Q1. The target business analytics problem of your choice

Information sharing is a pivotal element in enhancing an organisation's competitive edge, necessitating seamless information flow among its members. Li and Lin (2006) underscore that the efficiency of information exchange is influenced by several contextual factors, including the industry type, organisational size and the specific nature of the organisational structure. Among these, organisational structure emerges as a crucial determinant that significantly influences the dynamics of information sharing.

Organisational structure is not simply a framework for allocating tasks and coordinating efforts towards achieving common objectives (Nene and Pillay, 2019). It also encompasses the complex network of relationships between individuals and positions within the organisation. This structure delineates the established patterns of interaction among organisational components, defining hierarchical connections and communication pathways essential for the organisation's effective functioning and the achievement of its goals (Darwin, 2017). Consequently, the structure of an organisation significantly influences the internal flow of information, either facilitating or hindering effective communication, which in turn impacts its competitive positioning.

Despite all this, the crucial role of a well-conceived organisational structure is often underestimated by organisations. The companies do not realise the potential benefits that may come from such design. This oversight is particularly evident in organisations structured in silo-like configurations, be it through vertical divisions or horisontal functions. According to de Waal *et al.* (2019), these organisational structures are prone to fostering cultural tribes – distinct communities within which individuals strongly identify, motivating them to commit to the collective goals of their teams or communities, and providing a sense of belonging. However, this segmentation can give rise to a silo-mentality, where groups, teams, or departments become insular, resisting the exchange of skills, knowledge, or information with other parts of the same organisation (Forsten-Astikainen *et al.*, 2017). This mentality hinders the organisation’s ability to operate as a unified entity, leading managers to focus solely on their department’s objectives. This working environment breeds personal conflicts, damaging politics and power struggles among unit leaders, undermining trust and collaboration. Consequently, employees adopt a defensive posture,

rallying within their silos and fostering an inward focus that neglects customer needs and stifles the organisation's adaptability and innovation (Dean, 2010).

According to a study conducted by Shakir *et al.* (2023) focused on the impact of silo mentality within the IT industry in Sri Lanka, it was found that siloed organisational structures obstruct the sharing of resources and information. This limitation hinders the identification of opportunities and threats, suppresses innovation, and leads to the inefficient use of resources and talent. Additionally, it demoralises the workforce, preventing the formation of meaningful inter-departmental relationships, contributing to a sense of isolation and leading to retention issues as employees become disengaged and contemplate leaving the organisation.

Q2. The justification for the choice of the problem

I chose this problem because cases like BlackBerry, Nokia, Kodak and the 2007–2008 financial crisis, among others, illustrate the pitfalls of siloed operations, including slow product development and neglecting customer needs (Nair *et al.*, 2014; Vinokurova and Kapoor, 2023; Tett, 2015). These are not isolated incidents but widespread challenges that jeopardise even established organisations. For instance, BlackBerry's practice of having its hardware, software and services divisions operate independently led to products that failed to meet evolving consumer expectations. This situation stresses the importance of fostering cross-divisional collaboration, adopting a customer-focused mindset, ensuring a cohesive strategy, and maintaining agility in the innovation process. Similarly, the financial crisis illuminated how structural divisions within organisations can veil potential risks and obstruct effective problem-solving, delivering lessons that are relevant across a variety of sectors. Hence, if departments do not communicate proficiently, it can cause misunderstandings about new initiatives and procedures, leading to a misalignment with the organisation's goals and impairing the efficacy of the organisational structure.

Accordingly, research has shown that by applying SNA within organisations, management is capable of identifying and implementing specific corrective measures to enhance communication and information sharing (Ryynänen, 2012). Leveraging insights from SNA allows organisations to grasp the nuances of their internal communication networks better, identifying and addressing any barriers or silos that restrict information flow. Strategic interventions can then be made to promote a more interconnected and agile organisational framework. The benefit of such measures is twofold: units within the organisation have the chance to learn from one another, benefiting from the new knowledge generated across different divisions. Encouraging the exchange of knowledge leads to mutual learning and collaboration between units, which in turn stimulates the generation of new ideas. This collaborative ethos is key to driving effective innovation, rapidly adjusting to market changes, and enhancing worker productivity (Senaratne *et al.*, 2023). Hence, this underscores the motivation behind my decision to explore this issue.

