Targeted Policy Making by Transforming Social Networks

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Abstract. Current economic conditions press governments worldwide to develop more efficient policies with significantly lower budgets. A possible way to achieve this is by exploiting online social networks. The tremendous impact of social networks in everyday life (e.g. obesity, financial situation, smoking etc.) is now well established in the literature. However, up to now, the impact of online social networks in policy making has not been thoroughly investigated. We claim that policies, in addition to their traditional aims, should also aim to improve the online connections of target population as this will enable more targeted thus more efficient and effective policy making. In this paper, we present this idea, relate it to traditional policy making lifecycles, and investigate relevant technological aspects. We anticipate this work will contribute to the on-going discussion on the pros and cons of exploiting online social networks in policy making.

Keywords: policy making, online social networks.

1 Introduction

Today, a large number of economic, social, health and other policies are not sufficiently successful. In many case, funding and social benefits do not reach those is real need. Even when they do so, they still fail to assist beneficiaries to permanently overcome their problems. As an example, many policies for promoting entrepreneurship provide funds for young entrepreneurs taking into account pre-defined criteria e.g. age, business idea etc. Additional funds may be also provided for supporting entrepreneurs in their first steps in terms of open lectures and workshops. These approaches however are expensive and in many cases have limited only effectiveness in terms of successful new businesses and economic growth.

At the same time, current conditions and especially the economic crisis press governments worldwide to develop more efficient policies with significantly lower budgets [1]. A straightforward way to achieve this is to develop more *targeted policies*, i.e. policies that reach and affect the target population in a cost-effective and efficient manner. To this end, policy modelling can assist in evaluating different approaches and forecasting the effect of policies.

Yet, an unexplored idea is to exploit the *full potential of social networks and particularly online ones* (e.g. those created in social networking sites). The fact that

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social networks have tremendous impact in a number of everyday areas (e.g. obesity, financial situation, smoking etc.) is now well established in the literature. The heavily influential book "Connected" in its final pages suggests that in order to reduce social inequalities we should also consider the personal connections of those we wish to assist [2]. As an example it is stated that we could reduce crime by *improving the connections* of potential criminals. But is this actually true? And if so, how social network analysis can be exploited in actual policy making?

During the last few years, an increasing number of research projects are investigating the potential of online social networks in policy making. For example, Padgets (e.g. [3]) developed a central system that publishes various types of policy-related content (e.g., short text long text, images, video) and micro-applications in multiple social media and collects back data on citizens' interactions (e.g., views, comments, ratings, votes, etc.). The platform also offers analytics, opinion mining and forecasting future trends through simulation modelling to support policy making. WeGov project (e.g. [4]) developed an online toolbox for policy makers to engage with citizens on social networking sites (SNS). It provides three broad categories of functions, enabling the policy maker to (i) search for discussions, topics and opinions from different SNS; (iii) analyse and summarize these discussions to determine the themes and important posts; and (iii) inject information into the SNS. The topics and opinions analysis identify groups of words that represent the topics within a discussion. The prediction of user activity shows posts that are going to generate more attention and the modelling of user behaviour analysis classifies users according to their behaviour and interactions within the SNS. The on-going NOMAD project (e.g. [5]) aims to develop a technical platform that enables government agencies to search for content on a public policy under formulation in various social media and other sources (e.g. blogs and micro-blogs, news sharing sites, online forums, etc.). The gathered content is processed to extract arguments, opinions, issues and proposals on the particular policy, identify their sentiments (positive or negative) and finally summarise and visualise them.

In summary, current projects (such as Padgets and NOMAD) mainly aim to facilitate open and transparent discussions between policy makers and citizens through online social networks. WeGov goes further to classify users' behaviour. None however aims to *transform* online social networks.

The main objective of this paper is two-fold: First, to introduce an approach that enables exploiting online social networks in order to improve targeted policy making. Second, to present a high-level technological view of this approach, including how it fits a traditional policy making lifecycle, relevant high-level requirements and architecture, and a usage scenario.

The rest of this paper is structured as followed. In Section 2, the methodology is presented. In Section 3, the main principles of the proposed approach for targeted policy making are outlined while in Section 4 the relevant steps in a policy making lifecycle are provided. In Section 5, high-level requirements and a high-level architecture of a platform to support targeted policy making are presented. In Section 6, a usage scenario is presented on the envisaged use of the approach. Finally, in Section 7, conclusions are drawn and future work is presented.

