

SIMULATING NETWORKS: AN EXPERIMENT

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ABSTRACT

Simulating artificial social networks has become popular in recent years with new technological developments. However, the adoption of this new framework in this domain needs to be followed with training processes involving various professionals within the field. To facilitate the construction of this framework, one may suggest creating an artificial environment of networks that simulates regional capacity-building networks in different settings. The objective of this paper is therefore to develop and present an analytical framework that enables the creation and deployment of a certain regional capacity-building network in a government context. In order to accomplish this goal, a simulation game was employed and hierarchical cluster analysis was used. Our findings suggest that specific hierarchical and professional profiles within public administration deserve different government training endeavors. Further steps are outlined in order to consolidate a regional capacity-building network in government.

INTRODUCTION

Recent developments in government research makes social networks initiatives a popular method in the Public Administration arena. Moreover, in some settings, those even become mandatory. However, the adoption of this new paradigm needs to be followed up with training processes involving all the professionals within public organizations. In a general way, fragmentation can be perceived between these two endeavors (Biasiotti & Nannucci, 2004), i.e., the demand for social networks projects has increased more rapidly than the training of public administration personnel. Thus, as social networks initiatives have been undertaken without taking into account the skilled civil servants required, public institutions have been obliged to outsource external consultancies (Kaiser, 2004). One solution that has arisen lies in the creation of regional capacity-building networks in government scenarios, as is the case of the Scandinavian Network in government (see, for instance, Elovaara *et al.*, 2004). In this context, an Inter-American

Capacity- Building Network in e-government is gradually taking shape, sponsored by several organizations. The major challenge that still remains to be addressed is to determine who requires training – among the diversity of profiles within public administration – and to establish what content must be delivered to which group and with what workload. Thus, the objective of this paper is to develop and present an analytical framework that enables the efficient and effective creation and deployment of a regional capacity-building network in government settings. In order to achieve this, a social network approach outlined below is used as proof-of-concept of the framework developed by the researcher in order to clarify how to create homogeneous training groups of professionals, as well as how to define the necessary training content appropriate for each group.

The study is organized as follows: First, we review related literature. Then, we introduce the components of our model, propose several techniques for data and information processing and present the application with a patient database. Finally, we interpret the results and summarize the study.

LITERATURE REVIEW

The evolution and development of social networks over the past decade supported decision-making in various fields. Those fields range from biology to management. However, decision support is considered to be a difficult task. The reason for that is that those processes are complex and data relationships are hard to model. In their study, Dhar and Stein (1997) identify a few major difficulties when developing forecasting models to support decision-making using social networks:

1. Due to high complexity of markets today, models have to cover knowledge regarding data and information relationships where the type and intensity of the relationship can hardly be understood completely.
2. In several domains, including social behavior, forecasting models and system designs usually have to process and analyze data series featuring highly complex behavior.

3. Voluminous economic data series which relate to social behaviors have to be analyzed, especially when exploring intraday market behavior. Large amounts of data have to be processed to extract comprehensible information to investors.
4. Since the markets today are non-stationary over time, models and system design are required to be flexible regarding necessary adjustments.

In the following sections, the authors face these challenges and present an approach to evaluate social networks subsequent to the publication of government announcements (so-called ad hoc disclosures). Latest empirical findings from this type of research have revealed significant differences regarding the price effects within news sub-classes (Muntermann and Güttler, 2007). As some news sub-classes reveal either no or sporadic data effects only, the authors infer that building general forecasting models is not always preferable. Therefore, a two-stage analysis is proposed.

In addition to the difficulty to manage decision support systems in the context of social networks, the fast-pace growth of information and technology in the past 15 years requires a more rigorous understanding of stored data and information. Information and data are being accumulated in pace never seen before and traditional methods of handling those huge amounts are just not sufficient. This is particularly true in the healthcare industry. A search for a resolution yielded many potential solutions. One popular approach that is frequently being used in industry and that was proven quite efficient in analyzing data is social network analysis. Today, this method is widely used to understand marketing patterns, customer behavior, examine patients' data, and detect fraud.

As a result, this research follows social network analysis procedures and presents a model that transform data and information into knowledge in the healthcare industry. Several authors in the information systems field studied data, information and knowledge (Alavi and Leidner 2001). The dominant view in the field is that data is raw numbers and facts. Information is processed data, or "data endowed with relevance and purpose" (Drucker 1995). Information becomes knowledge when it adds insight, abstractive value, better understanding (Spiegler 2000).

