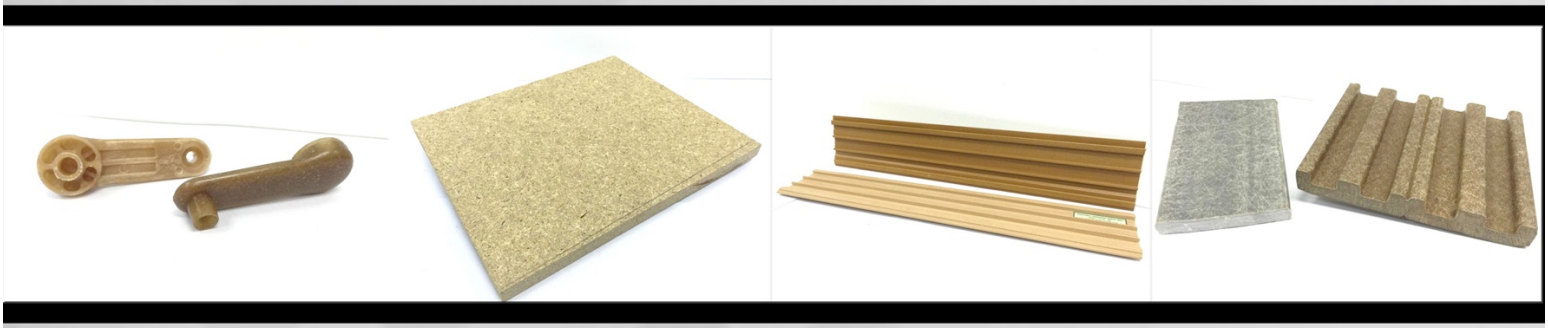
SUSTAINABILITY OF KENAF DEVELOPMENT

= *MOVING FORWARD*



Editors:

MOHD SHAHWAHID HAJI OTHMAN
AMIRA MAS AYU AMIR MUSTAFA
PARIDAH MD. TAHIR
AHMAD AINUDDIN NURUDDIN
FARAH MOHD SHAHWAHID
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Malaysian Environmental Economics Associations (MEEA)
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FOREWORD

PROF. DR. AZALI MOHAMED

DEAN, FACULTY OF ECONOMICS AND MANAGEMENT

UNIVERSITI PUTRA MALAYSIA

Kenaf is a new crop that has the potential to be an important raw material for processing into high value products that can generate export earning opportunities. Being a new industry, it needs intense research and development efforts both at the cultivation, fiber processing and product manufacturing. Kenaf products have high market potential to replace non-renewable product such as automotive components, building construction, furniture, aviation, pulp and paper among others.

This book covers a wide spectrum of topics from product developments, economics, social and environmental issues relevant to the Kenaf industry. The book has a chapter contributed by the joint authorship of the officers from the National Kenaf and Tobacco Board (NKTB) and researchers from Universiti Putra Malaysia (UPM) that provided the direction and challenges for the further development of the Kenaf industry.

It is my humble hope that this publication will serve as a useful future reference for the Kenaf farmers, industrial players, researchers and other individuals involved in Kenaf industry in Malaysia.

FOREWORD

PROF. DR, PARIDAH BT MD TAHIR

Director, Institute of Tropical Forestry And Forest Products

Universiti Putra Malaysia

Over the coming decades, the world will witness increased competition for limited and finite natural resources. The depletion of natural resources particularly petroleum, is transforming the world into a bioeconomy era as a response to key environmental challenges. A transition is needed towards an optimal use of renewable biological resources. We must move towards sustainable primary production and processing systems that can produce more food, fiber and other bio-based products with fewer inputs, less environmental impact and reduced greenhouse gas emissions. Malaysia is taking a challenge to develop kenaf as a substitute to non-renewable fibres. Kenaf has many advantages since it belongs to bast plants class where high-quality long fibres can be obtained and utilised for making various medium- and high-tech products. After almost ten years of supporting kenaf R&D, development and commercialisation, the government can now confidently declare that kenaf is a viable and valuable industrial material. Both the public and private sectors are becoming more conscious of kenaf and its potential.

