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Research paper

Identifying Social Roles in a Local Government's Digital Community

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Abstract

Social media have become an important interaction channel between the government and citizens in the era of the digital community. The adoption of social media in local government services offers a new channel to encourage citizen engagement in the public policy decision-making process. Moreover, communication with citizens through social media exposes large opportunities for the local government to analyse and appreciate the relationships among social media participants in the digital community to enhance public services. The purpose of this study is to understand the local government's social media network and identify the social role in the local government's social media network structure. Thus, this study adopted the social network analysis (SNA) approach on the Twitter data of a local government's official account in the UK as a case study. The study revealed that the internal local government stakeholders play an important social role in the local government's social media network. The implication of the study was discussed.

Keywords: *Social Role, Digital Community, Local Government, Social Network Analysis*

1. Introduction

The digital era of technology is transforming methods of interaction between the government and citizens into a real-time environment. Social media, a real-time media channel of interaction based on the Internet technology, are becoming a necessary tool for local governments to communicate with the public. The demand of using social media channels in the local government services cannot be avoided as the number of social media users is growing rapidly.

Previous studies have reported that government agencies adopting and using social media are engaging better with their citizens (John C. Bertot, Jaeger, & Grimes, 2010), which facilitate greater trust and transparency of the public administration (Criado, Sandoval-Almazan, & Gil-Garcia, 2013; Picazo-Vela, Gutiérrez-Martínez, & Luna-Reyes, 2012; Warren, Sulaiman, & Jaafar, 2014) and improve in policy making (Sivarajah, Irani, & Weerakkody, 2015). Moreover, social media channels can be a better place to promote and rapidly disseminate government information broadly at a minimum cost and can be easily accessed by the public(John Carlo Bertot, Jaeger, & Hansen, 2012).

Furthermore, the extensive use of social media in the local government services aids to understand the local communities who participate in the online discussion from a different level of analysis such as relationships among the social media users and characteristics of network structure. Analysing the pattern and relationships of social media network structure is important for government agencies to utilise the benefits of social media network and explore new insights to enhance public services.

In recent years, a few authors have begun to study social media network in different domains such as crisis management (Stieglitz, Mirbabaie, & Milde, 2018), political discussion (Dubois & Gaffney, 2014; Xu, Sang, Blasiola, & Park, 2014), and tourism reviews (Mkono & Tribe, 2017) so as to identify social roles such as opinion leaders, influencers, and brokerage. Knowing the social roles in the network will advance decision makers in their decision-making process.

However, the study of social media network and social roles in the context of local government is still in the early stages and has much more to explore. Thus, this study focuses on analysing the Twitter network in the context of local government to understand the social media network and identify the social role. It is important to guide the local government decision-makers in utilising the social media channels to promote and disseminate government information to the public.

The potential of social network analysis (SNA) to analyse multiple criteria of social media network has been recognised by the researchers across the discipline.

The remainder of this paper is set out as follows. Section 2 introduces the key concept of SNA, social role, and related works of this study. Section 3 explains the data collection strategy. Section 4 describes the analysis and findings, followed by Section 5 that presents the discussion. Finally, Section 6 draws the main conclusions and offers the final remarks.

2. Related Work

2.1. Social Network Analysis

A social network contains a set of actors linked by a set of ties (Kadushin, 2012). The actors represent concreteobjects or abstract such as people, computers, events, ideas, organisations, journal articles, and Twitter users' accounts. The ties emphasise relationships or connections that have been established between

two actors containing resources such as digital information in the case of social media networks (Newman, 2003).

Social network analysis (SNA) is a discipline of social science that seeks to make sense of the patterns or regularities in relationships across social networks (Caulfield, 2013). Giannakis(2012) referred SNA as a method that investigates the relationships between the social actors through an analysis of the structure of the social network, with the use of relational data. Moreover, SNA is defined as a technique that is increasingly used to identify the way information flows between different individuals, organisations, or entities (Benton & Fernández Fernández, 2014). Nevertheless, the most important goal of SNA is detecting and interpreting patterns of social ties among actors (de Nooy, Mrvar, & Batagelj, 2011).