2 Methodology

The overall methodology that is followed in this paper is influenced from the principles of software engineering and systems analysis and design. For example, an approach to systems analysis and design suggests one should start with a briefly described idea and then perform a feasibility study including technical, financial and organizational feasibility [6]. The technical feasibility aims to answer the question "*can we build it?*", the economic feasibility aims to answer the question "*should we build it?*" and the organizational feasibility aims to answer the question "*if we build it, will they come?*" In addition, architectural models, e.g. [7], have been proposed to describe the architecture of software systems based on the use of different viewpoints, such as logical, development, process, physical, and scenarios. Finally, usage scenarios have been proposed as a starting point for software development [8].

In this paper, we concentrate on presenting the driving idea as well as a high-level technological view to support it. In this respect, we follow a four-step approach.

First, we present the overall vision and approach towards targeted policy making (section 3). This clarifies the main idea proposed in this paper at a conceptual level.

Second, we outline how our idea fits a traditional policy making lifecycle (section 4). This enables putting our ideas in context of policy making but also deriving the high-level requirements of the necessary technical infrastructure to support targeted policy making. It should be noted that the ideas presented in this paper rely heavily on new technological developments and innovations. Hence, we chose to focus on technical aspects to also facilitate conducting a first technical feasibility study.

Third, we present high-level requirements and architecture (section 5) for the necessary technical infrastructure to support targeted policy making. Once again, these aim at evaluating the technological feasibility of our approach rather than providing detailed development guidelines.

Finally, we present a hypothetical usage scenario (section 6). This enables better clarifying the vision of targeted policy making and the role of the technical infrastructure in supporting it.

It should be noted that other equally interesting questions arise from introducing the idea of exploiting online social networks for targeted policy making. Some of these include an evaluation of the relevant benefits and pitfalls (e.g. using a SWOT analysis), the legal and ethical issues that may arise from introducing such policy interventions, the economic feasibility as well as issues related to acceptance by stakeholders etc. All these issues however are outside the scope of this paper. Nevertheless, we will come back to some of these in the last section.

3 Towards Targeted Policy Making

The main idea behind this paper is that policy interventions should not only be based on the characteristics of a person or a group (such as age, income, skin colour etc.) but also on the position of a person in a relevant social network.

We introduce the term *policy social networks to refer to social networks where nodes and links are important to a particular policy*. We claim that policies should not only try to *understand* and *exploit* but also *transform* policy social networks and we aim to investigate that by doing so, policies will achieve their goals in a more efficient and effective manner. If our hypothesis is true then e.g. an entrepreneurship policy that changes the structure of the relevant policy social network will be more efficient than a traditional policy. In other words, policies enabling to *improve the connections* of potential entrepreneurs will be more successful.

Thus, the main assumption behind this paper is that "*targeted policies that involve understanding, exploiting and transforming policy social networks are potentially more efficient and effective than those that do not do so*".

We believe it is important to scientifically investigate whether the hypothesis is actually true. Indeed, the potential of social network analysis in policy making has not been systematically examined [9] despite the efforts in various relevant but currently disparate scientific areas, e.g. agent-based simulation [10].

If this assumption is proven right, then policy making could become more targeted (even personalised) and thus potentially more efficient and cost-effective. Policy interventions could have maximum impact with less cost as they will no longer be horizontal but rather very much targeted by exploiting and even transforming relevant policy social networks to have desirable characteristics, such as improved connections.

As an example we consider promoting entrepreneurship, a policy particularly important due to the debt crisis [11] [12]. Here, the policy social network may contain nodes such as potential entrepreneurs, successful and unsuccessful entrepreneurs, venture capitalists, angel investors etc. and links may represent connections such as ones in Facebook and LinkedIn but also in real life. We claim relevant policies should aim to improve the connections of potential entrepreneurs and provide incentives for beneficiaries to do the same.