Q3. The network dataset suited to address the chosen problem

For the purpose of this report, let's consider a hypothetical international consumer goods company named GlobalHome, which operates in over 50 countries. GlobalHome has expanded through acquisitions and broadening its product range. Yet, this expansion has led to a complicated and compartmentalised company structure, hindering its ability to swiftly and effectively adapt to market shifts.

Challenges identified:

Complex and inefficient organisational structure: GlobalHome is divided into several divisions, like Kitchen Appliances, Personal Care, and Home Cleaning, as well as geographical regions like North America, Europe and Asia-Pacific. Each division functions independently with its own IT, HR and finance teams. This independence results in overlapping roles, inefficiencies and a bloated organisation that delays decision-making processes.

Slow innovation: siloed R&D operations hinder GlobalHome‘s ability to innovate quickly, and respond to market trends swiftly.

Inconsistent brand image: varied marketing strategies across regions and product lines have fragmented the GlobalHome brand, weakening its global market positioning and leveraging capabilities.

The goals of this initiative include:

Boosting organisational efficiency: by improving communication flows and streamlining the organisational structure, we aim to eliminate unnecessary complexities and duplicate functions.

Encouraging innovation: we plan to enhance cross-departmental collaboration and support key innovators in the company to foster a culture of innovation.

Cultural transformation: by promoting a culture that values openness, flexibility, and continuous learning, we intend to make GlobalHome more adaptable and agile.

Enhancing brand consistency: ensuring a unified brand image across all divisions and regions.

To achieve these objectives, I propose using Social Network Analysis (SNA). This will require gathering comprehensive data on employees and their interactions within the company's network. I will collect the data through surveys, internal social media and collaboration platforms, and emails and electronic communication logs. The survey will be designed based on the Relational Coordination (RC) theory. RC theory posits that the coordination of work activities is facilitated through a network of relationships among participants engaged in a work process (Gittell and Ali, 2021). It identifies three critical relational attributes that enhance coordination and overall performance:

Shared goals: foster a collective vision beyond individual objectives.

Shared knowledge: enable understanding of how individual tasks integrate into the overall process, offering a holistic workflow perspective.

Mutual respect: promote an environment that minimises status distinctions, encouraging recognition and appreciation of each contribution.

These relational dimensions are complemented with communication characteristics central for supporting coordination and optimal performance: frequency of communication, timeliness, accuracy and a problem-solving approach in the face of challenges, as opposed to attributing blame. These factors enable a unified understanding of each participant's role, facilitating effective, relevant and urgent cross-functional communication. The RC theory also clarifies that these relational dimensions are based on task-related connections between work roles, not on personal relationships, highlighting the emphasis on professional interactions over personal ones.

Here’s how I will structure the elements of such a network dataset using RC theory.

Nodes will represent the individuals within the organisation and edges the interactions between these individuals.

Moreover, both nodes and edges will possess various attributes, some of which can be quantified using a 5-point Likert scale where applicable. These attributes are:

Department: this attribute aids in identifying potential silos within the organisation.

Role: defines the employee's job role, crucial for understanding communication context.

Tenure: influences an individual's network position and relational coordination attributes. Longer tenure might correlate with stronger connections or central roles in the network, contributing to the core-periphery structure or small-world properties.

The edges will also have attributes that reflect the nature of the interactions based on the RC survey questions, like:

Frequency of communication: reflects how often employees communicate. This can be used to classify the strength of connections.

