SOCIAL MOVEMENTS IN E-DEMOCRACY: CIVIC NETWORKS IN HONG KONG, TAIWAN AND SINGAPORE

A Thesis in
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by
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ABSTRACT

The social movements shed light on dynamic practice of civic education to encourage students to be an actor in political arena, and transform the sense of conventional civic education into criticism-oriented one. The series of uprisings, the Occupy movements and demonstrations sprang up across North America, and the Arab World in the last couple of years. In Asia, there are three salient social movements launched by young generation in 2014, including the Umbrella Revolution in Hong Kong, the Sunflower Movement in Taiwan, and the Return Our CPF Protest in Singapore. Young generation finds alternatives to challenge traditional norms by disobeying governmental decisions to express the demand of social reform. These series of social movements can be identified as the wave of E-Democracy that social media not only broaden people’s political space and produce participation in public affairs, but also bring innovative tactics to different forms of regimes. Compared to authoritarian regimes, the social movements in three quasi-democratic regimes of Hong Kong, Taiwan and Singapore have broader public space for citizens to engage in public affairs. However, the rooted culture of Confucian meritocracy and filial piety potentially makes these three Asian states depart from liberal democracy. This study applied social network analysis to Twitter and Facebook data to take centrality, subgroup, and hierarchy analyses as a whole to explore the pattern of civic network in Hong Kong, Taiwan, and Singapore.

The findings show that civic networks in Hong Kong and Taiwan have similar traits that there is a group of actors with high centrality and multiplex clusters with dense interconnection within networks. Relatively, only few actors in Singapore can play a bridging role that activists or protesters are a small group of like-minded citizens who are affiliated to homogenous clusters. Civic networks in Hong Kong and Taiwan are toward
horizontal linkages across different bonding of citizens, while civic network in Singapore is more likely to be hierarchical structure that symbolizes power control and network cohesiveness. The hierarchical network is exclusive of diverse clusters and may be incapable of adapting to unexpected disruption or exogenous pressure. However, the analyses also indicate that three civic networks are still affiliated to relatively homogenous clusters instead of truly diverse clustering. As these three states are all identified as quasi-democratic regimes, governments potentially discourage citizens from any kind of opposition and people are more sensitive to social movement. This context may explain how rooted Chinese culture potentially makes three networks toward hierarchical structure at large, even though the result indicates that Singapore network is the most hierarchical one.

In addition, these quasi-democratic regimes may not fulfill students’ capacities for civic commitments, but lead to significant gaps between curriculum and practice. As students were major populations involving in these social movements, current civic education needs to be reformed in the wave of E-Democracy. Compared to conventional civic education emphasizing more on voting, charity or volunteerism, criticism-oriented civic education is needed to encourage students to find the causes of social problems and to involve in social movements. A colorful array for raising effectiveness of civic education should be an important field to provide students practical civic experiences to scaffold the sense of critical thinking and inquiry. The patterns of civic network not only bring insight into the complex interplay between quasi-democratic regimes and social movements, but also bring implication to the reform of civic education in the wave of E-Democracy.
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Chapter 1
Introduction

The social movements shed light on dynamic practice of civic education to encourage students to be an actor in political arena, and transform the sense of conventional civic education into criticism-oriented one. The civic networks in a given social movement are integral parts of civic education, not only shaping curricular sphere of knowledge and skills, but also constructing civic values of public discourse and civic commitment (Ballard, 2014; Catalano, 2013; Malin et al., 2014). Social movements are complicated interplay of political, economic, social and cultural flows that critical reflection and action are necessary for students to respond to social problems and structural critique. Students are expected to improve society by critically analyzing and addressing social issues and injustices.

Social movements launched by young generation reflect that current government, market, and judiciary cannot convince or satisfy people. Therefore, young generation finds alternatives to challenge traditional norms by disobeying governmental decisions to express the demand of social reform. For instance, the series of uprisings, the Occupy movements and demonstrations sprang up across North America, the Arab World and Asia in the last couple of years. The movements against the neo-liberal direction of current government, the authoritarian regime, and illiberal democracy unleash a wider seismic shift in democracy and produce a checkered map of civic engagement (Castells, 2012; Graeber, 2013; Parker, 2014; Talhami, 2012). For instance, the Occupy Wall Street in the United States was against the flawed capitalism and unbalanced income distribution. This rapid geographical spread of movement in 2011 reflected not only the distrust of existing financial system and political institution, but also the networking function of social media. The Arab Spring referring to a series of movements from North Africa (including Tunisia, Egypt, Libya) to the Middle East (including Syria, Bahrain, Yemen) was mainly against
militant armed conflict and corrupt politics around 2011. The young bloggers and local groups used social media to demand normal rights of citizenship and expose the structural weakness of Arab nationalist and authoritarian regimes.

In Asia, there were also three salient social movements launched by young generation in 2014, including the Umbrella Revolution\(^1\) (advocating for true democracy) in Hong Kong, the Sunflower Movement\(^2\) (calling for democratic rules) in Taiwan, and the Return Our CPF Protest\(^3\) (asking for transparency of government) in Singapore. These three movements not only expose the flaws in quasi-democratic regimes (e.g., infringement of media freedom, bureaucratic system, and inconsistency with universal standards of human rights and civil liberties), but also utilize social media to debate the policy, raise money for protest and diffuse information globally. The relationships between democratic regime, social media and social movement indicate the pattern of civic network. Civic network is applicable to describe how citizens involve in public affairs through different online connections, which are affected by different forms of regimes. These social movements can be identified as the wave of E-Democracy (electronic democracy) that can broaden people’s political space and extend civic engagement to daily life. The wave of E-Democracy makes social movements learn from each other and bring innovative tactics to different forms of regimes.

Democracy does not merely refer to election or voting, but is toward an ideal of liberal democracy in combination of individual liberties, political freedom, and human rights (Graeber, 2013; Campbell, 2008; Parker, 2014). Different forms of regimes have different possibilities of democracy and cause specific contexts of social movements based on the complex interplay

\(^1\) The Umbrella Revolution against China government violating the real democratic election in Hong Kong has up to 100,000 protesters occupy Central from Sept. 26 to Dec. 15 in 2014.
\(^2\) The Sunflower Movement against Taiwan government passing the Cross-Strait Agreement on Trade in Services illegally has up to 500,000 protesters occupy inside and outside the Congress from Mar. 18 to Apr. 10 in 2014.
\(^3\) The Return Our CPF Protest against Singapore government violating the freedom of speech and their benefits of Central Provident Fund (CPF) has up to 6,000 protesters at Hong Lim Park on Sept. 27 in 2014.
between cultural, historical, social and economic factors. The social movement itself is not just the expression of dissatisfaction or disobedience, but can be an awaking of democracy to bring permanent change and profound values to civil society. Social media can not only facilitate the flow of information and the connective relationships, but also transfer online connections to offline behaviors through online networks.

In view of social movement theories, the network perspective can provide the comprehensive view to explore the dynamic interactions between individuals and institutions (Christakis & Fowler, 2009; Diani, 2003; Prell, 2012). Specifically, the pattern of civic network can describe how sets of citizens involve in public affairs through different connections, and the analysis of civic network can capture how centralized/decentralized or hierarchical/horizontal regimes affect the centrality of individuals and cohesion of institutions involving in social movements. The online civic network can be transferred to offline practice through social media not only in a given social movement but also in daily life. Even though the ideal of liberal democracy is hard to achieve in a short time, the properties of civic network can fundamentally bring the implication to promote civic engagement and political participation in civil society.

Compared to authoritarian regimes, the social movements in three quasi-democratic regimes of Hong Kong, Taiwan and Singapore have broader public space for citizens to engage in public affairs. However, the rooted culture of Confucian meritocracy and filial piety potentially makes these three Asian states depart from liberal democracy. The merits coming with prestige and power are usually bound by cronyism, and the filial piety highlighting seniors’ wisdom and authority may make the youth confuse the virtue with obedience and compliance. Besides, the governments usually devalue disputation or opposition but highlight the frames of stability maintenance. This way fails to respond to the public and thus initiates a series of social movements. The patterns of civic network in these three states can give us the insight of the
complex interplay between quasi-democratic regimes and social movements. Hong Kong, Taiwan and Singapore may have competing interests in cultivating liberal democracy and preserving traditional social orders. These quasi-democratic regimes may not fulfill students’ capacities for civic commitments, but lead to significant gaps between curriculum and practice. In addition, as students were major populations involving in these social movements, current civic education needs to be reformed in the wave of E-Democracy. Compared to conventional civic education emphasizing more on voting, charity or volunteerism, criticism-oriented civic education is more likely to encourage students to find the causes of social problems and to involve in social movements (Schulz et al., 2010; Westheimer & Kahne, 2004). A colorful array for raising effectiveness of civic education includes street deliberation, community building, and participatory budgeting (Lerner, 2014; Youniss et al., 2002). Schools should be an important field to provide students practical civic experiences to scaffold the sense of critical thinking and inquiry.

The purpose of this study is to explore how social media activate a series of social movement to practice E-Democracy in Hong Kong, Taiwan, and Singapore. The social network analysis (SNA) provides comprehensive ways to understand the centrality of actors, division and cohesion of groups, and hierarchy of network. The research questions include:

1. What kind of actors can contribute to the three civic networks?
2. What are the features of subgroups in the three civic networks?
3. How hierarchical are the three civic networks?
4. What is the pattern of civic networks in the three quasi-democratic regimes?
Chapter 2
Theoretical Framework

The relationships between democratic regime, social media and social movement indicate the pattern of civic network, which is an important role in E-Democracy era and can capture the complex interplay between individuals and institutions in each specific context of social movements.

Democratic Regime and Social Movement

Democratic regimes along with specific cultural and historical contexts lead to different forms of democracy weighing political freedoms, civil liberties, and human rights differently. These three Asian states with quasi-democratic regimes not only share similar features which make regime potentially depart from liberal democracy, but also face specific challenge and political conditionality which kindle a series of social movements to contest pan-authoritarian governances.

Different forms of democratic regime

Democracy is not a simply dichotomized category of “democratic” or “non-democratic”, but can exit very different forms of regimes shifting from lower quality of primarily electoral democracy to higher quality of liberal democracy in which the elected representatives are subject to the rule of law and moderated by a constitution that protects individuals’ civil rights, liberties and freedom (Campbell, 2008; Parker, 2014). According to the typology of democracy from The Democracy Index 4 of the Economist Intelligence Unit, the forms of regimes can be distinguished as full democracy, flawed democracy, hybrid regime and authoritarian regime based on the view of political freedoms and civil liberties (EIU, 2015). The full democracy

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4 The questions in The Democracy Index are distributed in the five categories, including electoral process and pluralism, civil liberties, functioning of government, political participation, and political culture (EIU, 2015).
reflects a political culture of flourishing democracy in which not only media are independent and diverse, but also function of government and judicial decisions are relatively satisfactory. Compared to the form of full democracy in democratic regime, the form of flawed democracy is identified as quasi-democratic regime in this study that includes free elections and respects for basic civil liberties but may infringe on media freedom. Relatively, the hybrid regime along with widespread corruption usually imposes pressure on opposition parties as well as neglects the rule of law, and the authoritarian regime is usually outright dictatorship and without political pluralism due to state-owned media and pervasive censorship.

Taiwan (ranked 35th), Hong Kong (ranked 66th), and Singapore (ranked 75th) in South-East Asia are all categorized as flawed democracy of the quasi-democratic regimes in this study. In contrast to other neighboring countries, both Japan (ranked 20th) and South Korea (ranked 21th) are categorized as full democracy, and the quasi-democratic regimes with flawed democracy include Indonesia (ranked 49th), Philippines (ranked 53th) and Malaysia (ranked 65th). Relatively, Thailand (ranked 93th) and Cambodia (ranked 103th) are categorized as the hybrid regime, and both China (ranked 144th) and North Korea (ranked 167th) are categorized as authoritarian regimes.

In addition to the above standards of political freedoms and civil liberties, the principle of human rights is also an important standard of higher quality of liberal democracy (Campbell, 2008; O’Donnell, 2004). Human rights, a cluster of political rights, civil rights and social rights, are crucial for constraining state violence to transform individuals’ rights to real freedom (Campbell, 2008; O’Donnell, 2004). According to the Empowerment Rights Index of the Cingranelli-Richards (CIRI) Human Rights Data Project in 2011 (Cingranelli et al., 2014),

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5 The Empowerment Rights Index constructed from the Foreign Movement, Domestic Movement, Freedom of Speech, Freedom of Assembly & Association, Workers’ Rights, Electoral Self-Determination, and Freedom of Religion indicators (Cingranelli et al., 2014). The annually rating of a variety of internationally recognized human rights ranges from 0 (no government respect for these seven rights) to 14 (full government respect for these seven rights).
Taiwan was scored 11, Singapore was scored 6, and Hong Kong categorized as China was scored 0. Compared to neighboring countries in South-East Asia, two democratic regimes of Japan and South Korea were scored 12 and 10 respectively, and three quasi-democratic regimes of Indonesia, Philippines, and Malaysia were scored 5, 7, and 3 respectively. Overall, Taiwan is the state with better practice of human rights among quasi-democratic countries, and its score is even better than South Korea, a full democratic regime. Compared to other quasi-democratic regimes, Singapore showed less respect for human rights, and its score is even lower than a hybrid regime of Thailand (scored 8). Hong Kong today faces serious conflicts between the former British colony and the current China coercion to dispute over the rule in antagonistic approach.

