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Original scientific paper

Relations that Show the Network Potential for Spatial Data Sharing

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Abstract: Physical and functional cooperation based on a certain hierarchy among public institutions, local governments, private sectors and all other industries that work with spatial data is a very important dynamic. This cooperation between organizations or individuals is actually built with unofficial networks that are not bound by predefined rules. By utilizing network analysis, a formal presentation of the existing collaborations and communication networks can be made.The questions that were asked to organizations during the research were selected to determine various issues such as their collaborations within the network, data exchange potential and awareness to understand the direction of the flow. This study provided an insight into the organizations that should be prioritized in any regulation and initiative on the spatial data infrastructure (SDI). Furthermore, it is proposed that organizations that are currently less active with spatial data can play a more active role with the quantitative and qualitative increase in e-applications.

Keywords: interoperability; SDI; social network analysis; spatial data exchange

1 INTRODUCTION

Spatial data, which can be defined as data that have a spatial component, i.e. the data that are connected to a place in the Earth, have an economical value as an important component of public information [1, 2]. Additionally, it provides a basis for country politics and decision-making mechanisms and has a social importance due to its tangible benefits for public institutions and bodies and for the private sector [3, 4]. Decision making processes based on geographic information in projects can be performed with integrity using Geographic Information Systems (GIS) [5, 6]. However today coordinated generation, update, sharing and use of local/regional/ national and international level information has become an important necessity [7-9]. Spatial data and services are shared and integrated to use Spatial Data in decision making process to provide efficient services to citizens [10].

INSPIRE is an initiative started by the European Commission and developed with the cooperation of member states and participating countries. The European Union requires that spatial data should be provided efficiently to manage environmental issues and to develop environmental policies. Therefore, the European Commission started INSPIRE to develop, implement and monitor environmental policies [11, 12].

It is a system which enables both vertical and horizontal effective data sharing, instant access and use of services and interoperability that all public institutions and bodies, local governments, private sector and all other sectors working with spatial data need [13, 14]. It is a comprehensive system which is built to allow fast, cost-efficient and effective access to data which organizations require to carry out their activities [15]. Technological tools based on spatial data have been increasing and the number of users has also been increasing parallel to that [16].

To achieve data exchange between organizations, operational, physical and hierarchical boundaries of the organizations should be determined and an effective cooperation should be established. The system that will reveal the invisible cooperation between organizations is a social network [17, 18]. Social Network Analysis (SNA) can be defined as the digitalization of relations between actors used to convert existing intra-organizational or inter-organizational relations into digital data. As the form and shape of the network obtained with the digitalized data shows the efficiency of the intra-organizational or inter-organizational communication network, it provides guidance to take necessary measures or provide support for the subject analysed [19].

Their interoperability structure for spatial purposes is CBS. Interoperability in INSPIRE means the possibility to combine spatial data and services from different sources across the European Community in a consistent way without involving specific efforts of humans or machines. This definition does not focus on how systems interact but rather on the integration of the existing data obtained from different sources after the barriers that the system users frequently encounter are eliminated [20].

2 INTERNATIONAL STANDARD INSPIRE

The European Union (EU) member states are working to integrate in technical areas in addition to economic, social and cultural areas. The member states have realized the importance of having one single structure of spatial data under the EU and therefore started an important initiative. For this purpose, the European Parliament approved the directives on the infrastructure for spatial information and published in the Official Journal of the European Union and came into force on May 15, 2007. Thus the framework directives for the Infrastructure for spatial information in Europe (INSPIRE) have become something to act on [21].

The main objective of INSPIRE is to ensure spatial data sharing between member countries to develop, evaluate, monitor and implement EU policies, and ensure easy access to spatial data on environmental, agricultural, transport and other areas for citizens and business environment at the local, regional, national and international levels by providing high quality access to spatial data [22].

3 INFRASTRUCTURE FOR SPATIAL DATA

There are many national and international projects to build infrastructures for spatial data. INSPIRE initiated under the control of the Environment Directorate-General of the European Commission is an European Union (EU)

initiative which will provide coordination for the management of spatial information long Europe. The INSPIRE project develops technical standards, protocols to generate spatial data, to allow access and use of such data and regulations on public coordination and spatial data and acts as guidelines for any work on geographic data infrastructure of the European countries. This initiative aims to provide consistent, high quality, accessible and shareable information to support European policies on environment, agriculture, healthcare, transport and many other industries at local, regional and national levels [23].