This book is a compilation of intensive multidisciplinary research works on kenaf. The aim is to enhance the understanding of kenaf as a raw material in Biocomposite, pulp & paper, biopolymers manufacturing processess in Malaysia, and to be one of the main sources of reference on kenaf. The book is multidisciplinary in nature where science meets the social science which proven to be beneficial in escalating the impact of research and commercialisation. The content is simple and interesting for both fields of studies, and we expect more of its kind to be published in the future. Congratulations to all the editors and the contributors on their hard work!

ABOUT THE EDITORS

Mohd Shahwahid Haji Othman is a professor at the Faculty of Economics and Management, Universiti Putra Malaysia (UPM) and a research assoiciates at Institutes of Tropical Forestry and Forest Products (INTROP) and Institutes of Agriculture and Food Policy, UPM. He plays an active role in the implementation of the Environmantal Impact Assessment (EIA) processes at the Malaysian Department of Environment, either as an EIA government panel or as an EIA subject specialist consultant. He is also a committee member of the National Professorial Council's Natural Resource and Environment Cluster.

Amira Mas Ayu Amir Mustafa is a PhD student at the Institutes of Tropical Forestry and Forest Products (INTROP), Universiti Putra Malaysia (UPM). She holds a Bachelor of Economics and a Master of Science in Economics from UPM. Her research interests includes environmental economics, natural resources and policy, social network and life cycle analysis.

Paridah Md. Tahir is a professor and Director of the Institute of Tropical Forestry and Forest Products (INTROP), Universiti Putra Malaysia (UPM), Malaysia, a post which she has held since 2009. Her research has focused on natural fibre, wood adhesives and bonding, wood/fiber composites, and surface coating, and she has had extensive involvement in the wood-based sector, particularly in the area of biocomposites.

Ahmad Ainuddin Nuruddin, is a professor in Forest Microclimatology and Forest Fire Management at the Faculty of Forestry, Universiti Putra Malaysia and Deputy Director of the Institute of Tropical Forestry and Forest Products (INTROP), Universiti Putra Malaysia. His main research interest is forest fire, carbon and forest microclimatology. Currently he is active in forest fire, carbon and urban forestry research. Currently, he attached as a President of Malaysian Society for Arborist (PArM) and member of Institute Forester Malaysia (IRIM), International Society of Arboriculture (ISA) and International Society for Agriculture Meteorology (INSAM).

Farah Mohd Shahwahid is a lecturer in Commercial Law at the Faculty of Syariah and Law, Selangor Internasional Islamic College University (KUIS). She obtained her undergraduate degree LL.B from Internasional islamic University Malaysia (IIUM) and master degree (LL.M) at University Malaya.

Norfaryanti Kamaruddin is a research officer at Institute of Topical Forestry and Forest Products (INTROP). Qualified in Agribusiness, she accumulated more than 5 years research experience with UPM. She researches and writes in the field of green economics

Abdul Rahim Abdul Samad is associated professor at Faculty of Economics and Management, UPM and a research associates at Institute of Tropical Forestry and Forest Products (INTROP). His a member of international associations includes East Asian Association of Environmental and Resource Economics (EAAERE) and Economy and Environment Program for Southeast Asia (EEPSEA)

CONTENTS

CHAPTER 11

Analysing Social Network Relationship Between Important Stakeholder in Malaysia Kenaf Industry Using Social Network Analysis

Mohd Iqbal M.N.[1], Mohd Shahwahid H.O.[1,2], Amira Mas Ayu A.M.[1]

[1]Institute of Tropical Forestry and Forest Product, Universiti Putra Malaysia, Serdang, 43400 Selangor, Malaysia
[2]Department of Economics, Faculty of Economics and Management, Universiti Putra Malaysia, Serdang, 43400 Selangor, Malaysia

ABSTRACT

The purpose of this study is to show the current social network of stakeholders, interests and participation in Kenaf Automotive Industry by applying Social Network Analysis. The stakeholders are representatives from the supply chain side of Kenaf Industry. The social network study focused on the discrete ties (interaction flow) patterns for the industry and how these patterns can be used to manage the industry. This study revealed some important implications by giving a better insight into the supply network that can help researchers, policy makers and Kenaf industry itself. In using Social Network Theory for the framework of determining Kenaf Automotive Network, this study makes a significant theoretical contribution to Kenaf Industry and stakeholder perception literature.

