MAKING SMART CITIES SUSTAINABLE: EXPLORING ATTITUDES OF SOUTH KOREA S SMART CITY PRACTITIONERS USING Q METHODOLOGY

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Keywords (maximum 3): smart cities, sustainability, Q methodology

With regard to the applications of intelligent technologies in urban development, the concept of smart cities has spread widely and been applied to many empirical projects around the globe. In recent years, smart cities have employed the notions of the sustainable urban development with a great concern on global climate change. Although the current smart sustainable city model has particularly emphasised on energy optimisation and low-carbon management, the sustainability strategy of smart cities should go beyond the technological aspects of intelligent solutions. In order to address this emerging issue, planners have faced the complex challenge of how to develop smart cities in a wider sustainability context considering the city s economic dynamics, social di complexity. This research draws attention to perspectives and attitudes of the practitioners in association with sustainable strategies in the development process of smart cities, and Q methodology has been used for this purpose. To define the wider range of issues under study, the research explores lessons-learnt from the context of long-standing debates around collaborative planning practice towards sustainable urban development. Relevant stakeholders for Q analysis have been identified using author s earlier contacts and snowball-sampling technique. The research aims to demonstrate an overview of the subjective perspectives and attitudes on sustainability in the smart city development, especially from the standing point of the observed practitioners. The results may show how the smart city practitioners interact with very controversial and complex issues on environmentally-sustainable development in South Korea and around the world.

1. Introduction

New patterns of urban development with the uses of ICT (information and communication technology) have often described as smart cities . The concept of smart cities has be to urban development and management practices around the globe. Urban planners have also recognised smart cities as a potential tool to solve urban problems using innovative solutions, which might differ from the traditional methods of urban planning and development. There is a wider acknowledgement that smart cities can add value to urban environments and improve the quality of life of the city s inhabitants. In many urban development projects, the smart city model has been increasingly applied in order to optimise resource management and improve public services by integrating different urban systems, such as urban infrastructure, environment, transport, energy, healthcare, security, e-government, and so on.

In recent years, smart cities have employed the concept of sustainability. The combination of green and smart technology is notable in the contemporary eco-city developments (Joss et. al. development of smart cities has been seen as a catalyst to transform economic and social environments of the city to be more knowledge-based and eco-friendly (Kim and Wang, 2014). This new development style has been also considered as a valuable tool to reform the city s industrial network by attracting diverse ICT industries that could enable a low-carbon economy, and ultimately drive the city s sustainable growth (Steinert, et al., 2011). Although the adoption of intelligent technologies is now commonly accepted in sustainable urbanisation projects, there is a widely held view that this new practice has operational difficulties. One criticism of much of the literature on sustainability in the development of smart cities is that the current practice is narrowly focused on technological innovation on energy optimisation and renewable energy generation (Joss, et al., 2013). According to Kramers et al. (2014), the concept of a smart city does not fully involve issues of sustainability, and there is a lack of a connection between the notions of a smart city and sustainable development. The key argument here is that the existing accounts fail to achieve sustainability in a wider context of the

city s economic dynamics, social diversity and spatial complexity. Although there is little analys evaluation on how smart cities can be developed sustainably in practice, many smart city projects around the world have been keen to closely associate with the city s sustainability v environmental concerns. This is because the language of smart and sustainability was appealin politicians and developers for a self-promotion purpose by creating positive place branding of the technology-led innovation in a sustainable way.

This research, therefore, draws attention to the practical consideration in the development process of smart sustainable cities. This article aims to investigate the practitioner s perspective and attitude in dealing with sustainability aspects in the smart city development, and highlight lessons from their experience. The study of practitioner s attitudes is important because the attitu policy makers and researchers may have an impact on the development strategies and directions of smart sustainable cities, especially when there is no clear consensus built on this emerging issue. Barry and Proops (1999) also argue that identifying how individuals think about environmen significant element to judge whether relevant environmental policies are socially acceptable, and therefore able to be implemented. Similarly, unravelling subjective opinions of professionals in delivering the sustainability goal in the smart city practice requires data experiences and practices. The research uses Q methodology to measure attitudes and subjective opinions of practitioners. Q methodology is one of most effective tools of investigating perspectives, attitudes and subjective structures from the standing point of the person, in this case, observed practitioners (Peritore, 1989; Zraick and Boone, 1991; Brown, 1996).