When building of a SDI, existing positions of local and international organizational stakeholders should be determined. The potential of the stakeholders that generate and use spatial data to manage spatial data; hardware, software and electronic network infrastructure; regulations on data transfer/share process and employees' ability to use data are critical [24].

All industries that use spatial data such as public institutions and agencies, local governments, and private enterprises access the data they need and share the data they have via the services that allow "interoperability" in the SDI. Work on systems and software architecture that ensures the interoperability of applications that use different programming language, located in different locations on the network and work on computers with different hardware to perform the required tasks continues [25].

Pragmatic interoperability; interconnected systems understand each other. Thus they can use applications / service interfaces, retrieve methods and procedures and exchange the data they process with other systems. The most important feature of this interoperability is that it makes it possible for the systems to communicate or interact. Perfectly defined service interfaces are required to achieve this level of interoperability. At the same time, methods that recall data are required. The mechanisms that support interoperability are standards and practices including ISO standard 19128 (web Map Server Interface), ISO 19142 and OGC service interfaces [26].

4 SOCIAL NETWORK ANALYSIS

A social network consists of people who are referred to as actors and the connections between these people. SNA can be defined as the conceptualization of structures arising from the relations between these actors into mathematical format and then analysis of these relations using certain methods [27].

Actors are connected to each other in many networks in which each connection/tie represents a network in the complex structure of social relations. These complex relation structures are analysed by an analysis tool called Social Network Analysis. A social network analysis allows us to see the things that are not possible to be seen with the naked eye. The main objective of a social network analysis is to define and interpret paths of social ties [28]. SNA aims to understand the network structure by identification, visualization and modelling [29]. In a geometric plane, each unit is shown with a node (vertice) and the connections between nodes are shown with arrows or lines [30].

4.1 Social Network Analysis Measures

Based on the assumption of the importance of the relation between interacting groups, SNA is the analysis of all kinds of relations/ties between the actors i.e. organizations, individuals or groups that are shown as nodes on the lines. A SNA aims to make assumptions and generate data about an individual or group by examining the structure of a social network.

In order to conduct a SNA, certain data that explains which actor has ties with which actor must be available. Mathematical measurement and calculation methods used to define and analyse the social network mechanism after the network relation data has been entered are different from the statistical methods used for data analysis of any quantitative research in social sciences. Certain measurement methods are used to explain the positions of actors in the network and to define the network mechanism as a whole in the analysis of a social network mechanism. In Tab. 1 the definitions of the measures that are important to show the hierarchical structure of a network mechanism, to determine power relations and to identify communication methods are shown. Tab. 2 shows the definition of the task measures of the actors in the network [31].

Table 1 Social network mechanism measures used for actors

Measure	Definition
Degree	Number of direct connections to other actors [32].
Indegree	Number of connections of other elements to the actor (receiving connections).
Outdegree	Number of connections of the actor to other elements (sending connections).
Closeness	The closeness of an actor to other actors within the network or the degree of accessibility. It is generally calculated by averaging an actor's path distance (direct or indirect connections) to all others. While a direct relation is valued at 1, indirect relations are valued at a lower number proportionately [33].
Betweenness	It is the degree of an actor's preference to be or intermediate between two actors which are closest to each in the network mechanism. It is generally calculated according to the average of all possible bilateral relations in the network [34].
Centrality	It is the measure of an actor's degree of being positioned in the centre in the network mechanism. The measures of degree, closeness, and betweenness are generally used as the determinants of the centrality. Some centrality measures weight an actor's relation with others by using others' degree of centrality.
Density	The ration between current connections and possible connections in the network mechanism [35].

Table 2 Actors' roles in the network

Measure	Definition
Star	An actor with a high centrality in the network.
Intermediary	An actor which connects two or more groups which would not have any relation otherwise.
Bridge	An actor which is a member to two or more groups.
Gatekeeper	An actor that controls information flow over one single connection between one and another section of the network.
Isolated	An actor who has none or very few ties with others.

5 IMPLEMENTATION

The cooperation of organizations that generate or use spatial data within a network was studied using the SNA method. NetMiner 4 software program, which is one of the

SNA software programs that are preferred for scientific publications, was used for statistical and visual evaluations. In this study, 24 organizations in public and private sectors that used or generated spatial data were selected as the sample of the study (Tab. 3).