Keywords: *social network analysis, stakeholder*

INTRODUCTION

Kenaf fibers have been used in board productions along with polypropylene as the composites of choice for door trims for vehicles such as Toyota and Ford (Discover Natural Fibers, 2009). The potential for Kenaf is further enhanced with the reported application of Kenaf fiber into the production of bio-composite products such as chipboard, fiberboard, Fiber- Reinforced Plastic Composite (FRPC), Kenaf-oriented board, anti-ballistic products and lightweight and high-performance products made for the automotive industry (ECER, 2010). In fact, the government has been hoping that Kenaf could transform into a new source of growth in Malaysia to diversify the country's commodities sector (ECER, 2010). The automotive sector appears as an attractive market for Kenaf to venture into as material for automotive composite.

To make sure the success of Kenaf fiber in automotive industry, there is a need to identify the stakeholders involved and their stakes/influences to the industry. Understanding the relationships between stakeholders, such as investors, employees, suppliers, distributors, customers, and partners, can help the industry to compete better in the marketplace (Hillebrand et al., 2015). Recent literature has shown that the collaboration between each stakeholder can help boost productivity and consequently help develop positive attitudes toward the industry (Mohd Shahwahid et al. 2013).

In the context of Kenaf development in automotive industry, greater linkage among stakeholders and their involvement towards raising Kenaf production and utilization could overcome various constraints faced by this industries. Social network has been shown to be an effective tool to understand the behavior of people by determining their informal institutional structure (Carlsson & Berkes 2005). Social networks can improve collaborative governance processes by facilitating (i) the generation, acquisition and diffusion of different types of knowledge and information about the systems under management (Bodin & Crona 2009; Isaac 2012), (ii) mobilization and allocation of key resources for effective governance (Carlsson & Berkes 2005; Sandström 2008) , (iii) commitment to common rules among actors fostering willingness to engage in monitoring and sanctioning programs (Dietz 2003; Scholz & Wang 2006), and (iv) resolution of conflicts (Hahn et al. 2006).