The contexts of three social movements in quasi-democratic regimes

Each of the social movement manifests itself differently in response to different hierarchical structure and distribution of power in political realm. Different forms of regimes along with specialized culture and history develop different tactics to regulate legislature systems, judiciary systems, social media freedom, and political participation (Castells, 2012; Talhami, 2012; Tkacheva et al., 2013). For instance, in authoritarian regimes, the administration is transferred without fair election and the websites are required to register with the government to regulate the freedom of assembly and expression, while the regimes toward liberal democracy relatively guarantee at least civic liberties and somewhat respect human rights (Tkacheva et al., 2013). In this sense, activists and protesters may uphold different issues (e.g., political freedoms, civil liberties, human rights) to achieve individuals’ or communities’ goals, and adopt non-violent or more radical ways to change status quo. Therefore, different political conditionality may cause specific contexts of social movements to contest pan-authoritarian regimes.

Hong Kong
Hong Kong, as a Special Administrative Region (SAR) of the People’s Republic of China (PRC), has practiced autonomy under a constitutional arrangement of “One country, Two systems” since the British returned Hong Kong to China in 1997. Although the British transplanted the Basic law and the Rule of Law to Hong Kong in democratic approach, the contemporarily major Communist Party-ruled polity of China attempted to intervene in the candidate nomination process for the Chief Executive of Hong Kong. The candidates from the opposition parties and the public are ruled out by of the Central Government in Beijing, and this way is inconsistent with international standards of universal suffrage. Therefore, the social movement of Umbrella Revolution advocated the democratic and transparent election of the Chief Executive towards Western-style liberal constitutional democracy (Chen, 2014). As the ultimate goal for China is to marginalize the pan-democrats in the Legislative Council and control the substantive power of the Chief Executive, the appointment of prefecture and acceptable nomination became Beijing-supported parties’ hardball tactics in Hong Kong (Chen, 2014; Wong, 2015). The Umbrella Revolution, primarily led by university and senior high school students, had more than 100,000 people take to the streets and occupy the Central District, the business center of Hong Kong. They were calling for the universal suffrage consistent with international human rights standards against any nomination threshold or screening mechanism exercised over by sovereignty of China (Chan, 2014; Mullen & Shoichet, 2014; Kaufman, 2014). The student-led boycotts of large-scale demonstration had lasted almost three months since September 2014 to dispute the broken commitment of granting to HKSAR a high degree of autonomy and progressive democratization.

Prior to the Umbrella Revolution in September 2014, a series of the pro-democracy movements had unfolded in Hong Kong, including the July 1st marches involving averaged 500,000 protesters against controversial legislation of national security law in 2003; the
Anti-Patriotic Education Movement involving 120,000 protesters against brainwashing patriotic curriculum in 2012; the Occupy Central Movement involving more than 700,000 people supporting for referendum in June 2014. These social movements reflect that the status quo of democracy in Hong Kong is threatened by China and the voice of calling for liberal democracy undergirds grassroots energy against antagonistic regime.

Taiwan

Not only Hong Kong, but also Taiwan has strong association with colonial history and struggles for the historical relation with China because there are groups of ethnic Chinese exile from Mainland China (Shih & Jones, 2014). Hong Kong had been colonized by the United Kingdom for almost 150 years until 1997, and then has been governed by the People’s Republic of China (PRC). Taiwan had been colonized by Japan for almost 50 years until 1945, then was arguably ceded to the Republic of China (ROC) under the regime of Chinese Nationalist Party (also named as Kuomingtang; KMT). Taiwan got rid of party-state system after the Martial Law was lifted in 1987, and the direct election of president was held successfully in 1996. The partly alternation in presidential election was the milestone of practicing democracy to end party-state dictatorship in 2000. However, in view of China’s nationalism gripping the identity of ethnic Chinese and coveting Taiwan’s geographic location with economic potential and military strategic importance, cross-strait unification is an official policy of the government of China (Hsiao & Lin, 2009; Yan, 2009; Zhao, 2014). The current ruling party in Taiwan is KMT which is considered as a pro-unification party, and its cross-strait policies made by the President Ma administration and the KMT-led legislature are considered as the soft tactic toward China’s ultimate unification.

A series of cross-strait economic policies are controversial due to its spillover effect on
social integration with China. The scholars expressed particular concern if Taiwan relied on China’s burgeoning economy further, Taiwan’s independence would be deterred by the penetration of China (Hsiao & Lin, 2009; Zhao, 2014). The policy of the Cross-Strait Services Trade Agreement (CSSTA), an agreement for increasing economic integration between Taiwan and China, was unilaterally declared by the chairman (a KMT senator) of Internal Administration Committee in 30-second-muddled announcement that the review period had already ended and CSSTA would be submitted to a plenary session (Chen et al., 2014; Mullen & Shoichet, 2014; Rowen, 2015). The review process violating democracy in Legislative Chamber (the congress of Taiwan, also named as Legislative Yuan) culminated in large-scale of Sunflower Movement in March 2014. There were up to 500,000 protesters occupying inside and outside the Legislative Chamber and asking for repealing the trade agreement.

Similar to context in Hong Kong, there were two large social movements before the Sunflower Movement stirring up: the Anti-media-monopoly policy in 2012 involving over 250,000 people calling for the media freedom, and the Anti-military-injustice system in 2013 involving over 30,000 protestors successfully facilitating the reform of military justice system to transfer military prisoners to civilian prisons during peacetime (BBC News, 2013; Rawnsley & Feng, 2014). The energy and experiences from prior social movements are usually transmitted to the next one. The student-led Sunflower Movement actually reflected accumulated distrust6 of the Ma administration and dissatisfaction of pro-unification policies. As more Taiwanese are aware of the controversial identity of ethnic Chinese and the downside of KMT pro-unification policies affected by antagonistic regime of China, they are more willing to participate in democratization and political process. The Sunflower movement, as the result, became one of

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6 The survey made by ERA NEWS showed that the President Ma was at the new low record of 9.2% approval rating in September 2014, and the survey made by TVBS showed that satisfaction and confidence in the Ma administration have been at under 11% in November 2014 (Chung, 2013; Rowen, 2015).
largest civil non-violent disobedience actions in Taiwan.

**Singapore**

Singapore gained independence as the Republic of Singapore in 1965, and the first Prime Minister Lee Kuan Yew recognized as the founding father of Singapore led this city-state country toward strong economy over three decades. Lee combined regulation and patriarchal management to minimize any potential threats to the leadership of the People’s Action Party (PAP) to maintain political, economic and social stability (Ortmann, 2014; Soon & Cho, 2014). The logic is that democracy will not bring good government to new developing countries, so a meritocratic government is more beneficial than liberal democracy (Lee, 1992; Ortmann, 2014). In this sense, the good government is framed as an elitist view of politics, and PAP leadership identified as the guarantee of economic stability and prosperity becomes a strong rationale in Singapore to delegitimize opposition. As the discourse of a huge state-controlled structure is directed as economic stability, the state-owned investment companies and government-linked corporations play a substantial role in Singapore's domestic economy.

The social movement of The Return Our CPF in 2014 unleashed the conflicts between a leviathan-like government and defenseless citizen. The blogger and activist, Roy Ngerng, wrote an article in his blog exposing how the Singapore government was siphoning off the pension of Central Provident Fund (CPF) into state-controlled investment firms without any return to Singaporeans. However, Roy Ngerng was sued by the current Singapore Prime Minister, Lee Hsien Loong, for defamation due to misappropriating the pension funds. According to Roy Ngerng’s speech at the International Student Festival in Trondheim (ISFiT) in Norway, he only demanded for the transparency and accountability of CPF, yet the government agencies, state-controlled media as well as affiliated online media launched a campaign against him.
(Ngerng, 2015). For instance, he was given a termination letter from the workplace and was asked to leave there within an hour. Although Roy’s affidavit and evidence for the defamation suit were rarely reported by state-controlled media, there were up to 6,000 protesters (the size of movement is large enough in Singaporean history) occupying Hong Lim Park (the only place one can legally stage public protests in Singapore) to support Roy Ngerng. The Return Our CPF is not the only movement resisting patriarchal governance of Singapore government.

The values toward liberal democracy have gradually permeated through the people. There were two major social movements before the movement of The Return Our CPF sprung up. One is the movement of repealing Anti-subversion Law which may derogate constitutional rights and free expression (Kenyon et al., 2013). There were more than 3,000 people against state authorities being allowed to imprison suspects without trial (Jacobs, 2012). The other is The FreeMyInternet movement which was founded by a collective of bloggers who are against the licensing requirements (requiring online news sites to put up a performance bond of US$6,500 and comply within 24 hours to remove content) imposed by the Singapore government in 2013. Similar to contexts in Hong Kong and Taiwan, not only social media protract the energy of contesting official governance and make movements feasible, but also the democratization experiences are transmitted from prior movements to the next one.

**Similarities of three quasi-democratic regimes**

Although the three contexts of social movements are caused by different culture, history and political conditionality, these three Asian states share two similar features which potentially make regime depart from liberal democracy and initiate a series of social movements as well. One is the deep-seated Chinese culture of the Confucian meritocracy and filial piety, and the other is the frames of economic stability and social harmony.
On one hand, the Confucian meritocracy endorses the political system of capable monarch, and expects that the merit owning good character, wisdom and caring for the people shall be recommended by monarch to serve political community; however, not all of merits are selected impartially but institutionalized by hierarchical ties with monarch (Chan, 2007). The traditional understanding of the Confucian meritocracy still permeates into three Asian societies that merits' prestige and power are usually bound by cronyism and become corrupt easily. On the other hand, the culture of filial piety is identified as a virtue in families and schools to shape the adult-youth relationship. The responsibilities of raising and nurturing children well are heavily posed on the parents, and the children are also expected to respect and obey their parents and seniors. However, the negative effect of this virtue is that the adults are easily accustomed to mandate or press down on the youth, and the youth face conflicts between self-autonomy and adults' domination (Cand, 2013; Yeh, 2014). As the youth may confuse the virtue with obedience and indebtedness actually hinder a true democracy (Cand, 2013; Ortmann, 2014; Yeh, 2014). The ruling elites attempt to frame liberal democracy as inefficient mechanism to harm the economic stability, and opposition is often stigmatized as threat to social harmony (Leung et al., 2002; Ortmann, 2014). However, when the grievances cannot be expressed through official channels or government fails to respond to the public will, a series of social movement spring up. We can find that the three quasi-democratic regimes of Hong Kong, Taiwan and Singapore usually take economic stability and social harmony as the frames to simplify social problems against democratization, yet the three social movements are not frequently reported by monarch to serve political community; however, not all of merits are selected impartially but institutionalized by hierarchical ties with monarch (Chan, 2007).
movements of Umbrella Revolution, Sunflower Movement, and Return Our CPF framed liberal democracy as the shield against authoritarian governance.

This study explores different forms of democratic regimes, different contexts of social movements, and similar features in Asian context as a whole to understand the complex interplay between democracy and social movement in Hong Kong, Taiwan and Singapore. Exploring specific contexts of social movements in different forms of regimes can help us understand how different hierarchical structures and power distribution in quasi-democratic regimes affect the pattern of social movements.

**Social Media and Social Movement**

Social media construct strong online networks to facilitate the flow of power and the connections between individuals and institutions. A horizontal-like network can shape the space of autonomy and transfer online connections to offline behaviors. The offline behaviors in each social movement usually involve multiple units, such as civic institutions, student-led organizations, grassroots communities, political parties or a group of unaffiliated individuals. The interactive connections between multiple units can be identified as civic network which not only makes movements sustainable, but also unfolds the capacity of civic engagement. However, we cannot be sure if the involvement of multiple units is toward horizontal-like network or hierarchical one, especially in different forms of democratic regime. Social network analysis can help us capture the connectedness of involving unites and the pattern of civic network.

**The effect of social media on social movements**

Social media make people more informed that the external experiences of global democratization and international standards of human rights help them be aware of the irrationalities of authoritarian governances. Meanwhile, domestic people’s voices are more likely
to be heard worldwide through social media to expand democratic sphere to contest dictatorship. However, in view of social media causing information diffusion from the Internet, pan-authoritarian regimes also use social media to tightly censor dissidents and democratic movements to ban opposite voices and disputes, and decrease any threats to sovereignty as well. William Dobson (2012) argued that some authoritarians today take on a false democratic appearance to adopt subtler coercive ways to allow “personal freedom” (e.g., traveling, enjoying entertainment, browsing some webpages, joining parties) but block political rights and media freedom. This way lets people feel “free” but neglect the sophisticated methods (e.g., broad written laws, state-controlled media technologies, even the government-operated NGO) to discern the targeted groups the governments deem threats, to compete with outside criticisms and to maintain their power. Social media are not the only tool for protesters, but also for pan-authoritarian regimes.