Table 3 Organizations to which survey questions were asked

Name of Institution	Abbreviation
Usak Municipality	UM
Special Provincial Administration	SPA
State Hydraulic Works	SHW
Housing Development Administration	HDA
Forest Management Directorate	FMD
The Directorate of Highways	DH
Department of Environment and Urbanization	DEU
Directorate of Title Deed Registry and Cadastre	DTDRC
Foundations	F
Turkish Electricity Distribution Company	TEDC
Governorship	G
Provincial Directorate of Agriculture	PDA
Real Estate Agent	REA
Banks	B
National Real Estate Department	NRED
Licensed Bureau of Surveying Engineering	LBSE
Telecom Directorate	TD
Directorate of Disaster Affairs	DDA
Independent Survey and Cadastre Office	ISCO
Chamber of Commerce	CC
Chamber of Agriculture	CA
Directorate of Museums	DM
University of Usak	UU
Courts	C

Likert scale was used in this study. Based on the recommendations, an odd-numbered scale was used. Additionally, the scale of 0-8 was chosen to show the weight in the network figures clearly. As the study would have a network mechanism sample, sample was selected to be limited in space. The position-based approach was used to define the limits of samples [36]. In the position based approach, the presence of a membership relation for the network in which actors are in can be proved. The reason why limited space is used in the study is that the number of relations researched and compared increases exponentially with the number of volunteers. Therefore, studies in which sociometric data is collected and use a matrix approach usually have 40 or less samples [37].

Therefore, we can conclude the sample we used in this study is adequate for a sociometric research. All of the volunteers in the sample were engineers or people with a technical job.

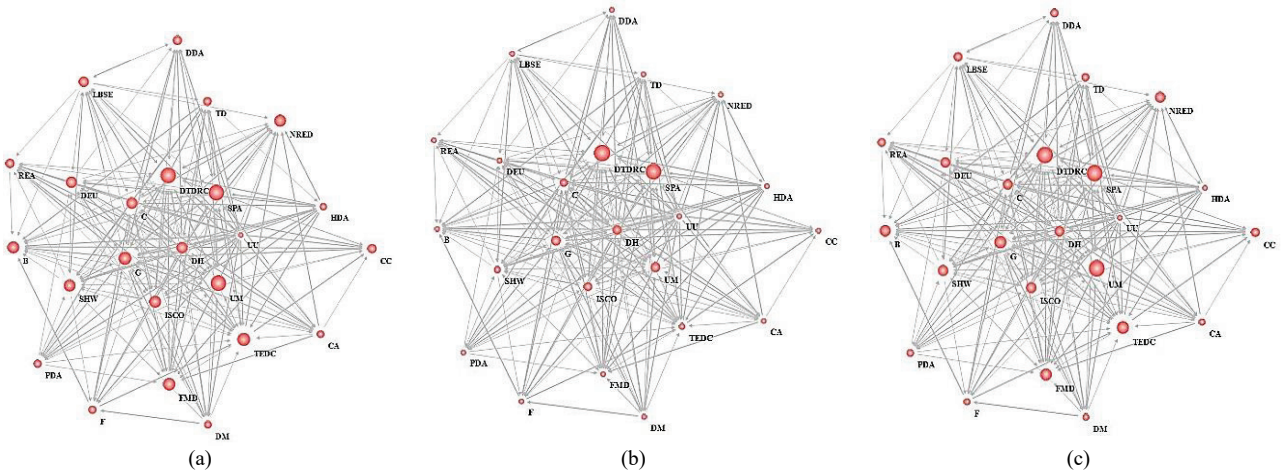
3.1 Relations Which Show the Network's Potential for Data Sharing

The potential for spatial data sharing of the organizations which generate and use data is mostly examined using existing data and software tools for the present state evaluation during the INSPIRE process. However, it is important to evaluate all components of the potential for spatial data management to determine present state and requirements in organizations.

Table 4 Survey questions which show the network potential for data sharing

No	Relations which show the network potential for data sharing	disagree ◄► agree
1	Can you have access to the following organizations to collect data?	0 1 2 3 4 5 6 7 8
2	To what extent the organizations provide you the data you need?	0 1 2 3 4 5 6 7 8
3	To which organizations you provide the data you generate and how often do you provide?	0 1 2 3 4 5 6 7 8
4	Do you know what kind of spatial data the following organizations generate?	0 1 2 3 4 5 6 7 8
5	How often did you get the spatial data you need from the organizations within the last year?	0 1 2 3 4 5 6 7 8

Survey Question 1: Each organization that generates or uses spatial data was asked the question "Can you have access to the following organizations to collect data?" and network and centrality graphs were created using the data obtained from the answers to this question. Actors and data access network among actors are shown in Fig. 1.



