Studying Structural Change of Business Networks

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Abstract

Business networks and business network dynamics can be seen, described and approached in different ways. Even within the definition of business networks as connected long-term reciprocal business relationships, widely different reasoning around, and approach to, business networks are possible and common. This paper describes an approach focusing the structural aspects of business networks. That kind of approach to business networks is described in this paper, contrasted to the more traditional focus on the parts constituting the network. Furthermore, the two different approaches give different meaning to business network dynamics, stretching from dealing with adaptation within business relationships to structural change of business networks.

In order to study structural change of business networks, a 'structuration technique' has been developed. The basic data used in the current application, called mabIT, is found in news items from 1992-2005 concerning mergers, acquisitions and bankruptcies involving Swedish IT-providing actors. Through a coding scheme, and a software tool managing the coding phase, these news items are coded into meta-data variables in order to capture events as well as the relations between actors. The result is a relatively large amount of interrelated coded meta-data, which should provide a unique opportunity to study structural change of business networks.

The paper concludes with showing an example of how the mabIT data can be visualized and approached by using a software for analysis and visualization of network data. The result of this paper is thereby a description and indication of how structural change of business networks can be perceived, captured and visualized. The visualizations clearly indicate the complexity of business networks.

Introduction

This paper deals with structural aspects of business networks, including structural change of business networks, and how it can be studied. The business network concept is being used in quite different ways. Often, research that is about market interaction or business relationships includes the notion of business networks in the sense that it claims the actors and the business relationships to be embedded in a network context. But few studies take the business network concept further and the inclusion of the network idea sometimes seem quite strained. In this paper, the concept of business network structure is used to elaborate further on business networks.

A business network is often defined as connected business relationships. Adaptations and interlinked activities, i.e. different kinds of dependence, makes the relationships connected in the meaning that what happens in one relationship affects other relationships (Forsgren & Olsson, 1992; Hallén, Johanson & Seyed-Mohamed, 1991). It is clearly so that if a company adapts its products or procedures to suit one relationship, this will affect other relationships of that company either in a positive or negative way. This interdependence between business relationships is of outmost importance, and as most companies have got more than one customer or supplier, a typical company is involved in numerous business relationships, which are all connected to each other. The connectedness of business relationships adds the network dimension to this theory. The connected relationships forms a consistent unity, a business network, which makes the actions of a company dependent not only on the business relationships it is involved in, but also the relationships connected in second line or even further away. (Anderson, Håkansson & Johanson, 1994; Axelsson & Easton, 1992; Blankenburg Holm, 1996; Håkansson & Snehota, 1989)

Most research on business networks is actually studying connected relationships, in the sense that the relationships are in focus and often one particular relationship is the point of departure. Another approach would be to look at a business network as a structure that actually means something, and the main focus would be on the network, not the parts of which it consist. This kind of network is not as strongly centred on a specific relationship, and it does not focus on connected relationships, but rather on the network structure. Suggesting this different approach to business networks implies that the reasoning on business network dynamics changes. Previous studies have been about change in the relationships or connections in the network, or how change in one relationship affects the connected relationships, but based on the network structure concept, business network dynamics should be described as structural change of business networks.

The aim of this paper is to approach business network dynamics as structural change of business networks and to describe a method that has been developed in order to capture structural change of business networks. Defining business network structure, and consequently structural change, can be done in many ways, and finding tenable definitions is one of the objectives in this paper.

Studying structural change of business networks naturally requires data and methods that capture changes of network structure. There is a clear need for studies of structural change of business networks, and especially longitudinal studies are rare (Knoben, Oerlemans & Rutten, 2006). The recent turbulence in the Swedish IT-industry, with many mergers, acquisitions and bankruptcies and consequently changing network structure, offers a suitable empirical situation, and in an attempt to study structural change, a method that allows business network structures to be captured and analysed longitudinally have been developed and is briefly presented in this paper. The method involves structurized coding and analysis of a large amount of secondary data, and although the processing of the data has only just begun, the method seems quite promising.

Traditional View of Business Networks

The concept of business networks is merely a description of the interdependence among actors, and there is nothing but the application and definition of the concept that decides what a business network is and what it looks like. The business network approach can be seen as a tool or map which can be helpful for describing, explaining and understanding business. However, the business network is a conceptual phenomenon, so we cannot study the *object* ‘business network’ but only the *concept* ‘business network’. This enables the possibility of attributing various meanings to business networks, and the flexibility of the concept has resulted in different interpretations and usage of the business network idea.

A group of business relationships is not necessarily a business network, as connectedness is a prerequisite for being able to describe a number of business relationships as a business network (Anderson, Håkansson & Johanson, 1994; Blankenburg Holm & Johanson, 1997). But the traditional business network studies clearly emphasize and take an interest in the parts constituting the business network, i.e. the actors, the business relationships and the connections between them. It is sometimes claimed in this kind of research that the business relationships are embedded in a network context, although the network dimension is not developed more thoroughly (e.g. Chetty & Eriksson, 2002; Hedaa, 1993). A traditional business network study can, for example, be concerned with how one business relationship is affecting, or is affected by, other business relationships. Therefore, some traditional business network studies can actually be said to deal with "sets of connected relationships" forming business networks (cf. Anderson, Håkansson & Johanson, 1994, p.1). It is not the business network at large that is of interest, but rather the parts of the network.

With an emphasis on the actors, business relationships and connections within the business network, the point of departure also lies in the parts of the network. Some specific actor or business relationship can be of interest for some reason, for example interesting technology (e.g. Anderson, Håkansson & Johanson, 1994; Waluszewski, 1990), changes of the actor (e.g. Bångens & Araujo, 2002) or perhaps specific characteristics of the business relationship. Studying the business network surrounding this focal point is, thereby, a matter of identifying business relationships that are connected to the focal business relationship or to the business relationships of the focal actor.

Performing such a business network study yields a network of business relationships that could be illustrated as in figure 1 below. Starting from one business relationship between a supplier and its customer, the grey circles in the figure, the illustration shows a vertical production flow with a number of suppliers and customers. All these actors, or rather the business relationships between all these actors, are included in this particular business network, since they are all connected to the focal business relationship from which the network originated. The parts are unique and an effort is made to identify the character of the individual actors and business relationships, hence the different sizes in the picture. This way of illustrating business networks has commonly been used in previous business network research (e.g. Anderson, Håkansson & Johanson, 1994, Figure 2; Bångens & Araujo, 2002, Figure 2-4; Håkansson & Waluszewski, 2002, Figure 1).

