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Mapping Conflicts in the Development of Smart Cities: the Experience of Using Q Methodology for Smart Gusu Project, Suzhou, China

Joon Sik Kim

(Dr. Joon Sik Kim, Xi'an Jiaotong-Liverpool University, No.111 Ren'ai Road, Suzhou Dushu Lake Higher Education Town, Suzhou Industrial Park, Jiangsu Province, China, joon.kim@xjtlu.edu.cn)

1 ABSTRACT

The concept of smart cities is now firmly on the current urbanisation agenda around the world. Although such ideas are now widely accepted, the planning practice has experienced operational difficulties in supporting the development of smart cities in the real-life context. While great emphasis has been laid on the importance of collaboration in the development of smart cities, there has been little analysis on how to develop an empirical framework to evaluate different opinions and potential conflicts in smart cities. This paper aims to investigate the stakeholder's perspective and attitude in the smart city development, and highlight lessons from their experience. For this purpose, the research uses Q methodology to measure attitudes and subjective opinions of smart city stakeholders. The research shows that stakeholders have expressed different priorities in the development of smart cities based on the particular standing point of the observed participants based on their work and social backgrounds. This subjective landscape on smart cities can be valuable to understand the existing debates in practice and implement projects more efficiently by mapping possible conflicts in advance.

2 ISSUES IN THE DEVELOPMENT OF SMART CITES

2.1 Three Views on Smart Cities

It has been evident that the ideas of smart cities can play a positive role in achieving benefits for the efficiency of city operations and the quality of living environments by engaging urban planning practice with ICT (information and communication technology). Over the last two decades, there have been various interpretations and definitions regarding the concept of smart cities (see Dutton, 1987; Ishida, 2002; Komninos, 2002; Aurigi, 2005; Hollands, 2008; Yigitcanlar et al., 2008; Shin, 2009; Tranos and Gertner, 2012; Kim 2015). In recent years, the term of smart cities has become a 'buzzword', and been used for the financial and political marketing purposes (Hollands, 2008; Chourabi et al., 2012; Dameri, 2013). Due to terminological confusion and definitional problems around smart cities, Kim (2015) argues that the term 'smart' is employed in a variety of ways in urban planning practice, for example, some use the term to highlight the technological and engineering features, whilst others relate this to social and cultural perspectives. Those different views on smart cities may be summarised in three categories: smart cities as engineering; smart cities as science; and, smart cities as studies.

2.1.1 Smart Cities as ENGINEERING

The first view on smart cities is to understand the innovative technologies that matter in contemporary urban environments. The concept of smart cities can be differentiated from earlier practices of technological transformation by emphasising two new innovations: 'Internet of Things' and 'System of System'. The radical technology advances not only allow a form of intelligent communication between the city's physical assets, such as facilities, buildings and inhabitants, but also enable correspondent actions to be taken more systematically in responding to the sustainability issues. This led to expanded research in cloud computing, wireless communication, wearable computing, human-computer interaction, sensor networking, computational intelligence, energy optimisation, and so on.

2.1.2 Smart Cities as SCIENCE

The second view is to investigate how our cities can use emerging technologies smartly. There are wider acknowledgements that smart cities can add value to urban environments and improve the quality of life of the city's inhabitants by improving the way people live, learn, work, and play. Innovative technologies have been recognised as a potential tool to tackle urban problems and resilience, which might differ from the traditional methods of the city's planning, development and management. The smart city model has been increasingly applied in order to optimise and improve urban services, such as urban infrastructure, water, transport, energy, healthcare, commerce, education, logistics, home and building automations, to name a few.

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2.1.3 Smart Cities as STUDIES

The third view is to investigate what smart cities mean for the economy and society. The complexity of smart cities is impossible to separate from the economic, social, environmental, cultural and political contexts. New patterns of technology integration have encouraged the society to be 'more' interconnected and interactive, not only to share information, but also to allow a novel form of transactional relationships between different actors in the society. Then, other questions need to be asked. How can a smart city assure the quality of life in a city? Can a remote communication replace a face-to-face communication? How smart does a smart city have to be? How can we tackle an issue of digital inequality?

