SOCIAL NETWORK ANALYSIS AS A TOOL TO EVALUATE
THE BALANCE OF POWER ACCORDING TO THE SERBIAN HEALTH INSURANCE ACT

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The Serbian Health Insurance Act of 2005 was supposed to be a corner stone for a more decentralised health care system, which offers to the insured, an opportunity for greater self-management. The questions now are whether the new organisational structure would foster a transition from a socialistic health care system to a more contribution driven system (which also is based on a rather decentralised decision making and funding), and how the balance of power is institutionalised. We have studied the structure of the Serbian health care system and describe how the various players are positioned in the network applying Social Network Analysis (SNA). Power arises from occupying advantageous positions. The distribution and balance of power may be depicted by three "measures of advantage" (indices): degree centrality, closeness centrality and betweenness centrality. The SNA was set up applying a position approach for two reasons: firstly, to analyse the formal structure as it is laid down in the law and, secondly, it is less time-consuming. Other options like reputation approach and decision approach would have to refer to surveys and questionnaires. The matrix of connectivity representing the directed links was exported to Visone 2.6.2 for further analysis and visualisation. The SNA depicted here and the corresponding distribution of power is a snapshot of players, their links and the associated possibilities to exercise power. The structure found is therefore the framework for concrete policy-making, enabling or impeding political problem solving. Our findings could be seen as a basis for further analyses of specific decisions/non-decisions where capacity is converted into concrete action.

Keywords: social network analysis, visualisation of networks, analysis of power in networks, power in Serbian health care system

INTRODUCTION AND BACKGROUND

In the past, the Government of the Republic of Serbia, as the centre of power and decision-making beyond the health care sector, decided on the composition of the Board of Directors, the Supervising Board and the Director. The Director was directly appointed and acquitted by the Serbian Government, the Managerial Board and the Supervisory Board were based on previously obtained proposals by the representatives of the insured population categories. The dominant characteristics of the institutional management of health insurance in Serbia reflected this marked centralization of power. The decision-making strongly depended on these "supreme authorities", lying outside of the health care sector. A "quasi-autonomy" of health insurance and its strong political dependence impeded initiative and entrepreneurship. This situation is equivalent to the existence of a strong macro level. Criticism focused especially on the structural fundamentals of the management of health insurance, which was completely dependent upon the external authority in making and putting decisions into practice.

The basic trends in reforms of the management of health care finance systems in the countries of the European Community, both developed and in transition [1], have been determined by the promotion of:

- the alteration of the state role
- the introduction of a controlled market
- reorganization of the entire health care system in terms of decentralization, and privatization, civil rights, citizens' choices and participation
- the enhancement of the role of public health.

Bjegovic et al. [2] emphasize, that decentralization plays an important role in the portfolio of possible activities to reform health policy in most European countries; this applies in particular for countries in transition. Decentralization implies a transfer of authority or competencies and responsibilities from the higher to lower levels. Transferring authority from the central administration to the bodies of smaller and local communities does not necessarily mean that the central administration is deprived of all authority and power. The central administration can retain some control along with essential tasks, such as legislative, financial, and regulatory duties. Finally, the gain in the health care system's performance in terms of efficiency and flexibility can outweigh the expected loss of central administrative power. However, the issue of decentralization is very complex and the extent of the decentralisation has to be appropriate. Any excess, whether it refers to total centralization or total decentralization, can harm the health care process [2]. It is not uncommon to find countries that previously engaged in radical decentralization to later recentralize their control over key elements of the system [3].

In the Health Insurance Act of 2005 (articles 208 et seq.) the Serbian Government [4] admitted that the reorganisation of the Serbian Health Care System has to take into account the following key issues: "The compulsory health insurance is provided and implemented by the Republic Institute of Health Insurance, with its official seat in Belgrade" (article 208). "The Republic Institute is managed by the insured that are equally represented in the Managing Board of the Republic Institute in proportion to the type and number of the insured established by this act (article 209)".

In order to provide and implement health insurance on the territory of the Republic of Serbia, the district branches throughout the country and the Provincial Institute of Vojvodina are founded. The branches are established for the territory of a region, with a seat in that region i.e. for the territory of the City of Belgrade, with the seat in Belgrade, whereas municipalities of Ražanj and Sokobanja pertain to the branch with the seat in Niš. The branch consists of organisational units (hereinafter referred to as branch divisions), which are organised in such a manner so as to make the services available to the insured on the territory of the Republic" (article 210).

The questions now are whether the new organisational structure fosters a transition from a socialistic health care system to a more contribution driven system (also based on decentralised decision making and funding), and how the balance of power is institutionalised.

