

Actor Identification that Affects Ridwan Kamil's Work Program for Smart City Using Social Network Analysis

Dini Turipanam Alamanda¹, Baiq Yuliasmi Nirwana Aulia Lastini²,
Khairunnisa³, Husni Amani⁴

^{1,2,3}(School of Economics and Business, Telkom University, Indonesia)

⁴(School of Industrial Engineering, Telkom University, Indonesia)

Abstract : *The development of telecommunications and information technology (IT) has been increasing rapidly, so that technology makes distance no longer a problem in communication, and the Internet becomes one of the media. This development facilitates the dissemination of information. This study aims to describe the pattern of interactions that occur in the network of Ridwan Kamil's Twitter, to identify actors having a role in supporting Ridwan Kamil's work program, and to describe the profile of influential actors. The data were collected by using online data obtained from the interaction between Ridwan Kamil with the community during the period of July 16th, 2013 - July 31st, 2015 by limiting the data retrieval using keywords related to Smart City in the form of tweets, reply and retweet, and then calculating the value and ranking of Degree centrality, closeness centrality, betweenness centrality and eigenvector centrality. The data then processed using Social Network Analysis approach. Gephi is the software used to compute and visualize the data. The Results show that Ridwan Kamil's Twitter contained 1,886 nodes (account) that are involved with 2,814 edges (interaction) that occur in the network. It is concluded that the actor (node) who influences most of the network is dominated by infobdg, DiskominfoBdg, relawan_bdg, Click Bandung, bdg_juara, infobandung, and Pemkot Bandung.*

Keywords: *Social Network Analysis, Centrality, Influencer, Smart City, Twitter*

I. Introduction

Internet users in Indonesia are growing, since the government introduced it around the 80's. The user growth indicates the penetration number of internet users in Indonesia [1]. In 2014, Indonesia with 252,4 million citizen and around 88,1 million among that are using the internet. The penetration number is 34,9%. The penetration number is increasing from 2013, which is only 28,6%. According [1] the survey of internet user profile in Indonesia in 2014, the following are the reason for using internet: accessing the channel for social and communication need (71,7%); daily information resource (65,3%); trend update (51,2%); fun purpose (32,6%); education purpose (29,3%); working purpose (26,5%); learn how to use internet (12%); lifestyle (0,2%) and to use idle time (0,1%) [1].

One of the social media channels is Twitter. Twitter offers micro-blogging facility. The Twitter user number kept growing since July 2009 [2]. Most of the country leaders are using Twitter as a communication channel [3]. Ridwan Kamil as the chosen Bandung mayor, is also using Twitter as his official communication channel to connect with the citizen of Bandung City [4]. In 2015, Ridwan Kamil is given an award as one of the inspirational people in the 4th Indonesia Public Relations Awards and Summit (IPRAS) [5]. As one of the inspirational people, Ridwan Kamil can be an influential agent for making Bandung as a smart city. Bandung as smart city can be created through utilization Information and Communication Technology (ICT) to connect, monitoring and controlling various resources within a city effectively and efficiently to maximize the society service.

In this research, we are analyzing Twitter as a media communication and calculated an individual influence in society. Focusing on Ridwan Kamil as an influential agent, we identified Ridwan Kamil's tweet content on smart city. To know how to interact and who is the most influential agent that involved in the interaction process, this research is using Social Network Analysis (SNA). So the purpose of this study is used to measure the strength, impact or the individual characteristic in society (based on their connect pattern). In a brief, SNA is a model to understand the social changes [6].

II. Literature Review

2.1. Smart City

A smart city is a sustainable and efficient urban center that provides a high quality of life to its inhabitants through optimal management of its resources [7]. Ref [8] examine a combined IoT-based system for smart city development and urban planning using Big Data analytics which consists of various types of sensors

deployment including smart home sensors, vehicular networking, weather and water sensors, smart parking sensors, and surveillance objects, etc.

According to IBM, there are 6 distribution of Smart City namely Smart Economy, Smart People, Smart Governance, Smart Mobility, Smart Environment, and Smart Living [9]. Discovery techniques based on social media have helped local governments to shape the future of the city and to determine what kind of Smart City should be. Social media provides a local government a powerful and flexible tool to provide information services through various channels [10].

Smart Cities should capture creative and collaborative innovation through (direct) interactions between public bodies, private actors and citizens in [11]:

- Dealing with the next data flood (coming from linked open data, big data, the internet of things, sensor data etc.);
 - Identifying and tackling new relational complexities between actors;
 - Facing grand societal challenges in a local context (e.g. mobility, security, local and participatory governance etc.);
 - Offering new and engaging experiences to citizens
- For example, Chinese governments have begun to integrate multiple marketing tactics to promote cities using social media since 2008 for city marketing [12].

