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Empirical social network analysis in sustainable supply chain in Vietnam

Dr Mohammadreza Akbari
School of Business and Management, RMIT University, Ho Chi Minh City, Vietnam
Email: reza.akbari@rmit.edu.vn

Dr Steven Clarke
School of Business and Management, RMIT University, Ho Chi Minh City, Vietnam
Email: steven.clarke@rmit.edu.vn

Duy Dang Pham Thien
School of Business and Management, RMIT University, Melbourne, Australia
Email: duy.dang@rmit.edu.au

Associate Professor Dr Mathews Nkhoma
School of Business and Management, RMIT University, Ho Chi Minh City, Vietnam
Email: mathews.nkhoma@rmit.edu.vn

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ABSTRACT

Acclimatisation of sustainable practices is becoming widespread in the supply chain network due to the expanding global awareness of ethical responsibilities to the economy, society and the environment. Existent literature discloses that there is a strong research highlighting information sharing and transparency between companies and negligible practices within supply chain networks. Research to date has focused predominantly on large companies in developed countries, while ignoring developing countries including Vietnam. To explore the implications of information sharing and transparency on sustainable supply chain proficiencies, this paper exploits social network analysis (SNA) to investigate information sharing flows between staff in Vietnamese industry. The proposed research will motivate academic researchers, managers, and have implications for enterprises who are cultivating sustainable supply chain practices.

Keyword: sustainability, supply chain management**,** social network analysis, information sharing, information exchange, transparency, Vietnam

INTRODUCTION

In the last twenty five years, the importance of supply chain management increased significantly due to globalisation (Konig & Spinler, 2016). The definition of supply chain management refers to the planning and control of the end-to-end processes of products or services to the end costumer (Christopher, 2016; Melo, Nickel, & Saldanha-da-Gama, 2009, Varsei, Soosay, Fahimnia, & Sarkis, 2014; Winter & Knemeyer, 2013). Due to the complexity of today's supply chains, businesses are more and more concentrating on the social, environmental and economic interests of the societies (Schaltegger & Wagner, 2006) by undertaking sustainable plans to moderate the negative influence of their operations on the environment and community (Carter & Easton, 2011). At the supply chain level, numerous researches show the increased participation of the organisation to implement the sustainable code of conduct for purposes of reporting and performance measures (Keating, Quazi, Kritz, & Coltman, 2009; Soosay, Fearne, & Dent, 2012; Moscardo, 2013; Varsei et al., 2014). Developing sustainable markets reflective of increasing customer awareness in economic, social, and environmental performance, including information sharing and transparency have become critical performance tools in sustainable supply chain management (Varsei et al., 2014).

Social network analysis (SNA) is an integrated and multidisciplinary research approach with a focus on evaluating the relationship of social networks and the impact on various social phenomena within the structure, based on "core concepts and processes" allowing for appropriate measurement and representation of the social network being studied (Butts, 2008). Further, mapping and measuring the flow of information between people, groups, organisation and/or any other forms of connecting information/knowledge units while associating the people and groups (nodes) and their relationships or interaction (links).

Information sharing creates competitive value, augments strategic impact (de Mattos & Laurindo, 2015), and furthers the exchange of essential intelligence, which may be commercially profound, to assimilate the collaboration between supply chain players. Quality decision making is dependent on timely, precise and germane information concerning supply and demand. Information sharing/exchange supports costs reductions, enhanced quality, improves responsiveness relative to customer's requirements and satisfaction (Chopra & Meindl, 2015; Christopher, 2016).

Researchers and scholars have suggested numerous laws and regulations that impose the businesses to reveal evidence of how they treat their employees (Doorey, 2011; Estlund, 2009; Williams, 1999). The law in regard to information transparency is already legislated in Australia that expects businesses to disclose the identity and location of their supply chains (Marshall, 2010; Rawling, 2006).