(a) (b) (c)

Figure 1 Based on the answers to the first questions, the following graphs for actors and ties between actors were created: (a) Degree network map and degree centrality graph; (b) Betweenness network map and betweenness centrality graph; (c) Closeness network map and closeness centrality graph

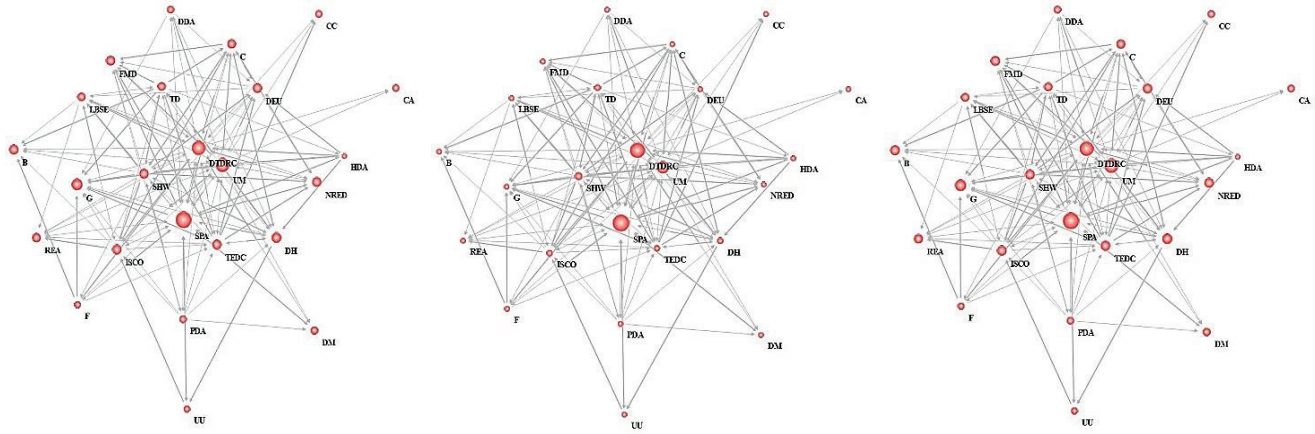
The survey questions in this study (Tab. 4) were developed based on the questions that aim to reveal important network relations included in the book "Hidden Power of Social Network". Based on the answers to the questions that show the network's potential for data sharing; network and centrality graphs which show important results on the organizations which generate data and whether the spatial data they generate is known; whether easy access to obtain from these organizations is possible, how often spatial data is obtained and to what extent the required data is provided and to which organization the generated data is provided were

developed. 3 maximum and minimum standard deviations and 3 deviations in organizations were added in the graphs created with the values of centrality measures (Tab. 5).

Table 5 Maximum and minimum values for the in-out degree, betweenness and closeness centrality of the question, *"Can you have access to the following organizations to collect data?"*

		Maximum		Minimum	Std. Dev.
In Degree	Usak Municipality	0,870	University of Usak	0,087	0,197
	Special Provincial Administration	0,870	Housing Development Administration	0,261	
	Directorate of Title Deed Registry and Cadastre	0,870	Directorate of Museums	0,304	
Out Degree	University of Usak	1,000	Chamber of Commerce	0,000	0,323
	The Directorate of Highways	1,000	Banks	0,000	
	Governorship	0,957	Forest Management Directorate	0,043	
Betweenness	Directorate of Title Deed Registry and Cadastre	0,102	Chamber of Commerce	0,000	0,029
	Special Provincial Administration	0,099	Chamber of Agriculture	0,000	
	Governorship	0,045	Directorate of Disaster Affairs	0,000	
In Closeness	Usak Municipality	0,872	University of Usak	0,468	0,109
	Special Provincial Administration	0,872	Housing Development Administration	0,479	
	Directorate of Title Deed Registry and Cadastre	0,872	Foundations	0,548	
Out Closeness	University of Usak	1,000	Chamber of Commerce	0,000	0,256
	The Directorate of Highways	1,000	Banks	0,000	
	Governorship	0,958	Forest Management Directorate	0,479	

Survey Question 2: Each organization that generates or uses spatial data was asked the question "To what extent do the organizations provide you the data you need?" and network and centrality graphs were created using the data obtained from the answers to this question. The overview of the network for actors and ties between actors is shown in Fig. 2.



