

Leadership and diffusion of information for policy implementation: a new methodological approach¹

Marta Pedro Varanda² and Filipa Carvalho³

The aim of this research is to explore more effective strategies to build leadership groups for the implementation of policies whose success depends on the massive mobilisation of targets. The underlying motivation for this work stems from the observation of a weak participation by traders in modernising a city's centre commerce in spite of high financial incentives. The analysis of the leadership – the board in charge of the trade association- whose main task was to lead this initiative, showed a poor performance in diffusing information. Using combinatorial optimisation techniques, two new leadership groups are built. The three leadership groups' performance in the diffusion of information is evaluated and compared. This reveals that, with the tools of social network analysis and combinatorial optimisation, the choice of leaders for policy processes can be improved.

Key words: leadership, policy implementation, diffusion of information, commerce, key players, social networks, combinatorial optimisation

¹ This research is part of a larger project (PRAXIS/P/SOC/11214/1998) which was financially supported by Fundação para a Ciência e Tecnologia .

² SOCIUS and ISEG/UTL

³ CIO (Centro de Investigação Operacional) and ISEG/UTL

Introduction

Competent leadership is a valuable resource for a collective engaged in a common task (Mellucci, 1996; Obershall, 1973; Ostrom, 1995; Taylor, 1987). Often collectives are unable to accomplish their task in an efficient and effective manner as they lack a resourceful leadership.

The leadership role, which may be very attractive in large, prestigious or powerful organisations, is not attractive in small, low prestige or powerless organisations which are unable to reward accordingly the extra effort of the leadership role. In the latter leadership is voluntary work, has low status, and it is subject to frequent attack by lower status members (Mellucci, 1996; Obershall, 1973). For these reasons finding the best individuals (or just any individuals at all) to occupy leadership positions is not an easy task.

In this paper we compare three different methodologies of building leadership groups whose mission is to mobilise individuals to participate in a policy program. The value added of this research is twofold:

a) It uses social network analysis (SNA) with optimisation as a tool to analyse mobilisation in contexts of policy implementation. The concept of network here has been given different meanings (e.g. Thatcher, 1998). One version of the policy network approach calls attention to the several interdependent actors involved in all stages of the policy making process (e.g. Klijn, 1997). This line of study tends to view networks as a specific form of governance structure, and uses the concept metaphorically. Research following this approach has failed to explain the policy process and has produced mostly descriptive studies (e.g. Dowding, 1995).

Another version views networks as relations - that can be measured and visualized - among actors. This view is consistent with that of social network analysts,

who do a systematic analysis of the pattern of interdependencies among the actors involved in any collective action, such as policy making⁴. This version has the potential to explain policy outcomes taking into account the network characteristics, but so far has produced insufficient explanatory research (Pappi and Henning, 1998; Carlsson, 2000; Thatcher, 1998), particularly concerning policy implementation.

b) It combines SNA with combinatorial optimisation techniques in which actors' attributes are taken into account. Borgatti (2006) acknowledged the interest of incorporating actor attributes, but so far this problem has not raised the interest of social scientists.

The baseline of this study is a leadership group, empirically observed, in charge of the modernisation of a city centre's commerce. Using combinatorial optimisation techniques two new alternative leadership groups are constructed. The three leadership groups are then evaluated and compared.

The empirically observed leadership group is the board of the trade association whose role is to induce traders to engage in the modernisation of their commerce, in particular through adhesion to a policy program offering financial incentives to those who remodel their shops. The success of this program, like most other policy programs, depends on the massive participation of targets. We consider that, given the situation under study, the two main tasks of leadership are to inform the target actors about the program, and to mobilise potential participants. Access to reliable information is of crucial importance for anyone having to take risky decisions, in this case, whether to participate or not in the program. A target actor's decision to participate is affected by a number of issues e.g. time spent on the application procedure, financial matters, disclosure of internal affairs to program sponsors, credibility of the program. Those better

⁴For a general reference on social network analysis see Wasserman and Faust (1994).

informed reduce such risk. Here the performance of leadership is operationalised as reachability capacity. Reach is defined as the number of people that board members can contact directly. Following Marwell and Oliver (1993) we also emphasise the idea of selectivity as the ability to communicate with those members of a network "who are most likely to contribute or who are likely to contribute the most" (p. 130). The ability to select is important because in heterogeneous collectives one person may be willing and able to contribute much more than another⁵. Through simulations of actors' mobilisation for collective action, Marwell and Oliver (1993) concluded that "the optimal strategy for organizers is one of "high reach and high selectivity"⁶ where everyone in the network is contacted, particularly those with the highest interests and resources". But, they recognize that "the costs of this option are often prohibitive". The alternatives, according to them, would be the strategies of "high reach and low selectivity" or "low reach and high selectivity", the first implying an impersonal, mass-mediated approach to getting messages to network members, and the second a personalized, communication networks approach. Given some relevant characteristics of our case study, such as the complexity of the message to be diffused, the heterogeneity of targets (who belong to different age groups and have firms of different dimensions, with different levels of performance, etc.) and the context of competition and low trust among traders (Varanda, 2005), a message of high reach low selectivity or low reach high selectivity would not be sufficient. Only a message of high reach and high selectivity is appropriate.