Health care systems - like any other social structure - can be perceived as networks of various players. Here, the players are those who directly or indirectly influence the health status of a population. Within these networks, players vary in their power and influence. Some players might even be grouped forming a hierarchy, each level of which, having various and specific roles and objectives. In some countries, e.g. Germany, three levels can be identified: macro level, mezzo and micro level. The top level, i.e. the macro level, is made up of governmental players. They control and regulate the behaviour of the other players by setting up a regulatory framework (laws, acts etc.). On the mezzo level, are the unions and other organisations. Here groups are differentiated into those organised on the corporate model (national health insurance, doctor's organisations) and organisations that are not directly linked to governmental activities. These act for the interests of their corporate members, e.g. doctor's association. The micro level consists of individual players that supply or demand such goods. These activities are limited by the regulatory framework [5]. The extent to which the various levels are filled with players might allow conclusions to be drawn about the underlying political concept of the health care system.

Using Social Network Analysis (SNA) and with a focus on testing the SNA methodology, we have studied the formation of the Serbian health care system, according to the Health Care Law of Serbia, and describe how the various players are positioned in the network.

METHODS
Definitions

A social network is the representation of a social structure, community, or society made of nodes that are generally individuals or organizations. Social Network Analysis (SNA) is a sociological paradigm to analyse structural patterns of social relationships [6,7,8]. There is a set of methods and measures to identify, visualise, and analyse the formal or informal personal networks within and between organisations. From a technical viewpoint SNA is applied Graph Theory [8].

The results are primarily presented in a target diagram. For this we used the built-in features of a specific software (*Visone 2.6.2*) which is designed to visualize networks [9]. The players (nodes) are placed according to their scores. The player with the highest score is positioned in the centre of the drawing and the others with decreasing scores are moved toward the periphery of the structure, correspondingly. In this way, the radial position of each node is set. The angular location is determined by a specialized layout algorithm that aims at minimizing entanglement by reducing the number of crossing lines and occlusions [10]. The different score levels are displayed as thin concentric circles. This allows comparing the scores of the players easily. Referring to the tables is not necessarily required [9]. Target diagrams have been successfully used to analyse local health policies and the underlying structure of the connected players. Brandes et al. [10] disclosed the differences in the local drug policy of two German municipalities and the networks of actors that form the basis of the policy making. To facilitate a holistic view of the indices applied, we summarised the results in a bubble diagram (three indices) and in a Principle Component Analysis diagram. Principal Component Analysis is a frequently used multivariate data analysis method to transform a set of observations of possibly correlated variables into a set of uncorrelated variables - socalled principal components [11;12]. It helps reveal the internal structure of the data in a way which best explains the variance in the data.

Power and influence

Power is not primarily conceived as an individual attribute; power arises from occupying advantageous positions in a network. These positions are virtual as they are depicted by connections and not by physical or geographical locations. Consequently any changes in the structure may lead to a reshaping of positions, and finally to a rearrangement of power and influence. The inequality of power in a population, or alternatively the concentration of power, may be depicted by various indices. SNA has several useful tools for analysing the sources and the distribution of power. The view of power and the corresponding definitions have been discussed controversially in political science and in sociology [13;14]. We simply define power here as the chance to force one's will in a social relationship, even against the resistance of others [15]. Power is the core of politics, and every actor strives for power. Exercising power has two important faces: overt i.e. the exertion of power by influencing decisions and problem solving, and a more latent or hidden face, revealed by the intermediation of values and norms [16]. For our analysis and the visualisation of the network we used *Visone2.6.2* [10].

Study setting and data collection

Data collection can follow the procedures of a reputation approach, decision approach or position approach [17-19]. For our analysis, we chose a position approach for two reasons: firstly, we want to analyse the formal structure as it is laid down in the law and, secondly, it is less time-consuming. Both reputation approach and decision approach would

have to refer to surveys and questionnaires. Nevertheless, they could be an option for further research.

Steps
In an ad hoc group meeting, the authors listed the players and identified the links between the players and the perceived strength of their relationship. The links are directed links, which means that they can be unidirectional or bidirectional. The strength of the relationship was depicted by weights in the range 1 to 4. The weights are currently based on the assessment of the authors. The resulting matrix of connectivity was exported to *Visone 2.6.2* for further analysis. The outcomes of the analysis and the input matrix will then presented to a round table of experts for further critical evaluation. After this validation of the structure the players will be allocated to the different levels (micro, mezzo, macro). This provides another indicator of a balance of power.

Measures
To break down the abstract concept of importance or influence several measures have been derived. As Brandes et al. [9] highlight, centrality is regarded a critical feature of policy networks; it gives an indication of the ranking of players, by importance, in the network. Centrality measures identify the most prominent players, i.e. those players who are extensively involved in relationships with other network members. The concept of centrality helps to identify key players [20].

The most frequently used centrality measures are degree centrality, betweenness centrality and closeness centrality. They are based on the fundamental idea that information is transferred along the shortest pathways. While betweenness centrality measures the extent to which a node (player) is between pairs of other nodes, i.e. on shortest paths connecting them, closeness is just the inverse of the average distance to other nodes [21]. A frequent concern, which has been raised over those shortest paths based measures, criticises that they do not take into account diffusion along non-shortest paths. For this they are seen as not being appropriate in cases where the content distribution is governed by other rules [22]. Newman [23] applied leanings from the flow of electrical current to the SNA. Applying this principle leads to two new measures, i.e. current flow betweenness and current flow closeness. These proposals have raised considerable attention [21].