2.2 Coordinating Different Views in the Smart City Development

The 'new' practice requires wider involvements from a significant number of stakeholders including urban planners and ICT engineers who were not directly engaged in traditional planning practice. It has been widely discussed in the literature that poorly-managed conflicts during implementation can diminish the potential of smart cities and discourage future improvements. Therefore, planners have faced the complex challenge of how to deal with the different views and conflicts among different players in relation to the smart city development including: service providers (public sector); business operators (enterprises); and, end-users (local communities). The aim of this research is to investigate the stakeholder's perspective and attitude in the smart city development, and highlight lessons from their experience. The research involves a case study to investigate the local issues perceived by local government, enterprises and communities, and map conflicts in the development process of smart cities. The study of stakeholder's attitudes is important because the attitudes of decision-maker, professionals, and local communities may impact on strategies and directions of the smart city development, especially when there is less clear consensus built on this emerging issue. Additionally, considering the fact that many smart cities around the world are closely associated with planning activities driven by the public sector, it is also important to examine whether the smart city strategies are the result of wider stakeholder views including enterprises and local communities, and designed to meet their needs.

In order to identify and measure those perspectives and priorities in the development of a smart city, this research used Q methodology together with literature review, media review, interview, questionnaire survey, and brainstorming methods. Q methodology is one of most effective tools of investigating perspectives, attitudes and subjective structures from the stand point of the person, in this case, observed stakeholders. The research uses a case study of a smart city development in Gusu District, the historic city centre of Suzhou, China. This paper explores, firstly, the principles and implementation process of Q methodology. Secondly, the research moves on to developing a potential smart city model for Gusu District based on requirement survey (interviews) with government, enterprise and local communities. Thirdly, by analysing the participant's responses on the proposed smart city model, which is translated in 33 Q statements, the research is concluded by mapping subjective landscapes between different stakeholders, and proposing a strategic direction for the development of smart cities.

3 RESEARCH METHOD: Q METHODOLOGY

Q methodology was originally invented by a psychologist, William Stephenson, in 1935 in order to examine individuals' subjectivity systematically and scientifically, and then this research method has been developed further based on factor analytic theory (Stephenson, 1935; Brown, 1996). Although there had been a considerable peer criticism on Q methodology (Brown, 1997), it is now widely accepted as a scientific research method (Cross, 2005), and most frequently used method in studying attitudes (Petit dit Dariel et al., 2010). The method was initially applied to the academic field of psychology, however, it has recently been used in a wide range of disciplines, such as agriculture (Brodt et al. 2006; Davies and Hodge, 2012), public health (Kraak et al., 2014), rural planning (Previte et al., 2007), transportation (Rajé, 2007; Van Exel et al., 2011), e-learning (Petit dit Dariel et al., 2013), tourism (Stergiou and Airey, 2011), sustainability (Barry and Proops, 1999), and energy (Cuppen et al., 2010), to list a few. Despite the fact that Q methodology is not widely used in the field of urban planning, it is a well-structured and increasingly-used research method of measuring the different perspectives, attitudes or subjective opinions (Cross, 2005; Watts and Stenner, 2012; Zabala, 2014), and developing new ideas with a capturing of the human practice (Simons, 2013). Therefore, this research method has a potential in the investigation of planning practice by identifying stakeholders'

particular perspectives that could pass on to relevant planning actions, such as the development of strategies, plans, and guidelines, in response to the real-life practice.

Q methodology is recognised as an evaluation tool combining both qualitative and quantitative research techniques (Stenner et al., 2008). From the qualitative point of view, this emphasises on the subjective opinions and understandings of individuals. In contrast, this method employs quantitative tool of factor analysis in order to examine the statistical correlation between the different views of individuals. This can be explained in the following five stages of the Q methodology implementation (for more extensive information, see Barry and Proops, 1999; Davis and Michelle, 2011; Simons, 2013):