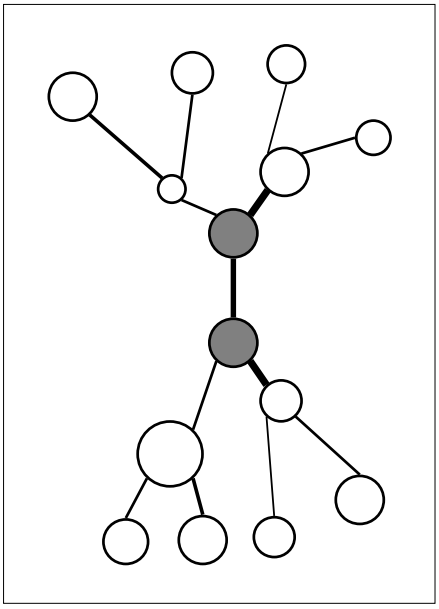

Figure 1 A traditional approach to the business network as connected business relationships

This picture is naturally simplified, but it is intended to give a hint of the traditional business network idea. It is reasonable to assume that the supplier's suppliers also have other customers, and that their business relationships to these other customers are connected to the focal business relationship. It is also possible that the actors in the business network are directly linked to each other through business relationships. Through this kind of reasoning, the limits of a business network are vague, and as a

traditional business network study takes its departure from an actor or, as in the above illustration, a business relationship, this results in the business network revolving around a centre point. By starting at a focal point and exploring the connections, i.e. the business network, from that point, it naturally becomes the centre of the business network. This centre is, thus, created by the study.

By taking an actor or business relationship as the central point of the business network and, thereby, studying the network as the business relationships surrounding this central point, the business network becomes the context in which the particular actor or business relationship acts (Snehota, 1990). Network context has been discussed in previous research as the connected business relationships that an actor considers relevant, and is more or less directly affected by (Blankenburg Holm, 1996; Grabher, 1993; Håkansson & Snehota, 1989; Snehota, 1990). The limited number of business relationships that are of great importance to the actor or its business relationships are, thus, what makes up the business network context (Thilenius, 1997).

Structural View of Business Networks

Some studies take a kind of holistic approach to business networks and deal with network-wide issues. Such an approach implies a different focus, treating the business network more as a structure, but the primary interest of these studies is often something other than furthering the business network idea. Describing the evolution of a business network surrounding technological development is one example of what such studies may be directed at (e.g. Lundgren, 1995; Waluszewski, 1990). Cook (1982, p.177) describes a shift in the focus of social network research, that the advances "have moved exchange analysis from a focus on relatively isolated dyadic exchange relations at the micro-level to a more macro-level consideration of exchange systems where dyadic relations are viewed as components of larger social structures". This could also be interesting from a business network point of view, so an alternative way of addressing business networks is to focus on the structural aspects of business networks rather than the constituent parts. The business network is, thus, seen as a structure with characteristics and functions.

Such an alternative way to study business networks is based on the same assumptions as the traditional business network studies, i.e. reciprocal long-term business relationships and connections between the business relationships, but the difference is how the business networks are approached.

Structural Aspects in Previous Network Research

An example of the previous use of structural aspects of networks is found in sociology, where social networks are looked upon as "macroscopic n-person social structures" (Cook & Emerson, 1978, p.721) which are closely related to power, which Cook (1982, p.183) expresses as "exchange networks thus represent the structure of resource dependencies across positions in the network".

Some research on business networks has also addressed structural aspects of networks, although the meaning of 'structure' is often not defined. Håkansson and Johanson (1993) describe the structure of the industrial network as constituted by the "patterns and character of the connections between the relations" (p.42), and further claim that the network structure is formed and modified through the interaction within the structure. Håkansson and Snehota (1995) regard the business relationships as part of a broader network structure, and later claim that the business relationships are elements making up the network structure, whereas Easton (1992) focuses more on the actors, as structure "is based upon firms as the elements of structure" (p.17). Structural aspects of business networks in some literature are, however, mentioned without any specific explanation, and are sometimes almost synonymous with 'business network' (e.g. Benassi, 1995; Halinen & Törnroos, 1998; Thilenius, 1997). Another example is the use of the 'structuring' of a business network to label the formation of the network (Uusitalo & Möller, 1997). Also vague is Covielli (2005) who refers to a structurally hard network dimension in opposition to an interactionally soft dimension.

Some have touched upon the different characteristics of network structures. The research on social networks has also acknowledged different characters of the structural aspects, such as the size (Anderson, Butts & Carley, 1999), density (Anderson, Butts & Carley, 1999; Breiger, 2003; Carley, 2003; Scott, 2000) and centrality (Freeman, 1979; Gomez et al., 2003; Zemljic & Hlebec, 2005). Concerning the effects of a business relationship dissolution, Alajoutsijärvi, Möller and Tähtinen (2000) claim that a 'tightly structured' network enables a beautiful exit. What makes a business network tightly structured is, however, not specified. Other aspects of possible characters of business networks are the density and size of the network (Coviello, 2005, p.41) as well as the power distribution (Forsgren &

Olsson, 1992). Before furthering the knowledge on structural aspects of business networks, a way of addressing it, both theoretically and empirically, is required.

Addressing Structural Aspects

The suggested alternative way to study business networks attempts a more generic analysis, by moving the focus from the parts of the business networks to the structural aspects of business networks. Structural aspects of business networks, thus, concern the arrangement of mutually dependent business relationships, which is closely related to the composition of a business network.

A business network can be considered borderless, which makes it hard to relate to the business network structure as a whole. Capturing and studying this composition of business relationships is therefore difficult, since it is problematic to delimit business networks, and only pieces of this body, or business network structure, are likely to be included when studying business networks (Easton & Håkansson, 1996). It is therefore suggested, and further developed in the following sections, that the structural aspects of business networks could be approached by studying 'network elements'. To put it briefly, a 'network element' can be seen as a subset of a larger business network structure of which the composition can be studied.

Consequently, a 'network element' is here defined as an organised body of mutually connected business relationships being a component part of a network. A network element is, consequently, not just some business relationships, but the business relationships that make up a network element are connected in the sense that what happens in one business relationship affects the other which affects the third etc. It is, thus, a subset of a larger business network structure, and in this subset the composition and other structural aspects can be focused. It is important to note that a network element is seen here as a partial business network structure, and that the business network continues beyond the network element. All studies on business networks deal with incomplete pictures of the network (Easton & Håkansson, 1996), and this is not an attempt either to study entire business networks. The use of network elements does not solve the problematic issue of delimiting a business network, but it is a way of addressing structural aspects of business networks without relating to the 'whole' network.