Degree centrality is the sum of all other players who are directly connected to a specific player. Two perspectives are possible: ego-centred, i.e. from the focus of a specific player (ego) only, and socio-centred, i.e. focus on all connections and all players. Degree centrality signifies activity or popularity. Many ties coming in and many ties going out of an actor will increase degree centrality. In asymmetric networks the distinction between "indegree" and "outdegree" has to be taken into account [20].

Closeness centrality is based on the notion of distance. If an actor is close to all others in the network, a distance of no

more than one, then she or he is not dependent on any other to reach everyone in the network. Closeness measures independence or efficiency [20]. Efficiency means the larger the closeness centrality of a node, the shorter the average distance from the node to any other node, and thus the better positioned the node is in spreading information to other nodes [24]. With disconnected networks, closeness centrality must be calculated for each component.

Betweenness centrality is the number of times an actor connects pairs of other players, who otherwise would not be able to reach one another. It is a measure of the potential for control as a player who is high in "betweenness" is able to act as a gatekeeper controlling the flow of resources between the other nodes that he or she connects [20].

Analysis
In a first step, we identified the relevant players and their connections. The relationship between the players, and the strength of the links, is based on a best guess assessment during the ad hoc meeting of the authors. No questionnaires were used to determine the strength of the connections. The main features of this approach and the related processes were outlined in more detail elsewhere [25]. In a second step, we visualised and analysed the network with the help of indices.

Table 1 shows the relevant players. The ID numbers were used to identify the players in the graphs where labels could not be applied for reasons of improved readability. The numbers in brackets refer to the paragraph of the law.

Special interest was given to the following players: Managerial Board of Republic Institute of Health Insurance Fund (8), President of Managerial Board of Republic Institute of Health Insurance Fund (9), Director of Republic Institute of Health Insurance Fund (13) and the Deputy Director of Republic Institute of Health Insurance Fund (14), as they could be perceived as parts of the self-management of the health insurance as pointed out above.

RESULTS
Figure 1 shows the structure of the network. It is made up in such a way that different types of relationship can be identified.

The network consists of directed, valued relations (arrows). The numbers indicating the strength of the connections (possible values between 1 and 4; 1 meaning weak and 4 meaning strong) are attached to the arrows. A very small value of 1 was not identified and therefore was not allocated.

Degree centrality is measured by the incoming and outgoing connections held by a network member; it is the sum of all relationships of a player. In asymmetric networks, it is important to distinguish between "indegree" and

Table1. Players according to the Health Insurance Act (4)

ID	Player
1	Government
2	Trade Unions
3	Association of Pensioners
4	Association of Agriculture
5	Chamber of Commerce
6	Association of Persons with Disabilities
7	Ministry of Health (MoH)
8	Managerial Board of Republic Institute of Health Insurance Fund (221)
9	President of Managerial Board of Republic Institute of Health Insurance Fund
10	Members of the Managerial Board of the Republic Institute of the Health Insurance Fund
11	Supervisory Board of Republic Institute of Health Insurance Fund (224)
12	President of Supervisory Board of Republic Institute of Health Insurance Fund
13	Director of Republic Institute of Health Insurance Fund (227)
14	Deputy Director of Republic Institute of Health Insurance Fund
15	Managerial Board of Provincial Institute of Health Insurance Fund of Vojvodina
16	President of the Managerial Board of the Provincial Institute of the Provincial HealthInsurance Fund of Vojvodina (228)
18	District branches of the Republic Institute of the Health Insurance Fund (213)
19	Council of Branches of the Republic Institute of the Health Insurance Fund (216)
25	Director of a Branch of the Republic Institute of the Health Insurance Fund (215)
26	Health Institutions (providers): Primary Health Care Centres, Hospitals, Institutes of PublicHealth
27	Provincial Institute of Health Insurance Fund of Vojvodina (217)

The ID numbers identify the players in the graphs. The numbers in brackets refer to the paragraph of the law.

"outdegree". Player receiving many connections (high indegree) have a high prestige and might be important, because many other players seek to connect to him [26]. Players who send out many links (high outdegree) are able to exchange information with many others and make other players aware of their view. A high outdegree centrality discloses influential players [27]. (Figure 2).

The target diagram contains three different kinds of information: degree centrality, indegree centrality and outdegree centrality. The players are placed according to their degree centrality score. The most central node is placed in the centre of the drawing and the others with decreasing centrality toward the periphery of the structure. Showing score levels as thin circles allows to compare centrality scores exactly without being obliged to look up the tables (9). The shades of black of the players (circles and rectangles) depict the indegree, ranging from dark black for highest score to faint grey (lowest score). The size of the circles and rectangles visualise the outdegree. The rounded rectangles stand for the Managerial Board of Republic Institute of Health Insurance Fund (8), the President of Managerial Board of Republic Institute of Health Insurance Fund (9), the Director of Republic Institute of Health Insurance Fund (13) and the Deputy Director of Republic Institute of Health Insurance Fund (14).