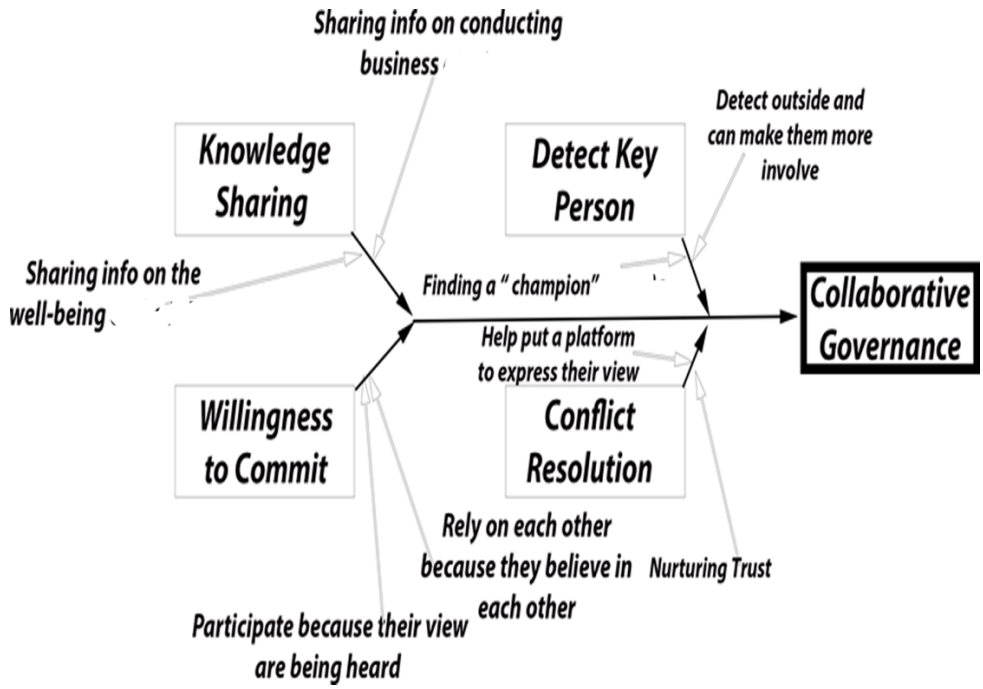

Figure 1: Social Network Mind Map

There are limited empirical studies mapping and investigating the interactions of stakeholders in the management and development of Kenaf, except for (Shahwahid O & Mas Ayu M, 2012). However, these studies tend to focus on the relationship between individual type of actors and not the overall supplier network. Work focusing on supply network lacks in interpreting the network metric in the context of Kenaf supply chain. Studies linking the actors recognized by the supply network and specifying their roles inside the network would provide a better understanding of Kenaf industry's supply chain.

This study's main objective is to show the current social network of stakeholders, interests and participation in Kenaf industry. The stakeholders are representatives from the supply chain side of Kenaf automotive industry from government, industry and plantation sectors. The social network study focused on the discrete ties patterns and how these patterns can be used to manage Kenaf automotive industry supply chain.

This study can help the policy maker in accomplishing its policy and goal towards sustaining Kenaf industry. With knowledge on the social network in the automotive industry the policy maker would be able to understand the issues, concerns, limits and opportunities the industry faced. Further to date, empirical social network analyses of automotive industry in developing countries like Malaysia are still limited, making this study helpful. In the next section, the network theory will be discussed to provide a foundation for identifying critical actors inside the social network of the automotive supply chain.

METHODOLOGY

Social Network Analysis analyses the relationship pattern inside a network. A network is a string of nodes that are inter-correlated with one another via ties (Borgatti & Li 2009; Kim et al. 2011). Nodes might represent a stakeholder, person or any agency that has an ability to make a choice. Ties have a content, ties can be friendship, cash flow, competition, knowledge sharing and many more (Crona & Bodin 2006; Bodin et al. 2006; Borgatti & Li 2009; Kim et al. 2011).

SNA can analyze the most influential individual or stakeholder inside the network by developing a range of network metric analysis. There are two levels for network metric analysis - nodes level and network level. Nodes level refer to the way an individual/stakeholder is characterized inside the network and network level analyzes the overall network ties observed from outside the network (Borgatti & Li 2009). The study focuses on three types of node level; degree, closeness and betweenness centralities and two types of network level; density and centralization. The next section of this paper will discuss the network metric analysis (Node level and Network Level) and how it will be linked to the study.

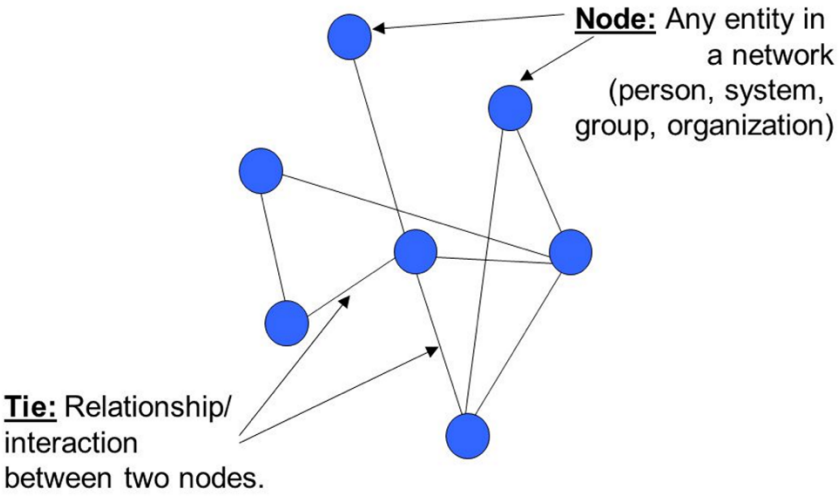

Figure 2: Relation in Network Analysis

Network Metric Analysis

This study focuses on information network ties- the network ties describe the suppliers' ties on communicating with each other regarding information that involves their business inside Kenaf Industry.

Node Level

SNA principles state that the position of individual/stakeholder inside the network displays the role of the individual/stakeholder behavior and well-being (Freeman, 1978; Wasserman & Faust, 1994). The position inside the network or in the network term; centrality, has been associated with social status, prestige and power and it is called position at the node level (Burt, 2001; Coleman, 1988; Freeman, 1978). There are many ways to calculate the centrality at the node level. The most common types being used in the literature are degree, closeness and betweenness centralities.

