resiliency. The RFs are presented in their original, unprocessed types in **Fig 4**.

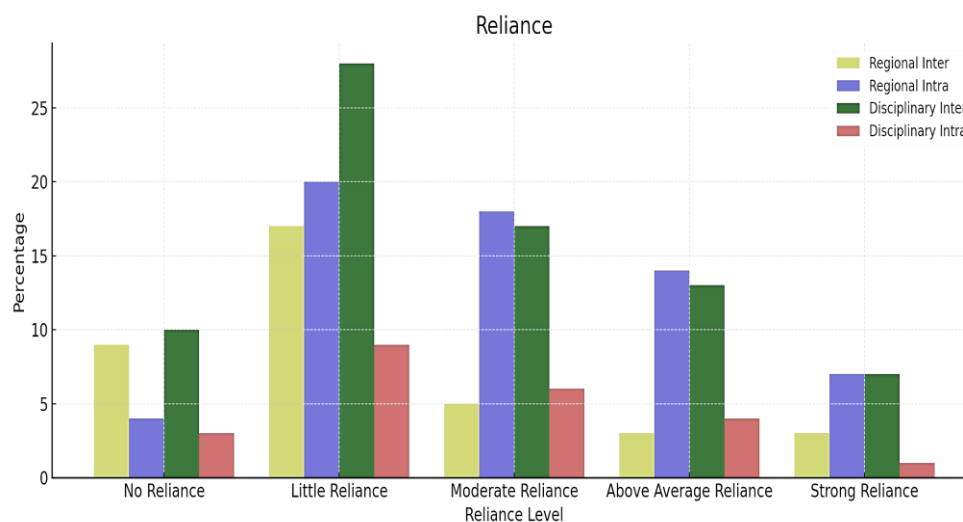


Fig 4. Relative Frequencies Representing KSCs Resilience Levels

V. DISCUSSION

The results demonstrate the impact of crossing geographic and disciplinary boundaries on the development of KSC within an internationally dispersed intra-organizational network that spans multiple disciplines. Significant patterns can be identified based on the following observations (OB):

OB1: The Number of Linkages Between Different Disciplines is Greater Than the Number of Connections Between Different Regions in KSC.

Both the 3-month and 12-month KE frequencies showed a much higher occurrence of links within regions compared to connections between regions. Inter-disciplinary KSCs were more common than intra-disciplinary KSCs. Within a construction environment, it is anticipated that there will be a substantial amount of inter-disciplinary connections as a result of the diverse range of disciplines involved in the task. The majority of employees will interact on a daily basis with

individuals from diverse fields, although this is not always true for individuals from different geographical areas. It has been discovered once again that being close to others is important for exchanging information and forming relationships [54].

The relationship between the spatial organization and knowledge bases of innovation is determined by the level of formalization of the knowledge, which is utilized. This connection is built upon the knowledge base framework, as discussed by Chung, Nam, and Koo [55]. structured knowledge is more readily transmitted remotely compared to less structured knowledge. This is why collaborations that rely mainly on analytical information are often arranged over long distances, while connections that rely on symbolic and synthetic knowledge are more commonly localized within a specific region. This is because analytical knowledge can be transferred through remote means, whereas synthetic knowledge requires frequent in-person interactions to transfer tacit knowledge, and symbolic knowledge necessitates the sharing of cultural codes, values, and expectations.

Nevertheless, an excessive correlation between the knowledgebase and the physical distance between couples overlooks the significance of other types of proximity that are not related to physical space. Information diffusion refers to the process in which individuals, both intentionally and unintentionally, share their information through direct or indirect communication [56]. The effectiveness of knowledge dissemination relies on the intents and capabilities of the senders to communicate, as well as the willingness and ability of the recipients to perceive and absorb knowledge. According to Yli-Renko, Autio, and Sapienza [57], the capacity to acquire new knowledge is typically enhanced when the subject of learning is connected to existing knowledge. Therefore, there is a positive impact on it of the cognitive convergence between two actors' cognitive "interpretation systems," as defined by Colby, Fernandez, and Kronenfeld [58]. These reasons could be featured as the level of cognitive or technological distance between actors, and the fact that this creates a positive effect regarding the probability and quality of information dissemination. Ferretti et al. [59] asserts that, apart from cognitive closeness, there are four other proximities that enhance the likelihood and effectiveness of information diffusion: inter-organizational, inter-institutional, inter-social, and inter-geographical closeness.

