UNDERSTANDING INTELLIGENT ACCESS AND POLICY TRANSFER THROUGH SOCIAL NETWORK ANALYSIS

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Abstract

This paper explores the transfer of a program of regulatory compliance in the road sector from Australia to Sweden. Of special focus is the role networks of actors play in the transfer of the Intelligent Access Program (IAP). To investigate these networks a methodology titled Social Network Analysis (SNA) will be employed. This paper seeks to gain insights into how a Social Network Analysis of a case of transport policy transfer can reveal the dynamics of transnational policy transfer. Visualisations of the actor networks are created and presented in this paper, allowing the authors to map the network of key actors involved in the development and sharing of ideas that results in the ongoing development of trucking and road transport regulation. This information is of value to road transport regulators and practitioners who are interested in establishing intelligent access systems to help manage and achieve improved access for high capacity vehicles.

Keywords: Intelligent Access, Network Access, Road Transport Regulation, Social Network Analysis, Policy Transfer, Heavy Vehicles, Policy Diffusion

1. Introduction

Heavy vehicle regulation and policy underpin and provide the operational framework that defines the functioning of the road transport sector in domestic and international settings. These policies are location specific but also simultaneously influenced by other heavy vehicle policies from around the world. How ideas about trucking regulation are shared and spread and the role networks of individuals and agencies play is an important focus of this paper. To investigate these networks a methodology titled Social Network Analysis (SNA) will be employed. Using SNA a case study is examined that involves a program of regulatory compliance operating in Australia that has, following a period of collaborative discussions and investigations, been adapted for implementation in Sweden. The primary research question that drives the analysis of this case centres on how SNA and the visual representation of the network of actors involved in policy transfer can assist with understanding the dynamics of transnational policy transfer. More precisely;

- What insights does a Social Network Analysis of a case of transport policy transfer between Australia and Sweden reveal about the dynamics of transnational policy transfer?

The findings from the analysis of this case may also provide some tentative insights into the broader utility of SNA as a possible methodology applied in policy transfer research. Furthermore, analysing the case of Intelligent Access allows this study to map the network of key actors involved in the development and sharing of ideas that results in the ongoing development of trucking and road transport regulation, particularly those interested in improving access and management of for high capacity vehicles across the road network.

To address the research question the paper is organised into the five sections. Following this introduction the literature review aims to briefly introduce SNA and the potential insights its use may provide in the analysis of policy transfer. This discussion leads into an explanation of our methodology including an account of our regulatory compliance case study, the Intelligent Access Program (IAP). Part three of the paper presents the results including SNA diagrams of the networks of actors involved in transnational policy transfer. Following the discussion and analysis of results the paper concludes summarising the key findings against our research question and noting potential areas for further research.

2. Social Network Analysis (SNA) and Key Insights for Policy Transfer

Social Network Analysis (SNA) is a methodology that centres networks as the main structure of social systems, foregrounding relationships between actors (or ‘nodes’) that can be individuals, organisations, collectives or other entities. Proponents of this theory study the relationships (or ‘links’) between actors, analysing the positions of actors within the network. Through this lens relations themselves are just as important as the actors they connect (Hanneman and Riddle, 2005). Data on these relationships is gathered through qualitative and/or quantitative methods. Using various programs, such as UCINET and NETDRAW, this data is analysed and visualised, producing sociograms. These visual maps can be used to understand the structure of a social network, the nature of relationships between nodes, and the centrality of nodes in the network (Borgatti et al., 2018).

Analysing and mapping the interaction and relationship between actors in a network will help uncover the dynamics that exist within a group, a chain of organisations, industry or sector.

SNA helps translate social and behavioural aspects of actor interaction into relational maps. What is particularly relevant to the study of policy transfer is how SNA can be used to '…describe the transmission of knowledge or useful information through interpersonal ties and social contacts with individuals' (Bossche and Segers, 2013, p. 39). The nature of relational ties within networks exposes individuals to different kinds of information and knowledge transfer.