- Identification of the 'concourse': this stage is to develop a wide range of discussion and discourse under investigation. The concourse is commonly described as a set of views, ideas, values, opinions, or beliefs that shared by a population under study in relation to the research question. In order to collect the concourse, many researchers have generally used the multiple survey methods of interviews, focus groups, or literature and media reviews.
- Definition of Q statements: the broader discourse collected from the above stage needs to be summarised and reduced to a manageable number of the concourse, which is often referred to Q statements. The number of Q statements is usually no more than sixty, although it varies in different studies. The most important of this stage is that Q statements should reflect the full range of the concourse.
- Implementation of Q sorting: this stage involves the survey participants to ask them to rank all Q statements on a scale from 'disagree (-4)' to 'agree (+4)'using a Q table (Fig. 1). The range, such as -4 to +4, will be used to sort the statements in the later stages.
- Factor analysis: when Q sorting is completed, the correlations between Q sorts are calculated by using the factor analysis methods. This statistical analysis is to identify and classify a distinctive group of Q sorts that shares a similar subjective opinion or position.
- Interpretation of the factors: the final stage is to interpret the results of the factor analysis. Typically, the researcher gives a name to the statistically calculated factors in order to describe the meaning of factors. Those categorised Q sorts can represent distinct characteristics of shared perspectives in the study topic.

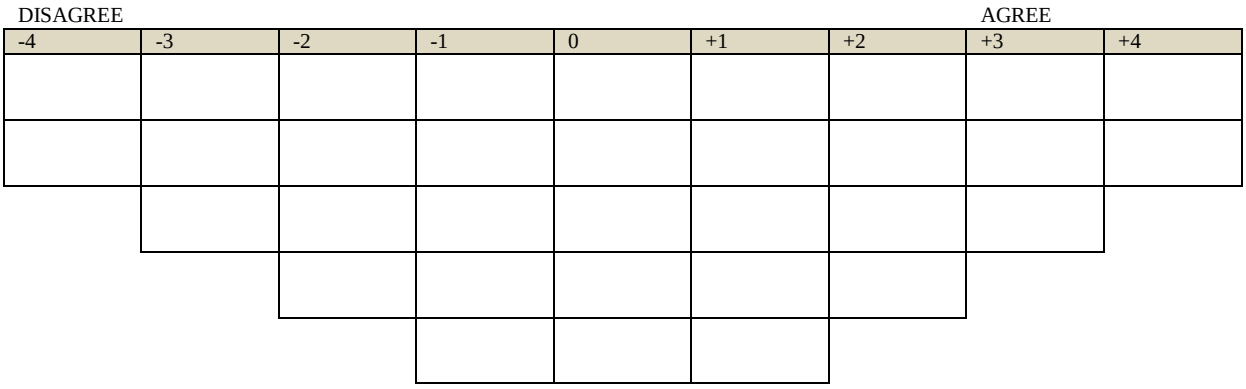

Fig. 1: Example of a Q Table.

The qualitative and quantitative features of Q methodology provide an empirical framework to translate a particular individual's dialogue into a systematic analysis. The advantages of Q methodology have emerged from the fact that the sorting activities are self-organised by participants, therefore, no built-in assumption has been applied into the method. This enables the results of Q sorting to be formative and emergent, and consequently, the method has the power to surprise (Cross, 2005). The greatest concern over the disadvantages of Q methodology is perhaps the lack of reliability that may provide little basis for systematic generalisation. The primary argument is that the results of Q sorting may not be the same even if it is repeated on the same individual. Taking this into account, Cross (2005) emphasises the importance of the participant's responses in the limited accounts of pre-determined statements. In order to represent the view on the research subject more accurately, it is necessary to derive Q statements from various sources and employ a number of different data collection techniques. Moreover, the wording of statements should be

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carefully designed to allow participants to think about the issue, rather than make them confused (Simons, 2013).

4 CASE STUDY: SMART GUSU PROJECT

According to China Smart City Huimin Development Evaluation Index Report (Information China 2014), the development of the smart city in China has improved the city's competitiveness potentiality. Based on comparative case studies among 369 cities of China, the report has suggested that the development of smart cities have generally improved the work efficiency of the city's public services due to new information systems, and facilitated new business opportunities such as new ICT projects initiated under the concept of 'smart tourism' and 'smart communities'. By 2013, over 310 cities in China had proposed or started the construction of smart cities (EU-China Smart and Green City Cooperation 2014). Smart city-related IT investments at the national level had reached more than 1 trillion RMB by 2012, and been estimated to be more than 2 trillion RMB by 2015 (Yang 2013). A recent study by CCW Research (2014) reported that there are four common development strategies of smart cities that have been used widely in China: (1) providing an intelligent urban lifestyle for citizens; (2) developing smart industries; (3) applying smart technologies and facilities (4) developing a creative city. While China has developed their own empirical ways to apply the concept of smart cities to the practice of urban development, most pilot smart cities in China have faced challenges of technology standardisations, collaborations with urban planning, and citizen-centric services (Liu and Peng 2014).