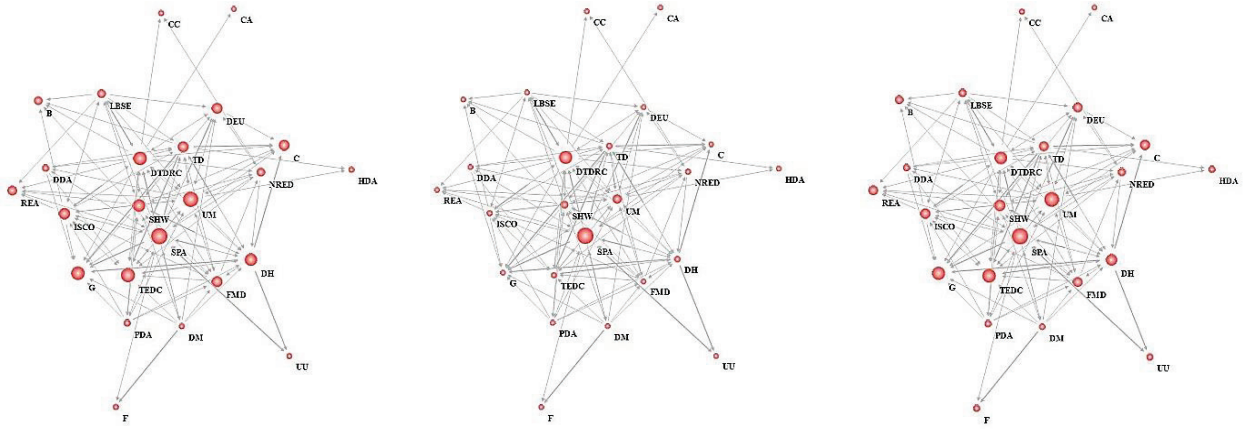
(a) (b) (c)

Figure 2 Based on the answers to the first questions, the following graphs for actors and ties between actors were created: (a) Degree network map and degree centrality graph; (b) Betweenness network map and betweenness centrality graph; (c) Closeness network map and closeness centrality graph

Table 6 Maximum and minimum values for the in-out degree, betweenness and closeness centrality of the question, "To what extent do the organizations provide you the data you need?"

		Maximum		Minimum	Std. Dev.
In Degree	Special Provincial Administration	0,783	University of Usak	0,087	0,194
	Directorate of Title Deed Registry and Cadastre	0,696	Chamber of Agriculture	0,087	
	Usak Municipality	0,696	Foundations	0,087	
Out Degree	Directorate of Title Deed Registry and Cadastre	0,870	Governorship	0,000	0,269
	Usak Municipality	0,826	Chamber of Agriculture	0,000	
	Special Provincial Administration	0,826	Chamber of Commerce	0,000	
Betweenness	Special Provincial Administration	0,181	National Real Estate Department	0,000	0,05
	Directorate of Title Deed Registry and Cadastre	0,161	Directorate of Disaster Affairs	0,000	
	Usak Municipality	0,115	Forest Management Directorate	0,000	
In Closeness	Special Provincial Administration	0,785	Foundations	0,424	0,097
	Directorate of Title Deed Registry and Cadastre	0,713	University of Usak	0,424	
	Usak Municipality	0,713	Housing Development Administration	0,349	
Out Closeness	Directorate of Title Deed Registry and Cadastre	0,885	Governorship	0,000	0,258
	Usak Municipality	0,852	Chamber of Agriculture	0,000	
	Special Provincial Administration	0,852	Chamber of Commerce	0,000	

Survey Question 3: Each organization that generates or uses spatial data was asked the question "To which organizations do you provide the data you generate and how often do you provide?" and network and centrality graphs were created using the data obtained from the answers to this question. The overview of the network for actors and ties between actors is shown in Fig. 3.



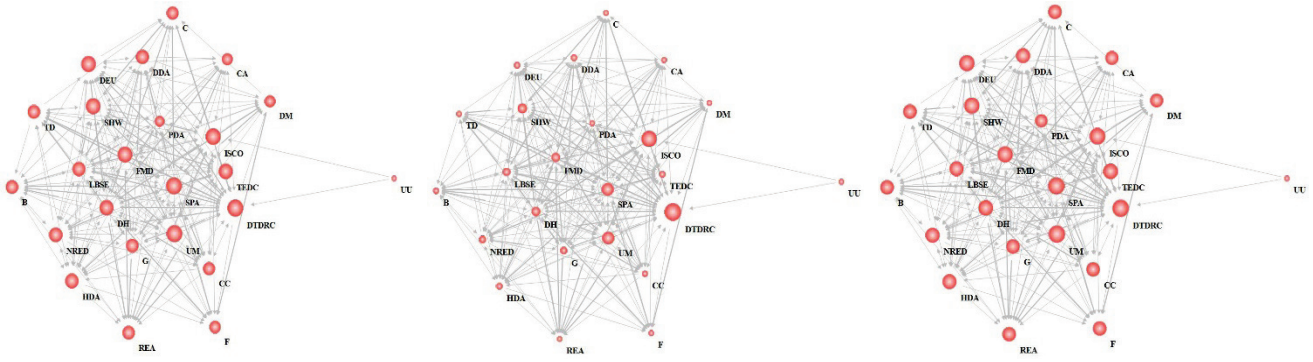
(a) (b) (c)