2.1 Social Network Analysis of Policy Transfer and Diffusion

A small number of studies have made explicit use of SNA to explore instances of transnational policy diffusion and transfer. These studies examine actor interaction through events, policy forums, conferences and meetings where information is shared and agreements reached on approaches to a common or shared problem such as climate mitigation strategies (Kammerer and Namhata, 2018) or health policy (Contandriopoulos et al., 2017, Shearer et al., 2018). Characteristic of these studies is the effort to identify participants in actor networks, analyse network structure and in the process identify key nodes of influence, translation and knowledge exchange (Pal and Spence, 2020, Gautier et al., 2020). The mapping of policy networks is seen as an effective way to identify pathways through which new ideas and innovation derive (Shearer et al., 2018, Spence, 2019). An important feature of this work is the use of centrality measures used to identify those actors that hold a central place in the network, frequently linking different clusters of the network (Spence, 2019). Some studies supplement the quantitative mapping of actor networks with qualitative thematic research to better understand the motivation and characteristics of actor connections throughout a network (Gautier et al., 2020, Contandriopoulos et al., 2017). The research notes that influences on actor interaction and knowledge transfer such as power, politics and analytical insight are hard to measure if solely reliant on quantitative techniques.

There now exists a small but solid body of research that highlights the value of SNA in the context of policy transfer research. The methodology allows for a more fine grained analysis of actor relations, their multiple connections and then allows the visualisation of how this actor interaction constitutes a network. Visual graphs help identify patterns of interaction, centres of intensity, structural complexity and peripheral actors that may previously not have been recognised (Spence, 2019). Pal and Spence (2020) ask how research might combine both the more traditional qualitative approach to policy transfer with the more technical, empirical and systematic analysis that SNA provides. Would a combined approach 'get better purchase on policy transfer' and advance the analysis within this research field (Pal and Spence, 2020, p. 7)? This study aims to respond to this challenge by extending and re-prosecuting research into a transnational policy transfer case that to date, has been dominated by qualitative methodologies (Walker, 2018). The aim is to uncover more nuanced details about the role and actions of actor networks in the transnational policy transfer process and address our research question regarding the potential insights a more empirically based SNA approach might reveal about this important and growing phenomena.

3. Methodology

In this project we apply SNA as a methodological tool to help explore and visualise the network of actors involved in the functioning of the Intelligent Access Program (IAP) in the road transport sector in Australia and the subsequent transfer and adaptation of the program into Sweden. We make use of UCINET and NETDRAW software to create sociograms that provide a visual representation of actors within the policy networks. Using this software we analyse the centrality of different actors and network density, measurements that provide valuable information about the policy network, how actors connect, who plays a key role in information

transfer and who may be facilitating connections between actors within the policy field. We are particularly interested in plotting the domestic policy networks in Australia and Sweden and then identifying how they connect and progress the process of transnational policy transfer.

3.1 The Justification for Case Selection

Briefly, for background purposes, the Intelligent Access Program (IAP) makes use of Global Navigation Satellite System (GNSS) to monitor the movement of heavy vehicles to enable safer and more efficient use of the road network. The program allows truck operators to trade off the requirement for 24/7 electronic monitoring to access specific regulatory concessions, such as permission to carrier heavier loads or allow unique configurations that may result in longer, wider or higher vehicles that exceed standard limits. Firms that volunteer to be part of the program may, depending on the nature of the regulatory concession, have their vehicles monitored for speed, time of travel and route compliance.

The extended process of interaction between Australia and Swedish policy actors around the IAP was noted as an important feature that made the selection of this case suitable for the application of SNA. In addition, the IAP represents a relatively well-defined example of transnational policy transfer; the program first existed in Australia and was then transferred to Sweden, the process being managed through relatively structured arrangements involving a collaborative three-year trial of the regulatory compliance technology in Sweden. Subsequent developments in heavy vehicle regulation and surveillance resulted in the adoption by Sweden of a modified Intelligent Access Control scheme which was influenced by this collaborative engagement. Therefore, for the purposes of this study it is possible to view a relatively complete transnational transfer process having occurred.

3.2 Our Method: an Intensive, Iterative Process of Data Collection, Visualisation and Validation

Our method involved carrying out a small number of intensive discussions with key informants to identify actors, their interaction and role in sharing information and facilitating transnational policy transfer. Interviews were used to validate the documented actor networks, and in each sequential step informants were asked to identify missing or additional participants in the policy field and their potential role in policy transfer processes. Sociograms were generated throughout the data collection process and used to both guide key informant understanding of the methodology and to build their own analytical insight and critique of the actor network and policy transfer interactions.