We follow this taxonomy in this paper and aim to generate knowledge to improve decision making in social networks. Specifically, we produce knowledge related to networks in government. This type of network is considered one of the most frequent networks in literature. Our main goal in this study is therefore to create a core social networks analysis application that helps identifying patterns in government.

From a technological perspective, according to Venkatraman (1994), the contribution of Information and Communication Technology (ICT) to business was permeated with skepticism in the early 1990s due to its failure to achieve the promised results. In view of this

perception, the author stressed the pressing need to create and develop new criteria to evaluate the impact of ICT on business, duly assessing automation logic, cost reduction and internal operation efficiency-based logic, which had prevailed until that time and might conceivably no longer constitute relevant parameters. The observations presented above are a clear indication of the pressing need for new business models – irrespective of the size and nature of organizations – that enable greater convergence between the physical world of producing goods/services and the virtual world based on information and connectivity (Ben-Zvi, 2009; Chen and Lin, 2009; Gulati & Garino, 2000; Porter, 2001).

This phenomenon is not just a characteristic of businesses, as it has a tremendous impact on government as a whole, since actions can be developed to use ICT to improve the quality of public services, through what is already widely known as e-government. Using social networks in the context of government is still an exploratory knowledge field and it is consequently difficult to define it precisely. Moreover, it encompasses such a broad spectrum that it is difficult to find one expression that encapsulates accurately what government really represents.

Authors define social networks in the context of government in a broad sense; see, for example, Kraemer & Dedrick, 1997. This concept government encompasses a broad gamut of activities, from digital data and electronic public service to online networks. Yet, the most recent definitions see e-government as the use of information technology to support government operations, engage citizens, and provide government services (Dawes, 2002). In other words, social networks in government are the achievement of public ends by digital means. In this respect, governmental organizations are striving to adopt the same modernization tools used in the private sector, mainly new business models where communication through the Internet plays a vital role (see Kubicek and Hagen, 2001; Lenk and Traunmüller, 2001) and new skills associated with technological change (Autor et al., 2003).

When considering analysis methods, one refers to the task of segmenting a diverse group into a number of similar subgroups or clusters (Chan and Lewis 2002). Unlike what happens in classification, there are no predefined classes or groups. The clustering algorithms work according to similarities that can be found in the data itself, without any predefined rules. When comparing classification and clustering, one needs to realize that even the resulted groups in clustering are not necessarily well-defined, and it is up to the miner himself to label the final clusters, according to the clustered data.

Today, social networks is applied in panoply of successful applications in many industries and scientific disciplines (Melli et al. 2006); for example, financial institutes (Chen et al., 2000), manufacturing (Ben-Zvi and Grosfeld-Nir, 2010); insurance agencies (Apte et al., 2002), marketing contexts (Berson et al., 1999; Davenport et al., 2001) and web mining (Scime, 2004). One important

application is in healthcare. Social networks can potentially improve organizational processes and systems in hospitals, advance medical methods and therapies, provide better patient relationship management practices, and improve ways of working within the healthcare organization (Metaxiotis 2006). You may use this method to make utilization analysis, perform pricing analysis, estimate outcome analysis, improve preventive care, detect questionable practices and develop improvement strategies (Chae et al. 2003; Chan and Lewis 2002). For concrete healthcare applications, the reader is referred to Rao et al. (2006), Apte et al. 2002 and Hsu et al. 2000).

METHODOLOGY

The benefits from the implementation and use of social networks in government hinge on the presupposition that qualified and skilled public administration personnel are on hand to deal with this new methodology. According to Dujisin (2004), it is not so much the challenge of having external specialists hired by government, but the need to envisage permanent training policies addressing the different knowledge fields embedded in e-government, as well as ensuring integration between them. On the other hand, it is necessary to understand that social networks in government are far more than mere technology (Lau, 2004). According to Biasiotti & Nannucci (2004), a mix of several disciplines must be created, encompassing not only Information and Communication Technology and Administrative Science, but also Social, Human and Legal Sciences, among others. Several endeavors are underway to train civil servants in government (see, for example, Augustinaitis & Petrauskas, 2004; Elovaara et al., 2004; Biasiotti & Nannucci, 2004). However, the training models are very much centered on the content and duration of the courses (Augustinaitis & Petrauskas, 2004; Kaiser, 2004; Lau, 2004), avoiding classification of the civil servants into specific training groups, according to the current hierarchy, so as to deliver different skills to different players within the public administration arena. A few examples are Biasotti & Nannucci (2004), Kaiser (2004) and Lau (2004), to name but a few. This led them to the following findings and conclusions:

Augustinaitis & Petrauskas (2004) focus their efforts on proposing training content, suggesting the following content modules for a masters degree program in governance or politics: Public Administration, Knowledge Management and Knowledge Society, Information Technology and e-Governance (including e-governance, e-democracy; data security and protection; regulatory frameworks and eservices). Conversely, Lau (2004, p. 238) understands that four facets must be developed in an e-government training initiative, namely: Information Technology; Information Management; Information Society and Management. Consequently, it becomes clear that there is a pressing need to link all the aspects involved in e-government training efforts into a single integrated framework, so as to allow

capacity-building endeavors to achieve the efficiency and effectiveness sought by policy-makers. However, according to Elovaara et al. (2004), e-government is so expansive and interdisciplinary that there is a need for countries to network in order to get a better overview of what they are actually attempting to develop. Moreover, this network must take into account the cultural, social, and economic national differences of the countries involved (Banerjee & Chau, 2004).

The increasing importance of Information and Communication Technology (ICT) on the work of public administration highlighted the need for the creation of regional networks for government capacity-building institutions to allow them to pool their efforts. The concept of a network – not an organization per se, but a group of committed institutions – was devised in order to enhance the capacity of civil servants and explore new financing mechanisms that would promote the development of modern academic programs to train public servants in government. The presentation of various experiences in social networks in government led participants to a diagnosis of the current situation in several regions around the world, as well as to an evaluation of public sector needs in terms of human resources for the implementation of government strategies. The methodology applied by the researcher in this research, with a view to developing a framework to create the desired network, drew upon focus groups created by the sponsors during the aforementioned meeting. Thus, the participants invited were divided into groups in order to address the essential issues relating to the creation of a regional network. In addition, a focus group may be defined as an interview style designed for small groups. Using this discussion-based approach, researchers strive to learn about conscious, semi-conscious, and unconscious psychological and socio-cultural characteristics and processes among various groups. So, focus group interviews take the form of guided discussions addressing a particular topic of interest or relevance to the group and the researcher. The participants were divided into three different focus groups. Each one was supposed to discuss concurrently one specific issue under the guidance of a facilitator from one of the sponsors' organizations, usually called the moderator, and then present the results to the whole group for discussion. The participant discussed several issues, such as regional diagnosis in the network, analysis of the needs for network formation and an analysis of existing capacity-building programs in government.

After discussions mediated by the simulation administrators, a framework developed by the researchers was presented to the group, in order to support the capacity-building network. We specifically addressed the questions of the relevant participants and the content and workload of the training for each specific group. Next, we took note of the statements and numerical output from the focus groups, the researcher conducted a triangulation exercise using both qualitative and quantitative analysis. The former analysis aimed at recognizing patterns in the material collected; the

latter analysis collected numerical tables and tested the outcomes using Hierarchical Cluster Analysis.

RESEARCH FINDINGS

For this research we conducted the simulation in a large university that has more than 46,000 full-time students, from 30 provinces, municipalities, and autonomous regions and representing 19 ethnic minorities. This makes the university the largest private university in the Beijing area. This research investigated 985 students proportionally from various departments and got 912 effective cases. There are 725 male students and 187 female students. In analysis, variables include the several items and they depend on the structure of the network. In this paper, The dimensions in decision making were a cluster of variables, as illustrated in Table 1. The Degree of Speed was an important factor in the formation of the network, as well as comprehensiveness in gathering and integrating the information. In addition, we measured the effort invested in the process and realism, consultation with others, analytic information-processing, which are used for six factor of career decision-making style. At the same time, the value of unit, level, size, social status, the size of the cities, the opportunity of development etc. is defined as honor (occupational prestige value) dimension and the factors of Can play, hobbies, independent, fair competition is defined as identity (Occupational intrinsic value) dimensions; Incoming, benefits, opportunities for going abroad, and other elements defined as profit (professional external value) dimensions, which are measured as individual values for professional decision-makers. The 912 sample data use for building the network was based on three factors. The results showed that the ratio of sample categories is similar and center values of clustering remain unchanged.