In the following section, firstly, the principles and implementation process of Q methodology will be introduced. This is to provide an overview of the research structure and process, because the research methodology used in this study, Q methodology, is little known in the field of social science and urban planning (Barry and Proops, 1999; Previte, J. et al., 2007). Secondly, the next section will move on to conceptualising smart sustainable cities by bringing the notions of smart cities and sustainability together. The major concern here is that the current practice of smart and sustainable cities is limited on the energy-related issues, and it is, therefore, important to explore the sustainability issues in a wider context. For this purpose, lessons-learnt from the long-standing collaborative planning debates in delivering the city s sustainable vision will be discussed. A key task in this section is to iden common structures (so called Q statements) of the smart city practitioner s att sustainability issues. Thirdly, by analysing the participant s responds on Q statements, the findings and the principal issues which have arisen in this Q analysis will be provided. This paper will be concluded by proposing a strategic direction for the development of smart sustainable cities based on the analysis results drawn from the practitioner s perspectives.

2. Understanding Q methodology

Q methodology was originally developed by a psychologist, William Stephenson, in 1935 in order to examine individuals subjectivity systematically in a scientific way (Stephenson, 1935; Brown, 1996). This research method has been developed further based on factor analytic theory, although there was a considerable peer criticism on Q methodology (Brown, 1997). However, 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). While the method was initially applied to the academic field of psychology, 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 little 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 planning

professionals 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 a combination of the 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 (Figure 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.

DISAGREE AGREE

-4	-3	-2	-1	0	+1	+2	+3	+4

Figure 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. methodology are emerged from that 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 the participant s responses in the limited ac 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 carefully designed to allow participants to think about the issue, rather than make them confused (Simons, 2013). Given the importance of defining Q statements, the following section will conceptualise smart sustainable cities in a wider context. As explained earlier, the current practice is narrowly focused on energy-related perspectives. Therefore, before proceeding to collect concourses, it will be necessary to develop a framework to capture the full range of views involved in the issues of smart sustainable cities.

3. Conceptualising smart sustainable cities

The city is at the heart of both carbon emission problems and solutions. The mitigating problems associated with climate change given the critical mass of people and resources at the city s disposal. New innovative technology is already used to make the city s living environme more convenient and comfortable. Ironically, these new comforts can requir produce more carbon emissions than the older ways of living. Bearing in mind that there is a potential conflict between the two concepts, smart cities and sustainability, this section addresses the key aspects of sustainability delivery in the development process of smart sustainable cities, by reflecting lessons-learnt from the collaborative planning practice.

3.1 Definition of a smart sustainable city

There is no single model for the correct form of smart cities, and many cities around the world have translated the concept of smart cities differently in order to mirror their particular economic, political and cultural environments (Neirotti, et al., 2014; Kim, forthcoming). It has commonly been assumed that not all elements of smart cities have equal weighting in the planning and development processes of smart cities (Hollands, 2008). Not surprisingly, the same principle might be applied to when smart cities adapt the concept of sustainability. For example, the concept of smart cities in South Korea has been transformed to the idea of U-Eco City (Ubiquitous-Eco City) by mirroring the national of Low Carbon Green Growth (Kim et al., 2012). Chinese government has launched its national low carbon pilot programme based on the National 12th Five Year Plan, which emphasises a great importance of low-carbon city construction. This influences the recent development of the term low carbon smart cities in China. The language of green smart city has been collaboration on the development of smart cities between Chinese government and European Commission (Yanrong et al., 2014). In an international context, International Telecommunication Union, which is the United Nations specialized agency, defined a smart sustainable city as:

> "an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects (ITU-T Focus Group on Smart Sustainable Cities, 2014:13) ."