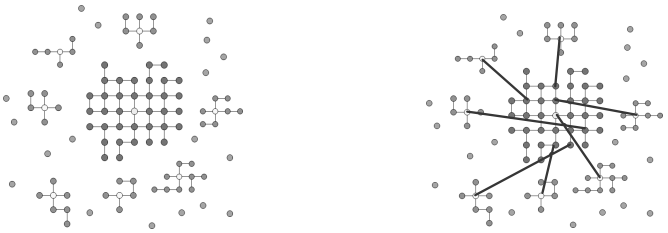

Fig. 1. A. Before policy intervention B. After policy intervention

Here, policy analysis might show that in *young entrepreneurship*, it is essential for new entrepreneurs to exchange ideas with successful businessmen and venture capitalists. The analysis might also show that currently, the social network of potential entrepreneurs in one region is isolated from such other groups. We therefore need to first of all represent this *policy social network* (see fig. 1A). There is therefore a need to develop and possibly simulate various alternatives aiming to change the structure of the network to facilitate improved communications. A technological platform is

needed to exploit social media (such as twitter, LinkedIn and Facebook) trying to propose connections between entrepreneurs in the region with successful businessmen and venture capitalists. As an example, the platform might include software agents in Twitter that will (a) understand that entrepreneurs do not *follow* successful businessmen and venture capitalists, and (b) try to establish such connections e.g. by sending introductory invitation tweets. This will change their social network which will now have the desirable characteristics and measures values e.g. in terms of new connections that will enable ideas on entrepreneurship to flow to new entrepreneurs (see fig. 1B). In fig. 1B the new lines represent new connections (e.g. realised through *follow* in Twitter) that were introduced by the platform to implement the targeted policy interventions. These connections were deemed essential for new entrepreneurs to acquire the needed position in the network in order to succeed.

4 Targeted Policy Making Lifecycle

In this section we present the enhancements needed in a traditional policy making lifecycle to incorporate and exploit Policy Social Networks (PSN) for more targeted policy making. These enhancements provide an upper level description of the requirements of a relevant supporting technical infrastructure to assist in targeted policy making.

Fig. 2. Traditional policy making lifecycle

The policy-making lifecycle is usually defined as a 5-levels process [13] including:

1. The *agenda-setting* stage, referring to establishing the need for a policy change and defining what the problem to be addressed is.
2. The *analysis* stage, referring to exploring the challenges and opportunities regarding an agenda item, gathering evidence and knowledge on it as well as citizen opinions, understanding the context and developing alternative options.
3. The *creation* stage, referring to drafting of a policy document but also including formal consultations, pilots' studies, etc., if relevant.
4. The *implementation* stage, referring to the development and implementation of the relevant legislation and/or regulations.
5. The *monitoring* stage, referring to closely following policy in action and evaluating its impact.

Actually, the traditional lifecycle is a circle (from monitoring back to agenda setting) but we present it here as a sequence for simplicity. In traditional policy lifecycles, policy modelling is restricted mainly to evaluating alternatives and forecasting

policies (or the lack of any policy) impact on the population. Different approaches have been followed for this purpose including, for example, agent-based simulation and mathematical epidemiology modelling.

In this paper, we suggest integrating and exploiting the concept of Policy Social Networks (PSN) in the policy lifecycle. For this purpose, contributions to each of the policy-making stages are required as follows:

- To the analysis stage, a new way to define and explore different policy options by exploiting trends and knowledge gathered from the policy's social network and by simulating different policy alternatives is required.
- To the policy creation and implementation stage, an environment for defining and implementing a policy alternative by performing certain interventions on the PSN and actively transforming its structure and other characteristics is required.
- To the monitoring stage, an environment for closely monitoring policy implementation and its impact on the social interconnections of the targeted subpopulation is required.

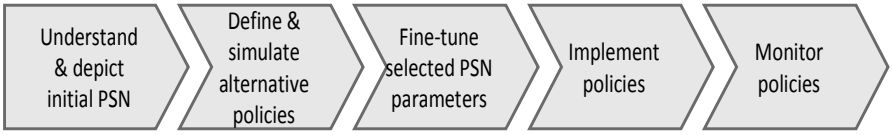

Fig. 3. Targeted policy making lifecycle

The proposed enhanced targeted policy making lifecycle consists of 5 steps (fig. 3):

Step 1: Understanding and depicting the policy social network (PSN). This step initially involves the understanding of the policy area and the definition of all important (influential) parameters and network characteristics relevant to the selected policy area. Furthermore, this step involves the definition of the selected policy's social network (PSN) for a targeted population and its depiction both topologically and numerically by measuring its most important characteristics. Essentially, in this step, the policy maker obtains an overall understanding of the social networks' potential in the selected policy area and gets acquainted with the relevant policy social network (PSN) and its characteristics.