Even though, three salient social movements in Hong Kong, Taiwan, and Singapore still took advantage of social media to provide online space for different institutions and individuals to share commutative consciousness. For instance, in view of China’s nationalism and pro-unification policies, a series of pro-democracy protests rally a strong sense of local identity in Hong Kong and sovereignty in Taiwan (Ortmann, 2014; Shih & Jones, 2014). These distinct identities of Hong Konger and Taiwanese, especially in younger generation, are facilitated by multiple online communities on Facebook Fan Page, such as “I am a Hongkonger”, “Cantonese Rfa”, “I am Taiwanese”, and “Taiwan is Our Country 我是台灣人 · 台灣是咱的國家”. Besides, social media can also link online space to offline behaviors. For example, the Sunflower Movement in Taiwan raised over US$210,000 within 3 hours online to buy a full-page advertisement on the New York Times entitled “Democracy at 4am” (cf., http://4am.tw/) to explain the reasons for student protests (Chen et al., 2014; Moura & Zou, 2014). Similarly, the
movement of Return Our CPF in Singapore also raised $70,000 online in three days to support Roy Ngerng’s defamation lawsuit accused by the Prime Minister Lee Hsien Long (NBC News, 2014).

In this sense, the social media construct strong social network to connect different resources and mobilize information to make participants take part in offline movements. These movements involve multiple units across civic institutions (e.g., the foundation or NGO advocating for perennial issues), student organizations (e.g., on-campus and off-campus ones), grassroots communities (e.g., bloggers, ethnic communities, and pro-democracy alliance), and opposition parties (Chen et al., 2014; Rowen, 2015; Shih & Jones, 2014; Soon & Cho, 2014; Wong, 2015). Specifically, student-led organizations and grassroots communities are the main actors in these three social movements instead of opposition parties or senior politicians. The independent media (i.e., exposing non-mainstream news or underlying theme against hegemonic perspective of state-controlled media) are willing to report videos and testimonies from grassroots perspective, and to produce detailed stories in the way of balance. Therefore, social media play an instrumental role to make movement diversified far beyond student-led organizations and grassroots communities. The aspiration of movement eventually kindles multiple units’ interest to enlarge the scale of social movements.

### Social media and transition of social movement

The pattern of these three social movements indicates a horizontal network involving several groups which have relatively equal status. Horizontal or informal network can help participants conduct the boundaries of specific organizations (Diani, 2003). Castells (2012) also valued horizontal communication in digital networks due to the space of autonomy and deliberation, and he defined social movements as exercising counterpower to produce new
values and goals which can be transformed to new norms by institutions of society. The
counterpower of social movement here is in contrast to the legitimacy and institutional power
embedded in major network to weaken the system of domination. In other words, the autonomy
of communication in less hierarchical mechanism is essential in social movement, and can help
protesters transform emotion into action to contest systematic power.

However, the literature is not clear enough if counterpower of social movement facilitates
horizontal linkages between participatory groups or mimics hierarchical structure within
governmental system. Furthermore, as the media freedom performs differently in these three
states, we are not sure if the horizontal networks are affected by different forms of democratic
regimes. According to the theories of social movement, the collective actions can be identified as
from uncoordinated bursts of irrationality, resource mobilization of structured organization, to
connective interaction of networks (Ansell, 2003; Chen et al., 2014; Diani, 2003; Lee, 2015;
Soon & Cho, 2014). Social media challenge traditional flows of power and blur organizational
boundary that the pattern of network can capture the connection between individuals, groups or
other units. The network of social movement can somewhat indicate if the participatory units are
toward horizontal or hierarchical relationship.

Social movement in organizational perspective

The traditional perspective on social movement took collective actions as spontaneous and
amorphous bursts of behaviors, and the behaviors usually act out of self-interest based on
weighing costs and benefits (Hannigan, 1985; Olson, 1971). The resource mobilization (RM)
theory revised the traditional perspective and argued that the power dynamics of organizational
nature driven by the political and social context can interpret how institutional resources launch
collective actions (Jenkins, 1983; McCarthy & Zald, 1977; Tarrow, 1994; Tilly, 2004). The
structured forms of organizations (formal, centralized, bureaucratic, or hierarchical ones) can recruit members and force social movements through formal ties (Buechler, 1995; Klandersman, 1993). In this sense, RM theory identifies social movement as organizational perspective to interpret the interrelationships between individuals’ collective behaviors and structured institutions.

However, RM theory fails to account for how the collective identity is constructed before collective actions emerge (Buechler, 1995; Melucci, 1988; Stoecker, 1995). Collective identity can somewhat complement the structural view of resources received to understand actors’ strong motivation in psychological perspective. Nonetheless, Stoecker (1995) found that neither collective identity nor structural variables can explain social movement dynamics. The structural contradiction still remains if organizational perspective fails to explain why diverse identities and structures can still lead to collective actions.

Social movement in unaffiliated perspective

As social media enhance social mobilization and lower the cost of information through the Internet, citizen self-mobilization and loosely bounded communities rise (Chen et al., 2014; Lee, 2015; Soon & Cho, 2014). The function of social media and the Internet somewhat substitute for structured organizations that individuals are capable of organizing themselves outside formal system (Anduiza et al., 2014; Earl et al., 2010). The online space not only provides digital linkages for unaffiliated units, but also cements weak ties between smaller groups or scattering individuals (Bennett & Toft, 2009; Hampton, 2003). Theses unaffiliated units sharing different knowledge backgrounds and connections can add flexibility to a movement instead of holding certain rules in structured systems (e.g., socioeconomic status, hierarchical status, elite allies). Furthermore, although unaffiliated netizens and ordinary citizens may not hold similar goals and
identities of movement, social media avail them of the opportunity to communicate with one another.

In this sense, the transition of social movement from organizational perspective to unaffiliated perspective can indicate the diversification of collective actions resulting from the use of social media and the Internet. However, some scholars argue that collective actions cannot capture the features of connective relationships between personal expressions and community websites (Bennett & Segerberg, 2012; Chen et al., 2014). These connective relationships are “networks of network” or “subgroups of network”. When the actor engages in a bigger network of social movement, he or she can be an unaffiliated individual with personal identity and also has connections with other subgroups or smaller networks to communicate with consciousness.

Social movement as network

The flow of information indicates the distribution of power and relative position in social network (Prell, 2012). Identifying social movement as “subgroups of network” provides us an alternative to explore the relationships between individuals and institutions in social dynamics. Diani (2003) also viewed social movement as networks because movement consists of independent actors who have specific identities and values as well as links to with various forms of cooperation and recognition beyond a given movement network. Social media open new opportunities to expand and redefine the ties as well as to navigate connections with broader groups, so individuals can flock to different units and choose to maintain cohesion or break traditional norms (Christakis & Fowler, 2009). The hierarchical-like structures with low segmentation/few subgroups usually have limited ties for an individual to change status quo, while the decentralized structure with more subgroups has relatively redundant of ties to represent a strong expressive capacity (Diani, 2003; Prell, 2012).
In this sense, the network perspective can somewhat complement organizational and unaffiliated perspectives to explore the dynamic interactions between individuals and institutions in social movements. Further, as different forms of democratic regimes lead to different contexts of social movements, the network perspective can somewhat capture how centralized/decentralized or hierarchical/horizontal mechanism affect the centrality of unaffiliated individuals and cohesion of subgroups.

Civic network in E-Democracy

The relationships between democratic regime, social media and social movement indicate the pattern of civic network. Civic network is applicable to describe how a set of citizens involve in public affairs through different connections. The features of connections affected by the forms of regimes and the use of social media are centrality of actors, division and cohesion of groups, and hierarchy of network. The practice of civic network can not only be shown in a given social movement, but also be extended to civic engagement and political participation in daily life.

A widespread civic network gives rise to dynamic forms of civic engagement. Civic engagement, a bedrock value in democracy, is usually defined as being able to influence choices in connective relationships that each citizen has right and responsibility to serve and interact with public spaces at large (Camino & Zeldin, 2002; Ekman & Amnå, 2012; Kahne & Westheimer, 2006). Social media can shape public spaces to lower the cost of engagement, facilitate the recognition of civic values, and develop electronic democracy (Bennett, 2004; Bryan et al., 1998; Schmidtke, 1998).

In addition to civic engagement, political participation can be identified not only as protest or extra-parliamentary political action, but also as less direct forms of civic engagement such as monitorial citizens seeking out information about politics and staying interested through social
media (Ekman & Amnå, 2012; Galston, 2004). Although empirical research indicated that younger generation is less involved in political participation than previous generations, young people may extend to wider political involvement and characterize their volunteering as an alternative to formal politics (Galston, 2004; Putnam, 2000; Tsagarousianou, 1998). For instance, previous generations usually narrowed political participation to voting and relied more on senior political leaders. However, tech-savvy or ordinary citizens with different knowledge backgrounds can take advantage of digital media devices to sustain a practice with multiple forms of political participation.

In a nutshell, civic network plays an important role in E-Democracy era to promote democracy through electronic devices. Citizens are supposed to participate in public affairs more equally, and their different connections become an important property in the practice of social movement and civic engagement.
Chapter 3
Method

There were three salient civic events in Asia launched by young generation in 2014, including the Sunflower Movement in Taiwan, the Umbrella Revolution in Hong Kong, and the Return Our CPF Protest in Singapore. The social media of Facebook and Twitter display a list of users with whom one shares a connection (e.g., common friends, twit/like/reply the same post), and include several representative civic networks to view users’ online behaviors in social movement. These two media are frequently used in these three states, and the portals of representative civic networks are easily accessed to retrieve data. This study examines the most representative Twitter and Facebook networks in each social movement to understand the pattern of civic network in these three states.

Data Source

Twitter and Facebook have grown as one of the most popular social media today to share domestic and international information quickly. Both social media of Twitter and Facebook are available for researchers to download the connection data in three civic networks of Hong Kong, Taiwan and Singapore. In addition, Facebook data can complement the limitation of Twitter data to manipulate the date of collected data, so the time periods of each set of data are nearly the same as those of social movements in these three states. Two or more civic networks data from Twitter and Facebook in each state can provide a better understanding of the distribution of online behaviors.

Twitter data

The study examines the most representative Twitter networks in three social movements. In Hong Kong, the name of civic network is the same as the name of movement, “Umbrella
Revolution (@UmbrellaRevHK), and the data include 471 actors and 470 unique edges. In Taiwan, the name of civic network is also the same as the name of movement, “Sunflower Movement (@SunflowerMvmt)”, and the data include 327 actors and 296 unique edges. In Singapore, the name of civic network is “The Real Singapore (@RealSingapore)”, and the data include 517 actors and 499 unique edges. In Singapore, although there is no any civic network whose name is the same as movement on Twitter, the online community of “The Real Singapore” is the most representative one discussing the movement of “Return Our CPF” based on searching #ReturnOurCPF on Twitter.

However, Twitter data have limitation. Twitter data can only provide the latest followers around the time the researcher collects data. The Twitter data was collected in January 2015, which was not the same as the period of three social movements. The names of Twitter networks in Hong Kong and Taiwan are exactly the same as the names of the social movements, so the relationships and communications within these two networks are assumed to be directly related to the social movements. In Singapore, there is no any network named “Return Our CPF”, and the chosen network of “The Real Singapore” is the most representative one due to frequent use of #ReturnOurCPF. However, the data collected from the network of The Real Singapore might not always directly relate to the movement of The Return Our CPF.

**Facebook data**

The study collected Facebook data to complement the limitation of Twitter data. The researcher can choose the date of Facebook data that the time period of data collection can be nearly the same with the period of social movement springing up. The time period of Facebook data collected in this study is almost one week starting from the first day of social movement. In Hong Kong, the name of civic network on Facebook fan page was the same as the name of civic
event, called “Umbrella Revolution”. The data obtained from Facebook was collected from September 26 to October 2, 2014 (the movement started on September 26, 2014). There are 261 actors and 16,191 unique edges. In Taiwan, the name of civic network on Facebook fan page was the same as the name of civic event, called “Sunflower Movement 太陽花學運”, and the data obtained from Facebook was from March 18 to March 24, 2014 (the movement started on March 18, 2014). There are 141 actors and 3,825 unique edges.