Gusu is located in the heart of Suzhou, China, which has been identified as a historic water town with its rich heritages and tourism resources (Fig. 2). The total population of Gusu district is about 742,000, but experiences the decline and aging of population (Suzhou Municipal Bureau of Statistics, 2014). According to the government reports, Gusu district has been promoting technology and information industries in order to tackle shrinking old town centre's economy, whilst there have been practical difficulties in attracting talented workers to Gusu district (Gusu District Government, 2015). The China's 12th Five Year Plan (2011-2015) has stressed a holistic approach connecting ICT and urbanisation by establishing the foundation for industrial development in association with the ICT industries (State Council 2011). As the following 13th Five Year Plan has also emphasised the important roles of ICT in urbanisation, Gusu District Government has initiated a strategic development of a "Smart Gusu" project in Gusu district, Suzhou, China.

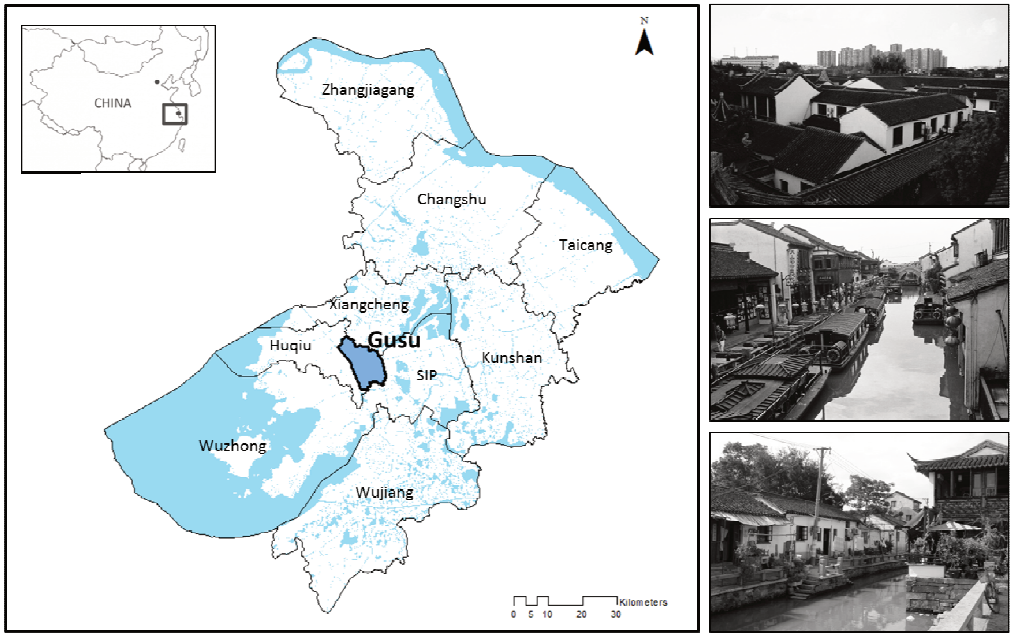

Fig. 2: Location of Gusu District and Images of the Gusu Historic Water Town.

5 IMPLEMENTATION OF Q METHODOLOGY

This research explores stakeholders' perception towards the development of smart cities, and Q methodology is used to examine the subjectivity of interests, especially from the stand point of the observed participants. The unravelled perspectives of smart city stakeholders in this paper cannot be translated as a general

discourse, as there are great differences among the political traditions and economic conditions in different countries and projects. However, the results may provide valuable features and critical arguments in mapping conflicts and subjective landscape in the current practice of smart cities.

5.1 Identification of the 'Concourse'

As the first step of implementing Q methodology in this research, the existing discourses in the relevant areas of smart cities have been explored using a number of different research techniques. Firstly, at the earlier stage of the research, literature and media reviews have been implemented to acquire basic information and current issues of Gusu district from previous studies and media means such as newspapers, websites, government documents, etc. Secondly, a seminar with four government officials in Economic and Technology Bureau of Gusu District Government has been organised (3rd July 2015). The seminar identified a number of key planning issues in the Gusu district, such as economic development, historical heritage conservation, river pollution and high population density. Thirdly, in order to represent the views on the study subject more accurately and widely, the interviews with wider stakeholders of Smart Gusu project were conducted (from mid-July to mid-August 2015) including: (1) five local community representatives; (2) three senior managers of ICT industries; and, (3) four government officials in Gusu District Government working in the relevant areas including economy, tourism, cultural heritage and civil affairs. Fourthly, after the interview analysis, a brainstorming was organised by the authors with three student volunteers (10th August 2015). As the results, 97 brainstormed ideas were identified that would be applied to Smart Gusu project (Fig. 3). Those brainstorming results have drawn upon the author's seven years' consultancy experience as a smart city practitioner, and been used as baseline information in developing Q statements.