Degree centrality signifies activity or popularity [23]. Based on degree centrality the Government (1) and the Director of Managerial Board of Provincial Institute of Health Insurance Fund (16) have strong positions, followed by the Managerial Board of Republic Institute of Health Insurance Fund (8). The position of the Ministry of Health (7) is characterized by a weaker degree. The management representation of the insured (9, 14)) is less important, with the exception of the Director of Republic Institute of Health Insurance

Fund (13) who ranks higher than the Ministry of Health (7). Based on the indegree measure of centrality (colours) the ranking changes. High indegree means that a player might be contacted by many others; it is a measure of importance (prestige). The Government (1), the Managerial Board of Republic Institute of Health Insurance Fund (8), the Supervisory Board of Republic Institute of Health Insurance Fund (11) and the district branches of the Republic Institute of the Health Insurance Fund (18) are prominent players with high prestige. At least one representative of the insured, the Director of Republic Institute of Health Insurance Fund (13), has a certain prestige, nevertheless it is notably lesser then those of the top rankings, like Government (degree score of 8.2 vs. 12.2). A high outdegree is a measure for a player's ability to make others aware of his/her opinion. Influential players, based on the outdegree, are the President of the Managerial Board of the Provincial Institute of the Provincial Health Insurance Fund of Vojvodina (16), Government (1), and less important the Ministry of Health (7) - (Figure 3).

Closeness centrality shows the integration or isolation of network members. It measures the reachability of members by including indirect ties. Closeness centrality focuses on the distance of a member to all others in the network through means of geodesic distance and thus, determines a member's integration within the network. High closeness centrality indicates the greater autonomy of an individual person, since he or she is able to reach the other members easily (and vice versa). Low closeness centrality indicates higher individual member dependency on the other members, i.e. the restricted willingness of other members to give access to the network's resources. According to Newman (2005), closeness measures the speed of information transfer from a given player to the others in the network.

In terms of closeness centrality, the Government (1) and the President of the Managerial Board of the Provincial Institute of the Provincial Health Insurance Fund of Vojvodina (16) are in prominent positions. The Ministry of Health (7) is characterized by a weaker position. This is true for the players 2, 3, 4, 5, 6, 13, too. The players 8, 9, 13 and 14 are in a comparable position as with degree centrality. High closeness is an excellent position to monitor the information flow in the →

Figure 1. The Network of Serbian Health Care System
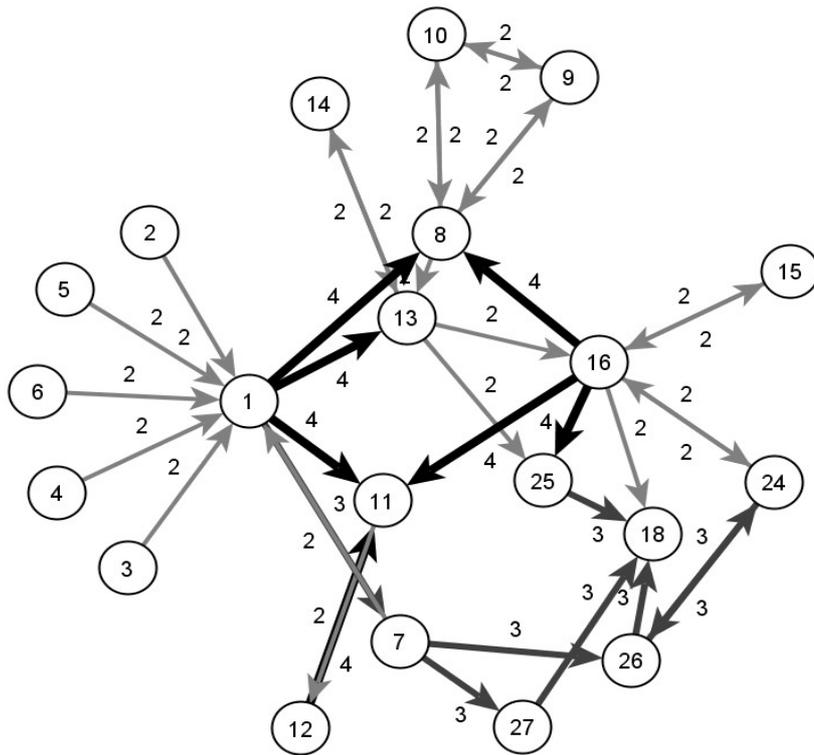
Arrows show the direction of influence, numbers indicate the strength of the connections. Possible values between 1 (weak) and 4 (strong).