2.2. Social Network Analysis

Social network Analysis (SNA) is the analytical method of social networks, which views social networks as relationships in a group, consisting of nodes (agents) and links (relationship) [13].

In this study, the nodes are agents (actors) while the ties between them represent relations [14]. One of the most important concepts of Social Network Analysis is the centrality that is used to identify who the most important person in the network [15].

a) Degree Centrality

The simplest is the size of the centrality degree centrality, which counts the number of bonds owned by a node with other nodes in the network [16]. Degree centrality is often used as a measure of the level of connectivity and therefore also affect the popularity of [17].

b) Closeness Centrality

Closeness centrality is used as a measure of affordability about how far an actor can reach other actors that exist in the network [17]. Closeness centrality is a measure of how quickly the actor can reach other actors in the network [17]

c) Betweenness Centrality

Betweenness centrality measures the proportion to the number of nodes along the shortest path between other node pairs [16]. Betweenness centrality is used to measure how often an actor becomes the main communication lines are bypassed by other actors [17].

d) Eigenvector Centrality

Eigenvector centrality is useful in determining the actors connected with the other actors who have a lot of connections [17]. Eigenvector centrality indicates how many nodes are connected into important nodes in the network [14].

2.3. Conceptual Framework

Ref [18] states that, essentially, in the social media, information dissemination and acceptance process has been tied to the process of its contents earning. Ridwan Kamil uses social media Twitter to interact, socialize work programs, and disseminate information to the public.

Dissemination of information on social media Twitter will form a social network. Social network itself is a mapping relationship between individuals so that their social activities can be observed. This study relevant with previous study of [19] about Citizen–government collaboration on social media “Twitter”.

Therefore, the conceptual framework of this study presented in Fig 1.

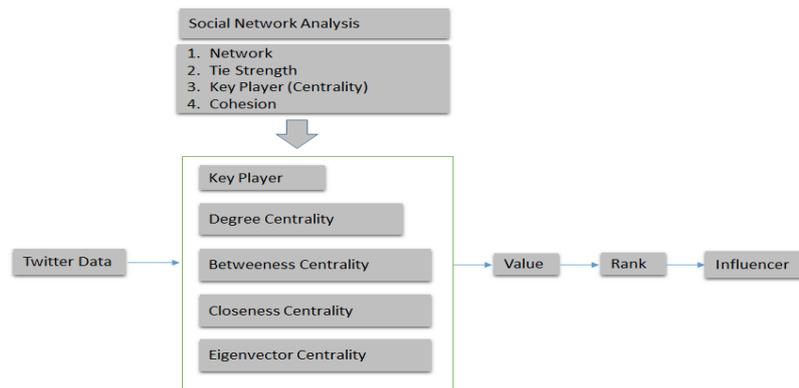


Fig 1. Conceptual Framework

III. Methodology

This study uses descriptive qualitative research. The data is processed using Gephi Beta 0.8.2 software that can analyze the concept of centrality values contained in the Twitter @ridwankamil. Referring to [20] Researchers of SNA mostly use the full network which means using census in the network.

The stages of the study (Fig.2) is shown to adjust the rationale consideration of this study as a whole. The data collection is done manually using website Twitter data collector, namely <https://www.twitonomy.com> [21] and <http://topsy.com> [22].

The data is processed using Gephi Software 0.8.2 and produce a visualization of network interaction. Visualization of network is a depiction of the interactions that occur in Twitter @ridwankamil. Then the most influential actors can be determined from that network based on its centrality value and ranking.

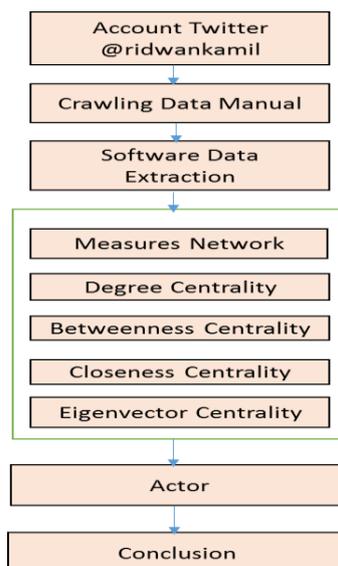


Fig 2. Research Stages

Using crawling data, the data is collected using the process of data mining from Twitter account @ridwankamil. The data containing tweets, replies or retweets with total 10.296 tweets that extracted during period since Ridwan Kamil took office (16 September 2013 until July 31, 2015).