The methodology for group formation to be presented here aims to facilitate the task of leaders who must attain both goals simultaneously: to reach the maximum number

⁵ When groups are homogeneous, everyone is interchangeable, and the collective outcome is a simple function of how many people participate (Marwell and Oliver, 1993).

⁶ Obviously, selectivity requires information about how interested each person is in the collective good, as well as their personal level of resources as an indicator of how much each is able or likely to give. This also suggests that the organizers need to know how to craft messages that focus on maximizing benefits for contributors while minimizing their costs (Marwell and Oliver, 1993).

of traders who need information to take a decision about participation⁷. This methodology involves a great knowledge of the collective and its social organisation and composition, which may entail high costs for the organisers of collective action, but is a necessary condition for the success of policy implementation (Wellner, 2008). Authors, such as Crozier and Friedberg (1977), have focused policy makers' limitations in conceiving good policies, due, if for no other reason, to the incapacity of obtaining quality information about the social system (communities, organisations, cities...). Often good technical and economic information about the problems is obtained, but it is forgotten that these can only be solved through "concrete systems of action", which are not reducible to material problems, and do not mechanically obey and follow the decisions of policy makers.

Unfortunately, most policy programs are conceived in total ignorance of the "concrete system of action" of the collective over which they want to intervene. It is not surprising that many policy programs rarely achieve their initial goals (Pressman & Wildavsky, 1973) and may even lead to perverse effects (Palumbo, 1987). The program we observed empirically is no different. Despite high financial incentives, it failed to mobilise traders: only 25,5%⁸ participated⁹. This level of participation was considered to be low by policymakers and traders alike, and in consequence there was no effective modernisation of the city centre commerce. City centre commerce in Portugal in general, and in this city centre in particular, is old-fashioned and unable to attract consumers (for an overview about city centre commerce in Portugal see Salgueiro 1996, Cachinho 2001, Varanda 2005). As such only a massive participation would result in real modernisation.

⁷ Some do not need information because they have already made a decision (i.e. whether to participate or not).

⁸ This level of participation was very similar to that observed in average value for this same policy program in the whole country.

⁹ For a thorough description of this study and the explanation for the failure in modernisation see Varanda (2005).

Some authors, for instance Strang and Soule (1998) and Ostrom (1998), have called for the need to examine collective action processes that fail, as there is a strong bias in research towards successful cases. It is agreed that obtaining more information on failed attempts and why they failed will shed light on those that do not fail.

1. The case study

1.1 A global overview

This case study focuses on the implementation of policies envisaging the modernisation of commerce in the historic city centre of a mid size town in Portugal. City centre commerce has suffered from the growing competition of large scale retail outlets (shopping centres and hypermarkets, mostly located on the peripheries), and policy makers contend that with no external incentives this type of commerce will tend to disappear, leading to the desertification of city centres. In this paper we focus on a policy program in which the Portuguese government together with the European Union offered traders a financial incentive up to 66,6% of their investment¹⁰. All traders located in the city centre – commerce, coffee shop or restaurant owners - could apply. The general understanding was that the financial incentive was quite high in comparison with that of other programs. Moreover, this program was more attractive than most other programs in that it accepted all applications, that is, everyone applying would obtain the incentive. For those whose application was deemed average, rather than high quality, the incentive was 50% of the investment. However, a number of costs are attached to the participation, such

¹⁰ This specific program was called Urban Commercial Project and was part of a larger program called PROCOM. Today a similar program called URBCOM is in place. This case study took place from 1999 until 2001.

as the inevitable share of traders' own capital investment, the low credibility of these governmental programs (e.g. delays in the payment of incentives) and the bureaucratic load attached. The benefit of having a nice looking shop, besides being a motive of pride and increasing the owner's status, is the expected increase in sales. But, unlike costs, this is more difficult to anticipate and quantify, because it is affected by external factors, such as the attractiveness of large scale retail outlets along with the desertification of the city centre.

1.2 Data

Data on the traders' attributes and relations were obtained through a questionnaire for the universe of traders. Traders were questioned about discussion relations concerning the program, and discussion relations concerning the situation of the city's commerce in general. This questionnaire was applied 6-9 months prior to the adhesion deadline.

Discussion amongst colleagues about matters concerning the business may seem trivial in many occupations, in which the interdependence among colleagues is well known and the exchange of resources is a necessary condition for good performance. However, in the context of commerce, in which independence and confidentiality are highly appreciated, discussing anything that relates to the profession is an important sign of openness to collective matters¹¹.