Degree Centrality

Degree centrality concept focuses on the number of ties connected between each node. The assumption is that when a node is connected to a large number of other nodes, the node has a

high degree centrality and the more nodes it is connected to, the more central and visible it becomes inside the network (Freeman, 1978). In this paper, a node with high degree centrality can influence other stakeholders inside the network on their operations or decisions as the stakeholder has more direct contact with others, while nodes with low degree centrality are considered peripheral in the network and removing this node has virtually no effect on the network (G. P. Cachon, 2003; G. P. G. P. Cachon & Lariviere, 2005). In term of information network ties, degree centrality can show: (i) which stakeholder has bigger influence than others, (ii) which policy making stakeholder should be reconciled with in developing a new law that might inflict a conflict because of the different interests of the stakeholders.

Closeness Centrality

Closeness centrality approach emphasizes the distance of an actor to all others in the network by focusing on the distance from each actor to all others. Depending on how one wants to think of what it means to be "close" to others, a number of slightly different measures can be defined (Freeman, 1978). From Kenaf industry context, stakeholders that have higher closeness centrality score can access high quality information while having a better ability in managing inventory and running at lower operational costs (Chen & Chen, 2010; Kim, Choi, Yan, & Dooley, 2011).

Betweenness Centrality

The final type of node level centrality measurement that will be used in this study is the betweenness centrality. Betweenness centrality measures how often a node lies on the shortest path between all combinations of pairs of other nodes (Kim et al., 2011). This measurement focuses on how other nodes are dependent on this node to reach out/contact other nodes inside the network. This node will have an intermediary role inside the network and with others relying on it. This makes the node central in the network. It is assumed the nodes with higher betweenness have a potential to exert control or influence the network because it has a great capacity to facilitate or constrain interactions between other nodes (Freeman, 1978; Kim et al., 2011).

Betweenness centrality in information network can show how the stakeholder with high betweenness has power to affect interaction among other stakeholders inside the network.

This happens because; the high betweenness stakeholder mediates many information pathways and thus can either smoothen or obstruct the network information. A stakeholder with high betweenness has control over others due to the leverage it has when it lies between two disconnected competing suppliers. They can control the price by playing the rivals between each other. (Choi & Wu, 2009; Kim et al., 2011; Wu & Choi, 2005).

At the network level, this study measures its performance by using network centralization (Bodin, Crona, & Ernstson, 2006; Scott, 2000). Network centralization is an extension of the node-level centrality, where a network with an unbalanced distribution of centrality will have a high centralization score and network with nodes that have the same number of connections have a low centralization score (Freeman, 1978). A network with too high or too low centralization measure will see that there is unbalanced distribution of power or control (Borgatti & Li, 2009; Kim et al., 2011). This study uses centralization based on degree, closeness, betweenness and density. Table 1 summarizes the definition and the formula used for measurement of the network both at the node and network levels. Table 2 shows the network level metrics and their implications for supply networks in this study.

Table 1 Social Network Analysis metrics definition and formula

Centrality	Definition	Formula
Density	How fast the information diffuses among the actors and the extent of the level of influence certain type of actor has inside the network.	$\sum \frac{i_a}{i_p}$ Where i_a is the actual number of ties inside the network and i_p is the number of possible ties inside the network.
Centralization	A network with too high or too low centralization measure will see that its distribution of power or control is unbalanced. Centralization has several indicators	
i.Degree	Number of other actors an actor is directly connected to	$C_D^{SN}(i) = \frac{d(i)}{n-1}$ for normalized node (node i) and $C_D^{SN}(G) = \frac{\lvert N(G)\rvert}{n-\lvert G\rvert}$ for a group node (node G)

ii.Closeness	The inverse of the distance of each actor to every other actor inside the network.	$$C_c(n_i) = \left[\sum_{j=1}^{g} d(n_i, n_j)\right]^{-1}$$
iii.Betweenness	Frequency with which an actor falls in between pairs of other actors on their geodesic (i.e., path of shortest distance between any two actors)	$$C_B^{SN}(i) = \frac{2 \times \sum_{i \neq j \neq k} \frac{p_{jk(i)}}{p_{jk}}}{(n-1)(n-2)}$$ for node i and $$C_B^{SN}(G) = \frac{2 \times \sum_{j<k} \frac{p_{jk(G)}}{p_{jk}}}{(n-\lvert G\rvert) - (n-\lvert G\rvert - 1)}$$ for a group of G nodes