The purpose of this paper is to promote information transparency in sustainable supply chain. Many organisations in developed countries benefits from involvement in sustainable supply chain in a global market, as a successful method for meeting customer satisfaction. However, organisation from developing countries face challenges due to lack of experience in their operational expertise. Research into information transparency and sustainable supply chain in Vietnam, where an absence of specified academic literature exists, could provide new insights into sustainable supply chain practices and challenges not only for Vietnam, but possibly for other similar marketplace. To tackle this issue, the researchers will attempts to response the following research question

RQ1 – How social network analysis (SNA) can be implemented to understand information sharing and transparency practices of sustainable supply chain management (SSCM) within organisations?

To address RQ1 the researchers will begins with the current theoretical aspects of information transparency and sustainable supply chain. The rest of this paper will discuss the practical and theoretical implication of information transparency approach, as well as, future direction in sustainable supply chain discipline.

SUSTAINABLE SUPPLY CHAIN

Supply chain development following the mid 1990's significantly intensified among researchers and professional (Konig & Spinler, 2016). Supply chain management is defined as the planning and control of a series of activities from raw materials to the final goods or services delivered to the customer (Christopher, 2016; Melo et al., 2009; Winter & Knemeyer, 2013). Globalisation has contributed to increased complexity and cost associated with strategic supply chain management (Janvier-James, 2012; Konig & Spinler, 2016). As a result, Christopher (2016) argues that

competition in today's global market strategy has evolved from enterprise versus enterprise, to supply chain versus supply chain. Competition in today's evolving global business ecosystem requires more conscientiousness and responsibility to society, environment, and economy (Singh & Trivedi, 2016; Varsei et al., 2014), by undertaking sustainable plans to eliminate negative influences of their operations on the environment and community (Carter & Easton, 2011). Sustainable supply chain management is a systematic coordination of the business processes that integrate and achieve social, environmental, and economic goals for improving organisational long term supply chain performance (Carter & Rogers, 2008). Sustainable supply chain management is a rapidly growing discipline for research and practices (Ashby, Leat, & Hudson-Smith, 2012).

Varsei et al. (2014) introduced a comprehensive framework for sustainable supply chain management, by considering social, environmental, economic objectives and performance measures (see Figure 1).

Figure 1: Sustainable Supply Chain Framework

Economic and Business Performance Measures: Profit maximisation or cost minimisation has been the conventional emphasis on the economic attributes of the supply chain (Shapiro, 2007). Supply chain costs can include transportation, procurement, production, warehousing, back order and lost sales (Chaabane, Ramudhin, & Paquet, 2012; Fahimnia, Reisi, Paksoy, & Ozceylan, 2013a; Fahimnia, Sarkis, Dehghanian, Banishashemi, & Rahmanh, 2013b).

Environmental performance measures: Incorporating environmental concerns in supply chain management comprised of:

- Greenhouse gas (GHG) emissions (Paksoy, Bektas, & Ozceylan, 2011).
- Waste generation (Tsai & Hung, 2009) and usage (Brent, 2005)
- Energy consumption (Cholette & Venkat, 2009).
- Hazardous and toxic materials (Hsu & Hu, 2009)

Social performance measures: Chaabane et al. (2012), and Seuring (2013) stated that social performance measures are difficult to incorporate in supply chain models; however, Varsei et al. (2014) adopted a weighted approach to quantify social performance.

At the supply chain level, abundant research and literature reflects an increased participation within the organisation to implement a sustainable code of conduct for proposes of reporting and performance measurement (Keating et al., 2009; Soosay et al., 2012; Moscardo, 2013; Varsei et al. 2014). The history of sustainable supply chain and information transparency magnified exponentially when Nike Inc. surprised the competition by publishing their complete set of records of its worldwide suppliers on its website in April 2005, followed by Levi-Strauss in October 2005 and then Timberland, Puma, Adidas and Reebok (Doorey, 2011). In developing sustainable markets with increasing customer awareness in green environment and corporate social responsibility (CSR), information transparency has become an ethical supply chain attitude for many organisations. Corporate social responsibility (CSR) refers to the integration of company's operations with social, environmental, and economic concerns on a voluntary basis (Manning, 2013). Information transparency is an element of sustainability enhancing the company's position in their supply chain while cooperating with other firms, for the purpose of mutual business growth (de Mattos & Laurindo, 2015).