Timeliness and accuracy of communication: indicate the responsiveness and reliability of information exchange, respectively. These attributes are weighed to understand the quality of interactions between nodes.

Problem-solving communication: shows whether interactions are collaborative or blame-oriented, essential for assessing the overall health and effectiveness of communication within the organisation.

Shared goals, knowledge and mutual respect: these reflect the degree to which employees are aligned in their objectives, understand each other's roles and respect contributions.

Q4. Main steps of the analysis

The main steps of the analysis would include the following:

1. Data preparation and network construction

Objective: ensure data accuracy and uniformity.

Activities: clean and organise data for analysis.

Construct the network with employees as nodes (with attributes like department, role, and tenure) and their interactions as edges (characterised by communication frequency, timeliness, accuracy, and nature).

2. Exploratory network analysis

Objective: understand the basic structure and identify immediate areas for intervention.

Activities: analyse degree distributions to identify key individuals and potential bottlenecks.

Use K-means clustering to detect organisational silos and examine intra- and inter-departmental collaboration levels.

Apply core-periphery analysis to find hubs of activity and information.

Investigate communication directionality for insights into hierarchical and collaborative patterns.

Employ community detection (like Louvain method) to see how shared goals, knowledge and respect foster collaboration.

3. Advanced analysis for strategic insights

Objective: dive deeper into dynamics that influence network efficiency and innovation.

List of activities: homophily and preferential attachment analysis, diffusion analysis, and cascade detection and benefit mapping.

4. Time-varying analysis for dynamic adaptation

Objective: establish a mechanism for continuous improvement and adaptation.

Activities: perform regular time-varying analyses to capture changes in network structure and dynamics over time.

Use these insights to adjust strategies, fostering an agile and responsive organisational network.

Q5. The justification for each step

Data preparation and network construction

This step ensures that the analysis is based on accurate, complete and harmonised data by systematically handling missing values to prevent biases or inaccuracies, organising and cleaning the data, and converting qualitative survey responses into quantifiable metrics. Such preparation lays the groundwork for constructing the directed network and applying SNA techniques.

Exploratory network analysis

SNA underscores the need to comprehend the context in which individuals or groups operate to predict behaviours accurately. This emphasises the organisational need to understand interpersonal systems and their influence on workplace dynamics as the success of organisational changes hinges on these social dynamics(Aggrawal and Anand, 2022).

In our directed network analysis, we employ degree centrality metrics, incorporating job role attributes, to elucidate the influence and connectivity patterns of nodes—individuals or departments. This approach discerns between in-degree and out-degree centrality, providing a nuanced view of communication flows. In-degree centrality highlights nodes as prominent receivers (authorities) of information, indicating their potential role as knowledge or information gatekeepers. Conversely, out-degree centrality identifies nodes (hubs) adept at disseminating information, reflecting their active role in communication.

By mapping these centrality measures against job roles, we gain a deeper understanding of the organisational hierarchy and collaborative dynamics. Further, analysing the degree distributions helps to determine if the network follows a scale-free structure, characterised by a power-law distribution, revealing the network's resilience and the strategic importance of hubs and authorities in information flow and innovation diffusion.

The spread of complex information and the facilitation of behaviour change demand a network structure that balances dense local clusters with broader connections that act as bridges for information flow. Highly connected networks without subgroups may efficiently spread simple

information but often lack the localised social reinforcement needed for complex ideas and innovations to take hold.

This justifies our strategic approach combining K-means clustering, core-periphery analysis, and community detection. These methods synergise to unravel the intricate web of interactions within our organisation, pinpointing both strengths and areas for improvement. K-means clustering is our starting point, identifying clusters of employees who interact frequently within their group but rarely outside. This step is crucial for spotlighting silos. Core-periphery analysis complements this by differentiating between highly connected nodes, or hubs, central to our activity and information flow, and less connected, peripheral nodes. This differentiation is vital, highlighting both the influencers within our network and the outliers who may require more integration. Building on this foundation, community detection dives deeper, identifying groups within our organisation bound by shared goals, knowledge and mutual respect. Recognising these communities is key to fostering a unified culture that prizes collaboration and innovation, aligning with GlobalHome's ambitions for a transformative cultural shift.