| Factor | Number of Cases |
|--------|-----------------|
| 1 | 231 |
| 2 | 125 |
| 3 | 87 |
| 4 | 254 |
| 5 | 32 |
| 6 | 183 |
| Total | 912 |

We compare the results of this study with those of other researchers. Lavrenko et al. (2000) present a similar approach to identify and recommend news stories that will most likely to have an impact and effect. In contrast, Wuthrich et al. (1998) are aiming at intraday decision support and address adjustments in the networks to news releases. In order to evaluate their forecasts, they present a simple trading simulation. The simulated cumulative profits are significantly higher compared to simulation runs working with randomly triggered investment decisions. The

work of Schulz et al. (2003) addresses the problem field of identifying and forwarding highly relevant company announcements wireless to mobile devices of retail investors. Therefore, they classify these company announcements using different software.

With forecasting and evaluation periods of one hour to several days, these existing works disregard the empirical findings published by the financial research community. Intraday event study analyses that explore the speed at which securities adjust to new information provide evidence for shorter periods after which prices fully reflect information. Furthermore, employing content analysis techniques was found most promising when capital markets react promptly to new information. Moreover, significant differences in price effects were observed among news subclasses. Incorporating these findings, it seems most promising to forecast price trends for news classes for which significant capital market reactions have been revealed.

Overall, one can notice that the major effect of ideal fitting for the model further demonstrates the feasibility of the individual decision-making study conducted for this research. Moreover, we were able to establish an effective model that is able to discriminate between different factors and therefore, make predictions with regard to the network's structure. We use this tool as a practical method to analyze the structure of networks. From the practical level, prediction of the model solves the problem of advisory individual decision-makers at the qualitative analysis. The model, in values, reveals that the biggest factor about career decision-making impact of individuality are the intrinsic value of occupational and career external value, the value of the career degree of reputation and in career decision-making style, that the individual factors are the speed of the individual decision-making, degree of soliciting other views, Individual autonomy, the degree of comprehensiveness in gathering and integrating the information, effort Invested in the Process and Realism, Analytic information-processing. The result shows the impact of career value have greater than career decision-making style. Meantime, the model can explain type of single decision-makers at any time, so as to solve the vague diagnosis of the problem that the former career decision-making guider uses only the norm for visitors. Table 2 presents an example of such prediction, according to the six factors used for this study.

| Factor | Network type | Prediction |
|--------|--------------|------------|
| 1 | Aggregated | 23 |
| 2 | Loose | 124 |
| 3 | Connected | 55 |
| 4 | Loose | 235 |
| 5 | Tied | 15 |
| 6 | Aggregated | 35 |

CONCLUSIONS

When considering accuracy analysis in networks, we are able to show that some factors make a stronger impact than others. That means that they have good explanatory ability. In fitting analysis of partial least squares, the model can effectively predict results with regard to network evolution and structure over time. In addition, partial least-squares regression methods can also be effectively resolved problem of former decision-making. In former research, some authors refer to social network as a topic that represents behaviors. However, as this topic becomes more and more popular within the information systems field, we are able to establish more robust models, as models from that discipline are employed. This of course, may encounter a difficulty for proper analysis; however, many researchers tend to encounter the same problem and therefore, novel models are warranted. This study was able to track the factors that impact social network in government settings. Those factors were consistent of the factors extracted in previous studies. From this perspective, the six factors that we were able to extract may have the consistency of response over time to: (1) network formation; (2) network evolution; and (3) network structure.. We can get precise analysis of this model by using the partial least squares regressions and establish the model.

However, when using the partial least squares regression we state a caveat. This method has not good result if the data are few points and very high dimensionality. Therefore, we need to be careful when examining different types of social networks. This ability to do inference in high dimensional space effectively makes this regression method an ideal candidate for a kernel approach, which need to solve by further study ,and in decision-making, it should be noted that this have an important issue for further study: the relationship of regression value and decision-making style. If the growth process of individual decision-making within the network is considered, they are both the product of environment adaptation and seem to be reciprocal causation and the relationship that a person need to choose and adapt the environment from born. In this process, the success of an individual actor, situated within the network, can be retained and gradually formed according to the decision-making style of the entire network. This is accompanied by the unconscious and positive, emotional experience. Thus, conscious values of person are formed, which in turn will strengthen the stability of decision-making style. Then, whether corresponding relation between them can attain accurate description and prediction, it is that the researchers need to further research and discussion. Future research should concentrate on revealing the relationship between the different actors either by using the proposed method or another novel technique.

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