Figure 3 Based on the answers to the first questions, the following graphs for actors and ties between actors were created: (a) Degree network map and degree centrality graph; (b) Betweenness network map and betweenness centrality graph; (c) Closeness network map and closeness centrality graph

Table 7 Maximum and minimum values for the in-out degree, betweenness and in-out closeness centrality of the question "To which organizations do you provide the data you generate and how often do you provide them?"

		Maximum		Minimum	Std. Dev.
In Degree	Special Provincial Administration	0,565	Chamber of Agriculture	0,043	0,152
	Usak Municipality	0,522	University of Usak	0,087	
	TEDC	0,478	Directorate of Museums	0,087	
Out Degree	Special Provincial Administration	0,870	University of Usak	0,000	0,263
	Directorate of Title Deed Registry and Cadastre	0,870	Chamber of Agriculture	0,000	
	State Hydraulic Works	0,609	Chamber of Commerce	0,000	
Betweenness	Special Provincial Administration	0,139	University of Usak	0,000	0,034
	Directorate of Title Deed Registry and Cadastre	0,103	Chamber of Agriculture	0,000	
	Usak Municipality	0,052	Chamber of Commerce	0,000	
In Closeness	Special Provincial Administration	0,568	Chamber of Agriculture	0,296	0,07
	Usak Municipality	0,533	Chamber of Commerce	0,316	
	Directorate of Title Deed Registry and Cadastre	0,473	Directorate of Museums	0,328	
Out Closeness	Special Provincial Administration	0,885	University of Usak	0,000	0,321
	Directorate of Title Deed Registry and Cadastre	0,885	Chamber of Agriculture	0,000	
	State Hydraulic Works	0,719	Chamber of Commerce	0,000	

Survey Question 4: Each organization that generates or uses spatial data was asked the question "Do you know what kind of spatial data the following organizations generate? " and network and centrality graphs were created using the data obtained from the answers to this question. The overview of the network for actors and ties between actors is shown in Fig. 4.



(a) (b) (c)

Figure 4 Based on the answers to the first questions, the following graphs for actors and ties between actors were created: (a) Degree network map and degree centrality graph; (b) Betweenness network map and betweenness centrality graph; (c) Closeness network map and closeness centrality graph

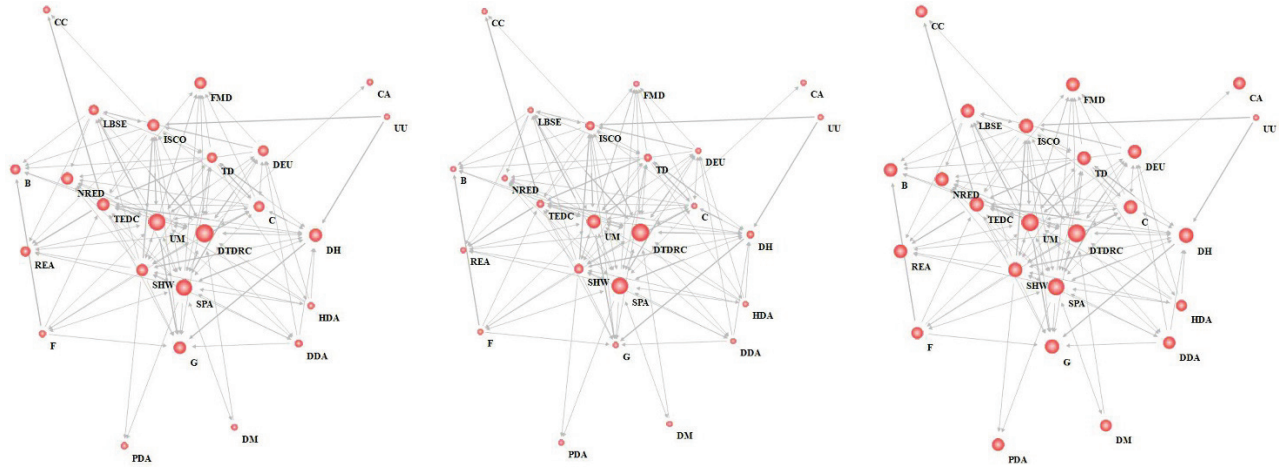
The first evaluation was made for density measures in order to analyze the complex structure of the network, and to make the network more understandable. The high density of number of ties between the nodes in a network means that the actors (organizations) either know each other or the number of interactions is high. The maximum number of ties for the network in the SDI performed for the twenty four organizations (n) in this study is 552 ($n(n-1)$). The calculations "General density of the network depending on the number of ties" in the chart 8 shows the percentage of potential ties that have been made.