¹¹ This measure has limitations if we think that the coordination of effort involves not only communication, but also influence and enforcement (Marwell & Oliver, 1993). We do not question this, but in this paper we are simply concerned with the reachability aspect. Nonetheless, in contexts where actors are competitors valuing the secrecy of their strategies, discussion relations are more meaningful than they would be in a context where individuals openly discuss among themselves.

The traders' network is a graph representation of the city centre traders and their relationships. Each node of the traders' network represents a trader eligible for the program. Given a pair of nodes, a link exists between them if the corresponding traders share information.

Based on the sociometric data, we have obtained the following structure for the traders' network:

- one component composed of 159 nodes and 304 edges.
- one component composed of 2 nodes
- 31 isolated nodes

Even a quick look at this network structure, composed of a large number of isolates, denotes the difficulty of wide diffusion of information in the collective. From now on we will restrict our analysis to the largest component, as access to the two node component and the isolated nodes would be enormous for any leadership group willing to mobilize traders.

We will denote by V the set of nodes of the largest component and by E its set of edges. The density of this graph, 2.4%, indicates that information diffusion among members of this collective is quite poor.

Based on the literature on small commerce and on our knowledge of the field, we know that the information circulating among traders came up against the obstacle of suspiciousness. Since, in the context of commerce, secrecy is the rule of the game, in our analysis we considered that only information shared across adjacent nodes was given credibility.

1.3 The leadership of the city centre: the board of the trade association

The leader of this initiative in the city studied was the local trade association¹².

We should note that traders are a group that traditionally resist associative strategies (Hosgood, 1992). According to Bechhofer and Elliott (1981) they are “*loners , not joiners*” (p. 195). The trade association studied is typical for the Portuguese context: it had a small number of associates – 1600 – and just three staff, two administrative and one technical, which was hired at the time of the program. Just prior to launching the program the trade association was undergoing a leadership crisis; there was no elected board, instead, two traders were in charge of administrative matters. One of these traders, who had been a member of past boards, viewed the program as a great opportunity to revive the city centre commerce and took the initiative of inviting colleagues to form a board of directors. He invited six other traders – this particular trade association had a board of 7 directors - following the lines of friendship/acquaintanceship and perceived competence. The board perceived the policy program as a historic moment for modernisation of the city centre, and as an effort to recover the market share they had been losing to large scale retail outlets. Another important initiative of this board was to extend opening hours on Saturday from morning only to morning and afternoon, a time schedule that was not practised by the majority of traders in the city centre but was usual practice in large scale retail outlets. This was considered a controversial initiative especially among older traders who were used to having Saturday afternoons as rest periods (for more details see Varanda, (2005)).

¹² We should note that the program also supported a marketing campaign to be conducted by the trade association. The association’s financial incentive was calculated as a proportion of the total amount of investment of individual traders.

This particular board is composed of seven members, all male, two of whom are not eligible for the program¹³. These two board members, plus a third one who is an isolate, have no representation in node set V . The average age of the five eligible board members is 50 (only one of them is aged under 40), and they are all commerce owners, i.e. no one owns coffee-shops or restaurants. Their business' performance either has been going up or is stable and their shops are all concentrated in just two of the city centre streets (we have considered a total of 30 streets/alleys/squares). All but one open the shop Saturday afternoons, and all but one are planning to adhere to the policy program. With regard to reachability, the board of the trade association¹⁴ has direct links to 45 other traders. This means that 110 traders are not directly reached by the board. For a leadership group whose main mission is to develop the program in the city centre the low reachability can be considered a poor diffusion of information. This observation was the motivation underlying the theoretical construction of alternative boards.

2. Boards' construction

In this section we present the theory - sociological and/or mathematical- that underpins the construction of the three boards analysed: the board that was empirically observed, which acts as our baseline, and two theoretically constructed boards.

¹³One of them was not eligible because his business was located outside the city centre and another because his field of business was not considered eligible by the incentive program. These two members were not included in the sociomatrix. This was not considered problematic as they were not cited by any of the eligible traders.

¹⁴Here just 4 board members were taken into account – those represented in node set V - because, as we said, two were not eligible and a third one was isolated. Through field work we found out that he was not involved in the city's commerce and his participation on the board was also diminishing (for instance he was frequently absent from meetings).