Source: Social Network Analysis Handbook, 2005

The stakeholders involved with this study are categorized into seven types of stakeholders. This study began by identifying the important actors involved in Kenaf automotive industry, and then they were asked about their ties with other actors. Actors included in this study were the ones who are involved or affected by Kenaf involvement in automotive.

For the SNA, the questionnaire answers were inputted into a datasheet by following the SNA data entry system. UCINET and NetDraw softwares were used to analyze the network data in this study. The data was collected through field surveys using a standardized questionnaire.

Defining the boundaries of the network or choosing the right actors to include in the network has been a challenge of network analysis study. The boundaries of networks are unclear and hard to define. However, (Scott, 2000) has proposed three types of sampling to use in network study (positional, reputational and participation). This study used reputational sampling methods.

In the reputational sampling approach, everyone in the stakeholder list was interviewed, who then identified another for interviewing. Each person was asked the same questions and then they will identify another management personnel to be interviewed. The process continued until there were no new actors being recommended and the desired population targeted. This type of sampling allows the actors inside the network to set the network boundaries.

Sandström & Rova (2010) said that in network studies, this sampling reflects the actual population better than using informed experts. Further as (Scott, 2000) observed it will be too time consuming to generate relational data through observation since it is hard to expect the network size. Next, through the comprehensive interviewing process of nominated respondents, has helped complete the mapping of social relations of each study site to get the network structure.

RESULTS AND DISCUSSIONS

The network data are put as a binary adjacency matrix by making the stakeholders to represent both the rows and columns of the matrix (Wasserman & Faust, 1994). If there is a relation between two stakeholders linked by either information or material, the cell would equal to "1", while the cell would equal to "0" if there are no relation. The matrices were then imported into UCINET 6 program and are used as tools to value the network (Borgatti & Li, 2009; Kim et al., 2011). UCINET program is one of the most used tools for conducting network analysis, the program can measure dozens of network analytic methods and it can create network visualizations.

The stakeholder groups comprised of: Government Agency, Farmer, Automotive Industry, Malaysian Kenaf Manufacture, Automotive Manufacture, Researcher and Oversea Manufacture. A visualization of the network shown below in Figures 1. Table 2 shows the list of top five key stakeholders for information network at the node level. The stakeholders are identified by the centrality score they obtained for each type of centrality construct mentioned in Table 1.

Stakeholders who have the highest degree have a big impact on how other stakeholders behave inside the network as they can play a role as coordinators. These influencing factors can contribute to the way policies and laws are being enforced on the island. This result indicates that Kenaf industry rely on government entities to get any information regarding the way their business work.

The result of closeness centrality shows that Kenaf industry are not open in sharing information between them. Researcher have higher informational independence that they play

the navigator roles in leading their network in offering needed tourism services. Stakeholders with high scores in betweenness can play a role as brokers for the networks. From the result, government can play a broker role in this network as they have control over the interaction among other suppliers inside the network. Therefore, it appears that to better contribute towards increasing the practice of sustainability, this stakeholder need to be approached by policy makers to ensure that the trade information is flowing smoothly.