Using the UCINET software we generated sociograms illustrating network density, degree centrality and the clustered nature of networks according to the attributes of nodes which included industry, government, private telematics companies or international actors. The density of the network measures the number of links that exist between nodes and is divided by the number of all possible links that could exist between nodes (Bojovic and Giupponi, 2020, Wellman, 1983, Borgatti et al., 2018). The degree centrality relates to the structural position and importance of a node in the network and specifically indicates the total number of ties or edges a node has with other nodes (Bojovic and Giupponi, 2020, Borgatti et al., 2018, Hanneman and Riddle, 2005). Actors with a high degree of centrality are generally at the centre of a network and are considered to play influential roles in communicating information with a high number of other network actors (Bojovic and Giupponi, 2020, Koschutzki et al., 2005, Cross et al., 2002). These three core interpretations of actor networks formed the basis of our analytical critique.

Figure 1 presents a summary of the sequential steps and actions that constitute our methodology. This intensive and iterative process both builds a data base of actor interaction and concurrently validates the data base. Key informants are involved in the task of data generation and through the visual critique of network sociograms contribute to the analysis of policy network structure, including the role and interaction of central nodes and other network actors in information sharing and transnational policy transfer activities.

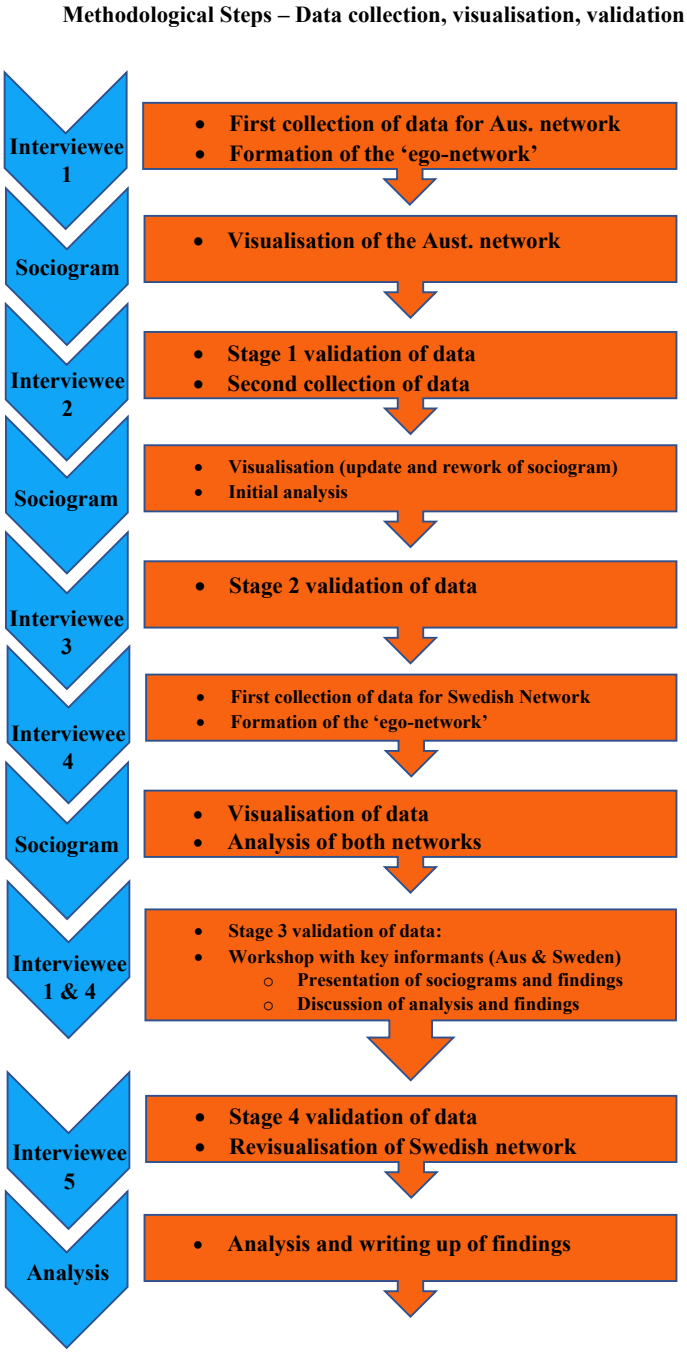

Figure 1 – The Methodological Process

Building the Data Base

The first interview involved a key informant at the centre of the development and implementation of the IAP. This individual, or 'node', was based at Transport Certification