Figure 2. Degree Centrality within the Serbian Health Care System
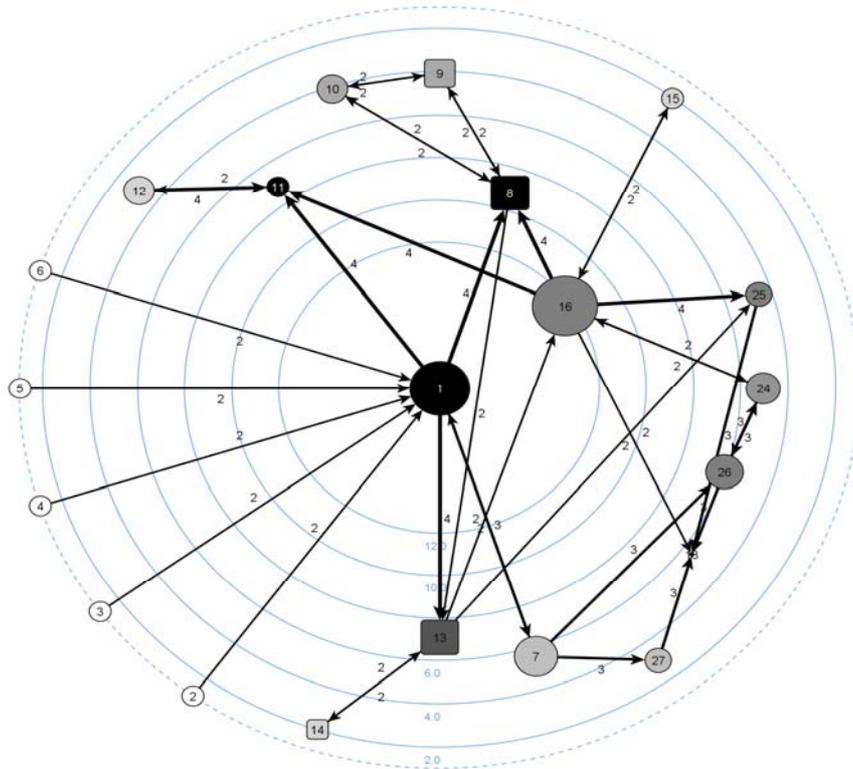
Arrows show the direction of influence, numbers indicate the strength of the connections. Possible values between 1 (weak) and 4 (strong). Players are placed by degree centrality. The shades of black depict the indegree. The size of the circles visualises the outdegree.

network, and gives best visibility into what is happening in the network.

Importance and power also depend on how a player can control the flow of information and knowledge. Scott [8] exemplifies a situation where a player with a relatively low degree may play an important "intermediary" role and be very important for the network due to a high betweenness. Betweenness centrality helps to identify knowledge brokers and gatekeepers within a network. It is a measure of the extent that a network member's position falls on the shortest paths between other members of a network. It determines whether an actor plays a (relatively) important role as a gatekeeper of knowledge flow with a high potential of control on the indirect relations of the other members. A player who is high on betweenness degree is able to act as a gatekeeper or information broker [20]. In innovation and knowledge management literature, the role of brokers and gatekeepers is always stressed as being of overall importance and it is considered advantageous to identify gatekeepers, since they are performing a vital role in knowledge communication processes [28;29] - (Figure 4).

The Director of Republic Institute of Health Insurance Fund (13), the President of the Managerial Board of the Provincial Institute of the Provincial Health Insurance Fund of Vojvodina (16), and the Managerial Board of Republic Institute of Health Insurance Fund (8) are of comparable importance and are able to control the flow of information at most. They are brokers or gatekeepers with a high potential to control the indirect relations of other members. The Government (1) is not in the centre of influence. The Ministry of Health (7) is also moved more to the periphery. The players 9 and 14 are not so important; they are at the outer periphery. The three indices used show different facets of power. For a final assessment and a more synoptically view we combined the three indices (see Figure 5).

The size of the bubbles (area) reflects the betweenness centrality (%). The green circles represent the players that were perceived as self-management of the health insurance.

The Government (1) now shows the highest level of activity or popularity (degree centrality) as well a high level of independence and efficiency (closeness centrality) but is relatively low ranked in terms of gatekeeping (betweenness centrality).