Although there is a degree of uncertainty around the terminology in this area, the term smart sustainable city is used here. The primary concern on the definition of smart sustainable cities is the capability of coving wider-ranging sustainability issues. While the current practice has not tackled a wider range of issues than merely energy-related aspects, this research aims to address the complexity of smart sustainable cities which is impossible to separate from the economic, social, environmental and political contexts. This raises questions about the conflict interests and issues involved in smart sustainable cities which will be discussed in the next section.

3.2 Smart city implementation and sustainability delivery

Although sustainability issues are emphasised in the field of smart cities, little is known about its implementation in a real-life context. The apparent nature of smart sustainable cities must be seen in line with the dynamics in political, economic and social environments in the development process. There are two arguable issues in applying the sustainability concept to the smart city practice, and vice versa.

Firstly, sustainability issues are not the top priority of all key stakeholders involved in the smart city development. As sustainability issues are related to the global concerns on climate change, the shared consensus on sustainability can be readily built between smart city stakeholders. However, the implementation issue is another potential concern. Although most stakeholders may understand the importance of sustainability in smart cities, it is difficult to generate tangible commitments from stakeholders. There is also a concern that the most polluted cities are located in developing countries where the smart city concept is not fully established (Neirotti et al., 2014). The issues of sustainability may create a consensus on the need of comprehensive interactions between participants in the development process of smart cities. However, sustainability does not generate obvious tensions between players to compete for limited resources for the immediate gains. The high costs of taking no action can be the incentive to collaborate (Gary, 1989), but sustainability may not stress threat or scarcity of resource loss among participants. This lack of tension between stakeholders around smart sustainable cities makes it difficult to encourage them to put their extra time, money and effort into the project. Barry and Proops (1999) also argue that there is a shared perception that environmental problems have not been very important comparing with other social ills, such as unemployment, being far more prioritized. Moreover, comparing with other urban problems, such as housing supply and basic infrastructure, smart cities have been seen as an added-value and not been a top priority for all interest groups. Kim (forthcoming) has reported that developers have seemed uninterested in implementing the task of smart cities in meaningful ways once the initial excitement of smart cities has died away after being used for marketing and publicity purposes at the early stage of the urban development project.

Secondly, compartmental approach to the development of smart sustainable cities may be another obstacle to achieve effective collaborative efforts in delivering smart and sustainable goals for the project. While the core concept of smart cities emphasises the integration of a cit
(Ebrahim and Irani, 2005; Dirks and Keeling, 2009; Kitchin and Dodge, 2011), it is evident that smart city practitioners have faced practical difficulties in an effort to incorporate the fragmented working process with the engagement of many organisations and individuals not directly connected each other previously (Kim, forthcoming). This becomes more problematic when sustainability issues are involved. The wide-ranging sustainability challenges cannot be tackled by any single organisations, and should allow open, collaborative and innovative approaches (Steinert, et al., 2011). The complex and compartmental operations in the practice of smart sustainable cities have become a barrier to facilitating active involvement from all actors to achieve the sustainability vison of a smart city in practice.

Despite the arguments above, there is also an advantage in engaging the concept of sustainability to smart city practice. A certain work scope of smart cities, such as tasks related to intelligent technology, may promote more focused efforts, comparting with wide-ranging sustainability issues in the general urban development projects. However, it is necessary to overview the existing practice of smart sustainable cities in order to develop an overarching framework to evaluate wider-ranging sustainability issues in the practice of smart sustainable cities.

3.3 Evaluation framework for smart sustainable cities

A smart sustainable city is a relatively new concept and its theoretical and empirical frameworks have not been clearly developed. Consequently, some operational problems have been identified with particular reference to the idealism of smart sustainable cities itself. However, the arguments on how

to accommodate multiple processes in planning practice to draw those complexities and dynamics of delivering sustainability are not new. Viewed from a collaborative planning perspective, there has been a concerted effort among planning professionals and academics to achieve benefits for sustainability by means of collaborative actions for the last three decades (Forester, 1989; Healey, 1997; Susskind, et al., 1999). There are relatively extensive literatures on collaborative planning for sustainability. In a systematic approach to explaining an empirical framework of delivering collaborative actions in planning practice, Kim (2002) has identified three key aspects of sustainability delivery based on the notion of collaborative planning: consensus building, facilitation and open participation.

