SOCIAL NETWORKS IN LOGISTICS SYSTEM DECISION-MAKING

Branko Arsić [a], Petar Spalević [b], Ljubiša Bojić [c], Adela Crnišanin [d]

[a] University of Kragujevac, Faculty of Science, Serbia
[b] University of Priština in Kosovska Mitrovica, Faculty of Technical Sciences, Serbia
[c] University of Lyon, Institute for Political Studies Lyon, France
[d] University of Novi Pazar, Department of Technical Sciences, Serbia

Abstract: *Social networks, such as Facebook, Twitter and LinkedIn have been becoming very popular during the last few years. Facebook is currently the world's most populous "country" with more than 1.3 billion "inhabitants". According to the statistical data, the users share their impressions daily in the form of statuses about upcoming events and present state of affairs, their problems, plans, novel experiences about the products, political stances, and alike. Having the possibility to extract the information of interest from a huge amount of hand-created data about the users' personal affinities and their usage within logistics system, it is facilitated to meet the customers' needs. In this paper we present a procedure for finding and analyzing valuable information related to the specific products, and its effect on logistics system decision-making. Filtering is being done by already developed software for neurolinguistics social network analysis - "Symbols". This software offers graphical representation of statistical data for selected brands based on the social network statuses, its implications, as well as target group demographic and territorial structure. The results obtained point out possible increasing/decreasing demands among separate user groups, therefore giving a factual basis for logistics changes.*

Keywords*: social networks, information retrieval, logistics system decisions.*

1. INTRODUCTION

Enterprises create and deliver products and services through increasingly global and complex supply chains (Binder and Clegg, 2007). Nowadays, business requests are demanding and enterprises have to continuously seek ways for business improvement. Improvement indicators are numerous and vary from decreasing operational costs, providing satisfactory customer service, to minimizing existing disruption risks. These pointers can be achieved by means of efficient supply chain design and management.

In the traditional analyses performed in logistics and supply chain management (SCM) research relationships among buyers and suppliers are observed as linear (Cox et al., 2006). The traditional approach puts an actor (individual or organization) participating in a supply chain into the focus, thus isolating a unit of the analysis. Contrarily, social network analysis (SNA) focuses on actor-actor relationship patterning. Relationships among individuals within a social network can reveal highly indicative results that a conventional survey in the field of logistics and supply chain management could never yield. These relations may be established through, for instance, friendship, liking, ''talked to over the last month'', ''sent e-mail to'', workflow,

money flow or the exchange of goods among actors (Scott, 2000). Basically, flows and transfers are the most important kinds of relations. Yet, they are rarely surveyed and are presumed from interactions or social relations. In case of real data want, since they are not collected, scrutinized or available due to company security and privacy policy, we have focused on company and fan profiles on Internet social networks, such as Facebook.

Unlike classical offline techniques, Internet offers unique and immense possibilities for market research, giving real-time data access and insight into the people's changing preferences thus providing room for innovation in the field. In this paper, we demonstrate how to use social network analysis and online communication for logistic problem investigation, advising amendment for certain supply networks, their activities and plans. Filtering of collected statuses throughout news feed was done by software for neurolinguistics social network analysis "Symbols" which is presented in more details in the fourth section. Finally, we compared our results with the results of existing surveys for beverages brands available on Internet.

The remainder of the paper is structured as follows. Section 2 gives an overview of the literature. Section 3 presents the details of our software "Symbols". Section 5 describes our research methodology. In Section 6, we provide interdisciplinary research opportunities for using our software in supply chain system (SCS) and enterprise system research. Section 7 concludes the study.

2. LITERATURE REVIEW

Inter-connected companies which are integrated into supply networks participate in procurement, use, and transformation of raw materials to provide goods and services (Harland et al., 2001). Traditional approaches in analyzing supply chains are characterized by different issues which can be overcome with viewing supply chains as a network for all actors. If we take a look at one company, its "supply network" will consists of relations to its direct suppliers and customers, and relations between them and their direct suppliers and customers, and so on, thus forming an ever more complex network.

Relative position of individual firms within network influences strategy and behavior (Borgatti and Li, 2009), therefore it is increasingly important to analyze the network structure of supply relationships. A relation between two firms can be established based on their collaboration, a product development, sharing the trade organization or money exchange for services etc. Different metrics, node-level and network-level, provide researchers with a descriptive and statistical method for positioning and connecting the SCS actors (Wasserman, 1994). Degree centrality, closeness centrality, and betweenness centrality are different types of centrality metrics and they identify nodes that are important.