A few examples of what some of the previous research has named delimited business networks are 'blocks' (Lundgren, 1995, p.118), 'cliques' (Iacobucci et al., 1996) and 'focal net' (Salmi, 1995). These ways of addressing limited parts of business networks are beneficial for dealing with the delineating issue, but the subgroup delimitations used both by Lundgren and Iacobucci et al., however, aim at finding subgroups within already known and delineated business networks, i.e. when a specified set of actors and business relationships already exists. The borders of network elements should be quite intractable as there are no actual borders to look for, and the network elements are, for example, not primarily focused around a specific technology. How a network element is delimited is, therefore, up to the used data and analysis to decide.

Describing Network Elements

Network elements can be described in different ways, for example graphically through pictures or mathematically with logical denotation from Set theory. The properties of network elements can however be reasoned on conceptually. The size of a network element is a basic, but relevant, property. Two relatively simple bases for the size of a network element are the number of actors and the number of business relationships, both of which can be found in the literature (Easton, 1992; Håkansson & Johanson, 1993). Actors are, however, not part of a business network unless they are related to the other actors, i.e. having business relationships with the other actors. It is, therefore, natural for the emphasis to be on the connected business relationships when discussing business networks. The above definition of network elements emphasized the business relationships and, consequently, so should the size dimension. The minimum number of business relationships that are needed to fulfil the requirement of connectedness, as was stated in the definition of network elements, is two. The upper size limit of a network element, if there is an upper limit, is probably large, but for the clarity of reasoning only smaller network elements will be discussed here.

A dyad, as a two-actor-relationship is often called, is not the same as a *dyadic* network element, which comprise of two business relationships, and to be clear about this, the difference between the two is shown in figure 2 below. Of importance to note is that these pictures of network elements do not consider differences in the individual actors or business relationships, and, therefore, all circles

(actors) and lines (business relationships) are drawn equally large and widely. With the business relationships making up the basis of the network element reasoning, the actors are included in the picture mostly as nodes joining the business relationships.

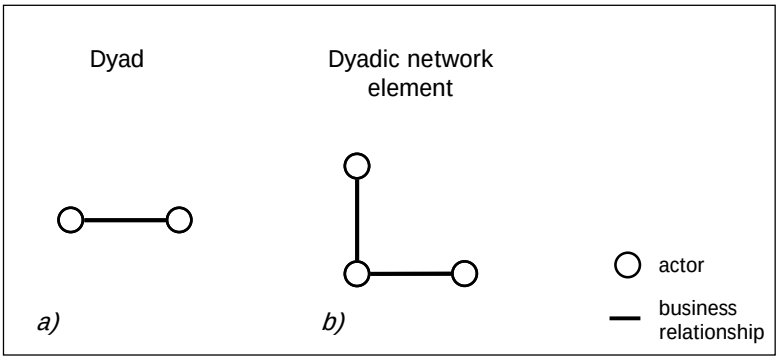

Figure 2 A traditional dyad (two actors) in *a)* compared to a dyadic network element (two business relationships) in *b)*

How the business relationships in the network element are configured is not reflected by the size, for example, a pentadic network element can involve a minimum of four and a maximum of six actors. Related to this is the density of a network element, which is a topic also found in the social network research (e.g. Breiger, 2003; Carley, 2003; Scott, 2000). The density of a network has to do with how interconnected the network is. An example is shown in figure 3 below, where different variants of a pentadic network element are shown.

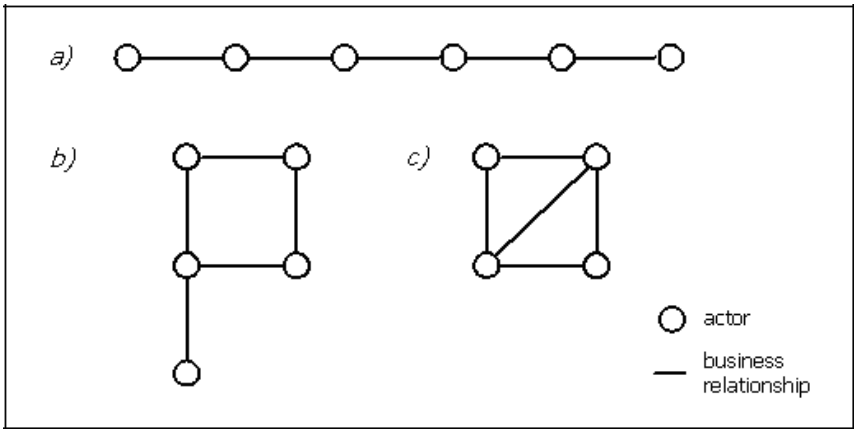

Figure 3 Three examples of a pentadic network element; with *a)* six actors, *b)* five actors, and *c)* four actors.

The density of a network element can be derived from the number of actors relative to the number of business relationships. Except for the dyadic network element, there is a span, of varying size, between the minimum number of actors and the maximum number of actors that are possible to construct a network element of a particular size. The character of a network element can most certainly be described with many different variables, and related to the density is the centralization of a network element. Surely, centrality could be interesting as an actor-based measure of positions is prevalent in social network research (e.g. Bonacich, Oliver & Snijders, 1998; Emerson, 1981; e.g. Freeman, 1979; Gomez et al., 2003; Zemljic & Hlebec, 2005). Relating this to network elements, the centralization of a network element could describe how congregated or scattered it is. The density may partly, but not completely, indicate the centralization.

Change in Business Networks

Although a basic assumption concerning the nature of business relationships is that they are long-term oriented and quite stable, it has been found that the business relationships and business network are constantly changing, thereby being, rather, in a situation of stable change (Gadde & Håkansson, 1992; Gadde & Mattsson, 1987; Håkansson & Snehota, 1995). The dynamics in business relationships have been highlighted as a central research topic (Wilson, 1995), and looking for patterns of change in business networks might be a way of addressing the network mechanisms that handle continuous change (Håkansson & Johanson, 1992).

Depending on how business networks have been approached, change could be discussed quite differently. While traditional business network studies are likely to concern change in the business relationships or connections in the network, business network dynamics can also concern structural change of network elements.