2.1 Acquaintanceship board

The tendency of individuals in general is to interact preferentially with people similar to them (Hinds et al., 2000). This has been designated as homophily tendency (Lazarsfeld and Merton, 1954)¹⁵. For this reason leadership teams in general, and of policy makers or boards of directors in particular, are very homogeneous (Middleton, 1987). But their homogeneity contrasts with the usual heterogeneity of the collective over which they rule. It is known that homophily reduces the psychological discomfort that may arise from cognitive or emotional inconsistency (Heider, 1958), and reduces the potential areas of conflict in relationships (Sherif, 1958). It is also known that, in groups of similar people, communication is easier and behaviour more predictable, which foster trust and reciprocity (Brass, 1995). Groups with such characteristics are expected to have high levels of group cohesion. However research findings on group cohesion do not support a solid and positive relation between cohesiveness and either individual or group performance (Mudrack, 1989; Levine and Moreland, 1990). Part of this has to do with the definition of cohesion (Levine and Moreland, 1990), and whether the definitions has a personal or task orientation to it (Zaccaro & Lowe, 2001). It is known that in groups in which the basis of cohesiveness is a shared commitment to the group task, rather than the maintenance of the interpersonal harmony, group performance may be better. In fact, a highly interpersonal orientation can create problems for a group and its members. According to Flache and Macy (1996), once friendships are established based on unconditional approval, it becomes much harder to change the rules of the game, so that approval becomes based on compliance with group norms. Strong ties may pose an

¹⁵ For a more recent approach and literature review concerning this concept, see for instance Mcpherson et al. (2001).

insurmountable second order free rider problem. By contrast, if cohesiveness is measured as a shared commitment to the group task, group norms would still be strong but rather than serve interpersonal comfort, they would encourage performance, productivity and efficacy (Hackman, 1995; Sakurai 1975). In any case it is always difficult to have people move beyond a focus on their personal rewards to focus on the achievement of collective goals. The right group composition, the right working context and the right leadership have to be in place.

Even if interpersonal cohesion has proved irrelevant for group performance, it is known that individuals prefer to work with others who are similar and with those they like. Working in a heterogeneous group is more complex in the sense that communication and coordination are more difficult, making it harder to obtain consensus on critical or controversial issues. More negotiation must be undertaken, which consumes additional time and energy. But, on the other hand, the decisions coming out of it add more value to the group and are much more likely to be adopted and implemented by a greater number. If this group has to lead a collective with an heterogeneous character, the only way to be representative is by having a truly heterogeneous leadership. A homogeneous leadership alienates part of the collective (Halliday & Capell, 1979).

2.2 Key player model

Some limitations to homogeneous groups composed on the basis of friendship ties can better be evaluated if compared to a group whose membership is selected for their optimal location in the network. Finding such a group involves looking for a set of nodes - key players - optimally positioned to quickly diffuse information, attitudes,

behaviours or goods. As asserted by Borgatti (2006), “the problem of identifying key players [meaning the most important individuals in a given collective] in social networks (...) is an old one”, and most work so far has relied on actors centrality for that effect. The limitations of this strategy have been shown by Everett and Borgatti (1999).

Borgatti (2006) proposes a new approach to the key player problem and defines two separate key player problems: the *key player problem negative* and the *key player problem positive*. The *key player problem positive* is defined as follows: given a social network, find a set of k nodes called a kp -set such that the kp -set is maximally connected to all other nodes. In this work we are interested in the following version of the key player problem positive: to find a set of k nodes (board directors) such that the number of nodes adjacent to at least one node in the set is maximized.

This combinatorial optimisation problem, referred to as (KP) from now on, may be formulated as follows:

$$(KP) \quad \text{Max } Z = \sum_{i \in V} z_i \quad (1)$$

$$\text{s.a} \quad z_i \leq \sum_{j \in V} a_{ij} x_j \quad \text{for all } i \in V \quad (2)$$

$$\sum_{j \in V} x_j \leq k \quad (3)$$

$$x_j \in \{0,1\} \quad \text{for all } j \in V \quad (4)$$

$$z_i \in \{0,1\} \quad \text{for all } i \in V \quad (5)$$

where $a_{ij} = 1$ if there is an edge linking nodes i and j , and $a_{ij} = 0$ otherwise, and:

$$x_j = \begin{cases} 1 & \text{if node } j \text{ is a key player} \\ 0 & \text{otherwise} \end{cases}$$

$$z_i = \begin{cases} 1 & \text{if node } i \text{ is covered} \\ 0 & \text{otherwise} \end{cases}$$

Constraints (2) state that for a node i to be covered there must be at least one key player j linked to i . Constraint (3) states that at most k nodes may be key players. Conditions (4) and (5) are integrality constraints.

Model (KP) is a covering problem known in the literature as the *maximum covering location model* (Daskin, 1995). The *maximum covering location model* on a general network is NP-complete (Garey and Johnson, 1979).

The key player set obtained from model (KP) solves the reachability problem but may endanger the cohesiveness of the group. If, for instance, one wishes to select the

set of key players of a collective that is highly heterogeneous, one must expect that the actors optimally located are themselves heterogeneous. By optimally choosing leaders a trade-off is made between homogeneity and reachability. Our concern with homogeneity, as we have seen, has to do not so much with the level of interpersonal cohesion but with the level of task cohesion, which is considered to have an impact on the group performance. By using this methodology we are not able to achieve the right mix of individuals needed for task cohesion. But, even when recruitment is done on a personal basis, the right mix is not easy to achieve. This is so because competence is difficult to evaluate, especially in a context where actors work independently from each other, and are recruited to perform tasks other than those they are known for doing well. Moreover it must be borne in mind that the level of group cohesion is a dynamic process: it may grow or decrease.