Most of the existing interorganizational SNA research has occurred in the strategic management arena (Pettigrew, 1992). SNA represents a valuable tool for analyzing structures and relations in different areas which could be transformed in network, including business studies, sociology, computer science, physics, and psychology**,** knowledge transfer, and innovation. Kim et al. used social network analysis to investigate the structural characteristics of three automotive supply networks reported in (Choi and Hong, 2002). SNA use could be seen in the analysis of communication patterns in organizations involved in humanitarian and tourist logistics operations (Holguín-Veras et al., 2012; Pesonen, 2011). Generally, SNA has not been applied in an empirical study of real supply networks. A general paucity of SNA applications in supply management arise from the lack of conceptual clarification as to how the key SNA metrics can be theoretically interpreted in the context of supply networks (Carter et al., 2007).

Here we tried to overcome mentioned issues by offering additional information about the company's business. Unlike SNA, where the obligatory unit of analysis is an organization, firm, or business unit, our approach is based on Facebook profiles network. Many social networks are

extremely rich in content, and they typically contain a tremendous amount of data that can be used for analysis (Aggarwal, 2011). There are no studies employing demographic data from Facebook for product popularity improvement. Following different parameters enables us to predict demands at a location, for a target group - the need for building new warehouses or rearranging transport routes and all according to the market changes detected online.

3. "SYMBOLS" DATA COLLECTION

When analyzing Facebook data, data collection was a major challenge. In our approach, we asked a group of people for the permission to access their data. This method results in a strong sampling bias and makes it difficult to acquire large samples.

For the purposes of web application named "Symbols", we developed a Facebook application SSNA (Software for Social Network Analyze). App users have to explicitly agree that the app is permitted to access the part of their data classified into two groups, static and dynamic data, explained below. They were informed that their data will be used only for scientific purposes and that it will not be given away to any third party. The app has had 46 activated, basic Facebook profiles during the data collection period, 12.12.2009 – to the present time. One part of the asked permissions refers to the friends' data; therefore, the data of 106,434 users could be retrieved. In the background, two time-based job schedulers (CRON) are processing every core profile. One job is to deal with the static data (education, birthday, city, job, fan page, etc.), and another one with dynamic data (statuses, likes and comments, all friends' data). The data includes the *friendship network* (friendship relations) and the communication network (*Like*, *Comment*, *Post* and *Tag* relations).

4. METHODOLOGY

Sample size for mineral water brands in Serbia taken into consideration are 422 for Knjaz, 249 for Aqua Viva, 859 for Rosa and 127 for Jana. Profiles who like brands' pages on Facebook constitute samples. For instance, pages taken into account for Aqua Viva mineral water are Aqua Viva, Aqua Viva - voda sa ukusom breskve, AQUA VIVA Breskva Hydroactive, Aqua Viva Sport.

Market Network (2014) is a source of information about mineral water market in Serbia for 2014. This web site provides research findings related to mineral water consumption. Market Network enlists sale channels. This is based on standardized research in Serbia that lasts since November 2002 and it encompasses 1500 families in the country. Among others, this web site lists the most popular water brands based. Based on this, list of mineral water brands for this research has been created. Other reports about mineral waters include text written by Smit (2009). As for sodas, some of the related research findings could be seen on website "Tvoj stav" (Online istrazivanja, 2010). Although similar research inquiries to our social network stratification have not been done in Serbia, goal of this paragraph is to list some of the findings of classical market research.

5. RESULTS & DISCUSSION

Goal of this paper is to see how real time data from social networks can be used in logistics. Figure 1 depicts age, education level and relationship status of those that like different mineral water brands on Facebook. These data are different for each brand so it would be possible to conclude that elder like Knjaz (30 years old in average) while the young like Aqua Viva (Figure 1-a). This awareness can optimize marketing by being leveled to chosen target groups in order to get customers from different age groups.