In doing filtering, many keywords are used, such us: Command Center, wifi, apps, e-government, online, smart, digital, social media, Bandung champion, smart green, smart Bandung city, ICT, smart cards and so forth.

IV. Result And Discussion

4.1. Interaction Pattern

Interaction pattern of a network described through direct and non-direct connection channel to extract and distribute information between nodes (Fig.3). Data exploration was given by Gephi 0.8.2 as the software used in this research shows the following result, Ridwan Kamil's Twitter (@ridwankamil) visualized interaction pattern for information spread that happened between 1,886 nodes (account). Interaction that happened between

nodes creates connection called edges, sum up to 2.814 edges. Graph type the researchers use in this research is the undirected network. Undirected network shows the connection between nodes without considering the direction or the connection between nodes. The following is the visualization of connection mapping (interaction pattern) between nodes:

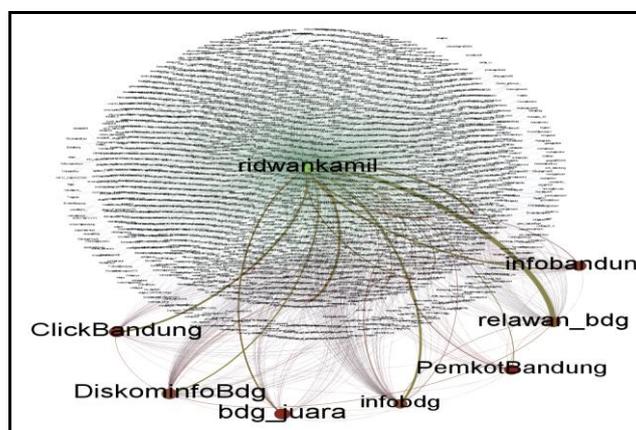


Fig 3. Visualization of Interaction Pattern in Ridwan Kamil's Twitter Network

The preceding figure is a visualization of Ridwan Kamil's network Twitter with Fruchterman Reingold layout model. Fig 3. shows the number of nodes and edges in a network. Not all the nodes are linked to one another. This suggests that not all Twitter accounts have interaction and communicate with Ridwan Kamil. A twitter account (e.q. account A) is interact with other Twitter account (e.q. account B) that also connected to another Twitter account (e.q. account C) creates a group in a network. In fig. 3 we are noticing several thicken edges. Those thicken edges effects by the weight of the edges. The higher the weight value indicates frequent interaction between nodes, shown by the thickening edge.

4.2. Centrality

After we get an overview of Ridwan Kamil's Twitter Account network, we perform a calculation on the centrality to identify the most influential actor in supporting Ridwan Kamil's working program on smart city strategy. The result from the centrality calculation is shown in the following Table 1.

Tabel 1. The Result Processed with Software Gephi 0.8.2

Rank	Username	Degree	Closeness	Betweenness	Eigenvector
1	infobdg	98	0,495	0,007	0,086
2	DiskominfoBdg	94	0,497	0,014	0,083
3	relawan_bdg	81	0,492	0,022	0,070
4	infobandung	57	0,486	0,003	0,060
5	ClickBandung	40	0,486	0,006	0,049
6	bdg_juara	36	0,482	0,009	0,043
7	PemkotBandung	28	0,485	0,002	0,043

Table 1. shows the result of centrality in Ridwan Kamil's Twitter are @infobdg, @DiskominfoBdg, @relawan_bdg, @infobandung, @ClickBandung, @bdg_juara and @PemkotBandung.

There are 4 (four) calculations that have been applied to determine the most influential actor in a network. The explanations are following:

1. Degree Centrality is used to determine an actor who has the highest interaction (edges). @infobdg account has the highest interaction value with 98 edges. Attended by @DiskominfoBdg account in second place with 94 edges.
2. Closeness Centrality is used to determine an actor who have the highest speed in spreading information within his reach. @DiskominfoBdg account has the highest value of 0,497. While @infobdg account comes in second place of 0,495.
3. Betweenness Centrality is used to determine an actor who has a strong influence and an important role to keep information flow not broken in a network. @relawan_bdg account has the strongest influence in a network with the value of 0,022. Followed by @DiskominfoBdg with the value of 0,014.
4. Eigenvector Centrality is used to determine an actor who has the highest popularity and also, interacted with another person who also has high popularity. @infobdg has the highest popularity with the value of 0,86. Attended by @DiskominfoBdg with the value of 0,83.