Change in Traditional Business Network Studies

Business network change has previously been approached as change in the parts of a business network, for example continuous adaptation, which makes the existing business relationships change (e.g. Anderson & Weitz, 1992; Hallén, Johanson & Seyed-Mohamed, 1991; Sandström, 1990). Besides adaptation within business relationships, the development of business relationships (e.g. Dwyer, Schurr & Oh, 1987; Hallén & Johanson, 2004; Håkansson & Snehota, 1995), or even the evolution of entire business networks (e.g. Uusitalo & Möller, 1997) have received some attention. If the change is limited to a single business relationship (confined change), it can hardly be referred to as business network change and is, thus, of less interest to the current reasoning on change in business networks than 'connected change' (Halinen, Salmi & Havila, 1999).

The origin for change can differ, and might for example be intentionally initiated by an actor (Hocutt, 1998) but also from actions taken by an actor not primarily to alter the business relationship, for example a decision to acquire a supplier. It is evident that a merger or an acquisition is capable of affecting, or even likely to affect, the business networks in which the actors are involved, and this issue has been acknowledged in some studies (e.g. Anderson, Havila & Salmi, 2001; Havila & Salmi, 2000; Havila & Salmi, 2002). Even though actor and business relationship-bound antecedents of change have received most interest, external factors and unintended events can be considered to be a third dynamic source.

Different forces or events are likely to yield different kinds of change. Incremental change is one of two types of change that are described in an analytical framework developed by Havila, Salmi and Havila (1999). It is used to denote "change in the character of a relationship", and is a kind of gradual evolution that takes place within seemingly stable business networks (Havila & Salmi, 2000). Adaptation of different kinds, which is one example of incremental change, is a fundamental part of the business relationship's long-term orientation (Hallén, Johanson & Seyed-Mohamed, 1991). More abnormal and serious change is, however, called 'radical' and means that "a relationship is terminated or established" (Halinen, Salmi & Havila, 1999, p.789).

Structural Change of Business Networks

When looking at the structural aspects of business network change, it is not change in the parts that is central. Instead, 'structural change' is change in the composition of a business network. One of few studies found that is taking a somewhat similar approach to this was made by Gadde and Mattsson (1987), in which they study stability and change from a "total network point of view" (p.32). By analysing the network data in aggregation, the proportion of newly established, continuing and disrupted business relationships could be studied. Gadde and Mattsson also saw the opportunity for analysing the business network aggregate in order to detect patterns of structural change. Another example of a study that concerns change in positions is found in Andersson and Molleryd (1999), where changing patterns of connectedness during variations in demand and conditions in a business network of telecommunication actors is studied. With the concept of 'power balancing', Forsgren and Olsson (1992) studied change of the interdependencies in a business network during a period of change which started with an acquisition. The number of studies of structural change is, however, not large, and the studies mentioned here use quite different techniques to study such change.

Change of Network Elements

Network elements were introduced as a way to address structural aspects of business networks, and structural change could thus be studied as change in the composition of network elements. Network elements were previously defined as an organised body of mutually connected business relationships that are a component part of a business network. What has been described as incremental change, for example adaptation, takes place within the existing business relationships and will, thus, not necessarily affect the composition or size of a network element. Radical change or possibly the radical step of an incremental process, which means that a business relationship ends or is established, is, on the other hand, likely to affect the structure of a network element. It is, therefore, primarily radical change that is seen when studying structural change.

A few characters of network elements, mainly the size and density, were discussed earlier, and these aspects are consequently also relevant when discussing how the structural change of business networks can be addressed by studying change of network elements. The density of a network element was described as an interesting aspect of the composition, and structural change could, thus, incorporate changes in the density as well as the size of a network element. A change in the density can be caused both by business relationship and actor-related changes, so a change in the density can, but does not have to, involve the introduction or disappearance of an actor.

When looking at the structural aspects of change in business networks it is not the radicality of a single event that is of interest; instead the structural change could be described as more or less intense. The intensity of structural change can certainly be described in many different ways, and one example is the description of network-wide effects as 'netquakes' which compares the intensity of change in business networks with the magnitude of earthquakes (Dahlin et al., 2005; Dahlin, Havila & Thilenius, 2004). It is however reasonable to include a time aspect in judging the intensity of the change, thus relating the extent of change to the passed time. Whether large parts of the network structure are changed, as opposed to concentrated change in a small and limited part of the structure, is also relevant when addressing the extent of structural change. Furthermore, if the structural change is preceded by incremental change, i.e. 'expected', the intensity can be considered lower.

How to Study Structural Change of Business Networks

How network elements and structural change can be found, captured and analysed is likely to require a different technique than those used to study traditional business networks, and change therein. One of the most common methods in business network research is case studies (Easton & Håkansson, 1996), which is a insightful method that could probably be also used for this purpose. But such a method is likely to give an actor's perspective, thereby making the business network the context of a specific actor rather than approaching the structural aspects of it. As have been highlightes, it is also beneficial to use a method that enables longitudinal studies when approaching structural change.

In order to study structural change of business networks, such change, or at least the probabilities of such change, must be found and organized. The turbulent years of the Swedish IT-providing companies meant that many companies were established, but later also went bankrupt, merged or were acquired. According to the theoretical reasoning on structural change, mergers, acquisitions and bankruptcies are examples of events likely to cause structural change, and should, thus, provide the opportunity to identify potential situations of structural change. To enable such change, and patterns of such change, to be studied, a structuration technique called mabIT has been developed. The name mabIT is an acronym for mergers, acquisitions & bankruptcies of IT-providing actors.

The basic idea behind the mabIT structuration technique is to use secondary data about mergers, acquisitions and bankruptcies, which is categorized and coded in different aspects, and can be processed and analysed. Some different secondary data sources are likely to contain information about these kinds of events, for example, newspapers, press releases and annual reports. The source used so far is news items on mergers, acquisitions and bankruptcies during an extended period of time, starting with 1992 and ending with 2005, that involves one or more Swedish IT-providers. Such news items are one of the primary sources in which information on these kinds of events is presented, and they do not only describe the events, but important counterparts are also often mentioned. By structuring the data, i.e. systematizing and coding it in interconnected variables, it is eventually possible to analyse network elements and structural change thereof. The structuration technique is a multi-step process, and the steps are shown in the figure below.