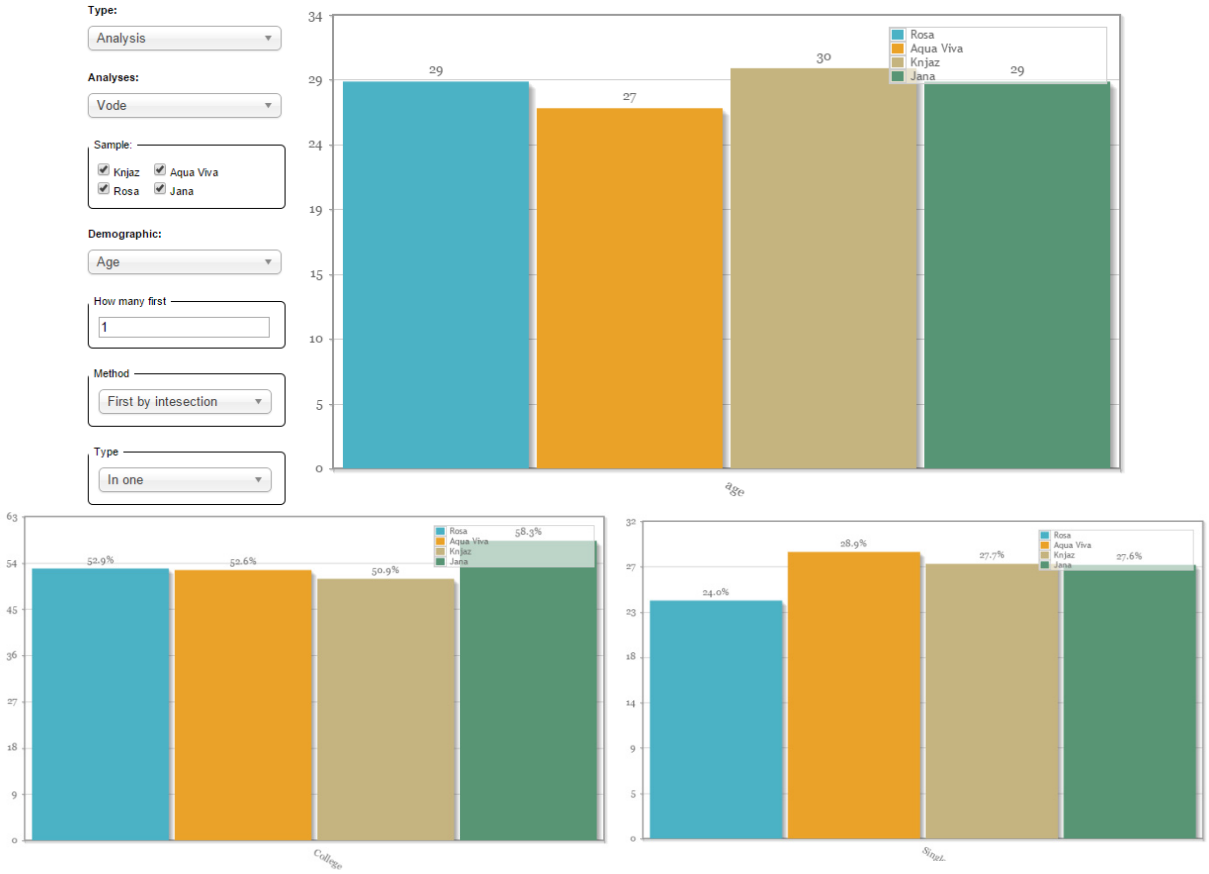

Figure 1. Statistics for a) Age b) Educational level c) Relationship status

Figure 1-b on the other hand, depicts that the most educated consumers of mineral water in Serbia are those that like Jana mineral water brand on Facebook, while the least educated are those that like Knjaz mineral water. Consequently, advertisements addressed to those people should be fittingly created. Knjaz mineral water brand manager should want to attract younger consumers by creating advertising campaigns that talk to youth more than to the aged, for example. The similar conclusion could be made when looking at Figure1-c which depicts that those who like Aqua Viva are the most "single" in terms of relationship status when compared to other mineral water consumers. On the other hand, most married people like Rosa mineral water. Additionally, we obtained that women prefer Jana mineral water while men prefer Knjaz mineral water. Similarly like in cases of first three graphs, data obtained from Figure 2 can be used in marketing. Whether this mineral water brand would go for one or the other advertising strategy it depends from decision of the company in question but the main point would be that social networks with use of adequate software can provide valuable logistics for marketing in terms of advertisements. Obviously, it is important that products in questions are mentioned online, and this is expected because they are widely consumed and they are parts of everyday life. In this way, online identification and quantification of logistics demands can be useful for brands.

Mentions of product category indicate the present needs for it. For example, water may be mentioned more times at some location because of hot weather conditions. On the other hand, water may be mentioned more in one place because of the problems in water supply. These circumstances can be registered on social networks by increased mentions of water product category, but also there might not be any apparent reason for the increase in demands. Measuring this online increase in needs would be valuable for logistics. This real-time statistics may be an input for top management in deciding for higher marketing efforts, increasing the

number of products on the market and in improving position of brands within the existing ones. These actions would result in better sales. This approach has its use in lower branches of management, as well. They would use the input for selecting where and how to implement decisions of top management (install water machines near appropriate institutions, how to organize distribution routes, design product for target population).