It could also be argued that this group formation methodology is inadequate because it fails to select those with the highest levels of motivation and commitment to the group task. Optimally positioned group members are not, a priori, motivated for the task at hand, but again, neither may acquaintances/friends be (even if the latter are, a priori, more easily convinced by the organiser). When members of the group are selected through an optimisation technique and tentatively recruited, and if they are not motivated or interested on the project to start with, two things may happen:

- the recruiter/organiser may be able to raise their interest, given the importance of the task at hand and/or by offering rewards such as good working conditions, competent staff, etc; or
- they may simply refuse the invitation, and in this case the recruiter will have to look for the next optimally positioned actor.

Throughout this discussion we have taken for granted the existence of a highly interested individual who engages in group formation. We agree with Marwell et al. (1988), who say that “organiser centred mobilisations are the rule rather than the exception and that most collective goods are produced by actions that originate with one person, (or a few people) who plans a campaign and purposely seeks to draw others into it” (p. 529). If the organiser has high status and resources, the task will be easier. His/her tendency, as we have seen, will be to recruit among a pool of friends/acquaintances. But this organiser, given knowledge of the individuals who are more resourceful and a better warrant of task accomplishment even if they are not similar or well known, will probably not discard recruitment along those lines. Because they are highly driven to achieve the final objective, they may engage in the more difficult but more effective strategy.

In conclusion, a leadership that is optimally selected improves reachability, and does not necessarily put at stake its contribution to collective action. If the right context is reached, one in which cooperation is valued, it can perform well. Nonetheless the organiser and the resources he/she can mobilise play a crucial role in this process.

2.3 Attributes key player model

Model (KP) maximizes reachability but disregards the attributes of traders. This can be a problem. The literature on processes of diffusion of innovation and on the mobilisation for collective action has shown the relevance of considering actor attributes together with the relational contexts in which they are embedded. Marwell and Oliver (1993) have asserted that the production of collective action depends on the initiative of a sub-group comprising the most interested and resourceful, who through their behaviour influence others to participate. In the literature pertaining to mobilisation for social

movements, some examples of relevant attributes are the actors' cultural and ideological identification with the movement as well as with their leaders (Mellucci, 1996), their past participation in other movements, their current membership in other social movement organisations, the biographical circumstances of a person's life, and the expectation toward the movement' success (McAdam, McCarthy and Zald, 1988). In addition, Rogers (1995) has shown that leaders of innovative processes tend to be found among those who have higher formal education, own larger economic units (firms, lands, boats...) and are more cosmopolitan and better informed about the innovation. However the relevant characteristics of leaders change according to the characteristics of the social system (Rogers, 1995).

On the basis of this literature into account we will develop a new model called the *attributes key player model* to select a set of leaders based on both attributes and reachability criteria. The attributes to consider in such models are those that through fieldwork were found to potentially influence participation in collective action. These can be age, success, status, place of birth or attitudes (among others), since they will vary according to the context specificities. In our case, since our purpose is to illustrate an alternative methodology, we have selected the attribute "attitude towards participation in the program" only.

We consider that, to be part of the board, traders must show interest in adhering to the program. It is our supposition that this show of interest is a necessary condition to qualify as a potential board member who has to engage in the task of diffusing information about the program. When building a team to mobilise others to a policy program, their members must themselves be adherents of that initiative. In the attributes key player model only traders that show interest in adhering to the program will be considered candidates to be members of the board.

In addition, assuming that no set composed of k traders is able to reach all other traders in one link, only traders whose attributes will potentially favour the boards' mission of modernising the city centre commerce will be considered as targets. As such the targets will be the traders who have not yet made up their minds about participating.

Let B be the set of traders who have decided to adhere to the program and T be the set of target traders, i.e., those who have not yet reached a decision.

With the decision variables x_j and z_i defined previously the attributes key player model is:

$$(AKP) \quad \text{Max } Z = \sum_{i \in T} z_i \quad (6)$$

$$\text{s.a} \quad z_i \leq \sum_{j \in V} a_{ij} x_j \quad \text{for all } i \in T \quad (7)$$

$$\sum_{j \in B} x_j \leq k \quad (8)$$

$$\sum_{j \in V \setminus B} x_j = 0 \quad (9)$$

$$x_j \in \{0,1\} \quad \text{for all } j \in V \quad (10)$$

$$z_i \in \{0,1\} \quad \text{for all } i \in T \quad (11)$$

The meaning of the objective function and the constraints of model (AKP) is similar to model (KP). In (6) the number of traders who have not yet made up their minds about participating covered by the board directors is maximized. In (7), (8), and (9) only traders who show interest in adhering to the program are allowed to be part of the board. Model (AKP) is another maximum covering location model.