In Singapore, although there is one civic network on Facebook fan page with the same name as the social movement of The Return Our CPF, its size is too small (there are only 14 vertices) to view the pattern of online behaviors and to be compared with the other two civic networks in Hong Kong and Taiwan (there are above 100 vertices). In order to solve this problem, this study chose the other two representative Facebook fan pages, the two largest independent socio-political sites in Singapore, to complement the limited information of this small network. One is the media community of The Real Singapore (TRS)\textsuperscript{7} gazetted in 2013 and quickly gaining a strong readership in two years, yet TRS was charged with sedition by Singapore government in 2015 after related data in this study were collected. TRS was quite popular alternative of social media in Singapore owning two large news websites on Twitter and Facebook respectively. The other is the media community of The Online Citizen (TOC) founded in 2006 and having brought the significant inroads to cyber activism in Singapore. The period of each data set was from June 6 to June 10, 2014 (the movement started on June 6, 2014). There are 1,146 actors and 322,360 unique edges in TRS network, and there are 292 actors and 16,270 unique edges in TOC network. Two and more civic networks in each state from Twitter and

\textsuperscript{7} The Media Authority of Singapore (MDA) has suspended the statutory class license for the operation of The Real Singapore (TRS), and its related computer online services such as the TRS Facebook Page, Twitter Page and mobile applications in March 2015. The official statement claimed that TRS published prohibited material to be objectionable on the grounds of public interest, public order and national harmony. This charge may bring the chilling effect on the freedom of speech for media outlets and journalistic reporting in Singapore (Carlton, 2015).
Facebook data can provide a far richer set of analyses that are less susceptible to time effect and selection bias.

**Data Analysis**

The study conducts three main analyses of centrality, subgroup and hierarchy to understand the pattern of civic networks, the features of subgroups and the hierarchical degree in these three social movements. The softwares of NodeXL and UCINET are applied in this study.

**Asymmetric and symmetric matrix**

Twitter data are directed network along with asymmetric edges as person A can follow person B who will not automatically follow person A. The edges for each follows relationships include direction of “mentions”, “tweet”, and “replies to” which are coded as the binary asymmetric matrix. The binary asymmetric matrix contains 1 if there is one of three directed relationships, and 0 if there is no any kind of relationship.

In contrast, Facebook data are undirected network along with symmetric edges that if both nodes are friend on Facebook, they automatically have a reciprocal relationship with one another. The edges for each participant joining in same fan page include “like” and “comment” which are coded as the binary symmetric matrix. For comparing directed Twitter data with undirected Facebook data, the directed Twitter data have to be symmetrized to undirected network data via the software of UCINET.

**Centrality analysis**

*Fruchterman-Rheingold graph layout*, moving vertices closer to find the equilibrium, can speedup for centrality metric calculations (Hansen et al., 2011; Sharma et al., 2011). The general pattern of civic network is visualized by *Fruchterman-Rheingold layout algorithm* which is a common way to position the nodes of a graph in two-dimensional space via the software of
NodeXL (cf., Figure 1-1 and Figure 3-1). In the context of this study, Fruchterman-Rheingold graph layout can capture the overall properties of civic network to see how the central-peripheral participants locate themselves in large-scale mobilization of movement.

In addition to exploring the pattern of a whole civic network in macro way, the centrality analysis examines an individual’s position to understand one’s influence on the distribution of power and the flow of information at micro level. There are multiple centrality measures examining structural properties (Borgatti et al., 2013; Prell, 2012). The study examines betweenness centrality and closeness centrality which best capture the bridge role of brokering and the center role of transmitting to see how the individual independence over information flow in civic networks. The measure of betweenness centrality can analyze structural position and brokerage characteristics of social capital, political communication, diffusion of protest tactics between social movement organizations (Abbasi et al., 2011; Song & Eveland, 2015; Wang & Soule, 2012). In this study, the actors who have higher betweenness centrality in civic network usually are located on the geodesic path between unaffiliated individuals, any given pair of individuals or structured organizations to exploit information, and mediate the flow of power. They can stay at advantageous positions, even without direct ties, to bridge resources due to prior experiences of civic engagement and accumulated relationships with other units.

The measure of closeness centrality measures short path lengths and emphasizes central actors’ independence without relying much on intermediators, such as studying on core–periphery differences of urbanization value in citizen network, dominance behaviors, terrorist cells (Coleing, 2009; Enqvist et al., 2014; Krebs, 2002). In this context, the actors who have

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8 Degree centrality (for undirected data) and in/outdegree centrality (for directed data) is the most intuitive form of centrality to see an actor's involvement in activity, yet this measure can only be used to make meaningful comparisons among actors in the same network (Prell, 2012). The study has to compare different civic networks among three states, so the degree centrality and in/out degree centrality might not be appropriate to this study. However, the distributions of degree and in/out degree centrality have no substantial differences with distribution of betweenness centrality in the same networks.
higher closeness centrality play an important role in information transmission. They can usually perceive social climate accurately to spend the least time to reach one another. For comparing centralities of different civic networks in these three states with each other, both betweenness centrality and closeness centrality are normalized to understand the pattern of civic engagement across three different states (cf., Table 1-1, Table 2-1, and Table 3-1). The comparison between tables is visualized as Figure 1-5, Figure 2-1, and Figure 3-6. The software of NodeXL is applied for centrality analysis.

Subgroup analysis

Clauset-Newman-Moore (CNM) cluster algorithm is an improvement on clustering in terms of big dataset, the speed and same quality of the partition (Clauset et al., 2004). The features of subgroups in three civic networks are visualized by Clauset-Newman-Moore cluster algorithm which is an appropriate way for very large networks from Twitter and Facebook data. Figure 1-2 and Figure 3-2 show nodes sized by betweenness centrality, and Figure 1-3 and Figure 3-3 show nodes sized by closeness centrality. As CNM presents a hierarchical agglomeration for detecting community structure of very large network in real world, it is applicable in this study to extract meaningful communities from civic networks on Twitter and Facebook.

Besides, in order to compare different features of subgroups with each other, two properties of division and cohesion are included in this study, including the measures of modularity, component ratio (CR) and fragmentation. The analysis of modularity is proposed to measure the strength of division of that network into subgroups that higher modularity indicates that the more significant groupings are found (Borgatti et al., 2013; Newman, 2006). In this study, the civic network with higher modularity has dense connections within the division of subgroups that more units are likely to have connective relationships before a movement is initiated. This kind
of civic network is more likely to launch effective ways to tackle the problems produced in social movements. There are different ways to measure the cohesion characterizing the “togetherness” of subgroups, and this study conducts the common uses of component ratio (CR) and fragmentation to get a sense of the relative amount of cohesion at group level (Borgatti, 2006). The CR\textsuperscript{9} is an inverse measure of cohesion that its value ranges from 0 (every actor is attributed to one component) to 1 (every actor is isolated). The fragmentation\textsuperscript{10} is also an inverse measure of cohesion indicating that the proportion of pairs of actors who cannot reach one another by any path. The higher the fragmentation is, the less cohesive the network is due to its diverse components. In this context, if the civic network is more cohesive, there are few components that majority of individuals belongs to same subgroups. In other words, the characteristic of heterogeneity can be indicated in the less cohesive network. The softwares of NodeXL and UCINET are applied for subgroup analysis (cf., Table 1-2, Table 2-2, and Table 3-2). The comparison between tables is visualized as Figure 1-5, Figure 2-1, and Figure 3-6.

Hierarchy analysis

The hierarchy analysis can explore the pattern of reciprocal ties and specific unordered paths in a given network to see if the bonding of network is toward the dense interaction within clusters or toward the broader involvement across clusters. The analysis of hierarchical structure is an important property of civic network in different democratic regimes to see if one or a few activist in the center is more likely to own authority and information to maintain connective relationships in a given social movement. There are a variety of ways to measure the hierarchy of network, and this study conducts two ways to measure hierarchical degree of civic network:

\textsuperscript{9} The component ratio (CR) equals to c-1/ n-1, where c is the number of components and n is the number of nodes in the graph (Borgatti, 2006).

\textsuperscript{10} The fragmentation equals to 1- \(\sum_{i,j} r_{ij} / n(n-1)\), where n is the number of nodes in the graph and \(r_{ij}\) is 1 if nodes i and j are in the same component and 0 otherwise. The value refers to the proportion of pairs of vertices that cannot reach one another by any path (Borgatti, 2006).
Krackhardt's graph theoretic dimension of organizations (Krackhardt GTD) and clustering coefficient. The measure of Krackhardt GTD\textsuperscript{11} is applied to examine civic network’s connectedness and hierarchy to understand the proportion of reciprocal ties and mutually reachable pairs (Krackhardt, 1994). The higher the degrees of connectedness and hierarchy are, the purer the structural network is. The other relevant measure is clustering coefficient which has reverse indication of hierarchical degree that the clustering coefficient of the network decreases in a hierarchical structure (Baldassarri & Diani, 2007; Buchanan et al., 2010). The software of UCINET is applied for hierarchy analysis (cf., Table 1-2, Table 2-2, and Table 3-2). The comparison between tables is visualized as Figure 1-5, Figure 2-1, and Figure 3-6.

However, as Krackhardt GTD can only be applied to directed network data, the different hierarchy measure\textsuperscript{12} is necessary to analyze undirected data. The alternative measure of betweenness variance can be applied to hierarchy analysis that more hierarchical network is a more centralized structure to contain greater variance between the members (Everton, 2012; Rubinstein & Eaton, 2009). In addition, the measure of cohesion in above-mentioned subgroup analysis can also indicate the degree of hierarchy in some degree that a system of hierarchical nesting usually has low connectivity levels and is less cohesive (Debry, 2001; Moody & White, 2003). This study will take cohesion of subgroup analysis into account to understand the hierarchy of each civic network in comprehensive ways.

\textsuperscript{11} Krackhardt GTD includes four component dimensions: connectedness and hierarchy, efficiency, and least upper bound (LUB). This study conducted the first two measures of connectedness and hierarchy (both definitions are intuitive for understanding the hierarchical structure of civic network).

\textsuperscript{12} Although the concept of centralization can somewhat capture the extent to the degree of hierarchy in undirected network data, empirical research found that largely hierarchical network might be consistent with a range of centralizations (Crowston & Howison, 2006; Everton, 2012). Therefore, this study conducted betweenness variance to analyze hierarchy in undirected network data.
Chapter 4
Findings

The findings include centrality, subgroup, and hierarchy analyses to understand the pattern of civic networks in the quasi-democratic regimes of Hong Kong, Taiwan, and Singapore.

Centrality Analysis

The centrality analysis includes two main perspectives of betweenness centrality and closeness centrality to capture the bridge role of brokering and the center role of transmitting in civic networks.

Betweenness centrality

Betweenness centrality is applied in this study to analyze directed and undirected Twitter data compared with undirected Facebook data to capture the bridging position. The larger betweenness centrality the node has, the more control the node has over the interaction between other disconnected participants. The betweenness centrality is normalized to compare different civic networks with one another.

In directed Twitter data (cf., Table 1-1), the normalized betweenness centrality is .011 in Hong Kong, .007 in Taiwan, and .002 in Singapore. The normalized betweenness centrality in undirected Twitter data is same as the result of directed Twitter data (cf., Table 2-1). When three sets of data are compared with each other, the betweenness centrality is always the highest in Hong Kong, followed by Taiwan and Singapore. The results indicate that the actors in Hong Kong network are more likely to mediate the flow of information or resources, while there is less access for actors in Singapore to communicate with each other or limited opportunity to exploit connections with peripheral members. In general, the node with larger betweenness centrality is usually located in the center, and tends to cluster in certain subgroups as well as bridge other
major subgroups. For instance, in directed Twitter data (cf., Figure 1-2), the subgroup of G1 in each network has one central actor with the largest betweenness centrality. Compared to the network in Singapore, there are more subgroups in Hong Kong and Taiwan where at least one actor with larger betweenness centrality is located in the center. The subgroup of G2 in Hong Kong and the subgroup of G4 in Taiwan have more actors with larger betweenness centrality.

In undirected Facebook data (cf., Table 3-1), the normalized betweenness centrality is .067 in Hong Kong, .033 in Taiwan, .042 in first Singapore network (TRS), and .030 in second Singapore network (TOC). In comparison with Twitter networks, Facebook networks have far larger normalized betweenness centrality in general. Facebook is more likely to provide bridging function for users than Twitter. However, the comparison between four sets of data in Facebook networks shows the similar pattern of betweenness centrality to three Twitter networks. The actors in Hong Kong network still have the highest betweenness centrality to provide more access for others to connect with one another. The bridging roles in networks of Taiwan and Singapore are inactive in average to mediate the flow of information or resources. For instance, in undirected Facebook data (cf., Figure 3-2), the actors with higher betweenness centrality usually cluster in the same subgroup, such as the subgroups of G1 and G2 in Hong Kong, and the subgroup of G2 in Taiwan and the two networks in Singapore respectively. In Hong Kong, there is a group of actors with higher betweenness centrality scattered in different subgroups. In the first network of Singapore, most actors with higher betweenness centrality are clustered in the subgroup of G2. Relatively, in network of Taiwan and the second network of Singapore, there are fewer actors playing key roles in bridging. In addition, the actor with the highest betweenness centrality has cooperative ties across all major subgroups to enable interaction between diverse subgroups comprehensively (cf., Figure 1-4 and Figure 3-4). The results indicate that the actors who are more likely to provide civic information to others not only have connections with one
another, but also are a bridge to connect with different subgroups to enlarge the whole civic network.

**Closeness centrality**

A node put in civic network will affect how “close” a node is to other nodes. The actor with higher closeness centrality can quickly interact and communicate with other participants in social movements without going through many intermediaries. Closeness centrality is not only analyzed to capture the advantage for a node to reach the central node, but also normalized to compare different civic networks with one another. Closeness centrality is applied in this study to analyze directed and undirected Twitter data compared with undirected Facebook data to capture the individual independence over information flow.