Australia (TCA), the government agency responsible for managing the roll out and use of Intelligent Access technologies in the road transport sector. In the style of a personal network research design (Borgatti et al., 2018) we asked the individual to name all of the nodes who actively work, interact and/or share information with each other regarding Intelligent Access. What resulted was an 'ego network': a network that displays the links of the main respondent and the links between the actors identified by the respondent, known as the 'ego's alters' (Hanneman and Riddle, 2005, Borgatti et al., 2018, Bichler, 2019). Over two data collection sessions with our key informant the network quickly expanded, resulting in a network that contained 45 organisations. This data was entered into the UCINET and NETDRAW programs and sociograms were generated from the data.

We interviewed two more Australian key informants in leadership roles in the road regulation field. Using the sociograms we asked them to review and validate the data obtained from the first informant. Additional actors were included in the data set. This informant confirmed that our data base of actors in the IAP network had reached saturation. We used this as a cue to move to our next phase in the data collection process.

Mapping Network Channels for Transnational Policy Transfer

During the next phase, data collection focussed on actor interaction that was explicitly related to the discussion and exchange of information on the operation of the IAP between Australian and Sweden. Subsequent meetings took place with Swedish actors who are central to the debates of Intelligent Access in Sweden. We repeated the same intensive data collection with our first Swedish informant as with our first key informant on the Australian actor network. A separate list of nodes was created and entered into a spreadsheet and their connections mapped into sociograms. Our second Swedish informant further validated the information given to us by the first Swedish informant and identified additional actors to include in the data set. This exercise confirmed much of the actor and network information we had generated to date and provided a sense of saturation for the data collection and transnational network analysis exercise. At this point the authors moved to commence their own analysis of the actor networks involved in the functioning of Intelligent Access in Australia and the transfer of the policy to Sweden. The following section details the findings of this analysis.

4. Analysis and Findings

What follows is a number of sociograms that highlight different aspects and characteristics of the network. The density of the network is explored as is formation in relation to degree centrality measurements. A sociogram highlighting the 'attributes' of each actor is included (government, industry, telematic provider or international) and clusters these together, making clear the relationships that exist between different kinds of nodes. A sociogram relating to the network involved in the transfer of the IAP from Australia to Sweden is also included. This sociogram provides a clear illustration of the actors involved in the process and provides some clues as to why the IAP functioned differently in Sweden and was not an exact replication of the program in Australia.

All of the sociograms illustrate the complex network of interactions and the actor environment surrounding the IAP. Although some of this information was garnered through qualitative interviews in previous studies (Walker, 2018), filtering this information through SNA produces a clearer representation of the network. These sociograms therefore complement previous studies and extend the analysis. This level of detail provides a richer understanding of the

network and offers us information regarding how information has and does flow through this network.