When the relations that show the data sharing potential of the network were examined in Tab. 10, although the results to the questions on the knowledge of organizations about the data that the other organizations generate and mutual trust levels were above average, the access of organizations to other organizations to obtain data was found to be "moderate", frequency for obtaining information they need from other organizations within the last year, the extent of the data they provide to each other, the frequency at which they provide data to each other were found to be "low".

Table 8 Maximum and minimum values for the in-out degree, betweenness and in-out closeness centrality of the question, "Do you know what kind of spatial data the following organizations generate?"

		Maximum		Minimum	Std. Dev.
In Degree	Usak Municipality	0,870	University of Usak	0,000	0,186
	Special Provincial Administration	0,870	Provincial Directorate of Agriculture	0,391	
	Directorate of Title Deed Registry and Cadastre	0,870	Chamber of Agriculture	0,478	
Out Degree	Usak Municipality	0,957	Courts	0,000	0,321
	Special Provincial Administration	0,957	Foundations	0,000	
	The Directorate of Highways	0,957	Real Estate Agent	0,261	
Betweenness	Directorate of Title Deed Registry and Cadastre	0,047	University of Usak	0,000	0,013
	Independent Survey and Cadastre Office	0,043	Chamber of Agriculture	0,000	
	Special Provincial Administration	0,029	Courts	0,000	
In Closeness	Usak Municipality	0,872	University of Usak	0,000	0,167
	Special Provincial Administration	0,872	Courts	0,000	
	Directorate of Title Deed Registry and Cadastre	0,872	Foundations	0,000	
Out Closeness	Usak Municipality	0,957	Courts	0,000	0,265
	Special Provincial Administration	0,957	Foundations	0,000	
	Independent Survey and Cadastre Office	0,957	University of Usak	0,523	

Survey Question 5: Each organization that generates or uses spatial data was asked the question "How often do you get the spatial data you need from the organizations within the last year?" and network and centrality graphs were created using the data obtained from the answers to this question. The overview of the network for actors and ties between actors is shown in Fig. 5.



a b c

Figure 5 Based on the answers to the first questions, the following graphs for actors and ties between actors were created: (a) Degree network map and degree centrality graph; (b) Betweenness network map and betweenness centrality graph; (c) Closeness network map and closeness centrality graph

Table 9 Maximum and minimum values for the in-out degree, betweenness and in-out closeness centrality of the question "How often do you get the spatial data you need from the organizations within the last year?"

		Maximum		Minimum	Std. Dev.
In Degree	Directorate of Title Deed Registry and Cadastre	0,696	University of Usak	0,000	0,188
	Usak Municipality	0,652	Chamber of Agriculture	0,043	
	Special Provincial Administration	0,609	Directorate of Museums	0,043	
Out Degree	Special Provincial Administration	0,783	Chamber of Agriculture	0,000	0,245
	State Hydraulic Works	0,696	Chamber of Commerce	0,000	
	Usak Municipality	0,652	Provincial Directorate of Agriculture	0,000	
Betweenness	Directorate of Title Deed Registry and Cadastre	0,153	Chamber of Agriculture	0,000	0,044
	Special Provincial Administration	0,144	Chamber of Commerce	0,000	
	Usak Municipality	0,101	Provincial Directorate of Agriculture	0,000	
In Closeness	Directorate of Title Deed Registry and Cadastre	0,704	University of Usak	0,000	0,132
	Usak Municipality	0,671	Housing Development Administration	0,335	
	Special Provincial Administration	0,640	Directorate of Museums	0,361	
Out Closeness	Special Provincial Administration	0,809	Chamber of Agriculture	0,000	0,256
	Directorate of Title Deed Registry and Cadastre	0,752	Chamber of Commerce	0,000	
	Usak Municipality	0,726	Courts	0,000	