3. Board description

This section contains a characterisation of the two theoretically created boards – key player and attributes key player – according to their composition and reachability performance

3.1 Key player board

Since the acquaintanceship board is composed of seven members value k was set to 7 in model (KP). The greedy adding algorithm for the maximum covering location model (Daskin, 1995) was then used to find an approximate solution to (KP).

To evaluate the quality of the key player board obtained from the greedy heuristic we have computed an upper bound, UB , on the value of the optimal solution to (KP) by solving its linear relaxation. The commercial package Cplex 8.0 (ILOG, 2002) was used to compute this bound. The solution obtained from the greedy algorithm was then evaluated using the standard formula, $\frac{UB-LB}{UB} \times 100\%$, where LB is equal to the number of nodes covered by the key player board obtained from the greedy heuristic. As in this case, $UB = LB$, the key player board obtained from the greedy heuristic is optimal.

The optimal key player board is composed of five men and two women. The average age is 41 and four directors are aged below 40. The group has six commerce owners and one coffee-shop owner. Their businesses are spread out in six different locations of the city centre. Most of them run a successful business (only one had a business which was not doing well). Three of them are planning to adhere to the policy program, while five open their shops on Saturdays. We should also note that the key

player board has two members in common with the acquaintanceship board: the president of the board and the trader who had been in charge of the association prior to election. These are the two actors with the highest centrality degree in this network. With regard to reachability the key player team has direct links to 72 other traders. In total there are 79 traders with first hand or one link away information. This means that the board is unable to reach 80 traders.

3.2 Attributes key player board

To obtain the attributes' key player board, we considered model (AKP) with $k=7$. As in the case of the key player board, the greedy adding algorithm was used to obtain a feasible solution to the problem. This solution was evaluated using the same formula as that for the key player solution and was also proven optimal.

The attributes key player board is composed of five men and two women. The average age is 50 and there is only one director aged below 40. There are two coffee shop owners in the group. Within the group three traders recognise that the business is not going well. Their businesses are placed in five different locations, and all of them open the shop on Saturday afternoons. Like the key player board this board is quite heterogeneous in its composition. This board shares three members with the acquaintanceship board. The attributes key player board reaches 61 traders, 23 of whom are undecided traders.

3.3 The three boards compared

The acquaintanceship board is composed of seven members. While two of them are not eligible and one is an isolate, all seven members of the key player board are eligible for the program. In the key player board three members are unwilling to adhere to the program while only traders willing to adhere to the program are included in the attributes key player board. Since both key player teams are constructed based on previous knowledge about the social network and the rules of the program, it is assured that no one relevant for the success of the program was excluded, and that every potentially important trader was taken into consideration.

The key player and attributes key player boards are more heterogeneous than the acquaintanceship board. While no women are members of the acquaintanceship board, the key player and the attributes board comprise both men and women. The members' age is lower in the key player board and identical in the acquaintanceship and attributes' key player boards. The key player and the attributes key player boards have members in different types of businesses and placed in more locations than the acquaintanceship board. The heterogeneous character of both key player and attributes key player boards, as compared to the homogenous character of the acquaintanceship board is easily explained by the methods followed for their constitution - recruitment through friendship and acquaintanceship ties *vs.* optimisation. As we have mentioned above, the main mechanisms that drive relationships are similarity, predictability, and comfort. In the key player and attributes key player boards all subgroups of the city centre commerce are represented: men and women, commerce and coffee-shops, young and old, traders from main and secondary streets, those who are successful as well as those whose business is declining. In this sense, these boards are much more representative of the city centre

traders. With regard to diffusion of information the heterogeneous group performs better. Nonetheless heterogeneous groups have to engage in more negotiation during the decision-making process, which has costs namely in terms of time and energy. But there are benefits too as negotiation can generate positive sum solutions to problems and make innovation more probable. The information obtained through field work show that even a homogeneous group formed through the lines of acquaintanceship/friendship and perceived competence may engender negative work dynamics. We observed that the level of cohesiveness within the current board was falling. This was perceptible in the low participation by some members at board meetings and in the general activity of the trade association, and even in the disrespect of board decisions by its members. Since group work is a dynamic process, we can expect both declining cohesion in a group that started out as very cohesive and increasing cohesion in a group that started out with low cohesiveness.