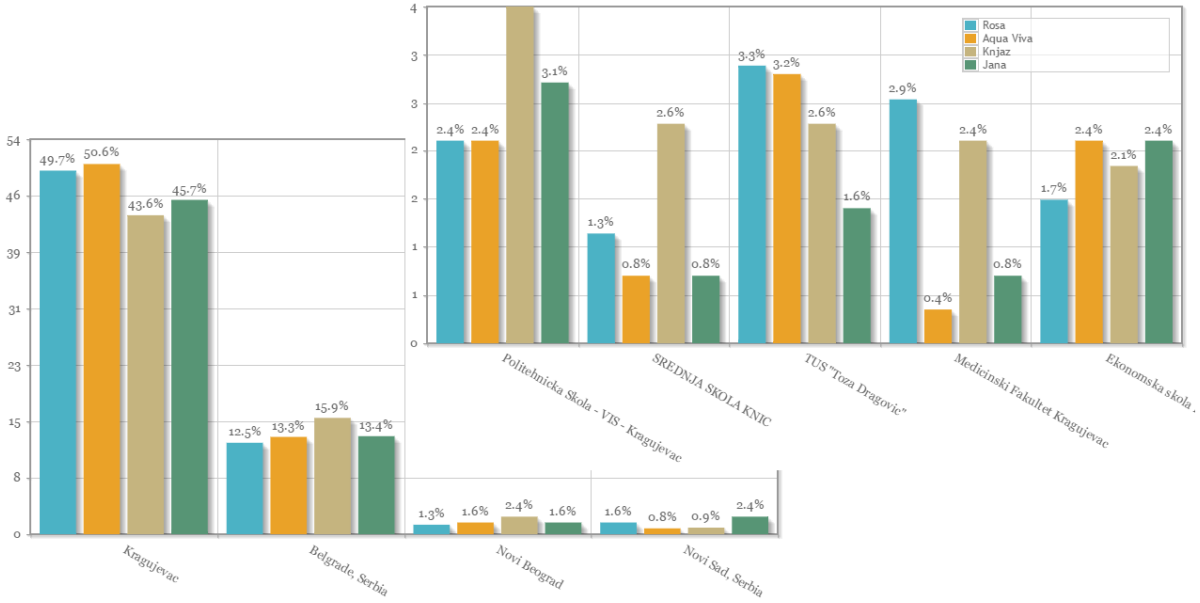

Figure 2. Statistics for location and schools in Kragujevac

Nonetheless, this method of research may have its implication in delivery logistics. When inquired into how many times people mention certain mineral water brand during a week, the findings show that water gets the most mentions from Kragujevac, which is a city in central Serbia (Figure 2). Hence, product category is talked about more in Kragujevac than in the capital city, Belgrade. This may imply that water brand should increase supply in this part of the country.

When looked more closely, Figure 2 shows which population from different schools in Kragujevac like mineral waters. Based on this graph it is possible to conclude that supply should be increased in the vicinity of the schools where pupils most like mineral waters, while for those schools in which brand in question is not so popular, advertising efforts should be increased. By gaining these pieces of information company can, for example, decide where to send promoters of mineral water as well as where to increase other kind of marketing efforts.

6. CONCLUSION

Internet social networks may be hiding an abundant source of opportunities giving space to the "parallel world" which can and in many ways does surpass the realty. Unlike SNA, in this paper we changed the focus from organization as a unit of analysis to company and fans profiles on Facebook social network. Yet, this research is not independent from previous SNA research; it only provides additional information about company's business. The result is a demographic representation offering new marketing advices for specific brands, in our particular case, for water brands. In the same time, we compared our results with some online surveys made by different marketing companies. The results presented in this study give affirmative answer to the research question whether it is possible to use Facebook demographic data for product popularity improvement, and point out the novel demands appearing in logistics.

The advantages of this approach are real-time information without conducting a survey. People impressions can be divided into information sets for different population structures such as age,

location, gender, educational level and many more. These sets influence on product design and marketing targeting. However, every new decision must be confirmed with "field" data.

Our future goal is to expand core Facebook profiles and to adapt application to the newest Facebook API 2.0. Finally, an application upgrade for Twitter news feed is real necessity.

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