Step 2: Definition and simulation of alternative policies. This step initially refers to the definition of different alternative policies by modifying the relevant PSN metrics and connections, thus designing target social networks that will have desirable policy characteristics and network measures' values to achieve the desired policy goal. Then, one or more alternative policies are being simulated providing to the user a depiction of the final PSN after policy alternatives' implementation. Essentially, in this step, the policy maker explores alternative policy options and experiments with their impact by

simulating the transformation of PSN for each option. Thus, the policy maker can take an informed decision on which policy alternative(s) to actually implement.

Step 3: Fine-tuning of the selected PSN. This step refers to selecting one of the alternative policies and refining its technicalities (e.g. finalise PSN metric changes needed to achieve target PSN) making it thus ready for implementation. Essentially, in this step, the policy maker selects one of the alternative policies explored in the previous steps and decides on suitable PSN interventions to be performed.

Step 4: Implementation of policies. This step refers to actual implementation of the selected policy alternative by modifying the relevant PSN connections, according to the decisions made in the previous step. Essentially, in this step, the policy maker applies the decided social network interventions to the current PSN in order to change it towards the target PSN. For example, the policy maker may propose specific, new connections to users so that PSN's density and central nodes are increased.

Step 5: Monitoring of policies. This step refers to evaluating the impact of implemented policies through real-time monitoring of PSN's topology and metrics and comparing progress of implemented policy vis-a-vis expected outcomes from prior simulation. Here, the policy maker can monitor PSN's transformation and conclude whether the expected impact of the implemented policy has been achieved. If not, the policy maker may decide to perform additional interventions to the PSN. Alternatively, the policy maker may decide to implement other policy alternatives, in which case the process makes a loop returning to step 2 and continuing from there on.

5 Towards a Platform to Support Targeted Policy Making

This section presents two artefacts towards a platform to support targeted policy making: high-level requirements and architecture.

Based on the analysis of the previous section, fig. 4 presents the main functionality expected from a supporting technical platform (i.e. platform). For this purpose, UML use case diagrams notation is employed. In UML use case diagrams, the stickman (called actor) represents a user of a system that can be either a human or another system, while the oval (called use case) represents an essential functionality of a system. A connection between the two suggests a user triggers or is involved in a specific functionality.

A relevant high-level architecture is depicted in fig. 5. This architecture can be used to illustrate the technical feasibility of the requirements presented above but also as a guideline for subsequent detailed architectures and ultimate prototype implementations. Some information on the architecture's main components follows.

The *Social Network Connectors* enable the connection of the platform with existing online social networks (e.g. Facebook, twitter and LinkedIn) thus feeding the platform with up-to-date information regarding the PSN under investigation e.g. connections and contacts of the nodes of interest, etc.

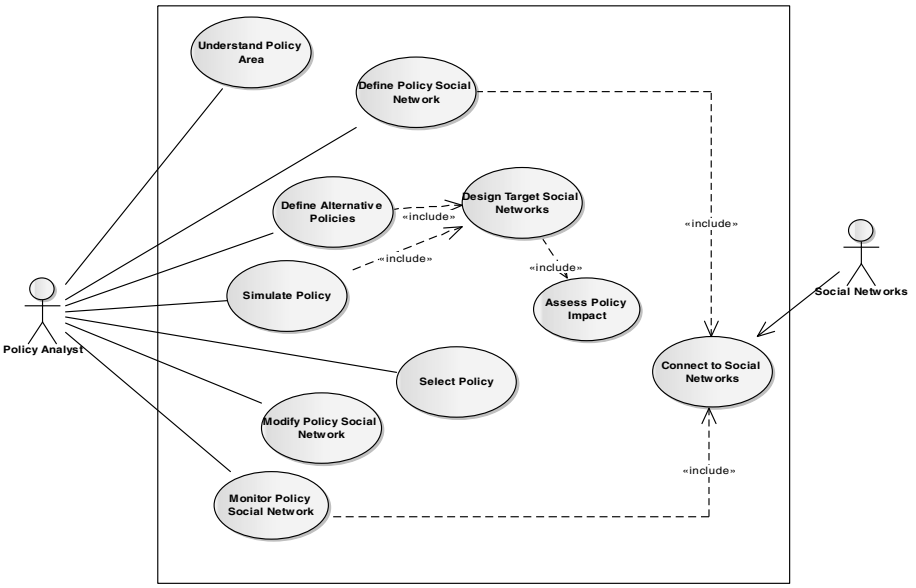

Fig. 4. High-level requirements (using UML use case diagram)

The *Social Network Interaction* layer provides the mechanisms and tools for the secure retrieval of data related to the PSN (the policy maker can define the target population and the type of network data that will be retrieved for the scenario under investigation) from the existing online social network and for the alignment, transformation, anonymisation and semantic interconnection of this heterogeneous network data to a common reference format. Finally, this layer provides the mechanisms and tools required for transforming social networks through effective social-computational network interventions.