Information sharing transparency in a sustainable supply chain context requires a blend of "sociocentric" and "egocentric network analysis".

- Sociocentric networks are whole/complete networks, resulting in one overall network perspective. The research question is about different patterns of interaction within defined groups.

- Egocentric are personal networks resulting in stand-alone or individual networks. The research question is about phenomena of or affecting individual entities across different settings. (Halgin & DeJordy, 2008)

There are nine important theories in sustainable supply chain management, identified by Sarkis et al. (2011), and Carter and Easton (2011); Resource-based theory (RBT), transaction cost economics

(TCE), stakeholder, institutional, resource dependence, ecological modernisation, information, and social network.

THE SOCIAL NETWORK ANALYSIS APPROACH

Social network analysis (SNA) as a research field exhibits four key characteristics, including: (1) the motivation to study the ties that link network actors together; (2) the systematic collection empirical data; (3) the use of graphic imagery; and (4) mathematical or computational models (Freeman, 2004). Social network analysis methods have been applied widely in the social science fields (Borgatti & Foster, 2003) and recently in the supply chain management areas (Borgatti & Li, 2009).

This approach differs from the traditional research approach in that it puts emphasis on the network ties as the main unit of analysis, thereby allowing in-depth investigations into the social context of the network actors (Otte & Rousseau, 2002). The network ties can have numerous qualities (e.g., strong or weak), and represent several types of social interactions and relationships (e.g., sharing information, influencing behaviors, attending the same events, having similar age, friendship, and acquaintance, etc.). An example of a social network, as studied by Hawe, Webster, and Shiell (2004), is shown in figure 2 below.

Figure 2: Graphical display of an interorganisational network with 19 actors

Researchers can collect network data from human actors by using sociometric surveys and other methods (e.g., interviews), which ask the participants to list out or nominate other participants who engage with them in a relationship or interaction (Borgatti, Everett, & Johnson, 2013). For example, we may survey all employees within a supply chain firm and ask them to nominate the names of the colleagues who often provide them advice about how to perform SSCM practices, or those who can influence the participant's SSCM practices. Depending on the contexts, whole-network survey can be used to capture the relationships and interactions among actors of the same community; or researchers may be more interested in capturing only the types of support possessed by each individual actor (i.e., ego-network design) (Borgatti et al., 2013). In the former case, network surveys that require

nominating real names may be perceived as sensitive and intrusive, which can affect the response rate, and techniques to alleviate such issues are recommended (Borgatti et al., 2013).

Network data are formally presented in the matrix form, where the presence of a network tie is indicated by a value in a cell between the row and the column actors. On this basis, matrix algebra can be applied to calculate various features of the actors and the entire network. For instance, the density of a network is the ratio of the existing ties over the total number of possible ties, which indicates the overall connectedness of the network (Otte & Rousseau, 2002).

Degree centrality is another fundamental measure that characterises individual nodes, which can be calculated by summing the number of network ties that directly connect with a node (Otte & Rousseau, 2002). Depending on the research setting, a node possessing a large measure of degree centrality may be interpreted as a key member of a network (e.g., can share information with or influence many others). Another centrality measure that reflects the prominent status of individual nodes is Eigenvector (for undirected networks) or Beta centrality (for directed networks), (Borgatti et al., 2013). Specifically, these measures evaluate a node's prominence, not only by its sum of direct connections, but also by how well-connected the node's neighbors are (Borgatti et al., 2013). Therefore, an actor in a network, sharing information may not appear as influential when only their direct ties are counted; but the actor can greatly influence the full network by leveraging the connected people to disseminate their information further. The readers are referred to Borgatti's (2005) research for other types of centrality measures and their applications.

APPLYING SNA TO STUDY THE EMPLOYEES' EXCHANGE OF INFORMATION ABOUT SSCM PRACTICES

Having explained the SNA approach, we proceed with elaborating the types of SNA research and how to conduct these research types in the following sections.