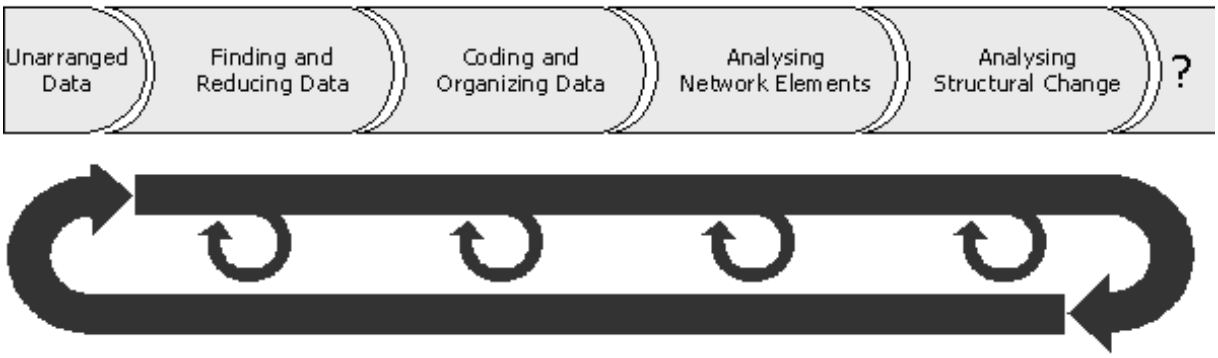

Figure 4 The multi-step processing of the structuration technique, and the continuous development of the technique. The question mark to the right represents the unknown possibilities of analysing the structurized data.

To describe the steps briefly, the structuration starts with finding relevant data, thus reducing the large amount of conceivable data sources by selecting and searching relevant newspapers. Since mergers, acquisitions and bankruptcies are selected as events possibly causing structural change, the papers are searched for news items mentioning such events. The items filtered out are then manually reviewed to find those that contain relevant information. The next step is to organize and code the information within the news items found. To make this possible, a computer software has been designed and created, so the organizing and coding step is, thus, performed by coding the news item information into the mabIT software tool. This step, as well as the data-finding step, is, to a large extent, a kind of ongoing analysis of the data, so the figure above should not be interpreted as the analysis being only the last steps. The structuration technique is a series of analyses, although the analysis aiming at capturing network elements and structural change of business networks cannot be done until the data has been structurized.

Finding and Reducing Data

The absence of compulsory registration of concentrations of companies in Sweden is remarkable and has been noted by, for example, Rydén (1971) and Holtström (2003). News items holds information about mergers, acquisitions and bankruptcies, and also information that can be perceived as revealing business networks, and therefore appears promising. The news items that are used offer relatively unbiased information as they mainly set out to inform about the event. Newspaper texts that are written to argue for a certain cause, or as debates, are not used as a data source. To complement the news items, there is a possibility, depending on the result of the processing of the news item and the progress of the analysis, of collecting additional data from other sources such as annual reports (e.g. Rydén, 1971), press releases (e.g. Öberg, 2004), and company web sites.

Some previous studies within the field of M&A have also made use of secondary data in the form of news items (e.g. Bushnell, 1961; Nelson, 1959; Rydén, 1971), and indirect sources such as newspapers can be advantageous when studying M&A to avoid adjusted statements from the involved parties (Trautwein, 1990). The news items containing information about the events and companies were observed and recorded at the time of the event. This means that the risks associated with historical review methodology, for example, selective perception and difficulties of remembering, are avoided (Ghauri & Grønhaug, 2002). This is a definite advantage when performing longitudinal or historical studies, for example when looking for change.

The coverage of mergers and acquisitions in media was found, by Vaara and Tienari (2002), to portray the consolidation as a rationalistic action, thereby stressing the positive aspects of the M&A. The structuration technique is, however, not explicitly interested in the values of the news items, and they are not regarded as ‘true’ descriptions. The news items provide information on different issues.

Besides descriptions of some kind of event, relations can also be identified, as important customers, partners etc. are often mentioned. Some events are described in longer articles while others are mentioned very briefly, but an extensive description is not absolutely necessary to get the essential information. Using news items provides information on many events, which is a necessity when searching for patterns. The mabIT tool is, however, neither aimed at giving a complete picture of the events of the IT-providing companies, nor supposed to give a thorough understanding of an individual event. What mabIT does offer is something in between these two, as a large number of organised small case descriptions which, although each and every one of these descriptions might be quite short, together constitute a large amount of data which can be used separately or aggregated.

The news items are collected from databases containing articles from Swedish newspapers and journals. The use of computerized article databases allows fast and stringent surveying of the included sources, as an important step in the data reduction is filtering the articles with specific search terms. Choosing appropriate search terms is, naturally, decisive for the result, and the search terms used to capture the events are the Swedish words for *merger*, *acquisition* and *bankruptcy*, and the IT-providers are simply addressed with the word *IT.*

The filtered texts are then manually read through, assessing their relevance. So far, a trade paper specialized in IT, called Computer Sweden, has been used for the data collection. The used article database covers Computer Sweden from 1992 and up until the present date, which enables a large part of the turbulent era to be covered. The period from 1992-01-01 to 2005-12-31, i.e. 14 years, is included in the collection of texts, and the searchable archives of news items enables the texts to be found in the same way, irrespective of whether they are from two or ten years ago.

Current State and Example of a News Item

Although the initially intended data has been coded and organized, the possibility to complement the data with more years and other sources still exist. However, the total amount of published articles in Computer Sweden during the years 1992-2005 is 86 791. After filtering, by using search terms, 2 689 articles were extracted from the total. The manual read-through during the coding has, so far, given a usability ratio of about 62% of the filtered articles.

The search for news items described above results in a number of articles of varying content and length. Below is an example of a news item, translated into English, that the search has result in. It describes an acquisition, but also the acquired company's size and some of it's customers.

Computer Sweden 2001-04-25

Sigma Buys IT-Company

The IT-consultant Sigma is buying Datorex Nova from Bollnäs for 14,7 million Swedish kronor. Sigma, thereby, takes control of 180 companies in the retail trade that are currently using e-trade systems from Datorex Nova.

The computer company Datorex Nova develops and sells information systems within the retail trade. The company has 22 employees, and this year's estimated turnover is 16 million Swedish kronor. Among its customers are MQ, Levis and Filippa K. In total, 180 companies with 190 stores in eight countries use products from Datorex.