In directed Twitter data (cf., **Table 1-1**), the normalized closeness centrality is .088 in Hong Kong, .084 in Taiwan, and .064 in Singapore. The normalized closeness centrality in undirected Twitter data is the same as the result of directed Twitter data (cf., **Table 2-1**). When three sets of data are compared with each other, the closeness centrality is always the highest in Hong Kong, followed by Taiwan and Singapore. The actors with the highest betweenness centrality are located in the center of subgroups, but the vertices with the highest closeness centrality within Twitter networks are usually scattered around periphery (cf., **Figure 1-3**). The smaller the size of subgroup is, the larger the number of actors with higher closeness centrality is, such as the subgroups of G4 and G5 in Hong Kong, the subgroups of G2 and G8 in Taiwan, and the subgroups of G2, G3, G4 and G8 in Singapore. Most smaller subgroups have more actors with higher closeness centrality that they have shorter distance to diffuse information quickly.

In undirected Facebook data (cf., **Table 3-1**), the normalized closeness centrality is .003 in Hong Kong, .004 in Taiwan, .001 in first Singapore network (TRS), and .002 in second
Singapore network (TOC). In comparison with Twitter networks, Facebook networks have far smaller normalized closeness centrality in general. Twitter is more likely to provide independent relationship for users than Facebook. However, the comparison between four sets of data in Facebook networks shows the similar pattern of closeness centrality to three Twitter networks. The normalized closeness centrality is the highest in Taiwan, followed by Hong Kong and Singapore (TRS). The results indicate that civic networks in Taiwan and Hong Kong have more potential for individuals to take advantage of transmitted information independently, while individuals in Singapore networks rely more on specific actors to each other.

However, compared with central-peripheral distribution of high-low betweenness centrality in Twitter networks, the size of subgroup is relatively equivalent in Facebook networks that the actors are distributed evenly due to their equivalent closeness centrality (cf., Figure 3-3). In addition, in both Twitter and Facebook networks, the gap of closeness centrality between each individual is relatively smaller than that of betweennes centrality (cf., Appendix A and Appendix B). Most vertices have equivalent closeness centrality in both Facebook and Twitter networks, while their betweenness centrality is relatively different. In general, centrality analysis from Twitter and Facebook data indicates the similar pattern in these three states. Both normalized betweenness centrality and normalized closeness centrality are higher in Hong Kong, followed by Taiwan and Singapore.

**Subgroup Analysis**

The subgroup analysis includes Clauset-Newman-Moore cluster algorithm, modularity analysis, and cohesion analysis. The cohesion analysis includes two measurements in component ratio and fragmentation. These analyses can explore the pattern of density and cohesion among the natural division of subgroups in a given network.
Clauset-Newman-Moore cluster algorithm

In directed Twitter data (cf., Figure 1-2), there are 246 clustered groups in Hong Kong, 6 of which are major subgroups\(^{13}\) (larger than a triad). The vertices in these 6 subgroups take up 43% of all vertices in Hong Kong network. The largest subgroup has 58 vertices, while the smallest one has 15 vertices. In Taiwan, there are 233 clustered groups, 9 of which are major subgroups. The vertices in these 9 subgroups take up 24% of all vertices in Taiwan network. The largest subgroup has 35 vertices, while the smallest one has 4 vertices. In Singapore, there are 50 clustered groups, 5 of which are major subgroups. The vertices in these 5 subgroups take up 91% of all vertices in Singapore network. The largest subgroup has 472 vertices, while the smallest one has 4 vertices.

Based on the components of subgroups in each network, there are 57% and 76% of actors in Hong Kong and Taiwan respectively not belonging to any one of the subgroups but still joining in these civic networks. There are only 9% of actors in Singapore not belonging to the one big subgroup. In this sense, there are multiple forms of subgroups in Hong Kong and Taiwan. According to categories of mapping social network by Smith and colleagues (2014), the subgroup pattern in Hong Kong can be mapped as the category of “community cluster” that there are many small and medium subgroups with moderate connections. In Taiwan, the subgroup pattern can be categorized as “brand cluster” that there are many smaller subgroups with fewer connections. In Singapore, the subgroup pattern can be categorized as “broadcast network” that there is one large subgroup as a hub surrounded by many spokes without connection to each another, while other disconnected and smaller subgroups have inbound connections.

\(^{13}\) The self-group and subgroup equal to or less than 3 vertices on Twitter data are skipped in subgroup analysis that the structure of major subgroup in this study is larger than a triad (composed with three vertices) at least.
In undirected Facebook data (cf., Figure 3-2), there are 6 clustered groups in Hong Kong, 3 of which are major subgroups\(^\text{14}\). The vertices in these 3 subgroups take up 99% of all vertices in Hong Kong network. The largest subgroup has 121 vertices, while the smallest one has 40 vertices. Gender ratio in Hong Kong network is 54% males to 46% females. In Taiwan, there are 3 clustered groups, and all of three are major subgroups. The vertices in these 3 subgroups take up 100% of all vertices in Taiwan network. The largest subgroup has 51 vertices, while the smallest one has 45 vertices. Gender ratio in Taiwan network is 55% males to 45% females. In the first Singapore network (TRS), there are 2 clustered groups which are all major subgroups. The vertices in these 2 subgroups take up 100% of all vertices in TRS network. The largest subgroup has 617 vertices, while the smallest one has 530 vertices. Gender ratio is 78% males to 22% females in TRS. In the second Singapore network (TOC), there are 4 clustered groups, and all of which are major subgroups. The vertices in these 4 subgroups take up 99% of all vertices in TOC network. The largest subgroup has 133 vertices, while the smallest one has 34 vertices. Gender ratio is 84% males to 16% females in TOC.

Based on the components of subgroups in each Facebook network, most actors can be identified as at least one of the subgroups in each network. According to Smith and colleagues’ categories of mapping social network (2014), the three subgroup patterns in Hong Kong, Taiwan and the second Singapore network (TOC, labeled as c2) can be mapped as the category of “tight crowds” that there are two to six medium subgroups with high level of group interconnectivity and few unconnected participants/isolates. Relatively, the subgroup pattern in the first Singapore network (TRS, labeled as c1) can be identified as the category of “polarized crowds” that there are two large subgroups with few unconnected participants/isolates. The results indicate that The

\(^{14}\) The self-group and subgroup less than 3 vertices on Facebook data are skipped in subgroup analysis that the structure of major subgroup in this study is larger than a triad at least.
Real Singapore (TRS) tends to have one or two centralized component on both Twitter and Facebook. Relatively, the other Singapore community of The Online Citizen (TOC) is similar to the networks in Hong Kong and Taiwan where the network can be divided into different pieces of components.

**Modularity**

In order to compare the cohesion of clustered groups with one another in three directed Twitter civic networks, the measurement of modularity is applied to understand how good a clustering is. The higher the modularity is, the denser the connections between modes within clustered groups are. The result of directed Twitter data is the same as undirected data that modularity is .625 in Hong Kong, .492 in Taiwan, and .223 in Singapore (cf., Table 1-2 and Table 2-2). In general, the scores of modularity in the three states are all positive that the number of edges inside the subgroups is more than the expected number. The modularity in Hong Kong is the highest, followed by Taiwan and Singapore. The undirected Facebook data also indicate the similar pattern to the undirected Twitter data that modularity is .358 in Hong Kong, .525 in Taiwan, .218 in the first Singapore network (TRS), and .291 in the second Singapore network (TOC) (cf., Table 3-2).

According to Clauset and colleagues’ definition (2004), the community structure is significant if the modularity is more than .3. Both Twitter and Facebook data show that Singapore is the only state where the modularity of civic networks is less than .3. In this sense, the clustered groups in Hong Kong and Taiwan are significant that there are more natural divisions of vertices in these two states, while the clustered groups in Singapore are not significant. The results indicate that the strength of division within Singapore network is limited and the network is like one homogeneous component. In contrast, the divisions of subgroups are
quite dense in Hong Kong and Taiwan due to diverse subgroups.

**Cohesion**

1. **Component Ratio**

   The component ratio (CR) measuring cohesion reversely is based on the number and size of components in a network. If CR achieves its maximum value of 1.0, every node in a given network is quite isolated and the subgroups are less cohesive. If CR achieves its minimum value of 0, there is one component in a given network and the subgroup is highly cohesive. In directed Twitter data (*cf.*, Table 1-2), the component ratio is quite high in three civic networks that CR is .991 in Hong Kong, .994 in Taiwan, and 1.0 in Singapore. Compared with Hong Kong and Taiwan, the subgroups in Singapore are the most cohesive because there is one salient component connecting others. However, in undirected Twitter data (*cf.*, Table 2-2), the component ratio declines in three civic networks that CR is .515 in Hong Kong, .696 in Taiwan, and .093 in Singapore. Compared with directed Twitter network, CR declines a lot in undirected Twitter network because all the ties are identified as reciprocal relationships and toward the same component if there is no direction. For example, the network in Singapore is a star-like network (*cf.*, Figure 1-2). Most vertices have an arrow toward the vertex in the center but do not have any tie with others, so it is difficult for them to connect with each another. When the direction is absent, they can connect with each other through the vertex in the center. Even though CR declines in undirected networks of Hong Kong and Taiwan, their multiple subgroups keep CR moderate and larger than Singapore network.

In undirected Facebook data (*cf.*, Figure 3-2), CR drops to zero in all three states. The four undirected Facebook networks are obviously more cohesive than three undirected Twitter networks. As the measure of CR is based on the number and size of components, the number of
vertices and unique edges in Facebook networks may explain why CR drops even more in undirected Facebook networks than in undirected Twitter networks. The number of vertices and unique edges in Facebook networks is far larger than Twitter networks, so the actors can reach each other through multiple paths, making Facebook networks more like a cohesive big component.

2. Fragmentation

The fragmentation, the reverse measurement of cohesion, is defined as the proportion of pairs of vertices that cannot reach each other by any path. The fragmentation values are in a range between 0 and 1. If fragmentation achieves its maximum value of 1, the pairs of vertices are less likely to be in the same component and 0 otherwise. In directed Twitter data (cf., Table 1-2), the degree of fragmentation is really high in three civic networks that all scores of fragmentation are .998 in the three states. In this sense, the pairs of nodes are quite difficult to reach one another due to multiple fragments in three given civic networks. In undirected Twitter data (cf., Table 2-2), the degree of fragmentation declines in three civic networks that the score of fragmentation is .886 in Hong Kong, .956 in Taiwan, and .285 in Singapore. Compared with Hong Kong and Taiwan, the subgroups in Singapore are more cohesive that the pairs of vertices are more likely to be in the same components. The direction of connective ties will affect the identification of components or fragments.

In undirected Facebook data (cf., Table 3-2), the scores drop to zero in the three states that all four undirected Facebook networks are more cohesive than the three undirected Twitter networks. Each of these four undirected Facebook networks can be identified as one big component that pairs of vertices can reach each other by any path. Even though the number of vertices in three of the Facebook networks (i.e., Hong Kong, Taiwan and the second Singapore network - TOC) is equivalent to the three Twitter networks, the number of unique edges in
Facebook networks is far larger than Twitter networks. As the measure of fragmentation is based on the ties between pairs of vertices, the number of unique edges in Facebook networks may explain why the value of fragmentation drops even more in undirected Facebook networks than undirected Twitter networks.

After reviewing the analyses of component ratio and fragmentation as a whole, civic network in Singapore is more cohesive than two other networks in Hong Kong and Taiwan due to its one big star-like subgroup. In contrast, the subgroups in Hong Kong and Taiwan are less cohesive due to diverse forms of clusters. Besides, Facebook networks are more cohesive than Twitter networks.

**Hierarchy Analysis**

The hierarchy analysis includes Krackhardt GTD, clustering coefficient, and betweenness variance. These measures can provide insight to hierarchy of the network in terms of pattern of reciprocal ties and variance of unordered paths. More hierarchical the network is, more centralized the distribution of power is. In a hierarchical network, the connective relationships rely more on dense interaction within the same cluster instead of broader bonding across different clusters.

**Krackhardt GTD (for directed data)**

1. **Connectedness**

   In pure hierarchy, every member of the network is connected to someone else in the network that all of them are connected into a single component. The measure of connectedness is to count the ratio of the number of pairs that are reachable to the number of ordered pairs in the directed network. Therefore, the connectedness score is 1 in a pure hierarchical network (Hanneman & Riddle, 2005). In directed Twitter data (*cf.*, Table 1-2), the score of connectedness
is .115 in Hong Kong, .044 in Taiwan, and .715 in Singapore. Obviously, civic network in Singapore is more hierarchical than in Hong Kong and Taiwan due to its star-like structure. The civic network is least hierarchical in Hong Kong.