- *Consensus building* (Let s work together): consensus building has been recognised as a primary tool for implementing collaborative efforts. This focuses on a process of face-to-face dialogue to seek agreed outcomes, such as policies and action plans. The consensus building process would be able to make stakeholders reach shared statements for common goals on sustainability.
- *Facilitation* (Let s make it work): this emphasises a way of collaborative working by encouraging individual stakeholders to deliver the sustainability vision by taking action for themselves. Facilitation is to encourage participants to implement focused issues or projects on sustainability.
- *Open participation* (Let s bring all): this is a broad definition of involvement to consider a wider range of alternatives including multi-level co-operations. This would allow wider involvement of all interest groups willing to participate various aspects of sustainability delivery.

In a similar way, smart sustainable cities require a multiplicity of implementation processes in order to deal with complexity and dynamics of multiple issues involved in sustainability. Some processes such as providing supporting regulations for the development demand continuity of leadership from the public sector, but others require community participation approaches. This is because smart sustainable cities need collaborative working processes that emphasise both top-down and bottom-up approaches.

4. Implementation of Q methodology

This research explores smart city practitioners perception towards sustainability, and Q meth is used to examine the subjectivity of interests, especially from the standing point of the observed participants. The results of Q analysis presented here are derived from an on-going research of investigating the subjective perspectives and attitudes on sustainability in the smart city development around the world. In this paper, participants of Q sorting are mainly from ICT firms in South Korea. Although some of them have international experience working in multiple countries, the particular participant group here may hold a different view from the global professional population at large. The unravelled perspectives of smart city practitioners 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. However, the results may provide representative features and critical arguments in the current practice around the world, as South Korea is one of countries in which the smart city practice is firmly developed in urban development process.

4.1 Identification of the concourse

As the first step of implementing Q methodology in this research, the existing discourses in the relevant areas of smart sustainable cities have been explored using a number of different research techniques. The initial concourses have been identified based on the insights of th experience as a smart city practitioner in Asia and the Middle East. In order to represent the views on the study subject more accurately and widely, a series of interviews with three smart city professionals were conducted. Even broader subject issues were collected from academic literatures and media publications such as internet news and blogs. Stainton Rogers (1995) reports that the number of

concourses at this stage could be usually around three times more than the size of the final number of Q statements.

4.2 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 one hundred concourses 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. The previous studies (Dryzek, J. S. and Berejikian, 1993; Barry and Proops, 1999) reported that this matrix could be useful in several ways:

- the matrix could filter the statements to reflect more precise and essential arguments in the subject area; and,
- it could also enable an independent selection process by minimising the investigator s influence.

The concourse matrix was necessary in this research because Q statements should: (1) represent wider perspectives of sustainability, rather than energy-related issues; and, (2) mirror the quintessential discourse from the broader practice of smart and sustainable cities, rather than solely from the researcher s insights gained from one s empirical experience. Applying the three key a delivering collaborative actions for sustainability (consensus building, facilitation and open participation), this research developed and employed a concourse matrix illustrated in Table 1. In order to echo multiple processes of delivering the smart sustainable city practice, the categories of two different project types, strategy making and project implementation, were also applied. The use of this matrix may allow collecting much richer and more widely shared views and attitudes of the smart city practitioners towards sustainability. Based on this concourse matrix, thirty-three Q statements of the smart city practitioner s perception towards the sustainability issues were statements have been allocated in each cell of the matrix (9 cells in total), and the full set of Q statements is listed in Table 4.