We continue our analysis by analysing homophily (the tendency of individuals to associate with similar others) and preferential attachment (the tendency to connect with well-connected individuals) as they provide insights into the underlying mechanisms of network formation and evolution within GlobalHome. Understanding these patterns helps identify potential bottlenecks or resilience issues within the organisational structure. For example, excessive homophily can lead to silos, hindering cross-functional collaboration, while preferential attachment might concentrate information and influence within a small group, potentially stifling innovation and diversity of thought. Addressing these dynamics is critical for promoting a more inclusive, collaborative and innovative organisational culture.

Subsequently, we perform diffusion analysis to better understand how organisational changes, policy adjustments or the introduction of innovations spread within the organisation. This process helps GlobalHome identify both the key influencers who significantly impact the spread of these innovations and the obstacles that may slow down their adoption. Consequently, the company can strategically support these influencers, customise its communication and tackle any hindrances, thereby accelerating the adoption of beneficial organisational changes.

Once we've analysed how new organisational ideas or practices spread across GlobalHome, we'll next focus on cascade detection. This involves pinpointing the initial actions that set off sequences of responses throughout the organisation. Identify these triggers enables us to understand how information or behavioural patterns evolve into cascades. This insight is crucial for GlobalHome as it helps refine strategic communication and intervention plans, ensuring that essential innovations and practices are disseminated effectively.

Concurrently, benefit mapping plays a pivotal role in comprehensively analysing the realisation and distribution of advantages stemming from organisational changes, policy adjustments or the introduction of innovations. By pinpointing areas where anticipated benefits are effectively materialising—and identifying sectors that may not be fully capitalising on these changes—GlobalHome gains the insights needed to make precise adjustments. This ensures that all departments are aligned with the overarching business goals and actively contributing to the organisation's enhanced performance and efficiency. Undertaking this step is crucial for optimising the returns on investments in various initiatives and propelling continuous organisational advancement.

Q6. Set of possible actionable business analytics emerging from the project

Armed with these insights, we have designed targeted interventions to bridge the identified gaps that aim to foster an environment conducive to organisational learning and knowledge exchange. Let’s assume that from K-means clustering analysis, we've identified clusters of employees who interact frequently within their group but rarely outside it, revealing silos within our organisation. To counteract these silos, we will initiate cross-functional projects and innovation challenges. These initiatives require collaboration across different clusters, facilitating a blend of diverse perspectives and directly tackling the issue of siloed knowledge. This approach is crucial for fostering a culture of innovation. Moreover, thanks to the insights from the core-periphery analysis, we will engage central influencers in mentorship programs, empowering them to disseminate innovative ideas and practices throughout the organisation. For peripheral nodes, we'll implement targeted integration initiatives, such as shadowing programs and participation in key projects, to enhance their connectivity and engagement. Community detection has allowed us to identify groups within our organisation bound by shared goals, knowledge and mutual respect. Recognising these communities, we will design targeted communication and professional development programs. These efforts will promote a unified culture that values collaboration and innovation.

To mitigate identified homophily and preferential attachment issues, we plan to implement diversity and inclusion training, encourage participation in cross-departmental initiatives and create platforms for underrepresented voices. This strategy ensures a balanced network that supports healthy information flow and diverse idea generation.

With the insights and actions derived from our analysis, we will establish continuous monitoring through regular network analyses and feedback mechanisms. This allows us to measure the impact of our interventions and make necessary adjustments. As GlobalHome’s organisational network evolves, so too will our strategies. This adaptive approach ensures that we remain agile and responsive to both internal and external changes, continuously fostering a culture that is collaborative, inclusive and innovative.

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