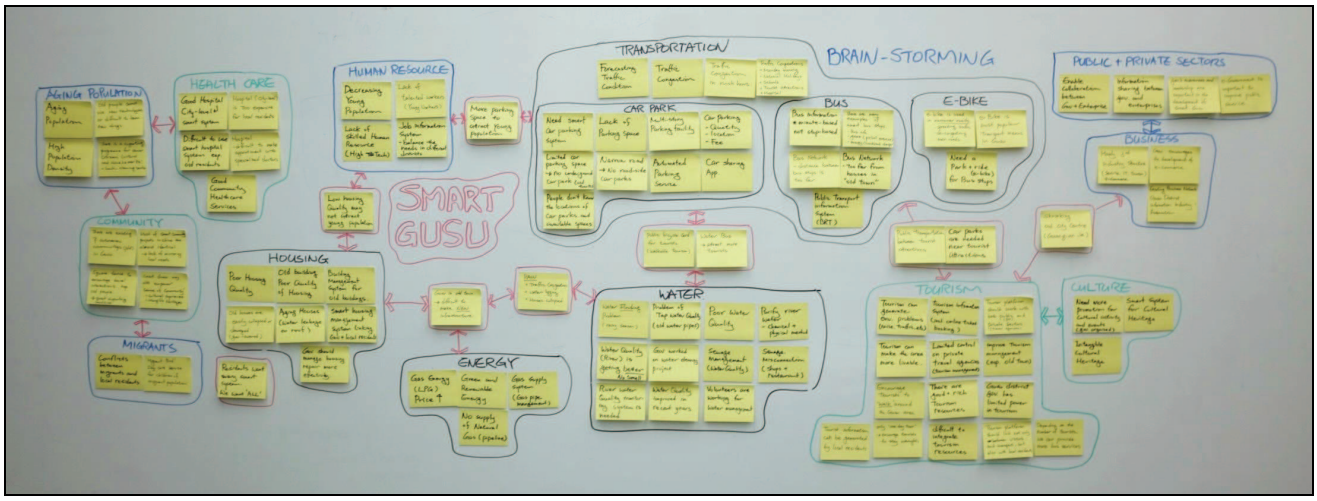

Fig. 3: Brainstorming Outcomes.

5.2 Definition of Q Statements

The next stage in the Q methodology process is to select a manageable numbers of statements for Q sorting, derived from over two hundred concourses and brainstorming results identified in the previous stage. There is variation in the size of the final Q statements in the literature, although the typical number of Q statements seems to be in between 30 and 60. Drawn from initial tests and pilot Q sorting, the research has found that 33 statements are suitable for this study. In this selection process of the final statements, a concourse matrix has been used in order to filter the statements to reflect more precise and essential arguments in the subject area by minimising the investigator's influence (Dryzek and Berejikian, 1993; Barry and Proops, 1999). Applying the key findings from the previous stage, this research developed and employed a concourse matrix with seven categories including public service, transportation, tourism, housing, water, economy, and community. Based on this concourse matrix, thirty-three Q statements were selected of the smart city stakeholder's perception in the development process of Smart Gusu (for full statements, see Table 2).

5.3 Implementation of Q Sorting

This stage of Q methodology involves the survey participants for Q sorting. Participants were asked to use an inverted pyramidal table (Fig. 1) in order to rank the 33 statements in a nine-relative scale (-4, -3, -2, -1, 0, +1, +2, +3, +4), based on how strongly they agree or disagree with the particular statement. Whether or not

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participants may agree or disagree on all statements, they are forced to rank the statements in the given structure. This process (so called, forced choice method) enables participants to consider the sorting process more carefully, and consequently, reveal their true feelings in response (Prasad, 2001).