4.1 Entire Australian Network and Degree Centrality

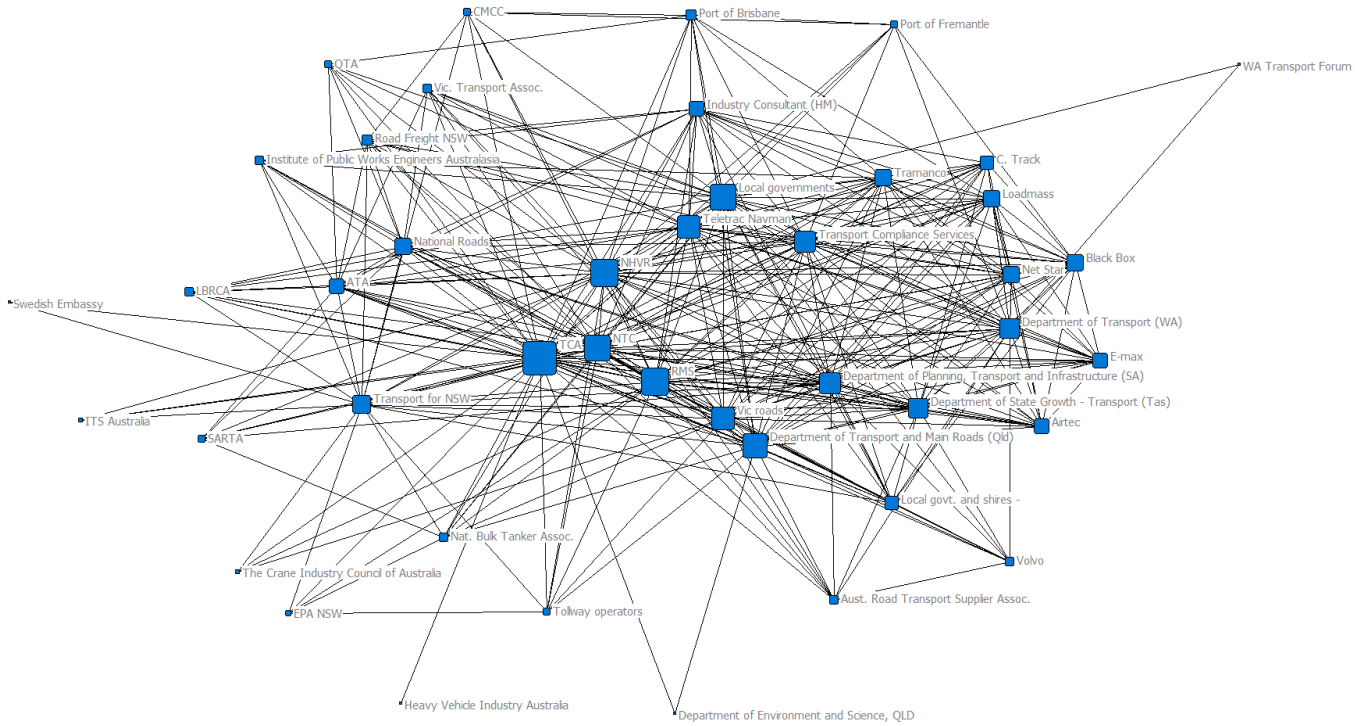

Figure 2 – Entire Australian Network and Degree Centrality

This sociogram presents a visualisation of all the actors within the network and the links each node shares with each other as well as the degree centrality measure. This sociogram presents a comprehensive picture, a 'lay of the land' of the network surrounding Intelligent Access in Australia. Here it is possible to see who is at the centre of the network and who is positioned further on the periphery. This positioning is based on the number of links each node has to other nodes. The complexity of the policy sector is made evident here as are the relationships that exist between nodes. We can see that there are a high number of connections between actors, and that there is no singular actor that essentially "holds the network together". Many nodes share connections with a high number of other nodes.

Degree centrality relates to the amount of ties a node has with other nodes, revealing the structural position of an actor in the network (Bojovic and Giupponi, 2020, Hanneman and Riddle, 2005). This position can be a point from which to hypothesise about the influence of a node in a network. For example, it can be hypothesised that the actor with the highest degree centrality may receive and share the largest amount of information flowing through a network (Borgatti et al., 2018). It is likely that this node will possess a large amount of influence within a network due to this feature (Bojovic and Giupponi, 2020).

In this sociogram the degree centrality is indicated by the size of the icon, with the node with the most ties having the largest symbol. As we can see here, TCA has the largest symbol and therefore the greatest number of ties at 42. This is followed by the National Heavy Vehicle Regulator (34), Roads and Maritime Service (33), local governments (32), the National Transport Commission (31), Department of Transport and Main Roads (29), Vic Roads (28),

Teletrac Navman (27), Transport Compliance Services (26) and Driving and Transport (25), to name the top 10 nodes in the networks. What this tells us is that these actors are the most structurally important nodes in the network (Borgatti et al., 2018). This influence may relate to their ability to control or facilitate the flow of information in the network (Bojovic and Giupponi, 2020, Koschutzki et al., 2005, Cross et al., 2002). In this case the leading presence of state regulatory agencies confirms the governmental nature of the program and its dependence on core service providers (Teletrac Navman). The density of the network between these major nodes confirms the likelihood of shared norms the existence of a supportive environment for the effective sharing of complex information (Shearer et al., 2018).

The key Australian informant observed that this sociogram supported his perception of TCA as a 'policy shaper' rather than a 'policy controller'. By this he is observing that although TCA has a high degree centrality measurement it is not alone at the centre of the network. The sociogram illustrates how multiple nodes have a high number of connections with other nodes. If TCA were to be removed the network would continue to function and information would continue to be shared between actors. The main informant went on to suggest that this structure shows that TCA has worked to construct an environment for Intelligent Access to work without building absolute dependence on the operation and contribution of TCA. The high number of links that exist between other primary nodes supports this suggestion.