The key objective of studying a social network is to understand the relationships among social actors, which generates patterns of relations. The patterns can be examined to advance knowledge in terms of the implications of these relationships and how the patterns of relations allocate resources in the social network structure (de Nooy et al., 2011; Wasserman & Faust, 1994; Wellman, 1988). Furthermore, the patterns of relations also determine the characteristics and behaviours of the actors or known as social roles. Knowing the social roles in a network structure can accelerate the opportunities, limitations, and threats related to it (Mislove, Marcon, Gummadi, Druschel, & Bhattacharjee, 2007).

SNA has been applied to measure social roles in many types of social networks such as leadership network (Benton & Fernández Fernández, 2014; Fransen et al., 2015), authors network (Hoffmann, Lutz, & Meckel, 2015; Saip, Kamala, & Tassabehji, 2016), public health network (Valente & Pitts, 2017), and sport management network (Quatman & Chelladurai, 2008).

In this study, SNA is defined as a technique to investigate the structure and pattern of the social network in the online community network focusing on the social media network. SNA uses network analytics metrics to evaluate the network structure and identify the position of actors within a network.

Centrality, a concept that is applied in the network analytics measure, illustrates the central actors in the network structure that control the information flow through the ties (Wasserman & Faust, 1994). There are three basic network analytics metrics including degree centrality, betweenness centrality, and closeness centrality (Freeman, 1979).

The degree centrality, or known as local centrality, measures the number of direct links between actors. In the directed network, the degree centrality is divided into indegree centrality to show input coming to the actor, and outdegree centrality to demonstrate the resources going out from the actor. An actor with a high degree centrality number indicates the central position of the actor in the network.

The second metric, betweenness centrality, identifies the actor's position, which stands in the middle between other actors. The betweenness centrality measures the extent to which an actor acts as an agent to other actors in the social network (Scott, 2000). The actor with high betweenness centrality represents the important position where other actors will depend on it to connect with other actors in the network and is likely to manage the resources flow in the network.

Finally, the closeness centrality denotes how quick an actor can reach other actors in the social network. The lowest average of steps to reach every other actor in the network is considered high-closeness centrality, in which the actor is perceived as a leader to disseminate resources in the network (Freeman, 1979) and is most efficiently to contact other actors (Scott, 2000). In an unconnected network, the harmonic centrality is applied as an alternative to closeness centrality (Rochat, 2009).

2.2. Social Role

The discussion about the social role concept among sociologists and social psychologists begins during the early 20th century when the first article was published in the 1930s. The main concern of the social role theory is defining roles based on human daily activities to form characteristics and behaviour patterns. The theory views each person as a social actor, a member of social positions, and acts per their social roles (Biddle 1986). A social role is a set of expected standards of responsibilities and obligations, conduct, and behaviours that each person should meet and accomplish. For example, a football player is expected to act and behave depending on the situation and player's position in the field. The goalkeeper and the striker have different roles and act accordingly.

The structural role theory, one of the prominent social role theories, explains a role from perspectives of a social structure that perform the social role and is less focused on the social actor's characteristics. A social structure is an interconnection between persons, positions and tasks. The position of a person specifies the behaviours and the way that person interacts with other persons (Forestier et al. 2012). In the case of a football game, the players' position is more important to define behaviours of each player as compared to the characteristics of an individual player such as name, age, or gender.

In the network analysis, a social role is determined from the interaction between actors or between positions, which generates relationship patterns. Actors with similar behaviours and relationship patterns share an equal position in the network structure (Forestier et al. 2012).

In social media, a social role is defined by the behaviour of users and communication patterns between them in the social environment(Junquero-Trabado & Dominguez-Sal, 2012). Thus, in online social media, a social role is a set of characteristic patterns of interactions between users in the context of online social communities.

Three types of social roles are defined and investigated in this study including brokerage, opinion leader, and disseminator. The brokerage is an actor in a middle position who connects between two or more clusters and has the potential to receive non-redundant resources from different clusters.