In order to conduct Q sorting survey, both offline (hardcopy version) and online (web version) survey tools have been developed. For an online tool, the research used FlashQ (Rick Hoodenpyle's version, available at http://qmethod.org/links), which is a free application originally developed by Christian Hackert and Gernot Braehler (2007). The online version of FlashQ was set up on a HTTP server with PHP by modifying FlashQ's XML and the PHP-backend source codes (available at http://qmethod.org/links and http://www.hackert.biz/flashq/downloads/). For both offline and online tools, when participants start Q sorting, firstly, 33 Q statements were given one by one randomly and asks the participant to split them up into three categories: disagree; agree; and, neutral. Then, the participant is required to place all statements into the Q table in a ranked-order according to the forced distribution. At the last stage of Q sorting, the participants are required to complete a questionnaire for their personal details.

For this survey, it was difficult to attract many voluntary participants to get involved in the survey due to the complexity and time-consuming process of Q sorting. The assistance from Gusu District Government was useful to identify and approach participants. As Akhtar-Danesh et al. (2008) pointed out, it is more important to represent different opinions in the study subject precisely in Q methodology, rather than the number of the participants. There were 11 participants in this analysis: 2 from Gusu Government; 2 from local ICT firms; and 7 local residents in Gusu.

6 Q ANALYSIS AND RESEARCH FINDINGS

6.1 Factor Analysis

The PQMethod software (Schmolck, 2014) has been used in analysing the data of Q sorting, which is available online freely. PQMethod has been seen as one of the most frequently used statistical programmes, which is customised particularly for Q analysis (Simons, 2013). Using the Q sorting data, PQMethod created a correlation matrix from Q sorts, and then the factor analysis was conducted. In this process, Principal Component Analysis (QPCA), which is the most popular method of factor extraction, was used. For the factor analysis, four factors with eigenvalues greater than 1.00 have been considered initially, but only three factors were chosen from the factor-analysed outcome due to the analytical significance. After a varimax rotation (QVARIMAX) on the factors, QANALYSIS was performed in order to differentiate the factors based on the participants' Q sorting. The results of factor analysis are shown in Table 1.

Q Sort ID	Sector	Age Group	Gender	Residence in	[Factor 1] Government Perspective	[Factor 2] Non-Gov. Perspective	[Factor 3] Maternity Perspective
1	Government	20-40	F	Gusu	0.7441X	0.3422	0.2635
2	Government	20-40	M	Gusu	0.8107X	0.0622	-0.0274
3	Business	20-40	M	Outside Gusu	-0.1673	0.1143	-0.2822
4	Business	40-60	M	Outside Gusu	0.1136	0.6826X	0.0516
5	Resident	60 above	M	Gusu	-0.0369	-0.6292X	0.1979
6	Resident	60 above	F	Gusu	-0.0065	0.7905X	0.0247
7	Resident	60 above	M	Gusu	-0.5436	0.4656	0.3512
8	Resident	60 above	M	Gusu	0.1815	-0.0302	0.2357
9	Resident	20-40	M	Gusu	-0.4607	0.1702	0.3658
10	Resident	20-40	F	Gusu	-0.0172	-0.2101	0.8276X
11	Resident	20-40	F	Gusu	0.0486	0.3577	0.6781X

Table 1: The Result of Factor Analysis (X indicates a defining sort resulted from automatic pre-flagging of PQROT).

The result of factor analysis shows that two participants are identified as significant relations on Factor 1. As they are all from government, Factor 1 has been named as 'Government Perspective'. Similarly, Factor 2 can be described as 'Non-Government Perspective', considering the three participant's background profiles

(business and resident) that are marked as significant relations in Factor 2. Two participants loaded in Factor 3 are female residents in the age group between 20 and 40, and Factor 3 has been named as 'Maternity Perspective'.

6.2 Interpretation of the Factors

Drawn from the factorised analysis, the detailed discourses will be investigated in this section in order to explore the subjective landscape of the 11 stakeholders in the development of Smart Gusu project. For this purpose, the above three factors have been represented by the three operant types of discourses: Discourse A (Government Perspective, Factor 1); Discourse B (Non-Government Perspective, Factor 2); and, Discourse C (Maternity Perspective, Factor 3). Table 2 shows each discourse representing the distinct perspectives and attitudes from the standing point of the participants. The presented factor arrays were produced by PQMethod in order to represent "ideal type" Q sorts by calculating a weighted average of the scores (Barry and Proops, 1999; Addams and Proops, 2000).