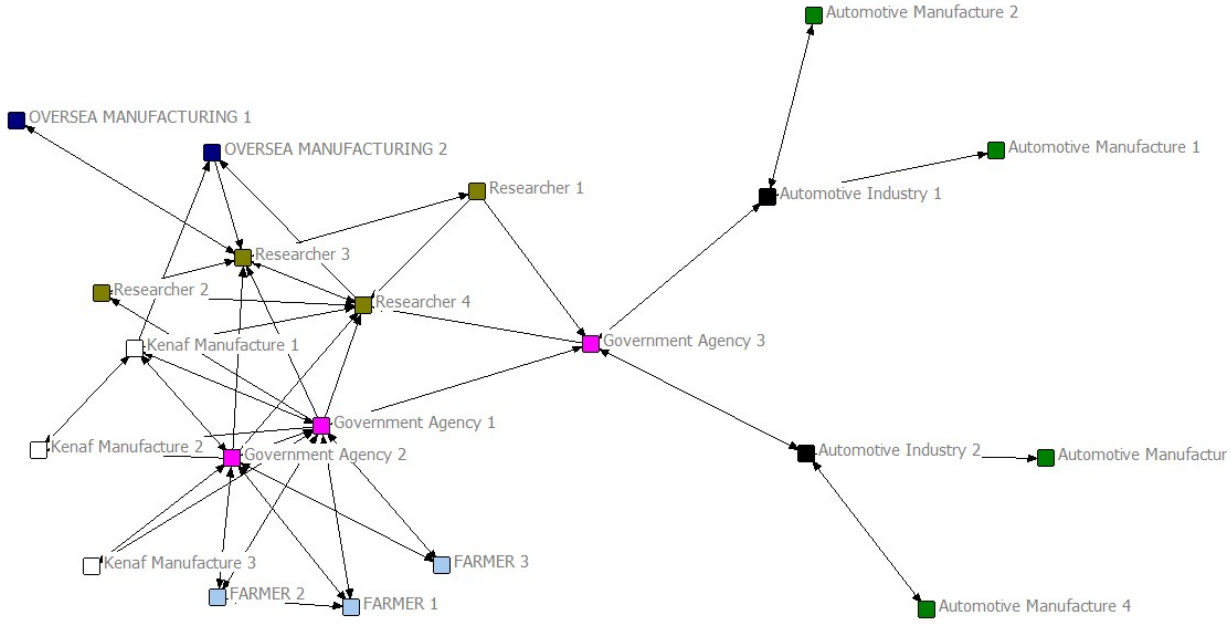

Figure 3: Kenaf Automotive Industry Network

Table 2: List of top five stakeholders based on information network

Top five Stakeholders	
Degree Score	
Government Agency 1	11
Government Agency 2	9
Kenaf Manufacture 1	5
Government Agency 3	4
Researcher 3	4
Closeness Score	
Researcher 4	54.054
Government Agency 3	48.780
Researcher 3	45.455
Government Agency 1	43.478
Researcher 2	41.667
Betweenness Score	
Government Agency 3	239.00
Government Agency 1	183.83
Researcher 3	103.83
Researcher 3	75.00
Automotive Industry 1	74.00

Table 3: Network-level results for information network.

Network Measures	**Score**
Number of Ties	64
Network Density	0.152
Average Degree	3.048

Average Closeness	35.103
Average Betweenness	39.238
Centralization (Degree)	41.750%
Centralization (Closeness)	40.84%
Centralization (Betweenness)	53.82%

CONCLUSION

This study suggests that policy makers should involve important stakeholders in decision making processes. Policy makers need to educate the stakeholders and convince them of the benefits on sharing information by convincing the stakeholders with high centrality scores to join the effort. With joint knowledge and awareness among the stakeholders, there will be greater levels of acceptance and more favourable perceptions of the Kenaf industry.

SNA plays an important role for the policy makers to understand their suppliers and can aid policy makers to incorporate greater sustainability ideas into the activities of the suppliers. This can enable greater synchrony between suppliers and policy makers. With the visualization of the relationship in the supply chain network, policy makers can see a more realistic picture of the network patterns and the dynamics of the suppliers. SNA network maps can help policy makers in planning and monitoring changes in the network because it provides its own methodological frame for collecting and organizing data.

This study is limited in ways that suggest opportunities for future research. This study is specific to only one type of industry (Kenaf industry) and one type of manufacturing (automotive). It might not be reasonable to conclude that this study as a general statement on the network of every Kenaf automotive industry in Malaysia. This study has also not been able to provide an ideal network model of Kenaf management. The study has shown that an integrative management approach by all relevant stakeholders has not occurred. Sustainability can only be achieved if all the major stakeholders participate as equals. For

future studies, SNA could be applied to advancing existing theories regarding social capital. A range of mathematical theory can be mixed with SNA to provide a range of network metrics.

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