Next, the actor who could generate resources (information, ideas, etc.) and disseminate the resources to influence other actors in the social network is known as an opinion leader.

Finally, the disseminator is the actor who rapidly spread resources throughout the network structure to influence the decision of other actors.

This study applied SNA at the actor level to identify social roles in the social media network structure. The network analytics metrics are used to measures actors in the network structure. Each social role defined in this study is measured using different network analytics metrics. The brokerage is measured with betweenness centrality, the opinion leader using indegree centrality, and the closeness or harmonic centrality measures the disseminator. **Error! Reference source not found.** summarizes the social roles and metrics.

Table 1: Social roles and metrics

Social roles	Descriptions	Metrics
Brokerage	An actor who links between two or more clusters and has the potential to receive non-redundant resources from different clusters.	Betweenness Centrality
Opinion leader	An actor who could generate resources (information, ideas, etc.), and disseminate the resources to influence other actors in the social	Indegree Centrality

	network.	
Disseminator	An actor who can spread resources to influence the decision of other actors in the social network.	Closeness/ Harmonic Centrality

2.3. Twitter

Launched in 2006, Twitter is one of the popular social media platforms that facilitate online interaction among social media users through short messages up to 140 characters in a post known as a tweet. Recently, selected users are allowed to send a single tweet up to 280 characters (Rosen & Ihara, 2017). Tweets may consist of texts, URL pages, images, hashtags, and mentions to other users. The hashtag (word preceded with the symbol "#") is used to highlight certain issues or trending topics. The mentions (username preceded with the symbol "@") are included to direct the tweet to the mentioned users. A tweet beginning with a mention will only be seen by the mentioned users, but a tweet containing a mention in the middle or end of the text is broadcasted to all followers (Cha, Haddai, Benevenuto, & Gummadi, 2010).

Twitter users subscribe to (or "follow") other users to receive status updates and develop social connections to interesting people, groups or organisations. Twitter users interact with each other by following other users' posts, responding to other users' tweets or forwarding interesting tweets by retweeting them. These interaction patterns contain several types of networks such as follower networks, retweet networks, and mention networks (Cha et al., 2010), which can be analysed using network analysis algorithms to measures the influence of users and social roles on the Twitter social network.

3. Data Collection

This is an exploratory research, aiming to understand the social media network related to the local government, and in this way, to identify the social role in the local government's social media network. The case study has been applied in one of the selected local governments in the UK.

The study only considered Twitter messages posted with a mention (preceded by the symbol "@") of the selected local government's official account. In total, 29,891 messages were mined from 1st March 2016 to 31st March 2017 via the Twitter Streaming Application Programming Interface (API) using a data mining tool called Konstanz Information Miner (KNIME). However, since this study focuses on analysing a retweet network, only 19,859 messages (retweets) were analysed including 6,123 Twitter accounts (actors) and 9,301 relationships.

4. Analysis and Findings

The analysis focused on the retweet network, a network of 'who retweets who'. For example, a user X posts a message in his Twitter account, then the message is retweeted by a user Y. Thus, this relationship is known as 'Y retweets X'. Figure 1 illustrates the retweet network used in this study.

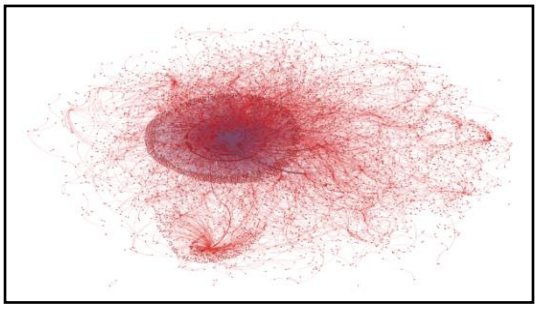

Fig. 1: Retweet network

Pajek(Mrvar & Batagelj, 2016), an open software applying social network analysis techniques, is employed to analyse the data in this study. At the actor level of analysis, three network metrics (betweenness, indegree, and harmonic centralities) were applied to measure the network structure and identify the social roles as explained in Section 2.