The acquaintanceship board reaches 45 traders, the key player board reaches 72, and the attributes key player board reaches 61 traders. In the set of traders reached by the acquaintanceship board only 12 are undecided. The remaining 33 traders have already reached a decision on their adhesion. The numbers of undecided traders for the key player and the attributes key player boards are, respectively, 18 and 23. Since the total number of undecided traders in the network is 47, the acquaintanceship board, the key player board and the attributes key player board reach 26%, 38%, and 49% of the undecided traders, respectively. Although the key player solution represents an improvement compared to the acquaintanceship board, its blindness to attributes, leads to a choice of directors who are not the most competent diffusers of information. As has been shown, the attributes key player board is an optimal solution to model (AKP). This means that, with a board composed of seven members that are willing to adhere to the program, at most 23 out of

the 47 target traders can be reached. In order to reach more target traders, an attributes key player board would need more than seven members.

4. Conclusions

The aim of this paper was to show that social network analysis together with combinatorial optimisation techniques are useful in the identification of key players in a collective whose task is to diffuse information. We have shown that the solution to the key player problem as presented by Borgatti (2006) - although optimal- may not be sophisticated enough to identify the most competent key players. For that reason we propose a modification of the key player problem, named attributes key player problem, which simultaneously takes into consideration actors' positions in the network and their attributes. We showed that this modification of the key player problem improved the choice of key players whose task was simplistically reduced to that of diffusing information.

We have also shown the limitations of a group formed on the basis of friendship/acquaintanceship criteria, that is following the homophily principle, as compared to a group formed based on optimisation criteria. When the collective is heterogeneous, the optimal leadership will necessarily be heterogeneous, and thus more representative. Thus in a collective that must adopt innovative behaviours the group leading the process has to be carefully chosen in order to avoid the trend toward homogeneity for such a trend will necessarily lead to low reachability.

Based on the network structure of this collective we have also shown that the policy implementation would never succeed if the task is to be undertaken solely by the board of the trade association. Prior to intervention the State, as the promoter and ultimate

responsible of the program's success, should have procured any additional resources that are needed. Ignoring this led to a waste of energy and resources. In markets composed of small independent firms that are competitors, the board of directors of the trade association may be incapable of massive mobilisation on its own. Policy makers should invest additional resources in devising and implementing new forms of diffusing information, rather than focusing solely on the attribution of financial incentives, which do not seem to have a strong effect on participation.

The limitations and problems of this work can only be fully apprehended after replication in other cases of collective action. The application in our case study is only an illustration. The data set used for our study, due to its low density, may not be ideal for methodological illustrative purposes. However, if we wish to study a collective where information exchange is rare and where mistrust abounds, one would not expect a very different network structure.

Another limitation has to do with the choice of just one attribute for board members and target actors. Other attributes could be added if considered meaningful for the selection of board members and target actors. But again, given the low density of this network, the choice of more attributes would not improve the explanatory objective of this paper.

In short, the objective of this paper was to serve as an illustration of how organisers of collective action given a knowledge of the "concrete social action" of the system and actor attributes may reduce the complexity of their task and the time and energy wasted, and consequently be more efficient and effective. With the tools of social network analysis and combinatorial optimisation, policy implementation processes could be made easier and more effective by helping with the choice of leaders and with the selection of the most relevant targets.

REFERENCES

- BECHHOFFER, F., ELLIOT, B., *The Petite Bourgeoisie: Comparative Studies of the Uneasy Stratum*, NY: St. Martin's Press, Inc, 1981
- Borgatti, S. 2006. "Identifying sets of key players in a social network." *Computational, Mathematical and Organizational Theory*, 12 (1): 21-34.
- BRASS, D., A social network perspective on human resources management, *Research in personnel and human resources management*, vol. 13, pp. 39-79, 1995.
- CACHINHO, H., *O Comércio Retalhista Português*, Lisbonne: GEPE, 2001
- CARLSSON, L., Policy Networks as collective action, *Policy Studies Journal*, vol .28, 3, pp. 502-520, 2000.
- Crozier, M., Friedberg, E.1977. *L'Acteur et le Système*. Paris : Éditions du Seuil.
- DASKIN, MS., Network and Discrete Location: Models, Algorithms, and Applications, in *Discrete Mathematics and Optimisation*, Wiley – InterScience Series, 1995.
- Dowding, K.1995. "Model or metaphor? A critical review of the policy network approach." *Political Studies*, XLIII :136-158.
- EVERETT, M.G., BORGATTI, S.P., The centrality of groups and classes, *Journal of Mathematical Sociology*, vol. 23, 3, pp. 181-201, 1999.
- FLACHE, A. MACY, M.W., The weakness of strong ties: collective action failure in a highly cohesive group, *Journal of Mathematical Sociology*, vol. 21, 1-2, pp.3-28, 1996.
- GAREY M.R., JOHNSON D.S., *Computers and Intractability: A Guide to the Theory of NP-Completeness*, W.H. Freeman and Company, 1979.

Hackman, J.R. Group influences on individuals and organizations , In *Handbook of Industrial and Organizational Psychology*, ed. Marvin D. Dunette and Laetta M. Hough. 2nd ed., Palo Alto: Consulting Psychologists Press, 1455-1525.