The *Policy Application and Simulation* layer implements the social network analysis and monitoring mechanism for representing the social network structure and calculating the values of its metrics**.** This will enable policy makers to understand the current state of the network and identify important metrics that could be improved through network interventions. The platform should also offer a recommendation mechanism to propose the most effective improvements (network interventions) related to the policy. The recommendations are based on identified social network patterns that define the "ideal" structure/characteristics of a social network. Moreover, the system analyses the PSN data and detects the current trends in the network, thus assist the policy maker to select the best policy. The layer should also provide mechanisms for: (i) initiating simulations to derive expected results of different potential policies and (ii) applying various social-computational network interventions to transform the network. Last, the layer should support a mechanism for identifying social network patterns in social relationships and how these may be related to metrics or behaviours.

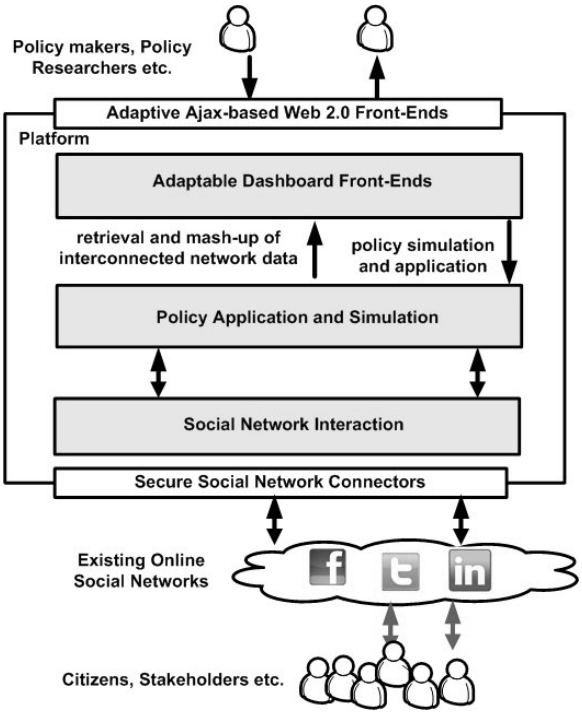

Fig. 5. High-level architecture

The *Adaptable Dashboard Front-ends* layer supports the user-centric focus of the platform and enables the easy, personalised access of users to the visualisation, simulation and intervention functionalities.

High-level requirements and architecture are first only steps towards platform development. However, they are sufficient for an initial technical feasibility study. They also provide the basis for further refinement towards platform implementation according to the principles of iterative and incremental software engineering.

6 Usage Scenario

In this section, we present a usage scenario to better illustrate the foreseen use of the ideas presented above. It should be noted that this scenario is based on the principles and high-level architecture presented above. Thus, no actual platform has been implemented yet. The scenario aims to facilitate a better understanding of the proposed approach and relevant requirements e.g. within a phase of system analysis.

Maria, a policy maker, wants to apply a policy in order to improve the entrepreneurship among young people. Due to economic constraints she cannot apply horizontal strategies, but she has to apply more targeted and efficient policy interventions.

Initially, Maria launches the platform dashboard (fig. 6) to define the targeted Policy Social Network (PSN) (i.e. the targeted population of the policy). The platform

offers tools and mechanisms that help Maria define the basic characteristics of the PSN. When the PSN is defined, Maria can see a visual representation of the social network showing the relations between the individual social entities of the network through the "Current Policy Social Network" tool of the dashboard. In this case, relations can be *follow* relationships in Twitter.