Figure 3. Degree Centrality and Closeness Centrality within the Serbian Health Care System
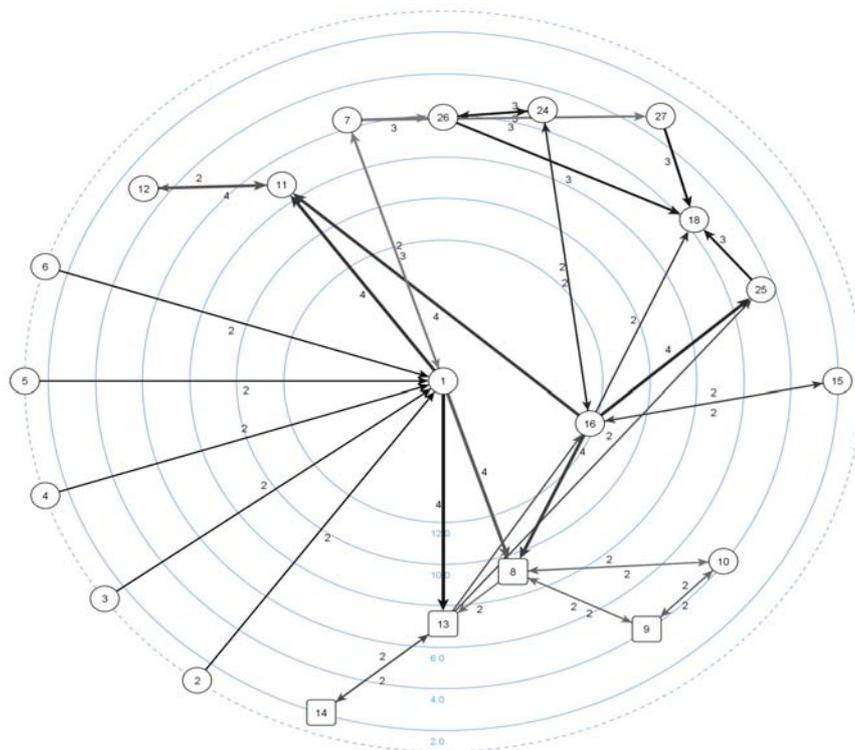
Degree Centrality
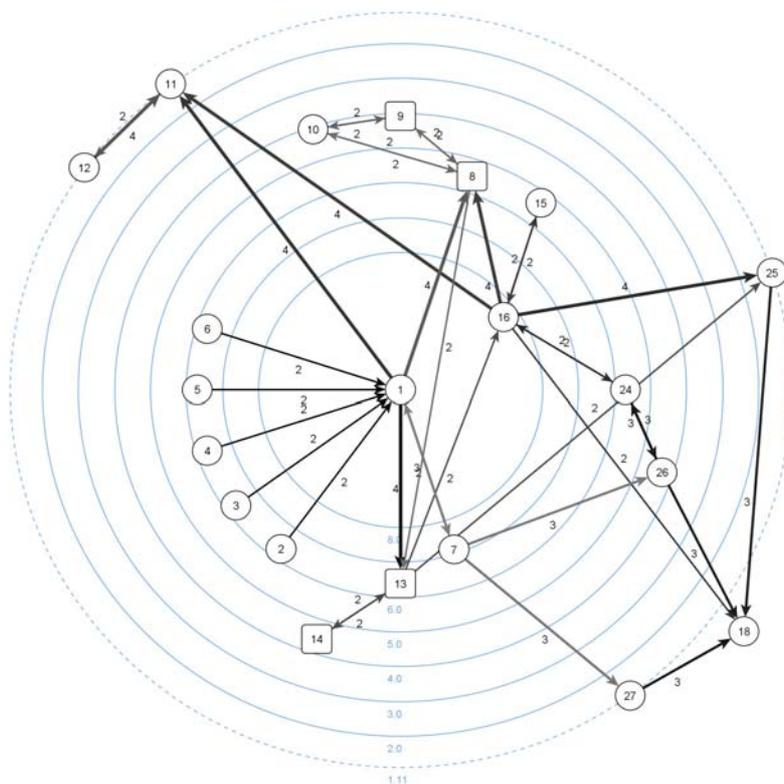
Closeness Centrality

Arrows show the direction of influence, numbers indicate the strength of the connections. Possible values between 1 (weak) and 4 (strong). Players are placed by degree centrality or closeness centrality.