Table 1. Concourse Matrix of Smart Sustainable Cities

Key Aspects of Sustainability Delivery	Project Types	
	[Strategy Making] *Vision and Strategy*	[Project Implementation] *Development Project*
[Consensus Building] Let s work together	*Q Statement No.1 to No.6*	*Q Statement No.7 to No.12*
[Facilitation] Let s make it work	*Q Statement No.13 to No.18*	*Q Statement No.19 to No.24*
[Open Participation] Let s bring all	*Q Statement No.25 to No.29*	*Q Statement No.30 to No.33*

* For the full sentences of Q statements, see Table 4.

4.3 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 (Figure 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 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, an online survey tool has been established. 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-bac codes (available at http://qmethod.org/links and http://www.hackert.biz/flashq/downloads/). When participants start Q sorting using this online tool, firstly, FlashQ displays 33 Q statements 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 an online questionnaire for their personal details.

For this survey, relevant stakeholders in the field of smart sustainable cities have been identified using author s earlier contacts and snowball-sampling technique. However, due to the complexity and time-consuming process of Q sorting, it was difficult to attract many voluntary participants to get involved in the survey. Therefore, the personal contact of the author in South Korea was useful at the earlier stage of the survey. There were 10 participants in this analysis. 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. Although most participants are in the private sector of ICT industries, the participants were selected on the basis of their work experiences and the areas of their expertise. This may mirror different viewpoints in the practice of smart sustainable cities. The details of the participants background can be shown in Table 2. Among 10 part participants have worked in the field of smart sustainable cities for more than 9 years, and four of them have work experience less than five years. There are five consultants and two marketing professionals in the participant pool, but the rest varies. Six participants have worked solely in South Korea, but four of them have the international work experiences in different counties.

Table 2. Participants Background for Q sorting

Q Sort ID		Work Period	Affiliation	Job Description*	Work Location
1	9ITCsK	More than 9 years	ICT	Consultancy	South Korea
2	7ELCsK	6-8 years	Manufacturing	Consultancy	South Korea
3	4ITPMK	3-5 years	ICT	Management	South Korea
4	4ITCsK1	3-5 years	ICT	Consultancy	South Korea
5	4ITCsK2	3-5 years	ICT	Consultancy	South Korea
6	9ITEgK	More than 9 years	ICT	ICT Engineering	South Korea
7	9ITMaMt	More than 9 years	ICT	Marketing	South Korea, China, Middle East, Europe
8	4ITMaKC	3-5 years	ICT	Marketing	South Korea, China
9	9ITCsKC	More than 9 years	ICT	Consultancy	South Korea, China
10	9ITCnMt	More than 9 years	ICT	Urban Development	South Korea, Middle East

5. Q analysis and research findings

5.1 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 provided by participants, the software created a correlation matrix from Q sorts, and then factor-analysed. For this purpose, Principal Component Analysis (QPCA), which is the most popular method of factor extraction, was used. In this factor analysis process, three factors with eigenvalues greater than 1.00 have been considered significant statistically. 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 3.

Table 3. The Results of Factor Analysis (Factor Matrix)

Q Sort ID		[Factor 1] *Korea-specific Perspectives*	[Factor 2] *Marketing-specific Perspectives*	[Factor 3] *Conflicted Views*
1	9ITCsK	**0.7848X**	-0.2255	-0.0405
2	7ELCsK	**0.6915X**	-0.0191	-0.4547
3	4ITPMK	**0.5605X**	0.1365	0.3376
4	4ITCsK1	**0.5805X**	0.1746	0.3298
5	4ITCsK2	**0.7413X**	-0.1932	-0.0707
6	9ITEgK	**0.7726X**	-0.5481	0.3501
7	9ITMaMt	0.2986	**0.5474X**	-0.0357
8	4ITMaKC	-0.2216	**0.8674X**	0.1137
9	9ITCsKC	0.1611	0.0300	**-0.6937X**
10	9ITCnMt	0.2714	0.0177	**0.6620X**

X indicates a defining sort (resulted from automatic pre-flagging of PQROT)