The top ten users from betweenness centrality and indegree centrality findings are selected to be reported in this paper. Based on these two lists, the harmonic centrality findings for these users are identified. The findings are illustrated in Table 1.

It can be seen from the table that User1 received the highest score in betweenness centrality, followed by User2 and User3. These users represent brokerages who link between two different clusters in the local government's social media network.

In the indegree centrality findings, User1 is listed again at the highest ranking, followed by User11 and User2. This shows another important social role, i.e. opinion leaders, in the local government's social media network.

The complete findings of harmonic centrality recorded 856 users with a score of 1.0. It means these users are in the strategic positions as disseminators and have the potential to broadcast government information in the social media network. However, only two users are listed in Table 2 and none of them come from the top ten ranking of the betweenness centrality list. Nonetheless, two users (User11 and User 12) are recorded in the top ten of the indegree centrality list.

Table 2: Findings of harmonic, betweenness, and indegree Centralities

User	Betweenness		Indegree		Harmonic
	score	ranking	score	ranking	score
User1	0.0509	1	2751	1	0.5134
User2	0.0062	2	129	3	0.4674
User3	0.0056	3			0.4766
User4	0.0052	4			0.3451
User5	0.0047	5			0.4455
User6	0.0045	6	65	8	0.4832
User7	0.0040	7			0.4372
User8	0.0040	8			0.4249
User9	0.0024	9			0.4009
User10	0.0023	10	120	4	0.3840
User11			436	2	1
User12			90	5	1
User13			80	6	0.3545
User14			67	7	0.3280
User15			62	9	0.3369
User16			61	10	0.3255

Based on the centrality findings, further investigation on the Twitter accounts identified the type of users listed in the top ten of betweenness and indegree centralities. User1 is an official Twitter account for the selected local government in this study, while the User2 is a Twitter account belonging to the Chief Executive of the local government.

The study classified users' account types into groups and individuals. In the group category, official and non-official accounts were determined. Official means the accounts belong to the local government and non-official refers to accounts not belonging to the local government. In the individual category, internal stakeholders are defined as a Twitter account belonging to the local government offices or councilors, while the external stakeholders are Twitter accounts not belonging to the local government's internal stakeholders. The findings in each category are as shown in **Error! Reference source not found.**.

Table 3: Top 10 Users' account types

		Betweenness Centrality	**Indegree Centrality**
Group	Official	3	2
	Non-official	2	4
Individual	Internal	5	3

	External	0	1

As shown in **Error! Reference source not found.**, eight out of ten (or 80%) of the top ten users in betweenness centrality comes from the officials and internal stakeholders of the selected local government; whereas 50% percent of the top ten users recorded in indegree centrality originate from identical categories.

5. Discussion

The study reveals that the basic network analytics metrics can be used to determine social roles in the local government's social media network. Three social roles (brokerage, opinion leader, and disseminator) identified in the local government's social media network represent the types of users who are located in the strategic positions of the social network. The findings show that the Chief Executive of Council Officer is in the strategic position of the social media network as a brokerage to link between different groups of users.

Surprisingly, the internal stakeholders of the local government are the most prominent users in the local government's social media network. This indicates that the local government's internal stakeholders are active in using social media channels and are located in the strategic positions to disseminate government information and influence other social media users.

One more interesting finding shows that the actors who act as brokerages and opinion leaders are not necessarily important as disseminators. However, since the network is unconnected, the disseminators play an important role to ensure that the government information is broadcasting in the network rapidly.

6. Conclusion

In summary, government-citizen interaction in social media channels presents enormous opportunities to understand the citizens' characteristics to enhance public services. The social roles in the government's social media network can be identified using SNA.

Future research may identify other important social roles that can contribute to the government in understanding their citizens in the social media network. The SNA approach has many other network metrics that have not been applied in this study. Applying other SNA metrics using the same social media channel can enhance the findings of this study.

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