4.3. Actor Profile

As the result of centrality calculation, @infobdg is the most influential actor in spreading information of Ridwan Kamil's Twitter. Followed by @DiskominfoBdg. This results are not surprising. @infobdg is an account that informed the newest event and breaking news around Bandung. @infobdg has the most followers compare to other accounts, 1,64 million account. Meanwhile, @DiskominfoBdg is an official account of Communication and Informatics Department in Bandung who has 19,7 thousand account as followers.

The third actor who has been supporting to Ridwan Kamil's program is @relawan_bdg. That Twitter account contains updated information about people who volunteered to fix Bandung city with Ridwan Kamil. @relawan_bdg has 21,2 thousand followers. Account @infobandung comes in fourth place. @infobandung is the first city account in the whole world whose idea comes from the citizen itself. @infobandung was born as a response from the growth of social media and combined it with the need from the Twitter user, to answer and spreading information from all around Bandung. This account has 809 thousand followers.

@ClickBandung ranked in fifth place with 21,8 thousand followers. This account has similarity with @infobdg. They informed the newest event that happening around Bandung. @bdg_juara comes in sixth place. This account spreads information about Bandung, including weather information, traffic condition and happening events to help the attainment of Bandung Juara. The seventh actors who support Ridwan Kamil's working program in Smart City is @PemkotBandung. @PemkotBandung account is also another official account from Bandung City Government. This account has 49,9 thousand followers.

The seven accounts that have been mentioned above is very active to help and support Ridwan Kamil in socializing his working program by doing: mention tweet, reply and retweet. So does Ridwan Kamil, he conveys his tweet by mentioning those accounts. Ridwan Kamil also replies the tweet that comes from those accounts. So, information will be transmitted widely with purposeful and efficient.

4.4. Comparisons With Other Cities

There are other cities in Indonesia that also implementing Smart City Strategy, such as: Surabaya, Jakarta, Makassar, Balikpapan, etc. The head of city government in those cities are also using Twitter as media to communicate with its citizen. Though, the communication intensity is not as vigorous as Ridwan Kamil. Based on the tweet from those head city of government, we can extract accounts that become an influential account to spread information. With on-line help from [21], the influencer in the head city of government Twitter in Surabaya, Jakarta, Makassar and Balikpapan has similar characteristic with influencer actor in Ridwan Kamil's Twitter. For example the influencer actor in Tri Rismaharini's Twitter (Mayor of Surabaya) are twitter accounts, such as: info_surabaya, kotasurabaya, etc. Influencer actor in basuki_btp (Mayor of Jakarta) twitter are better_indo, AhokDjarot, RELAWANMUDAJKT, etc. While the influencer actor in RZ_Effendi58 (Mayor of Balikpapan) twitter are Balikpapanu, FireFighterBpn, etc. The influencer actor in DP_dannypomanto (Mayor of Makassar) twitter are Daeng_Info, DiskominfoMks, KompasTV_Mks, etc.

Those actors are accounts that provide information services and news around the city from each cities. Other than that, there are also official government accounts. These characteristics can become a reference to other city governments in using social media, especially Twitter as the means of communication, spreading information, socializing the working program. Also delivering advice and criticism from citizen.

V. Conclusions And Recommendation

The interaction pattern network of Ridwan Kamil's Twitter is an indirect interaction network that consists of 1,866 nodes and creates 2,814 edges. The actors who have influence on Ridwan Kamil's Twitter are @infobdg, @DiskominfoBdg, @relawan_bdg, @ClickBandung, @bdg_juara, @infobandung and @PemkotBandung. The value of degree centrality, closeness centrality, betweenness centrality and eigenvector centrality shows the relation of interactions that one account has against another node. It also shows that those accounts have influence and act as a reliable central node in Ridwan Kamil's Twitter network to support his working program for Smart City Strategy.

Actor profiles who become an influence of Ridwan Kamil's Twitter: (1) infobandung account is an account Twitter that informed the latest news and events around Bandung; (2) DiskominfoBdg account is an official account Twitter of Communication and Informatics Department in Bandung; (3) relawan_bdg account is an account Twitter about updated information about volunteer activities who fix Bandung with Ridwan Kamil; (4) ClickBandung account is Twitter account that informed the latest news and events around Bandung; (5) bdg_juara account is an account Twitter who spread information about weather, traffic and events around Bandung to help the attainment of Bandung Juara; (6) infobandung account is an account Twitter that was born as a response from the growth of social media and combined it with the need from the Twitter user, to answer and spreading information from all around Bandung; and, (7) PemkotBandung account is an official account Twitter from Bandung City Government.