Six of the participants are identified as significant relations on Factor 1; two on Factor 2; and, two on Factor 3. Considering the participants profile backgrounds, Factor 1 can be described a specific perspectives , because the factor analysis result shows a strong distinction on t work locations. All six participants who are loaded on Factor 1 have mainly worked in South Korea and the rest participants have work experiences internationally in different countries. Based on the participants profile information, Factor 2 may be related to the participants jo participants loaded in Factor 2 are working in the area of marketing and sales in the development of smart sustainable cities. Therefore, Factor 2 is named as Marketing-specific perspectives . W Factor 1 and 2 seem to have profile-based relations, Factor 3 is rather related to the personal viewpoints of the two participants. Factor 3 shows conflicted views between two particular respondents on the domain of smart sustainable cities, although both participants have worked in the field of smart cities more than 9 years and internationally. It was found that the only difference on the participants profile is the job description as one has a consultancy background, but th urban development (construction) background.

5.2 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 ten practitioners in the development of smart sustainable cities. For this purpose, the above three factors have been represented by the four operant types of discourses: Discourse A (Korea-specific perspectives, Factor 1); Discourse B (Marketing-specific perspectives, Factor 2); and, Discourse C (Conflict views, Factor 3). Table 4 shows each discourse representing the distinct perspectives and attitudes from the standing point of the practitioners in the field of smart sustainable cities. For Discourse A and B, factor arrays that were produced by PQMethod are used. This is because a set of factor arrays represents ideal type Q sorts by calculating a weighted average of the scores (Barry and Proops, 1999; Addams and Proops, 2000). However, Discourse C employs actual Q sort scores from the two particular participants (C1 and C2) in order to compare their conflict views on each statement.

Table 4. Q Statements and Scores on the Four Extracted Discourses

	Q Statements	Discourses			
		A	B	C1	C2
1	Government should lead the development of smart sustainable cities.	-1	-1	-3	3
2	Smart sustainable cities should build up a city s resilience to natural disasters, all linked to climate change.	-1	0	0	1
3	Green and renewable energy technologies are at the heart of many smart sustainable city developments.	-1	-3	-2	3
4	Generally speaking, smart cities are not sustainable because they use more energy than before.	-4	-2	-2	-3
5	A key aspect of smart cities should be a new way of living sustainably, rather than conveniently.	-2	3	-1	-1
6	There is the lack of an understanding of stakeholders roles and responsibilities in the development of smart sustainable cities.	-1	-1	-1	2
7	Smart city projects should be implemented under the sustainability vision.		2	3	-4 1
8	The majority of people on smart cities prioritise the sustainability issues.	-1	-2	-3	1
9	It is necessary to organise a steering body involving wider stakeholders in the development of smart sustainable cities.	4	1	1	2
10	Making smart cities more sustainable needs more resources and therefore money.	-2	2	1	2
11	There is no dominant model for smart sustainable cities.	0	4	2	0
12	I am not very concerned about the sustainable development in smart cities.	-4	-2	-2	-3
13	Technical specifications for smart sustainable cities can be standardized.	1	-1	-2	-1
14	It is necessary to develop an evaluation framework related to the sustainability impacts of ICTs in smart sustainable cities.	0	0	-4	1
15	For a successful smart sustainable city, the integration of the city s diverse systems i essential.	-1	-4	4	-2
16	The notion of cyber-security (risk of hack) is becoming extremely important in a smart sustainable city context.	3	2	-1	1
17	The development of smart sustainable cities must be able to contribute to the city s economy e.g. jobs, growth, and finance.	2	0	-1	2
18	A smart sustainable city needs a wow factor : it should show something new and innovative.	-3	-1	0	-3
19	A lack of legislation framework on smart sustainable cities is one of significant obstacles in its implementation process.	1	2	-1	4
20	It is difficult to secure full benefits of smart sustainable cities if there are robust regulations on privacy and data protection.	-2	-2	0	-2
21	I think most future environmental problems can be solved by intelligent technology.	-2	-3	2	-4
22	I believe intelligent technology can be used to change people s behaviour to be more sustainable in their everyday lives.	2	0	3	1
23	Wireless network infrastructure is more vital in the development of smart sustainable cities than one of smart cities.	0	-2	4	4
24	People would not be willing to pay extra money for intelligent services making their lives more sustainable.	-3	4	2	0
25	The current practice of smart sustainable cities does not involve public participation as much as it should.	2	2	1	-2
26	The users of smart sustainable cities are not only municipal governments, but also enterprises and citizens.	4	2	-3	0
27	The sustainability strategy of smart cities should go beyond the technological aspects of intelligent solutions.	3	0	2	-1
28	Smart sustainable cities should act as a platform to learn sustainable practices.			3	-3 0 0
29	A smart sustainable city is a very good instrument to link people, and therefore increase local democracy participation.	0	-4	3	-4
30	Smart sustainable cities can strengthen community engagements by recognizing the citizen as a sensor.	0	-1	1	0
31	I see smart cities as a development tool of putting sustainable ideas into practice.	1	0	3	3
32	It is difficult to cooperate with private sectors in developing smart sustainable cities, as they take a short-term view.	-3	1	1	-1
33	Smart sustainable cities should make a great amount of public data available to users and software developers.	1	1	0	-2