Table 10 Density of data sharing potential of the network

Relationships	Determinations	The resulting number of relations (1)	The overall density of the network by the number of relationships (2) = (1)/552	Level of realization
Network data-sharing potential	Can you have access to the following organizations to collect data?	290	0,525	Middle
	To what extent the organizations provide you the data you need?	176	0,319	Low
	To which organizations do you provide the data you generate and how often do you provide?	148	0,268	Low
	Do you know what kind of spatial data the following organizations generate?	354	0,641	Above the middle
	How often did you get the spatial data you need from the organizations within the last year?	156	0,283	Low

5.1 Results for the Roles of Organizations in the Network

Centrality measures are important to determine the positions and roles or organization in a network. In the social network analysis measures section, five actors are defined for social networks as seen in Table 2. These are: star, gatekeeper, bridge, intermediary and isolated. When we examine the data sharing potentials of organizations in a SDI, organizations that have high degree, betweenness and closeness centrality measures are identified in order to determine these roles.

Star, refers to an actor at a central position in the network. When Degree, betweenness and closeness chart values are considered, organizations that are network stars are DTDRC, SPA and UM. As these organizations also have the highest number of direct ties, they have critical positions in the social network. These organizations are active in the network and play an important role for the network activity.

Gatekeeper, refers to a discrete actor that connects two different groups in a social network but does not belong to either of the groups. When the analyses for the social network structures were reviewed, there were no two groups that are independent of each other and there were no organization that has the gatekeeper role and was isolated from groups.

Bridge, this role is defined as membership to several groups and acting to provide connections with other groups. When the analyses for the social network structures were reviewed, as two or more number of blocks were not available in the social network, no organization assumed the role, bridge.

Intermediary, this role is defined as the actor that acts as the intermediary and controls the flow in the social network It is possible to identify intermediary organizations using betweenness centrality. When betweenness measures are examined, it is possible to observe that DTDRC and SPA can be intermediary organizations. These organizations have high potentials to control data flow among organizations, and act as the intermediary to the shared data in the network. When these organizations leave the network, it is possible that other organization couples' ties can be broken.

6 CONCLUSION

This study aimed to show the awareness of the organizations that generate and use spatial data and thus contribute to the on-going planning process for the SDI concept. Relations among public institutions and agencies, local governments that generate spatial data and all industries that work with spatial data were examined for the technical aspects and the interoperability which the organizations have created unintentionally and which do not have defined rules were shown with "social networks". It is possible to say that all these results and evaluations for the city represent the country in general.

The study shows the results and evaluations on the current state of the spatial data sharing; which organizations play an active role; which organizations generate the highest number of spatial data and which organizations use spatial data the most. Thus, this study provided an insight into the organizations that should be prioritized in any regulation and initiative on the spatial data infrastructure (SDI). Furthermore, it is proposed that organizations that are determined to be less active with spatial data in this study can play a more active role with the quantitative and qualitative increase in e-applications under the SDI. The priority goals for SDI are to ensure that the existing operations are carried out in the fastest, cost-efficient way without resorting to repetitive data generation and with a standard that can be used by every organization. Therefore, a study that shows the present state is important.

Organizations are generally aware of what the others generate as spatial data and what kind of spatial data they use. However, it was possible to understand from the spatial data the organization generates that awareness was only limited to the data related with their operations. The process of asking data from other organizations that involves many levels and much paperwork causes frustration. The logic of interoperable networks is that they are based on flexible structures contrary to the strictly regulated bureaucracy. Flexible structures required by networks facilitate information flow and share, and emphasize the importance of participation and shared responsibility. Therefore it is important to reinforce internal communications of the organizations and to build closer ties with different sections of other organizations based on trust. On the other hand, the fact that the amount of spatial data circulating among organizations is low demonstrates that data is generated repeatedly within organizations, which refers to a situation where no cost and time saving is achieved. Low network density, the fact that the percentage of the requested spatial data provided by other organizations is low demonstrates that organizational needs are not met and organizations generally carry out their operations using their own means. Repetitive data is generated due to the fact that the required spatial data is not provided by other organizations or that organizations do not know that the others have the data they need. As data is repetitively generated, the same data is generated by several organizations leading to economic losses and loss of time. It is important to identify potential users and make a clear distinction between organizations that generate or use data in order to clearly and correctly determine the spatial data that are generated repeatedly. It can be concluded that organizations with low network density have not adopted sharing which is one of the important stages of the SDI. Coordinated generation, update, sharing and use of information local/regional/national and international levels have recently become an important necessity. Sharing culture should be encouraged and widespread in the provincial organizations that are the smallest units in this hierarchy.

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