Among the players that represent bodies of self-management, only the Director of Republic Institute of Health Insurance Fund (13) and the Managerial Board of Republic Institute of Health Insurance Fund (8) are visible. They rank lower on the popularity level and the independence level but show a higher degree of betweenness, which means that they could control the flow of resources. As the overview of figure 5 does not include information about indegree and outdegree, we conducted a Principal Component Analysis (see figure 6). The horizontal axis is made up of degree centrality, betweenness centrality and indegree centrality. The vertical axis is made up of closeness centrality and outdegree centrality. This leads to the interpretation that the horizontal axis could refer to popularity or prestige. The vertical axis represents autonomy, independence and efficiency. The y axis could be named autonomy.
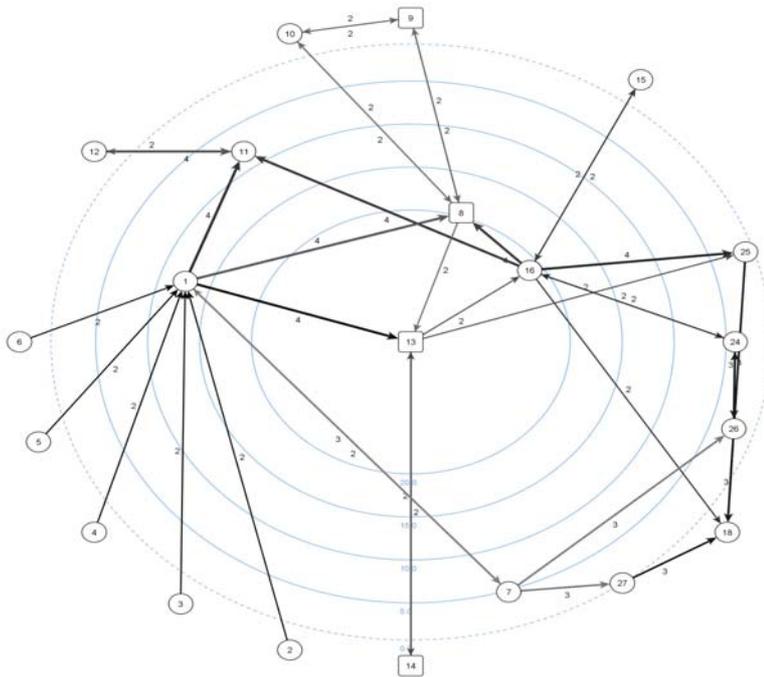
The green diamonds represent the players that were perceived as self-management of the health insurance.

The Government (1) ranks highest on the prestige axis. This means that many players are seeking contact. At the same time, its position on the autonomy axis is also quite high. The Director of Managerial Board of Provincial Institute of Health Insurance Fund (16) ranks highest on the autonomy axis and is quite high on the prestige axis, too. From the representatives of the insured persons only the Managerial Board of Republic Institute of Health Insurance Fund (8) and the Director of Republic Institute of Health Insurance Fund (13) are visible. The Deputy Director of Republic Institute of Health Insurance Fund (14) and the President of Managerial Board of Republic Institute of Health Insurance Fund (9) are in the lower left quadrant without showing prestige and autonomy.

DISCUSSION AND CONCLUSIONS
The power of a player is built upon the ability to hold advantageous positions in a network of connected players. To understand a network is essential because it informs about relevant determinants of policy-making and gives an insight how the decisions and political solutions were generated in specific surroundings. It can disclose which type of player is involved and how he possibly exerts influence in the policy-making process. The distribution of power also provides with insight on the access and the control over resources [9].

Figure 4. Betweeness Centrality within the Serbian Health Care System

Arrows show the direction of influence, numbers indicate the strength of the connections. Possible values are in the range between 1 (weak) and 4 (strong). Players are placed by betweenness centrality.

Figure 5. Overview on three Indicators of Network Positions
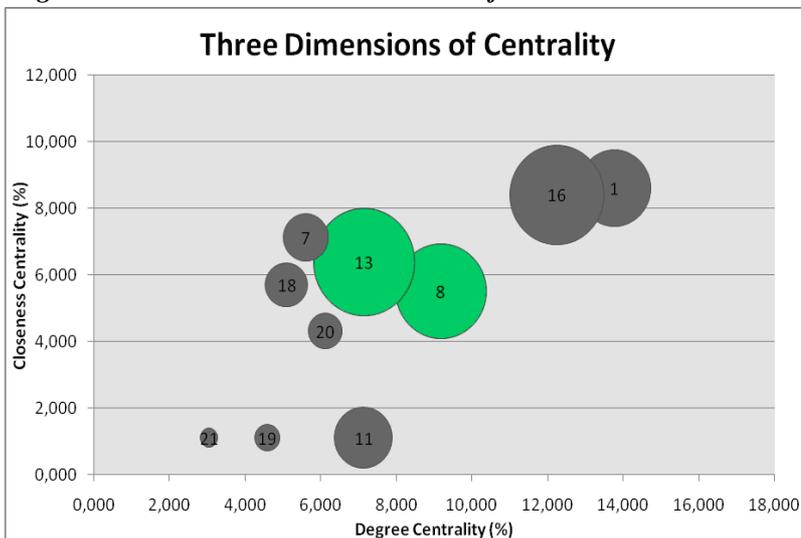
The size of the bubbles (area) reflects the betweenness centrality (%). The green circles represent the players that were perceived as self-management of the health insurance