- Through the acquisition, Sigma is obtaining a unique competence within retail computer systems. Along with our concentration on e-trade systems, this creates new opportunities for our customers, says Sune Nilsson, manager of the business unit Sigma e-solutions which, after the group's split into three listed companies, becomes the new Sigma AB.

The purchase-sum is 14,7 Mkr, and Sigma's goodwill post is estimated to increase by about 8 Mkr, and will be written-off in a 10 year period.

Example 1 An example of a news item from Computer Sweden 2001

Limitations of the Sources

Generally speaking, the greatest advantage of using secondary data is that there is a large saving of time and money (Burns & Bush, 2003; Ghauri & Grønhaug, 2002; Malhotra, 2004; Sekaran, 2002; Ticehurst & Veal, 2000). But there are, naturally, many disadvantages too. The data is most likely to

have been gathered with another objective, i.e. it might not be suitable for the purpose of the present study, and it might even have used different measures, terms and definitions. There is also an uncontrollable deficiency in that the information is probably incomplete in two ways; firstly, the information is intended as a news item and, therefore, probably not very detailed, and secondly, there is a clear selectivity in the events which are covered in a news item. The brief nature of these news items is, however, good as it increases the chance that the 'raw facts' are presented quite directly.

Although the news items can be argued to have been written for another purpose than that for which they are used here, it does not limit their largely useable content. As mergers, acquisitions and bankruptcies can be sensitive issues to discuss, there might be a risk for modification of the data, a kind of embellishment (Silverman, 1985). In addition to this, the original data has been interpreted by a journalist, and interpretations always carry the risk of distortion and omission. However, the information in the news items probably originates from some kind of press release or other kind of information from the companies involved in the event, unless they are based on, for example, rumours and speculation. This would mean that the information originates from the companies involved, which increases the substance of the information.

By taking these measures, and considering the intended use of the data to give a picture of events and business networks rather than any kind of complete description, the news items should provide suitable data.

Coding and Organizing Data

After the relevant news items are found, they are analysed in order to code the content of the text into different variables holding the meta-data, i.e. data on the data. The coding of the text in the news items aims at organizing the data in order to represent business networks and events causing structural change. This meta-data is very important as the subsequent analysis addressing network elements and structural change of business networks is an analysis of the meta-data, not the news items. The news items describe situations where something happens to an IT-providing actor, but it is the subsequent analysis of the text which decides whether the event is relevant to this study. Similarly, if the text mentions some of the company's customers, suppliers, partners or other counterparts, it is still the analysis of the text which determines whether it can be considered to be a business network. It is, however, not the texts themselves that are of interest to this study, which means that deeper text analysis methods, for example discourse analysis (e.g. Wetherell, Taylor & Yates, 2001), is of limited applicability to this study. So, the information in the texts is organized and coded, but a possible later use of the news items is to further analyse the texts per se.

To make the coding feasible, the mabIT structuration technique contains a computer software tool with several functions, as it is involved in storing, coding and analysis. The software tool has been designed and created based on the coding scheme and the wish to allow flexibility at all stages, which increases the opportunities of making a thorough analysis. The computer software, however, does not perform the analysis, it simply helps the human. There is a large amount of software that deals with qualitative data analysis of different kinds, of which NUD*IST is one of the most well known (cf. Prein, Kelle & Bird, 1995). While the standardized software packages offer powerful and advanced possibilities to perform analysis in many different ways with a general applicability, the software tool in mabIT has been designed and created for this study alone. The meta-data coding is made through a web-based graphical user interface. By using a web-based system, the software tool is accessible for many users from different geographical locations at once, while keeping all the data and administration centralized. The user interface can be modified if the needs or requirements change, and an important objective of the interface is to facilitate the coding and to make the coding more consequent.

Coded Aspects

The actual text describing the event is stored in the mabIT software tool, together with a reference to the source. This helps the operator during the registration of the event as well as enables verification and further coding at a later occasion. Among the most important variables concerning the event is the category, e.g. *acquisition, partial acquisition, merger* or *bankruptcy*, and an approximate date when the event occurred. After registering a new event, the actor or actors involved are connected to the event. This is done by matching an actor from the list of already registered actors, with the event, and by specifying the role of the actor in the event. The roles that an actor may have in an event are closely related to the categories of events that were previously listed, and are for example *bankrupt, being bought, buying, , merging, partially bought* and *selling*. There is also the possibility of adding a description of the involvement and marking the involvement for further investigation.

The news items do not explicitly describe business networks or network elements, but to include network data in the structurized data, the texts must be analysed based on the business network idea. Thus, the news items' information of a company's customers, or other descriptions of how actors are related to each other, can be used to build meta-data addressing the business networks. The coding of the business network aspects is mainly made up of two different groups of data; one describing the actors, which are mostly companies, and one describing the relations.

Besides basic facts about the actors, information such as the nationality is also registered to allow analysis of international aspects, and the product type is specified to indicate which actors provide IT-related products or services, as well as to enable further analysis on this aspect. It is important to note that it is not only IT-related companies that are included in the study. The IT-companies are in focus as M&A among them are what is searched for, but for example the customers to the IT-companies might well be working in other areas than IT.

In addition, some characteristics of the actors can be registered in the mabIT software tool at many different times, which provides an opportunity for following the development of an actor in terms of, for example, growth or decline. The kinds of characteristics that are registered are, for example*, employees, locations, profit* and *turnover*.

To capture business networks, not only actors are needed, but the business relationships are possibly even more important. Deciding what is a business relationship is a question for later analysis, but different kinds of relations can, however, be registered in mabIT by connecting two actors. Relations are changeable over time, so the approximate date when the relation started, or at least existed, and ended is, therefore, important to note when such information is available. A variety of different relation types are conceivable, such as *competitor, customer/supplier, distributor, owner, partner* and *retailer*. An extensive use of the opportunity to register relations should enable the database to address the business network aspect in subsequent analysis.

All of this data might not be accessible from a single news item, but it is possible to complement the data afterwards either from more news items or from other sources.

Possibilities for the Analysis

As is shown by the above illustration of how the coding is performed, the registration of the contents of the news items contains a large portion of analysis. It is not just the text itself that is registered in mabIT, but also highly interpreted extractions of the text. A large step towards the analysis of structural change of business networks is, thus, already performed at the coding phase of the structuration. It is, however, up to the later stages of analysis to process this coded meta-data and to make it represent network elements and structural change of business networks, and possibly to look for patterns of change therein.