HALLIDAY, T.C., CAPELL, C.L., Indicators of democracy in professional associations: elite recruitment, turnover, and decision making in a metropolitan bar association, *American Bar Foundation Research Journal*, vol.4, n. 4 Autumn, pp. 697-767, 1979.

HEIDER, F., *The psychology of interpersonal relations*, New York: John Wiley, 1958.

Hinds, P.J., Carley, K.M., Krakhardt, D., Wholey, D. 2000. "Choosing work group members: balancing similarity, competence, and familiarity." *Organizational Behavior and Human Decision Processes*, 81(2) March:226-251.

HOMANS, G., *The Human Group*, London: Routledge and K. Paul, 1951.

HOSGOOD, C., 1992, A 'Brave and Daring Folk'? Shopkeepers and Trade Associational Life in Victorian and Edwardian England, *Journal of Social History*, 1992, winter, pp. 285-308

ILOG, *ILOG Cplex 8.0 User's Manual and Reference Manual*, ILOG SA, <http://www.ilog.com>, 2002.

KLIJN, E-H, Policy Networks: an overview, in KICKERT, W. J. M., KLIJN, E-H, KOPPENJAN, J. F.M. (eds.) *Managing Complex Networks: strategies for the public sector*, London, SAGE, pp. 14-34, 1997.

LAZARSELD, P.F., MERTON, R.K., Friendship as a social process: a substantive and methodological analysis, in BERGER, M., *Freedom and Control in Modern Society*, pp. 18-66, New York: Van Nostrand, 1954.

Levine, J.M., Moreland, R.L.1990. "Progress in small group research." *Annual Review of Psychology*, 41: 585-634

MARWELL, G. OLIVER, P, *The critical mass in collective action*, New York: Cambridge University Press, 1993.

MARWELL, G., OLIVER, P., PRAHL, R., Social networks and collective action: a theory of critical mass.III, *American Journal of Sociology*, vol. 94, 3, pp.502-34, 1988.

MCADAM, D., MCCARTHY, J.D., ZALD, M., Social Movements in SMELSER, N.J. *Handbook of Sociology*, Beverly Hills: Sage, 1988.

MELUCCI, A., *Challenging Codes: Collective Action in the Information Age*, Cambridge: Cambridge University Press, 1996.

MIDDLETON, M., Nonprofit boards of directors: beyond the governance function, in POWELL W.W. *The nonprofit sector: a research handbook*, New Haven: Yale University press, pp. 141-153, 1987.

Mudrack, P.E.1989. "Group cohesiveness and productivity: a closer look." *Human Relations*, 42(9): 771-785.

OBERSCHALL, A., *Social Conflict and Social Movements*, New Jersey: Prentice-hall Inc., 1973.

OSTROM, E., *Governing the Commons: the Evolution of Institutions for Collective Action*, Cambridge: Cambridge University Press, 6th ed., 1995.

OSTROM, E., A behavioural approach to the rational choice theory of collective action, *American Political Science Review*, vol. 92, 1 pp. 1-22, 1998.

PALUMBO, D.J., (1987) III Symposium: Implementation: what we have learned and still need to know, *Policy Studies Review*, vol.7, 1, pp. 91-102

PAPPI, F.U., HENNING, H.C.A., Policy networks: more than a metaphor, *Journal of Theoretical Politics*, vol. 10, 4, pp. 553-575, 1998.

PRESSMAN, J.L., WILDAVSKY, A. *Implementation*, Berkeley, CA: University of California Press, 1973.

ROGERS, E. M., *Diffusion of Innovations*, New York: The Free Press, 4th ed., 1995.

SALGUEIRO, T., Do Comércio à Distribuição, Roteiro de uma Mudança, Oeiras: Celta Editora, 1996

SHERIF, M., Superordinate goals in the reduction of intergroup conflicts, *American Journal of sociology*, vol. 63, pp. 349-356, 1958.

STRANG, D., SOULE, A.A., Diffusion in organizations and social movements: from hybrid corn to poison pills, *Annual Review of Sociology*, vol. 24, pp. 265-90, 1998.

TAYLOR, M., *The Possibility of Cooperation*, Cambridge: Cambridge University Press, 1987.

THATCHER, M., The development of policy network analysis, *Journal of Theoretical Politics*, vol. 10, 4, pp. 389-416, 1998.

VARANDA, M., *La réorganisation du commerce d'un centre-ville: résistance et obstacles à l'action collective*, Paris : L'Harmattan, 2005.

Wellner, J. 2008. "Legitimacy and public policy: seeing beyond effectiveness, efficiency and performance." *The Policy Studies Journal*, 36(3):421-443

Zaccaro, S.J., Lowe, C.A. 2001. "Cohesiveness and performance on an additive task: evidence for multidimensionality." *The Journal of Social Psychology*, 128(4):547-558