4.1. Types of SNA research

In order to answer the research question for our study, it is imperative to understand the analytical capability of SNA methods, especially in the areas of information sharing and organisational research. The adoption of SNA methods to investigate organisational phenomena was proposed by Tichy et al. (1979) in the early days, which focuses on analysing the social structures and individual's leadership

behavior in the workplace. Fombrun (1982) further outlined three research directions when analysing organisational networks, which aim at explaining: (1) the benefits that individuals receive from their social position (i.e. focusing on the nodal attributes); (2) the changes in the social interactions' quality (i.e. focusing on the network ties); and (3) the evolution of the social structures as a whole (i.e. focusing on the triads).

Contemporary SNA research was argued to fall into four types: (1) structural capital; (2) resource access; (3) convergence; and (4) contagion (Borgatti & Foster, 2003). Specifically, the first type of SNA research focuses on the influence of the actor's network position and personal networks (i.e., ego-network) on their characteristics (e.g. performance, satisfaction). The second type is also interested in understanding such effects, while emphasising the resources delivered to the focal actor's through his or her connections with others (i.e., focusing more on the network ties and flows). The third type utilises concepts concerning the network structures such as structural equivalence and centrality to deduce the reasons why there are commonalities in similar environments (e.g., why people holding similar positions behave similarly). Last, the fourth type aims at understanding the mechanisms that shape individuals' perceptions and behaviors via social interactions (i.e., contagion).

Most recently, Carpenter, Li and Jiang (2012) categorised organisational network research into two primary themes; social capital, and network development research. Moreover, they specified that these two themes may be conducted at the interpersonal (i.e., between individuals) and interorganisational levels (i.e., between organisations). Similar to Borgatti and Foster's (2003) first and second types of network research, Carpenter et al.'s (2012) category of social capital network research includes those that are interested in the inter-relationship between the network's features (e.g., centrality measures, structures) and the actor's gains or benefits. More importantly, researchers conducting social capital network research may choose to analyses the network's features and individual's characteristics as predictors or predicted variables. On the other hand, network development studies investigate the unique patterns of the social networks and the underlying mechanisms of their evolution.

Such network development research (Carpenter et al., 2012) would be similar to another research stream in the SNA field, which focuses on designing and monitoring network-based interventions in

the form of an organisational change program. Notable research of this stream includes those that modified organisational networks that facilitate knowledge exchange (Cross et al., 2002; Hatala & Lutta 2009; Parise 2007); develop communities of practices (Cross Laseter, Parker, & Guillermo, 2006); and accelerate the institutionalisation of desirable workplace's culture (Cross, Johnson-Cramer, & Parise, 2009). Moreover, researchers have also developed strategies to guide these network-based change programs (Valente, 2012; Valente & Pumpuang, 2006; Valente & Davis, 1999).

4.2. Network research directions for examining SSCM practices within organisations

In line with the network research modes as elaborated above, we propose in this section, research directions that make use of the SNA methods to investigate and improve SSCM practices within organisations. By doing so, we answer our research question:

> "How social network analysis (SNA) can be implemented to understand information sharing and transparency practices of sustainable supply chain management (SSCM) within organisations?"

We selected Carpenter et al.'s (2012) taxonomy that categorises network research into social capital and network development research. Moreover, we focus on the organisational SSCM practices at the individual level rather than the organisational level, even though our proposed research directions could be applied at both levels without issues.