The Government (1), the President of the Managerial Board of the Provincial Institute of the Provincial Health Insurance Fund of Vojvodina (16) are ranked in high in terms of closeness centrality. The Ministry of Health (7) is characterized by a weaker position. This is true for the players 2, 3, 4, 5, 6, 13 as well. High closeness is an excellent position to monitor the information flow in the network. It implies best visibility into what is happening in the network. They are highly independent. The Director of Republic Institute of Health Insurance Fund (13), the President of the Managerial Board of the Provincial Insti-

tute of the Provincial Health Insurance Fund of Vojvodina (16), and the Managerial Board of Republic Institute of Health Insurance Fund (8) show a high degree of betweenness which means that they are gatekeepers with the potential to control processes. The members of the Managing Board (8) represent the interests of the insured in providing and accomplishing benefits deriving from the compulsory health insurance. They are responsible for the operation of the Republic Institute, especially by formulating the statute and other by-laws and formulating a finance plan. This Managing Board consists of 21 members, which are representatives of the different insured groups (pensioners, farmers, self-employed etc.) [4]. Both, the Director of the Republic Institute of Health Insurance Fund (13) and the President of the Managerial Board of the Provincial Institute of the Provincial Health Insurance Fund of Vojvodina (16) are more or less responsible for operating and executing the decisions of the Managerial Board (8) [4]. Hence, the stakeholder, who in fact stands for a certain influence by the insured (with regard to contents) has a relatively high prestige but a low degree of autonomy, lower than the operating stakeholders (see stakeholders 13 and 16) do.

The network depicted here and the corresponding distribution of power is a sort of a snapshot of players, their perceived links and the associated possibilities to exercise power. It is comparable to the notion of "potential energy" in physics. Potential energy could, but must not necessarily, be converted into kinetic energy. Correspondingly, power could be seen as a capacity, a potentiality, and it even may never be put into effect [13]. This means, the structure found is the framework for concrete policy-making, enabling or impeding political problem solving. Networks influence the policy process, i.e. the policy cycle [30], in many ways from agenda setting, formulation of the issue to the identification of options for actions. Our findings could be seen as a basis for further analyses of specific decisions/non-decisions where the capacity is converted into concrete action.

For further analysis, two analytical approaches will be helpful: (1) Grouping of the players into the three levels mentioned above. The extent to which the various levels are filled with players might allow drawing conclusions about the adequacy of the health care structure for a planned transition. This might also provide a basis for comparative evaluation and benchmarking with other health care systems. (2) Grouping of the players according to the model of Winstanley et al. [31]. They distinguish two aspects of power: criteria power and operational power. Criteria power is used for assessing a player's power to influence issues by defining the rules of the game. Operational power denotes the ability to make decisions within an organisation. The latter is a dimension for assessing the player's power to influence operational processes [32].

Figure 6. *Principal Component Analysis*
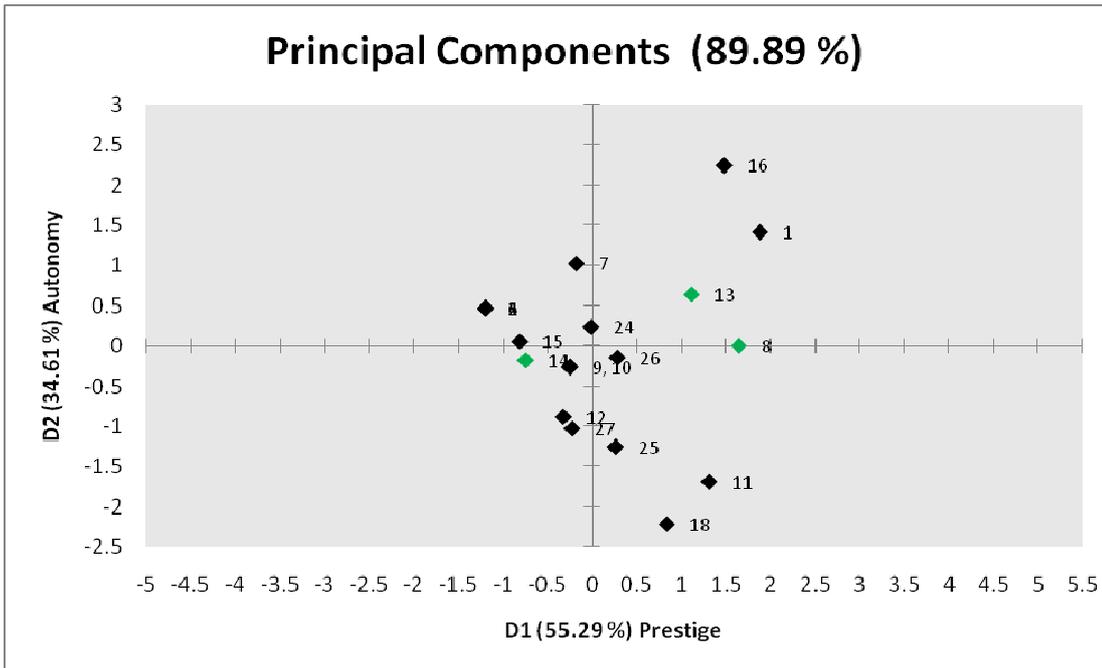
In their two-dimensional model they distinguish four categories of power: (a) arm's length power, which represents strategic level power, (b) comprehensive power, which represents both strategic and operational power, (c) disempowerment, which represents no real power, either strategic or operational and (d) operational power [31]. With their specific view on power in organisations, and their classification of the players, the structure found here could be analysed in more detail.

The green diamonds represent the players that were perceived as self-management of the health insurance.

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