Organizational proximity may be defined as the level of coordination within a relation. Organizational proximity is defined as the extent of shared business routines, hierarchy, and values; for instance, working for the same organization [60]. These conditions help in reducing uncertainty and opportunism, which on the other hand enhances the flow of information [61]. If actors belong to the same institution, that is, if they are guided by the same set of rules and bureaucratic regulations, we may arrive at the same conclusion [62]. According to Van Der Wouden and Youn [63], geographical distance can be considered as one of the constituent factors of knowledge distribution. Physical closeness means people meet face-to-face and build trust which are critical for KS [64]. However, Phelps, Heidl, and Wadhwa [65] opines that geographical proximity does not guarantee knowledge spread as other proximal factors are also vital. Besides the physical contact, Kumar and Sinha [66] suggests that diffusion is highly dependent on connectivity of the individuals to social relations, for instance, familial or friendly. Interactions are a multilateral and multilevel process that can serve as pathways for the transfer of knowledge, both in the first and second degree [67]. This is a concept that is commonly referred to as social proximity [68].

OB2: Inter-Regional KSCs, in Contrast to Inter-Disciplinary KSCs, Share Knowledge Less Often

Studying the knowledge transfer rule [69], the authors established that the knowledge distance played a significant role in the efficiency of the knowledge transfer process and that the optimal difference was neither too large nor too small. The Huggins and Johnston [70] sought to understand the static and dynamic forms of networks and knowledge flow by exploring the role of knowledge distance. They also understand that the feedback between neighborhood and knowledge transfer adaptation contributes to the co-evolution of a network and the global distribution of knowledge. In addition, some aspects of SMNs such as reputation mechanisms would enhance and enhance the effective flow of knowledge within an SMN. In order to employ reliable Web services in social networks, Wahab et al. [71] proposed the notion of cooperation reputation.

Furthermore, the frequency of interaction is a significant component that influences the dissemination of knowledge. Individuals that engage in regular communication are more inclined to share knowledge compared to those who speak seldom. Castillo, Hadjstavropoulos, and Brachaniec [72] posited that the frequency of interaction could impact the efficacy of knowledge dissemination. Pentina et al. [73] found a favorable correlation between social media usage and the quality of brand relationships. Peng, Li, and Yang [74] characterized the intricate and unpredictable nature of social influence through the concepts of interaction frequency entropy and friend entropy. Furthermore, the frequency of interaction is the primary determinant that influences the professional advancement of agents [75], which may be considered as the progression of a social network. Therefore, we contend that the frequency of interaction is a crucial component that impacts the effectiveness of information transfer.

Connections with a KE frequency of less than once in every week have a greater proportion of inter-regional links compared to inter-disciplinary links. Links with KE frequency exceedingly once every week exhibit a higher prevalence of inter-disciplinary links compared to inter-regional links. One potential explanation for this phenomenon is that inter-regional links are largely utilized for project-centered cooperation that is not frequently required. Another possible explanation is that variations in time zones require extra planning to coordinate activities and ensure that all requirements are met simultaneously. During the open-ended interviews, a participant emphasized the significance of inter-regional KS. They highlighted that each country had unique expertise, construction codes, climate conditions, legislation, and regulations. The employee in question was seeking specialized knowledge in order to compose a report that could be adapted to different geographical areas. Due to his lack of understanding about different countries, he had to seek assistance beyond his local network in order to establish worldwide KSCs.

There is a consistent pattern of KS between different fields of study. One motivation for venturing across disciplinary boundaries is to acquire technological expertise that would otherwise be challenging to acquire. A different worker stated

that they frequently sought out individuals from various disciplines for their technical skills and guidance. This suggests that the incentive for developing a KS relationship is focused on the project at hand. Global corporations have the capability to hire persons that possess specialized technological skills that may be utilized throughout the entire organization through contractual agreements. Teams involved in knowledge-intensive tasks frequently include workers from different locations throughout the world, as the nature of the work demands specialized skills that may not be found in one single place [76]. However, employees typically only need to venture beyond their local boundaries when they require technological skills that cannot be met locally. As a result, trading occurs more frequently inside regions than between regions.

OB3: The Occurrence of Sharing and Receiving Knowledge is Equally Common in Both Inter-Regional and Inter-Disciplinary Interactions.

Both situations involve most of KSC that are bi-lateral, meaning that the participants both provide and receive knowledge. If the primary reason for inter-regional connections is the pursuit of specific technical or region-specific knowledge, it is logical to anticipate a one-way flow of knowledge between these links. Nevertheless, this is not true. 1 interviewee explains the early stages of establishing an inter-regional link: “Initially, I will inquire about the interviewee’s professional responsibilities and the specific challenges they face in their daily work, such as the types of challenges they face and the nature of the projects they are involved in.” Based on this insight, my initial course of action would be to provide valuable information to them. I would attentively consider their perspective and see how it can improve or supplement the information. Initially, I would offer, and subsequently, I would anticipate reciprocation. From this material, it is insufficient to characterize a KS link as solely one person seeking information from another person. The social norm of reciprocity, as described by Burger et al. [77], requires employees to engage in a mutually beneficial exchange of knowledge, as discussed by Serenko and Bontis [78].