6.2.1 Discourse A: Government Perspective

The statistical analysis shows that the respondents in this discourse have particularly: agreed on Statement [2] and [13]; however, disagreed on Statement [18] and [26]. There are two respondents who have been loaded in this discourse, and they are working in Gusu District Government. In analysing the Q sorts, this discourse expresses a primary concern on the current agenda of Gusu Government. For example, this discourse emphasises more strongly the need of: developing smart government system (+4 for Statement [2]) in order to provide efficient administrative services; and supporting tourism industry (+4 for Statement [13]) as Gusu Government is committed to empower historic water town tourism in order to promote local economy.

Strong disagreements in this discourse are on importance of green energy solution (-4 for Statement [18]) and local community activities such as square dancing (-4 for Statement [26]). The two Statements are lowly-ranked in general across discourses, although the benefits of the two solutions are discussed significantly in the brainstorming workshop. While measuring subjective landscape can be valuable to understand the existing debates in practice, this echoes that the smart city strategy must not be developed by a single interest group, and it is important to facilitate collaborative approach involving diverse stakeholders such as public and private sectors, local residents, and experts in the development process.

Additionally, the data reported in this discourse appear to show a different view on the effective delivery of government services in relation to public housing management and public medical services. Respondents in Discourse A ranked significantly lower for: the need of smart solution for public housing management (-3 for Statement [15]); and, the need of improving the existing smart medical services in municipal hospitals (-3 for Statement [32]) than other discourses. This suggests that there are disagreements between government group and non-government groups in perceiving the quality and priority of the current public services. This gap of consensus is also necessary to be investigated further in order to develop a more citizen-centric Smart Gusu project.

6.2.2 Discourse B: Non-Government Perspective

The statistical analysis shows that, in this discourse, the respondents have particularly: agreed on Statement [22] and [29]; however, disagreed on Statement [7] and [26]. In general, this discourse expressed the importance of water management in the development of smart cities (Statements from [19] to [22]), but prioritised less the transport related issues (Statements from [3] to [8]). A likely explanation is that respondents in Discourse B may not experience car parking problems in their everyday life, but may be related more to water quality issues than the ones in the other discourses. Another strong agreement of Discourse B is on the importance of developing smart solutions considering wider users including aging population (+4 for Statement [29]). This may be because the three respondents in this discourse are in the age group of the above 40, who may experience difficulties in learning new smart applications. One possible implication from Discourse B is that the respondents in the same geographical area or social group might have similar views as they share similar experiences. In this context, the result of Q survey can play more positive roles if the analysis is coordinated with other investigation methods.