4.2 Attributes

In earlier work (Walker, 2018) a visual representation of the IAP created by TCA was employed to explain the working relationship between TCA, regulatory agencies, telematic providers and transport operators (Figure 3). Interestingly, when a sociogram was created that clusters nodes according to their attributes (government body, industry, telematics companies, international) the diagram closely resembled the IAP model (Figure 4).

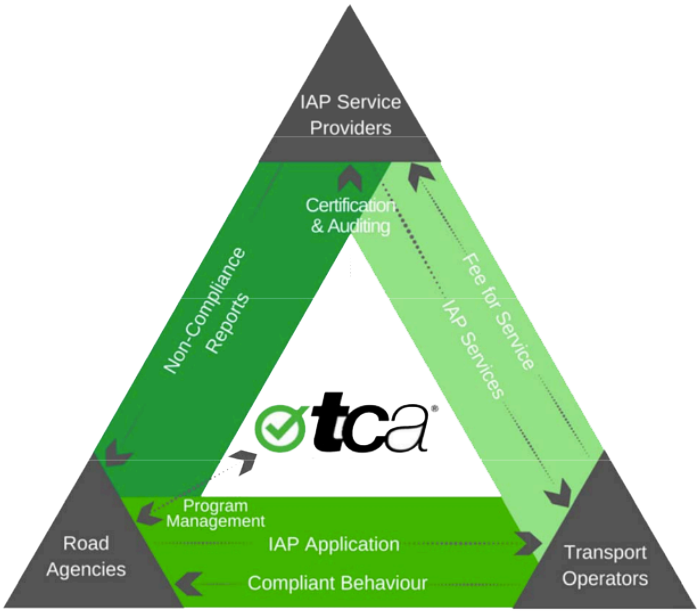

Figure 3 – IAP Triangle

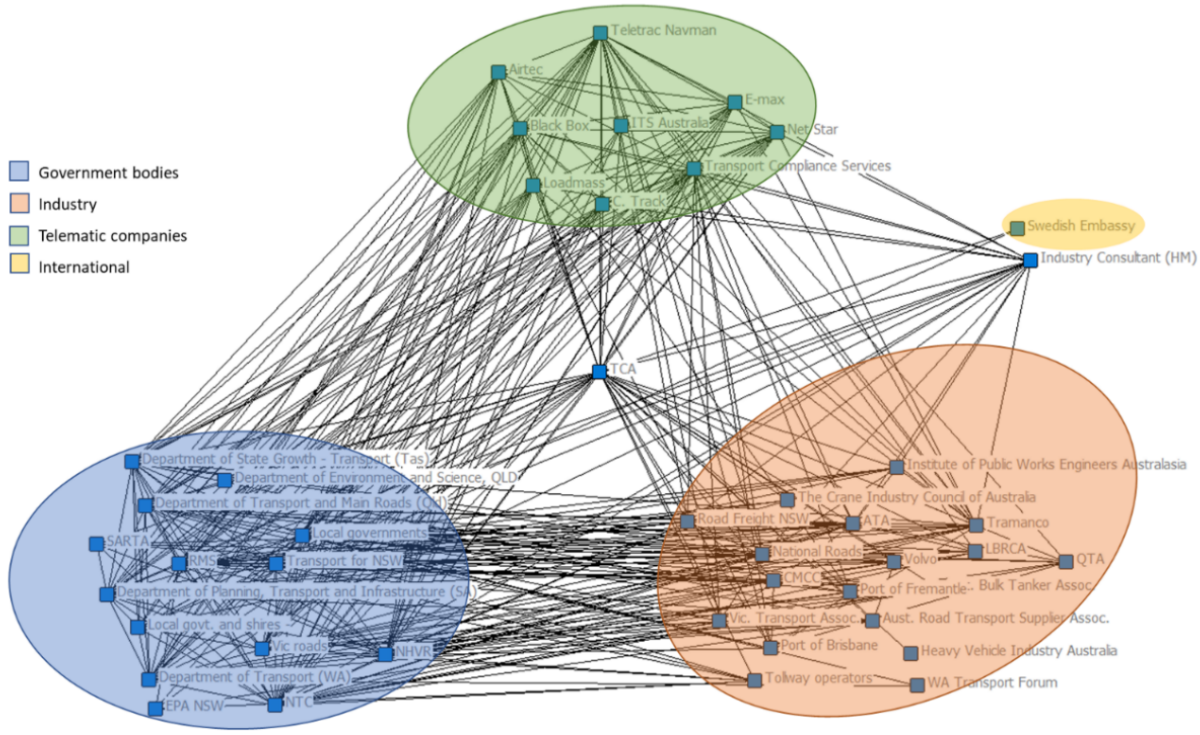

Figure 4 – Clustered According to Attributes

Here we can see that many links exist according to the channels outlined by TCA and in this sense the sociogram corroborates TCA's understanding of how the IAP works. From this we can begin to understand how attributes of the nodes influence who is connected with each other (Borgatti et al., 2018). What is made evident by the sociogram that is not apparent in the IAP triangle diagram is the high number of links between nodes within each cluster. Relationships not only exist between clusters as discussed in the earlier study, but also exists at a high density between nodes of the same attribute. The sociogram also reveals