A brief descriptive analysis shows that currently, a total of 1307 events, 2887 actors, 2880 relations and 2285 actor characteristics have been registered. These numbers are perhaps of limited value per se, but they indicate the amount of data that is handled with the structuration technique. Of the events, acquisitions are dominant with about 57% of the events, followed by mergers and bankruptcies at an almost equal frequency. About 50% of the actors are IT-related companies. Although not all actors' nationality is known, it can be seen that only about 46% of them are Swedish, which means there are a large international spread. The other Scandinavian countries and USA are also highly represented in the data. 1345, or about 47% of the relations represent relationships concerned with buying-selling, whereas 40% indicates an ownership.

This descriptive analysis of the present contents of meta-data in mabIT shows that a quite substantial amount of events, actors and relations have been registered. Both IT-providing and other actors have been included in mabIT, which is important to note as this study is not limited to the IT-sector. The description has also shown several aspects, for example nationalities and characteristics, that enables different approaches to the data and thereby creative analysis.

Using Software for Analysis and Visualization of Large Networks

One way of using the data is to turn to computer software made to analyse and visualize large networks, such as UCINET and Pajek. Pajek, which will be used in the following examples, has been created to analyse and graphically represent large networks of different kinds. It uses advanced algorithms, based on graph theory, to arrange the vertices (companies) and arcs or edges

(relationships) (Owen-Smith & Powell, 2004; Porter, Bunker Whittington & Powell, 2005; White, Batagelj & Mrvar, 1999).

Pajek can bee used in studies of for example genealogy, sociology, scholars' publications and citations, joint ventures and the internet (Batagelj & Mrvar, 2006), as it can handle any kind of situation that can be described as a network. In Pajek, many different characteristics of both the actors and relationships can be acknowledged. The algorithms can, for example, include relationship strength in the calculations, but also the visualization can show aspects such as different sizes of the actors, types of products and type of relationships. The important time dimension in the mabIT data can also be handled by Pajek, thereby preserving the possibilities for longitudinal approaches. Explicitly, for this purpose, this means that it is possible to depict a network at a certain point of time as well as visualize the structural changes occurring as time passes all based on the actual information in mabIT.

When working with a large data set, one can either take a global view, omitting the characteristics and details, or make a more detailed investigation of some selected part of the larger network (Batagelj & Mrvar, 2000). This has got large similarities to the network element approach described earlier as it focuses on the identification of certain characteristics of the network structure rather than the configuration of it. Below are two examples of how data from mabIT can be visualized in Pajek, after converting the data to Pajek's format. Figure 5 exemplifies a global view of the information of the meta-coding of uniquely identified relationships between specific companies. In all 1230 unique relationships are shown. If being interested in a particular actor, this view gets quite problematic to overlook. Still it provide a glimpse of the complexity network structures displays when not limited by relating it to a specific focal actor, relationship or event.

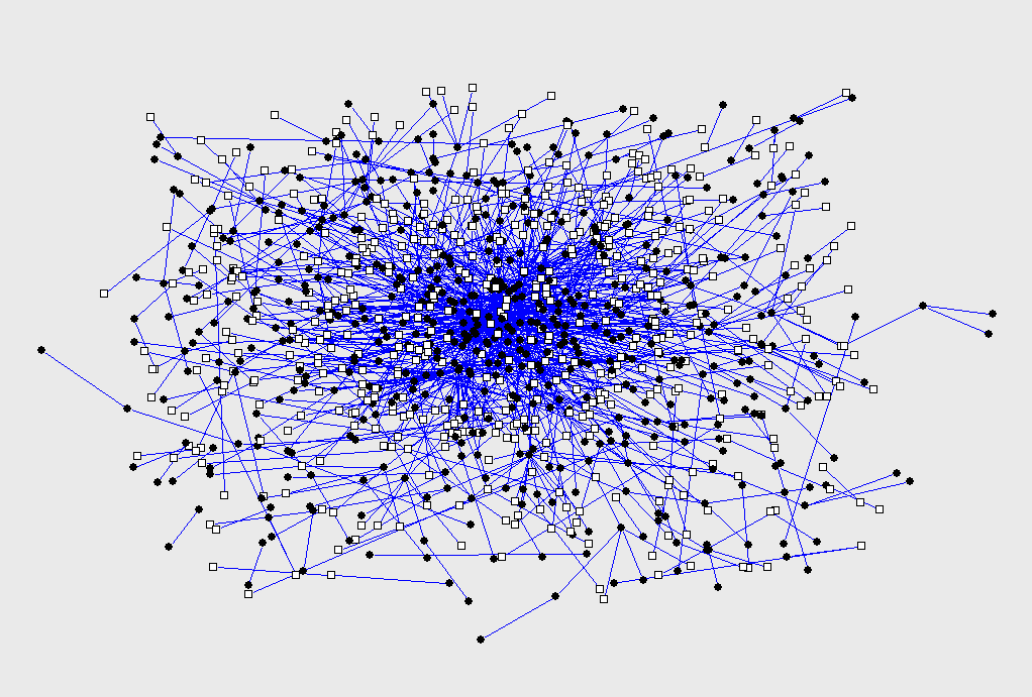

Figure 5 A global view, showing 1230 business relationships

Figure 6 on the other hand shows the network surrounding a specific actor (Nocom), extending two steps away in the sense that the relationships of the companies directly related to Nocom are also shown. As mabIT includes events, the picture also includes mergers and acquisitions, shown as thicker lines joining two actors. The conjunction of the business network and the mergers and acquisitions can thereby be seen.