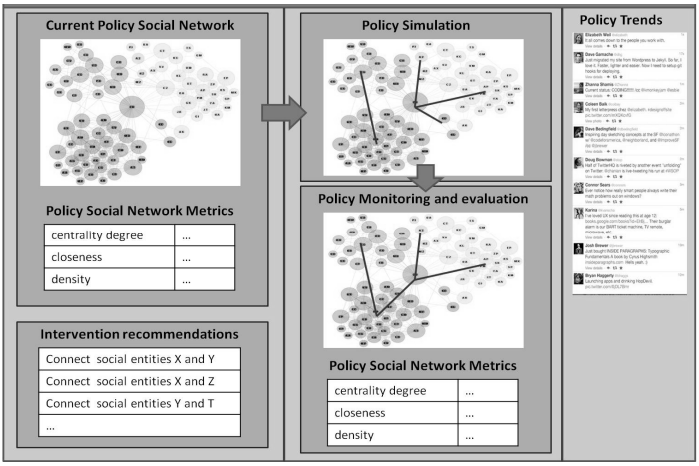

Fig. 6. Mockup of platform dashboard

The visualisation allows Maria to observe that a group of potential entrepreneurs in the PSN is probably isolated from other relevant groups, thus information and ideas do not "flow" to this part of the network. Additionally, the platform computes and displays a set of relevant metrics, through the "Current Policy Social Network" tool of the dashboard. This allows Maria to monitor the status of the online social network. These metrics are divided into network-level metrics (e.g. network density, centralization, hierarchy and symmetry, connectivity and complexity) and node-level metrics (e.g. centrality indices and ego-network indices). The former allow Maria to identify e.g. persons in positions of prominence while the latter allow the exploration of the social environment of a given individual.

In order to apply the policy, Maria has to select the most efficient network interventions. Due to the complexity of the social network the number of potential network interventions is large, thus making difficult the selection of the most appropriate and efficient. The platform offers an "Intervention recommendation" mechanism at the dashboard that recommends network interventions based on identified PSN patterns and on the metrics values of the current network. Specifically, the platform recommends the establishment of new connections (by sending introductory invitation tweets in Twitter) between budding entrepreneur of the isolated network and experienced entrepreneurs. Moreover, the platform analyses the PSN data and detects the current trends in the social network, thus assist the policy maker to select the best policy.

Before applying the policy to the social network, Maria wants to see the effects of the intervention to the social network. The platform enables Maria to simulate the policy in the PSN using the "Policy simulation" tool at the dashboard and measure the effects of the policy. This allows her to experiment with different policies and measure the results in a simulation environment (e.g. how did the PSN change after the transformation? What are the metrics values of the resulted PSN? etc.) before applying the policy to the real world social network.

The simulation results assist Maria to identify the most efficient policy strategy i.e. the one that has the best simulation results. Then, Maria applies the policy through the platform by transforming the social network, e.g. by sending introductory tweets to targeted persons. Finally, the platform enables Maria to monitor the results of the policy using the "Policy monitoring and evaluation" tool of the dashboard (e.g. to monitor if the suggested interventions have been adopted and the network metrics have been improved) and compare them with the expected results coming from the simulation process e.g. has the network structure improved the same at the real world and at the simulation? what type of differences exists? why these differences occur?

7 Conclusion and Future Work

In this paper we suggest that *online social networks* should be exploited for more targeted policy making. This can potentially increase the efficiency and effectiveness of policy making. For this purpose, we introduce the term *policy social networks to refer to social networks where nodes and links are important to a particular policy*. Therefore, the main assumption behind this paper is that "*targeted policies that involve understanding, exploiting and transforming policy social networks are potentially more efficient and effective than those that do not do so*".

We also present the amendments needed in a traditional policy making lifecycle in order to incorporate these ideas. This analysis reveals that a sophisticated technical infrastructure is essential to support the use of policy social networks within the policy making processes. It also reveals the high-level requirements of such technical infrastructure. We subsequent outline a high-level architecture for such infrastructure that can be used to investigate its technical feasibility and also as a guide for subsequent implementation. This is followed by a usage scenario to illustrate the policy making process and the use of the relevant technical infrastructure.

Although we believe the ideas presented in this paper seem promising we do not claim they have been investigated thoroughly in all their aspects. Indeed, further work is needed in various directions.

First, there is a need to more thoroughly investigate the idea of exploiting online social networks for targeted policy making. Indeed, analysing and using data from online social networks might be undesirable from a legal and/or ethical perspective. This can be due, for example, provisions related to data protection, such as those imposed by Directive 95/46/EC in the European Union. Furthermore, the idea that policy making will be based on data resting within private companies and governed by their access policies might not be appealing. Finally, one might claim that new

methods of fraud might emerge if, for example, one develops an artificial social network just to enable him to become beneficiary of a particular public service or benefit. Thus, additional research is needed in these directions. In any case, our position is that these ideas should be used with cause and to supplement rather than replace traditional policy intervention methods.

Second, research is needed in the technical aspects of these ideas. Here, development and evaluation of a prototype is an essential ingredient of future work needed in the area.

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