a more detailed depiction of how TCA interacts independently with different nodes in the network. When speaking with key informants they confirmed this depiction aligned with their expectations of how the applied policy world of the IAP would be connected.

4.3 The Swedish Network

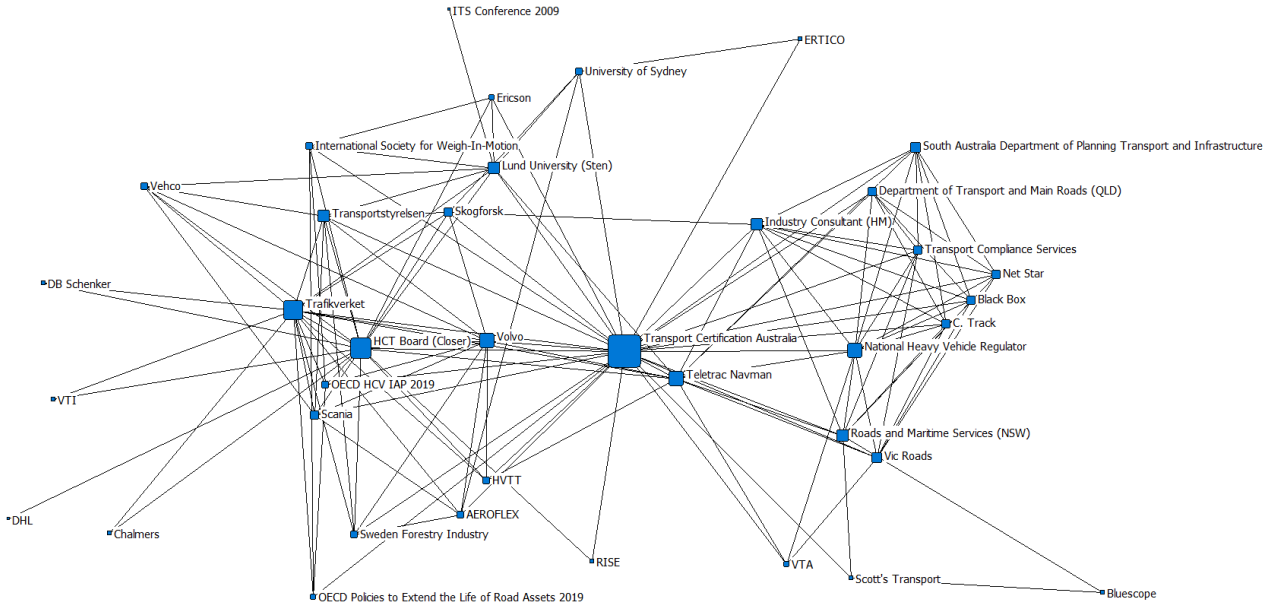

Figure 5 – Swedish and Australian Network and Degree Centrality

What is immediately apparent when viewing the sociogram of the entire Swedish network (Figure 5) is that it has less links than the Australian network. At the centre is Transport Certification Australia, indicating that in relation to the transfer of the IAP to Sweden TCA plays a central and fundamental role. This visualisation supports earlier research that places TCA at the centre of the transfer process (Walker, 2018). To the right of Transport Certification are nodes that are embedded in the Australian context. To the left is a number of Swedish and European actors. This sociogram more closely resembles a bow-tie structure in which one node is the 'bridge' between different groups of nodes (Borgatti et al., 2018). In this network TCA and Teletrac Navman represent the 'bridge', connecting the Australian and Swedish nodes together.