As described in the previous section, SNA methods analyse social networks based on the core concepts of nodes and ties (Borgatti et al., 2013; Otte & Rousseau, 2002). This approach allows researchers to calculate measures that capture structural features of the nodes (e.g., degree centrality) and the whole network (e.g., density, centralisation, and reciprocity). In our context, the nodes can represent the employees with their characteristics in the organisational environment (e.g., age, gender, seniority, tenure), while the network ties can describe a plethora of work relationships (e.g., to whom reporting, assigning to the same projects) and interactions that relate to SSCM practices (e.g., sharing information about/influencing others' SSCM practices). On this basis, an employee's degree centrality measure, which is their sum of direct network ties sent to or received from others, and reports the number of colleagues that the employee can directly reach to in the networks focused on information

sharing or influencing SSCM practices, thereby indicating the influential status of that employee. On the other hand, researchers can calculate the density and centralisation of those networks, which informs the activeness of the employees' engagement in exchanging information about or influencing SSCM practices, or the level of hierarchy in such networks. As a result, network researchers can use these structural features to conduct various network analyses as follows:

To begin with, researchers pursuing social capital research directions in our context, may be interested in finding the mechanisms that lead to the employees' exchange of information about SSCM practices. To this end, there are inferential network analysis techniques such as multiple regression quadratic assignment procedure (Borgatti et al., 2013) and exponential random graph modelling (Robins, Pattison, Kalish, & Lusher, 2007) that examine the co-occurrence of network ties, allowing researchers to determine the relationships or interactions that can motivate such information exchange. Ashforth (1985) and Weick (1995) discuss that employees have a constant need to make sense of their work environment, especially by engaging in the workplace's socialisation with others, to reduce ambiguity (i.e., too much overlapping information) and uncertainty (i.e., ignorance caused by lack of information). Moreover, Saint-Charles and Mongeau (2009) found that employees tend to reduce ambiguity by seeking advice from trusting friends in the workplace; while colleagues with expert knowledge were sought for reducing uncertainty. On this basis, it would be interesting and practical to determine which types of workplace contacts are more favorable when it comes to seeking advice to enhance SSCM practices.

While the above example explains the SNA methods that predict sharing information about SSCM by using other network ties (i.e., trusting relationship and seeking expert advice), researchers may examine the impacts of ego-network's features on individual's characteristics as well. For instance, network researchers in other fields have been examining the effects of social embeddedness, or the contextual features that surround each individual, and the individual's actions (Carpenter et al., 2012). Uzzi (1996) and Coleman (1988) suggested that individuals who are heavily embedded in a cohesive network, which is facilitated by strong ties and reciprocity between actors, would feel the heightened normative pressure that encourages cooperation. Likewise, researchers may calculate the density of individual ego-networks, which informs the level of support and availability of immediate resources

possessed by individuals (Sykes, Venkatesh, & Gosain, 2009). In our context, researchers can use social embeddedness and level of personal support, to predict the employee's performance of SSCM practices and their behavioral intention.

Furthermore, researchers can collaborate with industry partners in network development research, where they can design and implement network-based interventions to improve the workplace's SSCM practices. A common strategy to modify organisational networks is to make use of influential opinion leaders, and have them diffuse the intended agendas within the workplace (Valente, 2012). The researchers and collaborating practitioners may conduct SNA and calculate a wide range of centrality measures to select influential opinion leaders for such diffusion. Besides degree centrality, which measures the immediate impact of an actor on their surrounding environment, there are Eigenvector/Beta centrality measures (i.e., described in the above section), betweenness centrality, and brokerage values, which can be effectively used to identify key players in the workplace (Borgatti, 2005; Gould & Fernandez, 1989). More importantly, by implementing and evaluating the effectiveness of network interventions (e.g., using opinion leaders) to enhance SSCM practices, researchers can come up with practical guidelines and metrics for improving organisational SSCM performance. For example, the idea of transparency can be measured via the number of network ties or density of the networks exchanging SSCM-related information. In an organisation where these measures are high, knowledge and advice emphasising SSCM practices are circulated efficiently within the workplace, and employees would be less concerned having access to the sources of this knowledge. Determining the optimal values of such measures used practically as metrics, suggests organisational objectives that demand network development research.

