The Serbian Health Insurance Act of 2005 was supposed to be a cornerstone 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.
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 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 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 - so-called 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].

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].
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, criticisms 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
Table 1. Players according to the Health Insurance Act (4)

<table>
<thead>
<tr>
<th>ID</th>
<th>Player</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Government</td>
</tr>
<tr>
<td>2</td>
<td>Trade Unions</td>
</tr>
<tr>
<td>3</td>
<td>Association of Pensioners</td>
</tr>
<tr>
<td>4</td>
<td>Association of Agriculture</td>
</tr>
<tr>
<td>5</td>
<td>Chamber of Commerce</td>
</tr>
<tr>
<td>6</td>
<td>Association of Persons with Disabilities</td>
</tr>
<tr>
<td>7</td>
<td>Ministry of Health (MoH)</td>
</tr>
<tr>
<td>8</td>
<td>Managerial Board of Republic Institute of Health Insurance Fund (221)</td>
</tr>
<tr>
<td>9</td>
<td>President of Managerial Board of Republic Institute of Health Insurance Fund</td>
</tr>
<tr>
<td>10</td>
<td>Members of the Managerial Board of the Republic Institute of the Health Insurance Fund</td>
</tr>
<tr>
<td>11</td>
<td>Supervisory Board of Republic Institute of Health Insurance Fund (224)</td>
</tr>
<tr>
<td>12</td>
<td>President of Supervisory Board of Republic Institute of Health Insurance Fund</td>
</tr>
<tr>
<td>13</td>
<td>Director of Republic Institute of Health Insurance Fund (227)</td>
</tr>
<tr>
<td>14</td>
<td>Deputy Director of Republic Institute of Health Insurance Fund</td>
</tr>
<tr>
<td>15</td>
<td>Managerial Board of Provincial Institute of Health Insurance Fund of Vojvodina</td>
</tr>
<tr>
<td>16</td>
<td>President of the Managerial Board of the Provincial Institute of the Health Insurance Fund of Vojvodina (228)</td>
</tr>
<tr>
<td>17</td>
<td>Director of a Branch of the Republic Institute of the Health Insurance Fund (215)</td>
</tr>
<tr>
<td>18</td>
<td>District branches of the Republic Institute of the Health Insurance Fund (213)</td>
</tr>
<tr>
<td>19</td>
<td>Council of Branches of the Republic Institute of the Health Insurance Fund (216)</td>
</tr>
<tr>
<td>20</td>
<td>Health Institutions (providers): Primary Health Care Centres, Hospitals, Institutes of Public Health</td>
</tr>
<tr>
<td>21</td>
<td>Provincial Institute of Health Insurance Fund of Vojvodina (217)</td>
</tr>
</tbody>
</table>

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

*Note: Table 1 lists the players in the organizational management of the Health Insurance Act, with their respective IDs.*

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

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“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, the Director of Republic Institute of Health Insurance Fund (13), has a certain prestige, nevertheless it is notably lesser than 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
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).
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].
The Government (1), 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) 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].
The green diamonds represent the players that were perceived as self-management of the health insurance.

References
6. WELLMANN, B. and BERKOWITZ, S. D.-Social Network Analysis: A Practical Method to Improve Knowledge Sharing. In their two-dimension- nal 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) dis- empowerment, which represents no real power, either strategic or operational and (d) op- erational power [31]. With their specific view on power in organisa- tions, and their classifi- cation of the players, the structure found here could be analysed in more detail.

Figure 6. Principal Component Analysis

The Policy cycle

Principal Components (89.89 %)

D1 (55.29 %) Prestige

D2 (34.61 %) Autonomy

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