Here it becomes possible to see how much of a central role TCA and Teletrac Navman possess in the IAP policy network. In the earlier study of the transfer of the IAP to Sweden (Walker, 2018) one concern was to try to understand why the transfer of the IAP to Sweden resulted in the implementation of a hybrid and simplified form of the original program. The sociograms produced in this current study reveal that in Australia there exists at least one key actor (TCA) actively shaping behavior and interaction between actors. Sweden does not have an actor like TCA shaping interaction and working to constitute the regulatory field as has been the case in Australia. It does not have a central node that is connected to all, or nearly all, of the nodes in the network. This may indicate that the flow of information through the network is less fluid, lacks density and is constrained. These factors may explain why the transfer of the IAP to Sweden has resulted in a different and simplified implementation model.

This is further supported through the measurement and comparison of the density of each network. The measurement of the density of the network calculates the number of links that exist between nodes present in the network (Wellman, 1983). This number is divided by the number of all possible links that could exist between nodes (Bojovic and Giupponi, 2020,

Wellman, 1983, Borgatti et al., 2018). Borgatti et al. (2018) explain that network density is most useful when employed in a comparative way. Because network density adjusts according to the number of nodes in the network it is possible to compare density measures across different sized groups, which is the case between the Australian and Swedish networks. The network density of the Australian network is 0.376, with the number of all possible links being 356. The Swedish and Australian network has a density of 0.196, with 138 possible links. This is quite a significant difference and indicates that the Australian network has a greater density.

UCINET and NETDRAW and the analytical possibilities of SNA have shown to be very helpful tools in studying the networks surrounding Intelligent Access within Australia and the transfer of the IAP to Sweden. For example, the analysis of the Australian and Swedish networks reveals that the structured interaction of actors is important and influences policy adoption in new locations. It shows that making efforts towards structuring the local policy arena in a way to give effect to policy by actor interaction is essential to achieve policy transfer and take up at another location at the local level. Without the presence of a locally embedded central node such as TCA that plays a highly active role, the likelihood of a successful transfer of the IAP is limited. The channels through which policy information and ideas flow also appears to be more limited in the Swedish network, further diminishing the chances of a successful or full adoptive transfer of the Australian policy.

5. Conclusion

This paper has explored the usefulness of Social Network Analysis to studies of policy transfer and policy diffusion. Applying it to both a local and an international network, SNA has been employed as a means of gaining insights into a case study of transnational policy transfer. Through the creation of sociograms and analysis using the UCINET and NETDRAW programs it has been shown that there is great potential in the use of these programs and the visualisation of networks. Gaining an understanding of the density of a network and being able to see which actors are at the centre of a network and who is connected with each other provides an indication of how information flows through the network. In relation to policy transfer and diffusion this is a vital and very practical piece of information. By visualising networks we are also provided with helpful tools to understand why a case of policy transfer is successful or not successful. In this case study of the Australian and Swedish network it is possible to see that a major difference between the networks is that in one there is a central driving actor (TCA) present in the Australian network that is not present in the same way in the Swedish network. This may be a clue as to why the transfer of the IAP from Australia to Sweden resulted in modified adoption. It also becomes possible to gain insights into the level of influence different actors possess, another vital piece of information for the examination of policy transfer.

In the introduction and literature review we discussed the work of Pal and Spence (2020) exploring the analytical capability of Social Network Analysis in studying policy diffusion and networks. Pal and Spence (2020) present an empirical analysis of actors and the connections between actors within policy networks. This paper has continued this practice, applying SNA to a case study of policy transfer as a tool to investigate the structure of the network and the relationships it comprises. This work joins those discussed in the literature review; articles from a diverse range of disciplines that have employed Social Network Analysis. By formulating an iterative methodology that utilises SNA this paper offers a process through which to analyse cases of policy transfer and diffusion and to fill gaps in previous research projects. This opens up new possibilities for understanding the shape and importance of social networks in the development, sharing and transfer of policy ideas.

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