CONCLUSION

It has been ascertained that information sharing and transparency about SSCM practices can create competitive advantages for organisations. Our literature review suggests that there is a lack of empirical research that focus on these topics, especially from the network perspective. To address this gap, we proposed the adoption of the SNA approach to investigate the mechanisms related to the employees' sharing of information about SSCM practices in organisations. We elaborated on the details about the fundamental concepts of the SNA methods, how to collect organisational network

data, and the types of network research that can be conducted in relation to our context. Moreover, we provided examples of these research types and their analytical objectives, such as exploring the mechanisms of the employees' sharing of information about SSCM practices, or implementing and evaluating network interventions that improve organisational SSCM performance. We hope that our research would inspire future studies' adoption of the SNA methods to investigate and improve the employees' SSCM practices within their firms and the supply chain as a whole.

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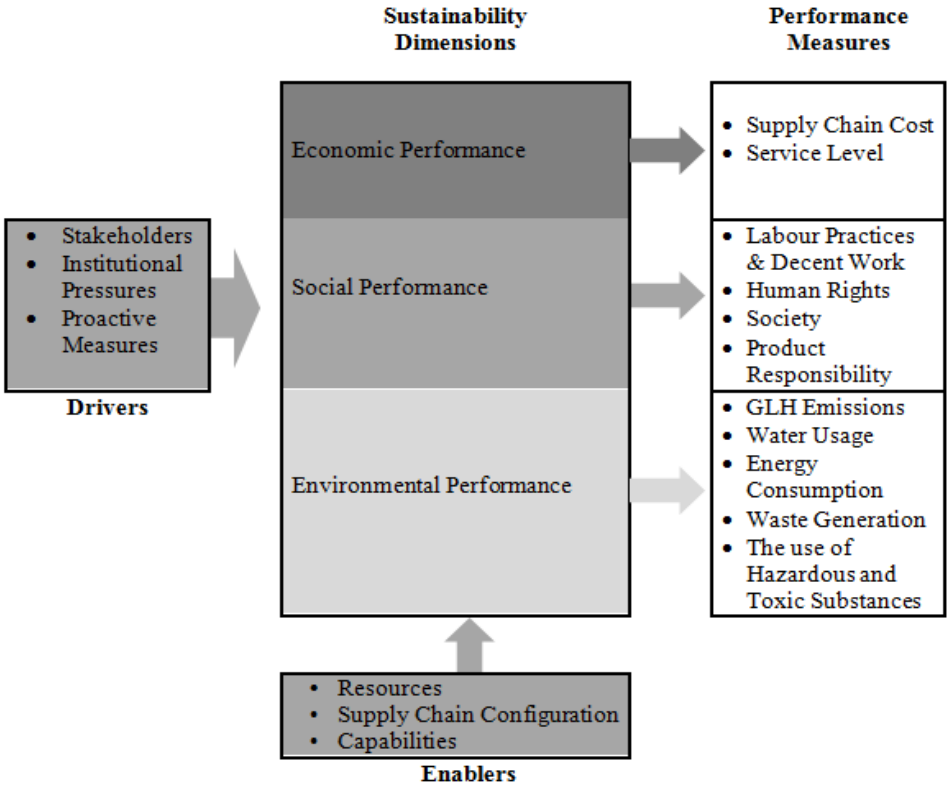
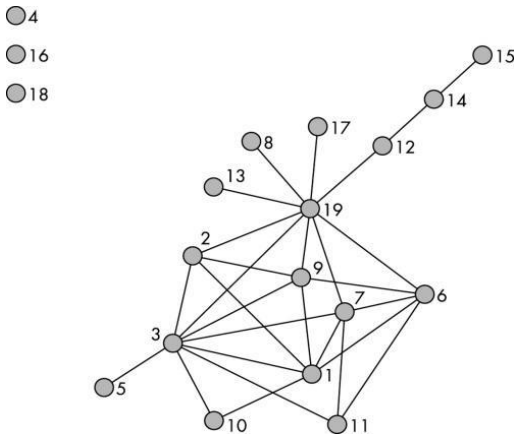
APPENDIX

Figure 1: Sustainable Supply Chain Framework



Source: Varsei et al. (2014, p. 248)

Figure 2: Graphical display of an interorganisational network with 19 actors



Note: 4,16, and 18 isolators

Source: (Hawe, Webster, & Shiell, 2004)