The reciprocity idea has held significant importance in the fields of anthropology and ethnography for many decades [79]. Saglam et al. [80] argues that reciprocity behavior in social exchange theory is advantageous for employees. Reciprocity, as discussed by Ilvonen and Vuori [81], refers to the exchange of knowledge for the purpose of mutual advantages among individuals and parties involved in sharing knowledge. When knowledge is advantageous for both the recipient and the giver, it is considered fair [82]. Werner [83] referred to it as a logical shared or mutual indebtedness. Reciprocity, as seen in [84], manifests as either a gain or loss when behaviors of knowledge are exchanged. It is fundamental to evaluate the values of their understanding and their involvement in the body of knowledge, a group, or other employees. The study by Su et al. [85] review the connections between KS reciprocity and KS behavior, utilizing social capital and social exchange theory. The inclination of organization members to maintain ties with employees and colleagues, particularly in the context of KS, is extensively examined by researchers, specifically in relation to interactions involving KE. Mitchell, Cropanzano, and Quisenberry [86], drawing upon social exchange theory, referred to these relationships as expected reciprocal relationships. Reciprocity, as described by Sunardi, Tjakraatmadja, and Bangun [87], refers to the act of exchanging knowledge in a way that is beneficial to all persons and groups involved in the advancement of KS. Fairness is commonly associated with situations where knowledge is advantageous for both the recipient and the supplier.

OB4: Participants Depend Less on KSC That Span Across Different Regions, And Rely More on KSC That Span Across Different Disciplines.

Social engagement enhances relation-specific common knowledge by increasing the breadth, depth, and frequency of information flow. According to Daghfous [88], possessing prior knowledge that is related to new knowledge boosts a firm’s ability to absorb and utilize that new knowledge. This is known as relation specific absorptive capacity, which is enhanced by common knowledge. Therefore, as the capacity of each member of a dyad to assimilate shared knowledge is improved by frequent social engagement, both individuals are more motivated to invest additional effort in routines that facilitate knowledge-sharing. Social contact, through intensified knowledge-sharing activities, enhances the ability of a young technology-based organization to recognize and absorb external knowledge from its primary client, so increasing its capacity and effectiveness.

Knowledge and resilience to effectively handle knowledge are crucial for achieving success in the majority of organizations in today’s knowledge-driven economy [89]. KS is a crucial aspect of the KM process, as highlighted by Intezari et al. [90], Huysman and De [91], Yiu and Law [92], Tan [93], and Osman et al. [94]. The effectiveness of KM programs is contingent upon the level of KS inside the organization [95]. KS imparts vital skills and knowledge to individuals, enabling them to enhance their work performance and attain their goals with greater efficiency. The efficacy of KS is crucial for the organization’s survival and long-term functioning [96]. While KS is recognized as a precursor to various advantageous outcomes for firms, it does not happen naturally. Hence, it is crucial be resilient and identify the factors that facilitate KS among members of an organization.

The relationship between frequency and reliance of KE is likely owing to the lower levels of both factors in inter-regional KSC compared to inter-disciplinary linkages. The available evidence is inadequate to establish a causal relationship. If the existence of these KSCs is indeed a result of the necessity for people to collaborate across different fields in order to carry out their job responsibilities, then it is reasonable to anticipate a greater dependence among persons who contact on a daily basis. This is because their job performance relies on their ability to work together effectively. Regular connection has the potential to cultivate increased trust and dependence among these individuals. On the other hand, those who do not engage in social interactions may have a lower propensity to trust one another.

VI. CONCLUSION

The investigation of Knowledge Sharing (KS) across distributed Communities of Practice (CoPs) in multinational engineering consultancies reveals the interdependence between disciplinary and regional affiliations. It is discovered that inter-disciplinary relationships are much higher than inter-regional one due to the need for various technical specialization needed for the successful completion of projects. This need ensures that various disciplines engage in constant and productive communications with each other that nurture sound and reciprocal relationship based on norms of reciprocity. On the other hand, inter-regional KS is less frequent but still very important for getting access to specific information that cannot be obtained through regional contacts. This suggests that there is a strong need for strategic efforts designed towards enhancing inter-regional interactions even though there are always some practical difficulties including but not limited to the difference in time zones and patterns of communication. Besides, more frequent and intense intra-discipline KSC interactions indicate the depth and frequency of these interactions, which strengthen trust and relational absorptive capacity in teams. Reciprocity emerges as a dominant theme in these relationships, serving to stress the importance of exchanging knowledge in both directions, thus spurring cooperation and creativity. Finally, it is crucial to foster more meaningful and frequent interactions with staff members originating from different regions and working in various fields of expertise to maximize Knowledge Exchange (KE) to positively impact project delivery and organizational adaptability in the context of a constantly changing global environment.

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The author reviewed the results and approved the final version of the manuscript.

Data Availability

No data was used to support this study.

Conflicts of Interests

The author declares that they have no conflicts of interest.

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