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Category	Q Statements		Discourses		
			A	B	C
Public Service	1	Information sharing between governments and enterprises would be an obstacle in the development of Smart Gusu.	0	-1	-1
	2	Smart government systems (advanced e-government) can provide citizen-centric services with efficient administrative procedure.	4	0	3
Transport	3	I am willing to use buses more often if there is an e-bike charging station at bus stops (park-and-ride).	-2	0	-2
	4	It would be more convenient if I know the exact time of the bus arrival to the bus stop.	0	-3	2
	5	Real-time information of available car park spaces can make drivers convenient and reduce carbon emission by optimising travel routes.	1	-3	4
	6	Online reservation of car parking space can be one of solutions for the shortage of car parking space in the city centre.	-3	-2	1
	7	In order to reduce traffic congestion and car parking problem in the city centre, a car sharing mobile app for commuters may be helpful.	-1	-4	0
	8	Smart waterbus service can be useful for tourists (sightseeing) and commuters (public transport).	-1	-3	-2
Tourism	9	There is a need of monitoring rubbish collection using intelligent technology in tourist designations to make residents and tourists happy.	-3	0	-2
	10	Monitoring the numbers of tourists in the city may help providing better services for tourists, such as bus links among tourist attractions.	2	-1	-2
	11	Tourism information platform should integrate information from public sector (government) and private sector (enterprises, travel agencies).	1	1	-3
	12	Rich tourism information may encourage self-organised tour instead of a one-day package tour, which may allow tourists to stay longer in Gusu.	0	0	2
	13	Tourism information should go beyond popular attractions, and cultural tourist information can be collected via smart participatory process with local residents.	4	2	-1
	14	It is necessary to promote intangible cultural heritage widely and user-friendly through various communication methods.	2	-1	1
Housing	15	Government needs a building management system for old houses in Gusu District to organise effective repair works in advance (before the rain season).	-3	2	1
	16	Old houses also need intelligent building management system and smart home service to improve living environments of the residents.	-2	1	0
	17	Smart home system in old district should include smart meters for cooking fuel (LPG gas) to alert the replacement time of the LPG gas tank.	0	3	1
	18	Green energy solutions (e.g. solar energy generator) are becoming important in the development of Smart Gusu.	-4	-2	-1
Water	19	Intelligent rainwater management is necessary to prevent waterlogging and flooding.	-1	1	-4
	20	River water quality monitoring system is essential in Gusu District.	-2	3	0
	21	Because sewage pipes directly connected to rivers cause water pollution, intelligent system for wastewater management is necessary.	1	3	-3
	22	To improve drinking water quality, it is necessary to develop water quality monitoring system for fresh water supply pipelines.	-1	4	-1
Economy	23	In order to attract young workers to Gusu District, a mobile job recruitment application will be useful.	0	-2	-4
	24	Regeneration of old city centre as a smart street (interactive shopping information, media art exhibition, smart street furniture, etc.) can bring people back to the area, and therefore, revitalise local economy.	3	1	3
	25	The image of Smart Gusu may attract more ICT (Information Communication Technology) industries to Gusu District.	2	1	0
Community	26	The practice of square dancing can be empowered by simple technology (i.e. installed speakers with wireless connection) that may improve sense of community.	-4	-4	1
	27	Mobile platform particularly designed for your community (linked to the management office) can be useful.	3	0	-1
	28	I need to learn how to use the new intelligent systems of Smart Gusu.	1	-2	-3
	29	The development of Smart Gusu must consider wider users including senior citizens, as there is higher ratio of aging population in Gusu.	2	4	2
	30	Emergency response system for elderly household could reduce the risk of medical and fire alerts.	2	2	2
	31	Remote consultations from medical doctors may improve community healthcare service.	-1	-1	0
	32	The existing smart medical service in municipal hospitals is not easy to use, especially by elderly patients.	-3	2	3
	33	Concerning the safety issue of school kids, especially ones from migrant family, parents should be able to track the real-time location of their children after school.	1	-1	4

Table 2: Q Statements and Scores on the Three Extracted Discourses.

6.2.3 Discourse C: Maternity Perspectives

This discourse would seem to suggest the shared views from a particular social group, middle-aged female residents in local communities, with underlying assumptions that they may have particular concerns on their children and the use of private vehicles. For example, the respondents have strongly agreed (scored +4) that a smart city should: concern the safety issues of school children (Statement [33]); and, develop real-time car park information systems (Statement [5]). However, this discourse ranked lower for the urban facility management system for water infrastructure (Statements from [19] to [22]), which may not affect their living environments directly, although water management solutions have been considered as primary smart infrastructure for a city in many literatures (Sensus, 2012). This also mirrors the previous discussion in

Discourse B regarding a potential of using Q methodology in mapping the perspectives and requirements from a particular social group, which can be positively contributed to the development of smart cities.

7 CONCLUSIONS

Initial observations in this study suggest that the stakeholders in smart cities have shown particular attitudes and perspectives based on their work and social backgrounds. This subjective landscape on smart cities can be valuable to understand the existing perspectives and requirements in practice. Difficulties may arise, however, when an attempt is made to apply the outcomes of Q methodology in planning practice, as it is also arguable how mapping possible conflicts in advance can implement projects more efficiently in practice. Although this research may have limitations in terms of a narrowed range of the participants, Q methodology has demonstrated great potentials in investigating the views and attitudes of the stakeholders that may influence the implementation of smart cities significantly. However, the results of Q analysis must be interpreted with caution because the methodology is to measure the individuals' subjective opinions and attitudes from the particular stand points of the observed participants with the possible bias in these responses, rather than generalise the results of the statistical aggregation from the anonymous data. It is also evident that smart cities should involve wider stakeholders including public, private and social sectors together with expert groups, in order to reflect wider considerations on local political landscapes, economic dynamics, and cultural identities.

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