2. Hierarchy

In pure hierarchy, there is no any reciprocal tie that the relations between give pairs imply unequal status. The measure of hierarchy is to count the ratio of the number of pairs with reciprocal ties to the number of pairs without any tie (Hanneman & Riddle, 2005). Therefore, the hierarchy score is 1 in a pure hierarchical network. In directed Twitter data (cf., Table 1-2), the score of hierarchy is .987 in Hong Kong, .988 in Taiwan, and 1.0 in Singapore. The measure of hierarchy does not necessarily show the similar traits as the measure of connectedness. Even though the value of hierarchy is still the highest in Singapore, followed by Taiwan and Hong Kong, the gap among the three states is not quite salient. In other words, in these three quasi-democratic regimes, the deviation from pure hierarchy is limited and each network is not a totally decentralized structure but reflects somewhat degree of hierarchy.

Clustering coefficient

Compared with the measures of connectedness and hierarchy focusing on the features of ties, the measure of clustering coefficient focuses on the features of vertices. The clustering coefficient is the degree to which vertices in a given network tend to cluster together and create tight interconnections. If the clustering coefficient is higher, most vertices can be clustered as diverse subgroups. In other words, the measure of clustering coefficient indicates that pure hierarchy has lower clustering coefficient. The vertices in a hierarchical network are difficult to cluster and belong to one big component.

In directed Twitter data (cf., Table 1-2), the score of clustering coefficient is .049 in Hong
Kong, .012 in Taiwan, and .007 in Singapore. The result is consistent with Krackhardt GTD analysis that vertices in Hong Kong network have higher probability to connect to their neighbors with similar status. In contrast, vertices in Singapore are more likely to be connected to one singular component. In undirected Twitter data (cf., Table 2-2), the score of clustering coefficient is .048 in Hong Kong, .018 in Taiwan, and 0 in Singapore. The pattern is similar to directed Twitter data that vertices in Hong Kong are more likely to be interconnected and belong to multiple components.

In undirected Facebook data (cf., Table 3-2), the score of clustering coefficient is .931 in Hong Kong, .970 in Taiwan, .940 in the first Singapore network (TRS), and .958 in the second Singapore network (TOC). The scores are all quite high these three states that the vertices in four Facebook networks are more likely to cluster than three Twitter networks. In general, four Facebook networks are less hierarchical than three Twitter networks due to relatively higher density of ties (the number of unique edges in Facebook data is far larger than Twitter data). In terms of hierarchy order among the three states, the patterns of connectedness and hierarchy within these four Facebook networks are consistent with those within three Twitter networks. However, the pattern of clustering coefficient is not. According to abovementioned analyses of hierarchy, the networks in Hong Kong and Taiwan are less hierarchical, while the network in Singapore usually refers to a hierarchical structure due to a single component, limited reciprocal ties, and less clustering. However, clustering coefficient analysis in Facebook data shows that the network of Taiwan is least hierarchical, while the network of Hong Kong is most hierarchical.

There are two possible reasons for this inconsistent finding. One is that there are three isolated vertices which do not belong to any clusters in Hong Kong network (cf., V1, V2, V3 in Figure 3-5). These three isolated vertices will lower the value of clustering coefficient. The other is that the number of vertices in the first Singapore network (TRS) is far larger than other three
Facebook networks. As the measure of *clustering coefficient* focuses on the features of vertices, a large number of vertices may lead to multiplex bonding of clustering. In this sense, the score of clustering coefficient in TRS network may increase a little bit, while the score in Hong Kong network may decrease.

**Betweenness variance** (for undirected data)

Betweenness variance regarding one’s position, unique information path, or connection with others can show the level of interaction and hierarchical nature of a given network. More hierarchical networks usually demonstrate more variance among vertices. In directed Twitter data (*cf.*, Table 1-2), betweenness variance is around 1,200,929 in Hong Kong, 66,174 in Taiwan, and 69,440,164 in Singapore. In undirected Twitter data (*cf.*, Table 2-2), betweenness variance is around 300,232 in Hong Kong, 16,544 in Taiwan, and 17,360,362 in Singapore. In undirected Facebook data (*cf.*, Table 3-2), betweenness variance is 32,670 in Hong Kong, 41,752 in Taiwan, 683,7067 in the first Singapore network (TRS), and 95,935 in the second Singapore network (TOC). Twitter data indicate that betweenness variance is the highest in Singapore, followed by Hong Kong and Taiwan. Facebook data also show that betweenness variance is the highest in the first Singapore network (TRS), followed by the second Singapore network (TOC), Taiwan, and Hong Kong. From both Twitter and Facebook data, the network in Singapore is toward a hierarchical one because the variance between individuals’ position, the path of getting information, or distance connecting with others are quite large in Singapore.

After reviewing the analyses of Krackhardt GTD, clustering coefficient, and betweenness variance as a whole, the vertex status in Singapore is unequal and the information flow is more likely to rely on the vertex at the center. In addition, as hierarchical nesting usually comes with less cohesive structure, cohesion analysis can also indicate hierarchy of a network (Debry, 2001;
Cohesion of subgroup analysis can also indicate hierarchy of each civic network. The result shows that the network in Singapore is less cohesive than Hong Kong and Taiwan. In other words, Singapore network is still more hierarchical than the other two states.
Figure 1-1. Fruchterma-Rheingold layout algorithm from three directed Twitter civic networks
Figure 1-2. Clauset-Newman-Moore cluster algorithm of subgroups from three directed Twitter civic networks: nodes are sized by betweenness centrality.
Figure 1-3. Clauset-Newman-Moore cluster algorithm of subgroups from three directed Twitter civic networks: nodes are sized by closeness centrality.
Figure 1-4. The ties of actor with highest betweenness centrality from Twitter civic networks.
Table 1-1. Summary of centrality from three directed Twitter civic networks

<table>
<thead>
<tr>
<th></th>
<th>Hong Kong</th>
<th>Taiwan</th>
<th>Singapore</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertices</td>
<td>471</td>
<td>327</td>
<td>517</td>
</tr>
<tr>
<td>Unique Edges</td>
<td>470</td>
<td>296</td>
<td>499</td>
</tr>
<tr>
<td>Normalized Betweenness Centrality</td>
<td>.011</td>
<td>.007</td>
<td>.002</td>
</tr>
<tr>
<td>Normalized Closeness Centrality</td>
<td>.088</td>
<td>.084</td>
<td>.064</td>
</tr>
</tbody>
</table>

Table 1-2. Summary of subgroups from three directed Twitter civic networks

<table>
<thead>
<tr>
<th></th>
<th>Hong Kong</th>
<th>Taiwan</th>
<th>Singapore</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modularity</td>
<td>.625</td>
<td>.492</td>
<td>.223</td>
</tr>
<tr>
<td>Cohesion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Component ratio</td>
<td>.991</td>
<td>.994</td>
<td>1</td>
</tr>
<tr>
<td>Fragmentation</td>
<td>.998</td>
<td>.998</td>
<td>.998</td>
</tr>
<tr>
<td>Hierarchy</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Krackhardt GTD</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Connectedness</td>
<td>.115</td>
<td>.044</td>
<td>.715</td>
</tr>
<tr>
<td>Hierarchy</td>
<td>.987</td>
<td>.988</td>
<td>1.0</td>
</tr>
<tr>
<td>Betweenness Variance</td>
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<td>66,174.115</td>
<td>69,440,163.746</td>
</tr>
<tr>
<td>Clustering Coefficient</td>
<td>.049</td>
<td>.012</td>
<td>.007</td>
</tr>
</tbody>
</table>
Table 2-1. Summary of centrality from three undirected Twitter civic networks

<table>
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<td>499</td>
</tr>
<tr>
<td>Normalized</td>
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<td>.007</td>
<td>.002</td>
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<tr>
<td>Betweenness Centrality</td>
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<td></td>
</tr>
<tr>
<td>Normalized</td>
<td>.088</td>
<td>.084</td>
<td>.064</td>
</tr>
<tr>
<td>Closeness Centrality</td>
<td></td>
<td></td>
<td></td>
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Table 2-2. Summary of subgroups from three undirected Twitter civic networks

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</tr>
<tr>
<td>Cohesion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Component ratio</td>
<td>.515</td>
<td>.696</td>
<td>.093</td>
</tr>
<tr>
<td>Fragmentation</td>
<td>.886</td>
<td>.956</td>
<td>.285</td>
</tr>
<tr>
<td>Hierarchy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Betweenness</td>
<td>300,232.202</td>
<td>16,543.529</td>
<td>17,360,361.705</td>
</tr>
<tr>
<td>Variance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clustering</td>
<td>.092</td>
<td>.016</td>
<td>.015</td>
</tr>
<tr>
<td>Coefficient</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Figure 2-1. Centrality and Hierarchy analysis from three undirected Twitter civic networks
Figure 3-1. Fruchterma-Rheingold layout algorithm from three undirected Facebook civic networks: nodes are sized by betweenness centrality, nodes are shaped by gender\textsuperscript{15} (solid square is male, and sphere is female)

\textsuperscript{15} The nodes in first Singapore network (i.e., labeled as c1) are unable to shape by gender due to oversize data.
Figure 3-2. Clauset-Newman-Moore cluster algorithm of subgroups in three undirected Facebook civic networks: nodes are sized by betweenness centrality, nodes are shaped by gender (solid square is male, and sphere is female)
Figure 3-3. Clauset-Newman-Moore cluster algorithm of subgroups from four directed Facebook civic networks: nodes are sized by closeness centrality.
Figure 3-4. The ties of actor with highest betweenness centrality from Facebook civic networks.
Hong Kong

**Figure 3-5.** The three isolated vertices and their ties in undirected Facebook network of Hong Kong
Table 3-1. Summary of centrality from three undirected Facebook civic networks

<table>
<thead>
<tr>
<th></th>
<th>Hong Kong</th>
<th>Taiwan</th>
<th>Singapore1</th>
<th>Singapore2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertices</td>
<td>259</td>
<td>141</td>
<td>1,146</td>
<td>292</td>
</tr>
<tr>
<td>Unique Edges</td>
<td>15,234</td>
<td>3,690</td>
<td>322,360</td>
<td>16,270</td>
</tr>
<tr>
<td>Gender ratio</td>
<td>54:46</td>
<td>55:45</td>
<td>78:22</td>
<td>84:16</td>
</tr>
<tr>
<td>Normalized</td>
<td>.067</td>
<td>.033</td>
<td>.042</td>
<td>.030</td>
</tr>
<tr>
<td>Betweenness Centrality</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normalized</td>
<td>.003</td>
<td>.004</td>
<td>.001</td>
<td>.002</td>
</tr>
<tr>
<td>Closeness Centrality</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3-2. Summary of subgroups from three undirected Facebook civic networks

<table>
<thead>
<tr>
<th></th>
<th>Hong Kong</th>
<th>Taiwan</th>
<th>Singapore1</th>
<th>Singapore2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modularity</td>
<td>.358</td>
<td>.525</td>
<td>.218</td>
<td>.291</td>
</tr>
<tr>
<td>Cohesion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Component ratio</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Fragmentation</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hierarchy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Betweenness</td>
<td>32,670.276</td>
<td>41,752.457</td>
<td>683,706.575</td>
<td>95,935.069</td>
</tr>
<tr>
<td>Clustering</td>
<td>.931</td>
<td>.970</td>
<td>.940</td>
<td>.958</td>
</tr>
<tr>
<td>Coefficient</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 3-6. Centrality and Hierarchy analysis from three undirected Facebook civic networks
Chapter 5
Discussion

Civic networks on Twitter and Facebook can be identified as the connective relationships between specific subgroups and individual participants, and act on behalf of the offline interests and behaviors in social movements. This study conducted centrality analysis to understand what kind of individuals can contribute to civic network. The actor with higher centrality usually has greater influence on the connective relationships to facilitate the social movement. Besides, this study conducted subgroup analysis to understand the pattern of clustering in terms of the dense and cohesive degree within and between different subgroups in a given movement. The heterogeneous clustering in a given network refers to salient strength of division and less-cohesive clusters. In addition, this study conducted hierarchy analysis to understand if the pattern of network in a given movement is toward decentralized structure or toward hierarchical one. The decentralized structure refers to horizontal linkages across different bonding of clusters, while the hierarchical structure usually has ordered path to strengthen the dense interaction within self-clusters. This study took centrality, subgroup, and hierarchy analyses into account to explore the pattern of civic networks in E-Democracy.

First, according to the finding from centrality analysis, the measures of betweenness centrality and closeness centrality can capture how the features of brokering and transmitting contribute to the scale of civic networks. The actors usually have higher normalized betweenness and closeness centrality in Hong Kong, followed by Taiwan and Singapore. The activists and participants in the movement of Umbrella Revolution can develop the bridging role well to connect different institutions with scattered individuals. Most of them are also more independent in civic network to get information effectively due to shorter distance connecting to others. In Taiwan, the actors participating in Sunflower movement can develop brokerage characteristic to
exploit information flow among multiple units. The closer relationships also benefit actors to communicate with one another without relying on intermediaries too much. Relatively, the participants in The Return Our CPF movement have weakness to connect different groups of actors, and the absence of bridging role makes scattered individuals or distant groups more isolated. The participants in Singapore are dependent more on one or a few central individual or institution.