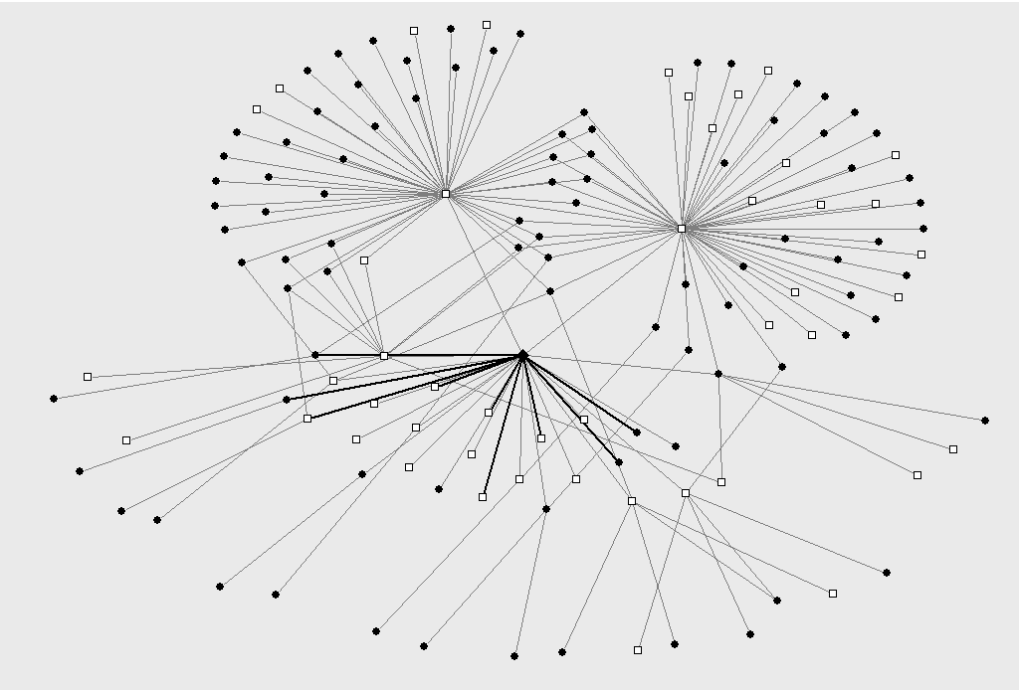

Figure 6 View focused on one company, showing related companies and, in turn, their respective relations. Thicker lines represent mergers and acquisitions.

In both figures, IT-related actors are shown as black ellipses and non-IT actors are the white boxes, which makes it evident that the data in mabIT cover a lot more than just the IT-industry. These pictures are primarily examples of how the mabIT data can be visualized, and the many possibilities for analysis of different kinds have not been used in what is shown here. Using this kind of software to work on the data in mabIT should however provide interesting possibilities both for analysis and visualization. It has proven useful for the analysis of other kinds of networks and there is no reason why it should not be so also for business networks.

Future Analysis

Searching for network elements and structural change of business networks with data of the described art requires that flexible and creative analysis is possible. In the existing research on business networks and change in business networks, there are examples of different kinds of research methods. A quantitative approach, using statistical analysis, has been used by some (e.g. Blankenburg Holm & Johanson, 1997), while others have taken a qualitative approach to change in business networks (e.g. Havila & Salmi, 2000). When studying structural aspects of business networks with a quite different method such as mabIT, both qualitative and quantitative analyses can be performed, but it is also likely that other kinds of data processing and analysis are useful.

Business networks, and not least network structures, are a theoretically defined phenomenon and exist only as a conceptual phenomenon, they are not objectively given (Hertz & Mattsson, 2004). Business networks can, therefore, never be directly captured by the mabIT structuration technique. It is, rather, the definition taken and analysis performed that enables business networks to be studied. The ability to register different kinds of relations between actors allows business networks to be studied in one way. It is not certain that all of these relations fulfill the criteria for being a business relationship, but that is a question for the analysis, and as these relations have been mentioned in the news items, they can at least be assumed to be quite important to the actor. The structuration technique used is most certainly not able to capture all the relations of every actor, but that is not the objective. What is captured is not complete business networks, but parts of networks which can be analysed with the network element idea in mind. The only thing an analysis of this data can give is a picture of business networks, which can be approached as network elements and structural change, and this picture is given by the data collected and the analysis conducted.

The characteristics and contents of the relationships are not included in mabIT, and change that takes place within the relationships cannot, therefore, be seen. However, the pictures of business networks in mabIT can be compared at different times and, thereby, reveal change of business networks. By identifying network elements, and by performing comparative analyses of the business network data at different points of time, mabIT provides the opportunity of studying the structural change of business network. The time dimension is found in the data both as the approximate date of the event, but also as the date of the sources. So changes of business networks can, thereby, be analysed as change from one state to another at different points in time (cf. Lundgren, 1995). By relating this analysis of change of business networks to the data on identified events, structural change should be identified more easily and the role of the events in structural change can be analysed.

Concluding Discussion

Roughly, this paper can be said to mainly have two inter-joined contributions. First, the description and definition of a structural view of business networks and structural change of business networks is important when doing more work with such a view of networks. Second, a technique with which business networks can be captured in a way suitable to address structural aspects has been developed and described. Although the technique has not yet been used to further the insight into business networks or structural change, this paper gives a hint of the data and how it is intended to be used in subsequent analyses.

The reasoning on what it means to approach business networks as structures is of value as it points at how this approach differs from the traditionally most common way, in which the parts (actors and relationships) of the network has attracted much of the interest. Traditional studies on business network dynamics tend to look at how change in one relationship affects another relationship, thereby not reasoning on a network level. The way of thinking of network structure inspired the development of mabIT, the technique to structure data in order to capture extensive network structures. This technique is based on coding and structuring data based on news items on IT-related companies, thereby capturing relations between companies and mergers, acquisitions and bankruptcies involving the companies. It is not possible to use the news items directly to analyse structural change of business networks, so the systematic meta-data coding in the mabIT structuration technique is an attempt to use the coding of the news items as pieces forming analysable data.

This paper has also shown brief examples of what can be accomplished by using graph theory based software, such as Pajek. Using this kind of software requires data that is flexible but still structurized. It has shown that mabIT holds suitable data, which also is arranged in a suitable way, to match the ideas behind Pajek. Although structural change was not shown in these two pictures, as the time aspect was disregarded, they clearly illustrate the complexity of business networks. Even though business networks are often depicted relatively small, for the sake of the analysis, it is reasonable to assume that business networks are actually really large. As most companies probably has got quite a number of customers and suppliers, and so do each and every one of the customers and suppliers, a business network quickly expand if one looks a few steps away, as figure 5 & 6 indicates.

Great attention is, by this assertion, set to the delineation of business networks. A common empirical limit is set by the time spent collecting data, for example performing interviews. The more or longer interviews that are made, the larger the network gets. In mabIT, the business network data is limited by the strength or importance of the relationships. This is because only the strong, or most important, relationships are mentioned in the news items. What is shown in figure 6 is in turn a delimited part of the network in figure 5, and as looking of parts of the larger network structure is an important way to perform analysis of network structure, the issue of delimiting clearly require the attention of more reasoning. Future studies, of this data as well as other data, are thus encouraged to explore the delimiting issue further.

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