According the result of this research with the on-line help from www.twitonomy.com, other city

governments are recommended to use Twitter as a social media to socialize and interact with its citizen by handpicked the similar actors as Ridwan Kamil's. Because the same characteristic of actors have been used by other head city of governments, such as; Jakarta, Surabaya, Makassar and Balikpapan. Other head city governments should be more active to use Twitter as their social media.

Those actors are accounts that provide information services and news around the city from each cities. Other than that, there are also official government accounts. These characteristics can become a reference to other city governments in using social media, especially Twitter as the means of communication, spreading information, socializing the working program. Also delivering advice and criticism from citizen.

References

- [1]. Pusat Kajian Komunikasi Universitas Indonesia and Asosiasi Penyelenggaraan Internet Indonesia, "Profil Pengguna Internet Indonesia," PUSKAKOM, Jakarta, 2014.
- [2]. H. Kwak, C. Lee, H. Park and S. Moon, "What is Twitter, a Social Network or a News Media?," in International World Wide Web Conference Committee, Raleigh, North Carolina, USA, 2010.
- [3]. Kompas, "Komunikasi Pemimpin Negara di Media Sosial, "6 Oktober 2014. [Online]. Available: <http://nasional.kompas.com/read/2014/10/06/23000061/Komunikasi.Pemimpin.Negara.di.Media.Sosial>. [Accessed 17 September 2015].
- [4]. Kompasiana.com, "Kicauan Ridwan Kamil di Twitter: Cukup Menghibur.," 2013. [Online]. Available: http://www.kompasiana.com/delianasetia/kicauan-ridwan-kamil-di-twitter-cukup-menghibur_552a8076f17e61dd14d62424. [Accessed 17 September 2015].
- [5]. Republika , "Ridwan Kamil and Ganjar Pranowo win Inspirational Public Figures award," 28 October 2015. [Online]. Available: <http://en.republika.co.id/berita/en/national-politics/15/10/28/nwx0rd317-ridwan-kamil-and-ganjar-pranowo-win-inspirational-public-figures-award>. [Accessed 2 January 2016].
- [6]. M. Tsvetov and A. Kouznetsov, Social Network Analysis for Startups, Gravenstein Highway, USA: O'Reilly Media, 2011.
- [7]. C. Calvillo, A. Sánchez-Miralles and J. Villar , "Energy Management And Planning In Smart Cities," Renewable and Sustainable Energy Reviews, vol. 55, pp. 273-287, 2016.
- [8]. M. Rathore, A. Paul, A. Ahmad and S. Rho, "Urban planning and building smart cities based on the internet of things using big data analytics," Computer Network, 2016.
- [9]. M. Cosgrove, "Smarter Cities Series: Introducing the IBM City Operations and Management Solution.," IBM Corp, 2011.
- [10]. IBM Corporation, "Smarter Cities IBM," IBM, London, 2009.
- [11]. N. Walravens, "Qualitative indicators for smart city business models: The case of mobile services and applications," Telecommunications Policy, vol. 39, no. 3-4, pp. 218-240, 2015.
- [12]. L. Zhou and . T. Wang, "Social media: A new vehicle for city marketing in China," Cities, vol. 37, pp. 27-32, 2014.
- [13]. C.J. Lee and C. Bonk, "Social network analysis of peer relationships and online interactions in a blended class using blogs," The Internet and Higher Education, vol. 28, no. January 2016, pp. 35-44, 2016.
- [14]. A. Nikakhtar, S. Abbasian-Hosseini and H. Gazula, "Social Network based sensitivity analysis for patient flow using computer simulation," Computers & Industrial Engineering, pp. 264-272, 2015.
- [15]. L. Ding and P. Shi, "Social Network Analysis Application in Bulletin Board Systems," Intelligence Science and Information Engineering, pp. 318-320, 2011.
- [16]. C. Sankar, K. Asokan and K. Kumar, "Exploratory Social Network Analysis Of Affiliation Networks Of Indian Listed Companies," Social Networks, pp. 113-120, 2015.
- [17]. G. Cheliotis, "Social Network Analysis (SNA)," National University of Singapore, Singapore, 2010.
- [18]. D. Zeng, H. Chen, R. Lusch and S. Li, "Social media analytics and intelligence," IEEE Intelligent Systems, vol. 25, no. 6, p. 13-16, 2010.
- [19]. P. Panagiotopoulou, A. Bigdeli and S. Sams, "The case of Twitter in the 2011 riots in England," Government Information Quarterly, vol. 31, no. 3, pp. 349-357, 2014.
- [20]. R. Hanneman and M. Riddle, Introduction To Social Network Methods, Riverside, United States:: University of California, 2005.
- [21]. <https://www.twitonomy.com>.
- [22]. <https://topsy.com>.