In this sense, the actors in Singapore have limited chance to strengthen the scale of social movement, while the actors in Hong Kong and Taiwan are capable of enlarging the connections by a large number of bridging roles. The previous experiences in social movements and accumulated resources may lead to a greater number of bridging roles in Hong Kong and Taiwan. However, in these three social movements, the gap of closeness centrality is smaller than the gap of betweenness centrality for both Twitter and Facebook networks. In other words, compared to closeness centrality, the bridging role in betweenness centrality contributes to these three social movements further. Besides, the individuals’ closeness centrality in Twitter networks is larger than in Facebook networks, while the individuals’ betweenness centrality in Twitter networks is smaller than in Facebook networks. Facebook and Twitter provides different functions for centrality that the connective relationships on Facebook strengthen participants’ bridging characteristic, while Twitter can reinforce individuals’ independence to get information through short paths.

Interestingly, the selected top 14 actors\textsuperscript{16} ranked in descending order of betweenness centrality in Figure 1-6, the gap of betweenness centrality between Hong Kong and Taiwan is not salient beyond the 20th actor. While comparing three states, the gap is not salient beyond the 14th actor. In order to better examine which actor has relatively high betweenness and closeness centrality, the study lists top 14 actors’ centrality to analyze their features in Table 1-3. Appendix B also lists Top 14 actors ranked in similar order of centrality from Facebook data in Table 3-3.

\textsuperscript{16} The selection criteria is indicated in Appendix A. Appendix A shows Top 14 actors ranked in descending order of betweenness centrality and closeness centrality from Twitter data. Based on the ranked distribution for betweenness centrality in Figure 1-6, the gap of betweenness centrality between Hong Kong and Taiwan is not salient beyond the 20th actor. While comparing three states, the gap is not salient beyond the 14th actor. In order to better examine which actor has relatively high betweenness and closeness centrality, the study lists top 14 actors’ centrality to analyze their features in Table 1-3. Appendix B also lists Top 14 actors ranked in similar order of centrality from Facebook data in Table 3-3.
centrality and closeness centrality in the three states can be categorized as four types: 1) journalists or reporters; 2) institutions with specific political stances; 3) online communities sharing critiques of modern and absurd news; 4) general citizen who self-identify as activists/cultural specialists, researchers, or foreigners. As social media can transfer online connections to offline behaviors, these online characteristics can somewhat resemble offline relationships in civil society. First, journalists or reporters usually have specific connections to get and transmit information effectively. The independent media plays an important role in social movement to expose underlying themes against mainstream news or state-controlled media. Second, institutions with specific political stances usually play a role opposite to ruling party such as either an apolitical disagreement or political conflict. They may take opportunities offered from social movement to reframe the discourse for next election or for transaction of party politics. Third, online communities sharing critiques of modern and absurd news can be identified as political participation in less direct form of civic engagement. They are citizens seeking out information and making good use of journalists and political institutions to construct political climate to facilitate the scale of social movement. Most of them are grassroots communities, such as student-led organizations, senior bloggers, political commentators, and specific communities advocating diverse goals (e.g., gender equity, environmental protection, judicial reform). Fourth, general citizens who self-identify as activists/cultural specialists, researchers, or foreigners might be ordinary citizens without direct connections with journalists or political institutions, yet they can be connected with one another via the bridging roles in a given civic network, especially in Hong Kong and Taiwan. A civic network is composed of these four categories of people that contribute to the scale of social movement. The participants do not necessarily share similar partisan attitudes or advocate similar goals, but can initiate the movement based on direct or indirect connection.
Second, according to the finding from subgroup analysis, Clauset-Newman-Moore cluster algorithm, modularity, and cohesion analyses can capture how the features of division and cohesion affect the pattern of subgroups in a given network. The civic networks in Singapore show broadcast network or polarized crowds due to more cohesive but limited clusters. Most participants can cluster into one or two large subgroups without direct connection with each other. They rely on inbound direction to the actors in the center, and only few of them are unconnected isolates. The social organizations behind the subgroups in Singapore civic networks include two main units. One is grassroots community of bloggers, and the other is a small group of ordinary citizens who usually self-identify as activists. The highly state-controlled media in Singapore lead to a group of socio-political bloggers provoking diverse voices against state-controlled journalists or reporters. The space for opposition parties is relatively small in Singapore regime with one big party, so there is no any organization with blatant label of opposition parties. The actors in the center of polarized network are usually the citizens who dare to challenge the authority of centralized government. According to public information from Twitter and Facebook data, they usually self-identify as activists who post political news or write comments frequently. The majority of participants in Singapore network are passive followers.

Compared with star-like network in Singapore, civic networks in Hong Kong and Taiwan are composed of diverse and tight clusters. There are heterogeneous and small subgroups with medium or few connections in Hong Kong and Taiwan, but they share tight interconnectivity between clusters. The social organizations behind the subgroups in Hong Kong and Taiwan civic networks are much more diverse than those in Singapore due to longer history of democratization and two-party politics. These institutions with specific political aims opposite to ruling party’s stance or current policies usually have interconnections with one another to facilitate the scale of social movement and to help them expand political space for advocating
new agenda or preparing for next election. Besides, online communities sharing critiques of modern and absurd news against mainstream media are composed of ordinary citizens with different careers and experiences. They contribute their knowledge to supervise specific policies related to their profession, such as medical care, environmental protection, educational reform, judiciary, same-sex marriage, gender equity, and animal protection. They may not have the same political stance, but may advocate similar policies. Furthermore, some salient groups in Hong Kong and Taiwan networks are student organizations ranging from middle school age to college students. One reason is that even though the rooted Chinese culture potentially discourages young generation from opposition, social media strengthen peer effect through horizontal linkages across multiple student organizations. The other reason is that in view of China’s nationalism and recent pro-unification policies, reform of civic education advocating patriotism and Chinese ethnicity led to a series of protests launched by student organizations and rallying a strong sense of local identity and language, such as Hong Konger with Cantonese language, Taiwanese with Hokkien language.

In this sense, the Umbrella Revolution in Hong Kong and the Sunflower movement in Taiwan were more likely to be organized by sparse relations across multiple forms of clusters. Even though the subgroups are loosely coupled and less cohesive, this pattern of subgroups gives rise to a considerable amount of intense exchange within each cluster to make social movement sustainable. If some subgroups withdraw from movement, there are still other units capable of adapting to unexpected disruption or exogenous pressure, such as police repression, scathing criticism, conservative attitude, or emotional irrationality. In contrast, the Return Our CPF movement in Singapore was initiated by few core actors. This pattern of subgroups results in hierarchical structure symbolized as power control and network cohesiveness. Most participants join in dependently and rely on centralized connection that has potential to launch a large-scale
movement. Once these few core actors withdraw from network, the whole structure will collapse immediately. In a nutshell, the multiplex bonding of clustering makes peripheral actors and sparse units bound together, even in the absence of direct relations between individuals. This may explain why the scale and duration of offline movements in Hong Kong and Taiwan are larger and longer than in Singapore, even if the numbers of vertices and unique edges in online Singapore networks are larger than in Hong Kong and Taiwan.

The different features of social media will affect cohesion of subgroups. The measure of cohesion (component ratio and fragmentation) can detect the difference among three Twitter networks, while it cannot among four Facebook networks. The reason is that the connections within Twitter network have direction between follower and someone being followed. The relationships of “mentions”, “tweet”, and “replies to” are not mutual ties. Relatively, the connections within Facebook network are reciprocal between pairs of common friends. A participant joining in Facebook community is identified as a member without direction, while one joining in Twitter community is identified as follower with direction. In this sense, Twitter network is more likely to cluster by different directions, while Facebook network is more likely to be identified as one big component by reciprocal pairs of users. Even though there is equivalent number of actors, the number of unique edges in Facebook network is larger than Twitter network. Different features of social media will lead to different patterns of subgroups.

Third, according to the finding from hierarchy analysis, the measures of Krackhardt GTD (connectedness and hierarchy), clustering coefficient, and betweenness variance can capture the features of hierarchy to see if the affiliation of multiple units is toward hierarchical structure or horizontal solidarity. The civic network in Singapore is more likely to be hierarchical because only few actors can stay at bridging position to control considerable information flow and mobilize others effectively. In contrast, the civic networks in Hong Kong and Taiwan are toward
horizontal solidarity that dense interconnections between multiple clusters make more individuals have higher centrality. The information flow does not rely on few actors, but on a group of people with relatively equal status.

In this sense, horizontal linkages in online network can facilitate movement toward broader offline involvement in the real world, and participants may have heterogeneous characters in a given movement. A hierarchical civic network is more exclusive to diverse clusters that most participants are associated with homogeneous clusters in social movement. The difference in hierarchy of civic network may explain why there is a gap between online actors and offline protesters in the three states. The offline size of Umbrella Revolution and Sunflower movement is around 100,000 protesters and 500,000 protesters respectively, while their size in Facebook networks is around 300 actors. Relatively, the size of the Return Our CPF is up to 6,000 protesters, while its size in Facebook network is 1,146 actors. The hierarchical online network in Singapore can mobilize participants effectively, yet the scale of offline movement may not always resemble the scale of online network. The differences in subgroups’ division and cohesion between centralized and decentralized network can bring implication to the differences in online network and offline social movement between the two different networks.

Although the measures of connectedness, betweenness variance and clustering coefficient show that Singapore network is the most hierarchical one, the measure of hierarchy does not show a salient difference in Singapore from the other two states. The civic networks in Hong Kong, Taiwan, and Singapore can still be identified as a hierarchical structure at large. The possible reason is that these three states are actually categorized as quasi-democratic regime with flawed democracy based on The Democracy Index of the Economist Intelligence Unit in 2015. Although there are free elections and basic civil liberties in quasi-democratic regimes, the governments may infringe on media freedom and censor opposition tightly. The rooted culture of
Confucian meritocracy and filial piety potentially makes these three Asian states depart from liberal democracy. The permeation of Confucian meritocracy highlights merits’ prestige and power but usually accompanies cronyism and corruption. Filial piety imposes a heavy responsibility on parents, while parents’ responsibilities press heavily down on children that the youth may face conflicts between self-autonomy and adults’ domination. The rooted culture potentially discourages young generation from opposition, and the youth become compliant to adults or obedient to merits in these three Asian societies. In this sense, young activists or protesters are more likely to be in a small and homogeneous group with like-minded people staying at bridging position to organize network with hierarchical ties.

Finally, this study takes centrality, subgroup, and hierarchy analyses as a whole to explore the pattern of civic network in comprehensive ways. Civic network in Hong Kong includes a group of actors with high centrality and multiplex clusters with dense interconnection. These features can facilitate horizontal linkages across different units and peripheral individuals in social movement. Civic network in Taiwan has similar traits to Hong Kong that participants can be in different components or smaller fragments. This pattern is more likely to be a decentralized structure that the gap between individuals’ authority is smaller. Compared with networks in Hong Kong and Taiwan, only few actors can play a bridging role in Singapore that most participants rely on few leaders and belong to homogenous components.

Different patterns of civic networks in these three states reflect the complex interplay between forms of democratic regimes, specific contexts of culture and history, and application of social media. The distributed authority and diverse subgroups in Hong Kong and Taiwan do not appear suddenly but are related to democratic history and accumulated experiences in social movements. Hong Kong experienced democratic rule for almost fifty years under the colonial regime of the British, and Taiwan has experienced a series of democratic reforms for almost
thirty years from getting rid of party-state system to improving civil liberties and political participation. Both civil societies have already had multiple communities with equal status to involve in civic engagement. People in Hong Kong and Taiwan are now sensitive to detect potential threats from authoritarian governance, and the conflicts between flawed democracy and liberal democracy emerged from a series of social movements. Social media facilitate existed connections between grassroots communities further to strengthen horizontal linkages across multiple communities. In Singapore, the meritocratic government has combined regulation with patriarchal management for almost fifty years. The hierarchical structure of state-owned investment and government-linked corporations represents an efficient pipeline of government decision-making and economic stability, yet a huge state-controlled structure may infringe on the freedom of media and the right of political participation. Both recent movements of FreeMyInternet and Return Our CPF were against government without transparency and accountability. Similarly, civic networks reflect a hierarchical structure with few core actors and homogeneous clusters. The population of activists and protesters in Singapore is relatively small due to social pressure and potential threats from government. Even though people have dissatisfaction with government, they are unaccustomed to join in offline movement but flock to website to support opposition indirectly. In this sense, the “minority” of actors becomes the central leader in civic network, and the size of online network is usually larger than the size of offline movement in Singapore.

In view of current orientation of civic education potentially discouraging young generation from opposition, the students are more likely to be compliant to adults or obedient to merits in these three Asian societies. Even though the youth are willing to engage in social movements as online actors, the patterns of civic network still reflect the sense of compliance and obedience detraacting from offline behaviors due to social pressure and potential threats from government.
However, the patterns of civic network indicate that student organizations are active and capable of responding to social problems through multiple online connections. Applying social media to civic education is necessary to make students communicate with one another more easily and have opportunity to cooperate with government or other civic institutions in practice.
Chapter 6
Conclusion

The series of social movements in recent years can be attributed to the wave of E-Democracy where social media broaden people’s political space and produce participation in public affairs. The wave of E-Democracy makes social movements learn from each other and bring innovative tactics to different forms of regimes. Different forms of regimes have different possibilities of democracy and cause specific contexts of social movements based on the complex interplay between cultural, historical, social and economic factors. Three Asian quasi-democratic regimes of Hong Kong, Taiwan, and Singapore not only share similar culture which makes regime potentially depart from liberal democracy, but also face specific challenge and political conditionality which kindle a series of social movements to contest pan-authoritarian governances. Three salient social movements of Umbrella Revolution in Hong Kong, Sunflower movement in Taiwan, and The Return Our CPF movement in Singapore took advantage of social media to provide online space for different institutions and individuals to share commutative consciousness. Social media can not only facilitate the flow of information and the connective relationships, but also transfer online connections to offline behaviors through online networks. Civic network analysis can provide comprehensive view to explore dynamic interactions between individuals and institutions in social movement. It can not only describe how citizens involve in public affairs through different connections, but also capture how centralized/decentralized or hierarchical/horizontal regimes affect centrality of individuals and cohesion of institutions in social movement. Three different patterns of civic network in Hong Kong, Taiwan and Singapore respectively can give us the insight of the complex interplay between quasi-democratic regimes and social movements.

This study took centrality, subgroup, and hierarchy analyses as a whole to explore the
pattern of civic network in comprehensive ways. The findings show that civic network in Hong Kong includes a group of actors with high centrality and multiplex clusters with dense interconnection that one can communicate with another without relying on intermediaries too much. Civic network in Taiwan has similar traits to Hong Kong that participants can be in different components or small fragments where one can get information effectively due to shorter distance. These two patterns are more likely to be decentralized structure where the gap between individuals’ authority is smaller and horizontal linkages across different bonding of clusters make individuals more independent. Relatively, only few actors in Singapore can play a bridging role that activists or protesters are a small group of like-minded citizens who are affiliated to homogenous clusters. Most participants rely on these few leaders, and limited bridging role makes scattered individuals or distant groups more isolated. The pattern of civic network in Singapore is toward hierarchical structure where ordered paths strengthen interaction only within self-clusters. In general, heterogeneous clustering in a decentralized network refers to salient strength of division and less cohesive clusters. Multiplex bonding of clustering in Hong Kong and Taiwan makes peripheral actors and sparse units bound together to make social movement sustainable. In contrast, homogeneous clustering in a hierarchical network symbolizes power control and network cohesiveness that is exclusive of diverse clusters. The centralized connections with homogeneous clusters in Singapore have potential to launch a large-scale movement, but are incapable of adapting to unexpected disruption or exogenous pressure.

Except the differences in centrality, subgroup and hierarchy analyses among these three states, there are four main similarities. First of all, the gap of betweenness centrality is larger than the gap of closeness centrality in these three social movements. The bridging role of betweenness centrality is important to contribute to the scale of movement. Secondly, different features of social media will affect individuals’ centrality as well as subgroups’ cohesion. Individuals’
betweenness centrality in Twitter networks is smaller than in Facebook networks, while individuals’ closeness centrality in Twitter networks is larger than in Facebook networks. Facebook and Twitter provide different functions for centrality that connective relationships on Facebook strengthen participants’ bridging characteristic, while Twitter can reinforce individuals’ independence to get information through short paths. Besides, compared with Twitter networks, the measure of cohesion is difficult to detect the difference between Facebook networks. As the number of actors and ties in Facebook networks is far larger than Twitter networks, the actors can reach each other through multiple paths, making Facebook networks more like a big cohesive component. The third similarity is that as these three states are all identified as quasi-democratic regimes, governments potentially discourage citizens from any kind of opposition and people are more sensitive to social movement. This context may explain why the measure of hierarchy indicates that all three networks are hierarchical structure at large, even though the other measures (connectedness, betweenness variance, clustering coefficient) indicate that Singapore network is the most hierarchical one. As being a member of political opposition is really tough in authoritarian country (Dobson, 2012), activists or protesters are relatively a small group of like-minded citizens whose rallies and supporters may live under intimidation or surveillance in quasi-democratic regimes. Therefore, the three civic networks are still affiliated to relatively homogenous clusters instead of truly diverse clustering. The fourth similarity is that actors with higher centrality can be categorized as media community, institutions with specific political stances, multiple forms of grassroots communities, and general citizens. These four components contribute to social movements through civic networks. The participants do not necessarily share similar partisan attitudes or advocate similar goals, but can initiate the movement based on direct or indirect connections.

In addition, the patterns of civic network in these three states not only give us the insight of
complex interplay between quasi-democratic regimes and social movements, but also bring implication to civic education, especially in the wave of E-Democracy today. The youth are considerably active in social movements that student organizations learn to respond to social problems or structural critique through online connections. However, current civic education in these Asian states is more likely to devalue disputation or opposition while highlighting social order and test-driven accountability. The quasi-democratic regimes in Hong Kong, Taiwan and Singapore usually take economic stability and social harmony as the principles to simplify social problems and to oppose democratization. Besides, efficient teaching is usually identified as high testing scores while the importance of civic education becomes more rhetorical than substantive. Most activity designs in civic curriculum focus on drilling declarative knowledge rather than discussing the causes of social problems or encouraging students to participate in real activities. This way makes civic education more rhetorical than substantive. An immediate reform of civic education is necessary for students to understand that their voices matter and to involve in decision making and reform processes. The youth can learn how to involve in context-specific setting and cooperate with adults. As a result, young generation will be capable of making commitments to serve community and participate in political affairs. Service learning, student voice initiatives and community building are suggested to become orientation of civic education in these three states.

Civic curriculum in service learning approach provides a powerful opportunity for students to understand the democratic purpose of education and social justice issues. Service learning engages students in community service and democratic politics to meet community needs through academic curriculum and real experience (Battistoni, 2014; Britt, 2012; Bringle & Hatcher, 2009; Camino & Zeldin, 2002; Jerome, 2011). In practice, service learning can be characterized by diverse pedagogical approaches for different local communities with different
societal values. In addition, student voice initiatives encourage students to involve in decision making and reform processes to learn democratic principles and shape their lives. Consequently, students are identified as a creator of meaning considering school problems as well as a facilitator of school reform providing possible solutions (Mitra & Gross, 2009; Mitra et al., 2012; Toshalis & Nakkula, 2012). Student voice can be reserved in service learning programs or formal curricular processes within schools to not only improve students’ self-consciousness of decision making, tolerance toward others, and increase in civic engagement, but also bring positive impact on adult attitudes to youth and community well-being (Mitra et al., 2012; Serriere et al., 2011; Toshalis & Nakkula, 2012). Furthermore, civic curriculum in community building approach can not only facilitate youth-adult partnerships to create and strengthen pathways for youth civic engagement, but also empower the whole community to democratically decide more issues that affect their lives. Collaboration between youth and adults allows students to assume leadership to make a difference, and autonomy enables students to have a stronger sense of self-worth to make schools more productive (Mitra, 2005; Mitra et al., 2012; Sears et al., 2014; Toshalis & Nakkula, 2012). The components of curricular design can also in return benefit youth-adult partnerships and community building. Community-level or bottom-up programs relevant to one’s life experiences and integrated in context-specific setting and collaboration can promote students’ active participation instead of being a passive learner without voice (Checkoway, 2011; Mitra et al., 2014; Ozer et al., 2013). Effective civic education can exercise the synthesis of knowledge, skill and commitment to facilitate civic engagement through critical thinking, inquiry and real actions.

There are several limitations in this study. First, this study examines the most representative Twitter and Facebook networks in each social movement, but these networks may not capture all characteristics of participants in social movements considering broad participants in real social
movements. In order to provide a better understanding of online network pattern, two and more civic networks for each social movement from Twitter and Facebook should be included in this study. In this way, the analysis would be less susceptible to time effect and selection bias. Second, according to the privacy policy of Twitter and Facebook, the collected data do not include details of personal information but only names of personal accounts. The collected data are not available to explore the relationships between individuals’ demographic characteristics and the pattern of civic networks further. Third, this study conducts social movement analysis to explore the whole pattern of civic network at large, but does not conduct content analysis to understand participants’ attitudes and ideologies behind comments, posts, or reply on Twitter and Facebook. Future research may combine social network analysis with content analysis to identify the pattern of civic network further.

In conclusion, actors with high centrality are weak ties to connect multiplex bonding of subgroups, and multiple fragments of subgroups with less cohesion might not be a negative feature but imply decentralized network with relatively equal status and authority sharing in a given social movement. The patterns of civic network bring insight into the complex interplay between quasi-democratic regimes and social movements.
Appendix A

Top 14 actors of three civic networks from directed Twitter data

Table A. Top 14 actors of three civic networks ranked in descending order of betweenness centrality and closeness centrality from directed Twitter data

<table>
<thead>
<tr>
<th>Top 14</th>
<th>Hong Kong</th>
<th>Taiwan</th>
<th>Singapore</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Betweenness centrality</td>
<td>Closeness centrality</td>
<td>Betweenness centrality</td>
</tr>
<tr>
<td>1</td>
<td>13950.395</td>
<td>0.002</td>
<td>4216.000</td>
</tr>
<tr>
<td>2</td>
<td>10520.000</td>
<td>0.002</td>
<td>958.000</td>
</tr>
<tr>
<td>3</td>
<td>10232.514</td>
<td>0.002</td>
<td>944.000</td>
</tr>
<tr>
<td>4</td>
<td>8252.710</td>
<td>0.002</td>
<td>868.000</td>
</tr>
<tr>
<td>5</td>
<td>6008.505</td>
<td>0.002</td>
<td>762.000</td>
</tr>
<tr>
<td>6</td>
<td>5735.848</td>
<td>0.002</td>
<td>638.000</td>
</tr>
<tr>
<td>7</td>
<td>3137.367</td>
<td>0.002</td>
<td>516.000</td>
</tr>
<tr>
<td>8</td>
<td>2293.786</td>
<td>0.002</td>
<td>388.000</td>
</tr>
<tr>
<td>9</td>
<td>2155.457</td>
<td>0.002</td>
<td>388.000</td>
</tr>
<tr>
<td>10</td>
<td>1768.533</td>
<td>0.002</td>
<td>132.000</td>
</tr>
<tr>
<td>11</td>
<td>1688.333</td>
<td>0.002</td>
<td>132.000</td>
</tr>
<tr>
<td>12</td>
<td>1267.000</td>
<td>0.002</td>
<td>132.000</td>
</tr>
<tr>
<td>13</td>
<td>801.667</td>
<td>0.002</td>
<td>132.000</td>
</tr>
<tr>
<td>14</td>
<td>702.000</td>
<td>0.037</td>
<td>29.000</td>
</tr>
</tbody>
</table>

Figure A. Distribution of Top 24 and Top 14 actors ranked by betweenness centrality from directed Twitter data
# Appendix B

Top 14 actors of three civic networks from undirected Facebook data

Table B. Top 14 actors of three civic networks ranked in descending order of betweenness centrality (B.C.) and closeness centrality (C.C.) from undirected Facebook data

<table>
<thead>
<tr>
<th>Top 14</th>
<th>Hong Kong</th>
<th>Taiwan</th>
<th>Singapore1</th>
<th>Singapore2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B.C.</td>
<td>C.C.</td>
<td>B.C.</td>
<td>C.C.</td>
</tr>
<tr>
<td>1</td>
<td>1025.137</td>
<td>0.004</td>
<td>1316.393</td>
<td>0.007</td>
</tr>
<tr>
<td>2</td>
<td>847.670</td>
<td>0.004</td>
<td>1316.393</td>
<td>0.007</td>
</tr>
<tr>
<td>3</td>
<td>847.670</td>
<td>0.004</td>
<td>1316.393</td>
<td>0.007</td>
</tr>
<tr>
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<td>0.004</td>
<td>536.250</td>
<td>0.005</td>
</tr>
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<td>0.004</td>
<td>408.143</td>
<td>0.005</td>
</tr>
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<td>0.004</td>
<td>408.143</td>
<td>0.005</td>
</tr>
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<td>847.670</td>
<td>0.004</td>
<td>408.143</td>
<td>0.005</td>
</tr>
<tr>
<td>8</td>
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<td>408.143</td>
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</tr>
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<td>0.000</td>
<td>0.004</td>
</tr>
<tr>
<td>10</td>
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<td>0.003</td>
<td>0.000</td>
<td>0.004</td>
</tr>
<tr>
<td>11</td>
<td>439.506</td>
<td>0.003</td>
<td>0.000</td>
<td>0.004</td>
</tr>
<tr>
<td>12</td>
<td>439.506</td>
<td>0.003</td>
<td>0.000</td>
<td>0.004</td>
</tr>
<tr>
<td>13</td>
<td>439.506</td>
<td>0.003</td>
<td>0.000</td>
<td>0.004</td>
</tr>
<tr>
<td>14</td>
<td>439.506</td>
<td>0.003</td>
<td>0.000</td>
<td>0.004</td>
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</tbody>
</table>
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