5.2.1 Discourse A: Korea-specific perspectives

Drawn from the results of the statistical analysis, the respondents in this discourse have particularly: agreed on Statement [9], [16], [26], [27], and [28]; however, disagreed on Statement [4], [10], [12], [18], [24], and [32]. In analysing the Q sorts, this discourse expresses a primary concern on collaborative efforts in the development of smart sustainable cities. This discourse emphasises strongly on the need of: an institutional arrangement for the wider stakeholder involvement (+4 for Statement [9]); and a consideration for wider users including public, private and community sectors (+4 for Statement [26]). The importance of integration shared by the respondents in this dis may reflect the particular interests in the South Korea s practice of smart sustainable cities because the evidence from the participants profile suggests that all six participants in had solely worked in South Korea without international work experiences in the other countries. Kim (forthcoming) reported that South Korea has developed in a standardised form of the smart city development as a series of U-City projects. While U-City projects focuses on the system in of public services provided by local authorities, the practice of smart cities in South Korea experiences a complicated challenge in managing diverse and conflicted interested involved in the development of U-City projects. This echoes a strong support in this discourse for the idea that smart sustainable cities can only be achievable by collaborative efforts from diverse stakeholders and the urban system integration is critical in the development of smart sustainable cities. This shared view on the integration of the city s core systems can have an effect on Statement [16] that is also highly-ranke this discourse, by emphasising the importance of the cyber-security in the development of smart sustainable cities. Additionally, because the Korea s smart city practice is mainly focused on p sector services and systems, it seems possible that this discourse expresses disagreement (scored -3) on the need of a wow factor to show something new and innovative in the deve sustainable cities [18], comparing with other discourses.

Another strong agreement of Discourse A is that the sustainability issues in smart cities must be considered from wider perspectives, rather than focused narrowly on the technology-led solutions. The respondents have strongly agreed (scored +3) that a smart sustainable city should: go beyond the technological aspects of intelligent solutions [27]; and, act as a platform sustainable practice [28]. The respondents in this discourse are very concerned about the importance of sustainability issues in the smart city practice [12], and optimistic about engaging the two concepts of smart city and sustainability in practice (see Statement [4] and [10]). The data reported here appear to show a different view on the earlier argument made by Joss, et al. (2013) that the current practice of smart sustainable cities has narrowly focused on technological aspects of energy-related issues. However, ironically, this discourse has also reported that the majority of people of smart cities may not prioritise the sustainable issues [8]. It seems that practitioners, at least in South Korea, have a clear understanding on the wider definition of sustainability, although they might feel that it would be difficult to implement sustainability in practice as it requires collaborative actions with wider stakeholders.

The findings in this discourse would seem to suggest that the practitioners in the same geographical area might have similar views on smart sustainable cities, as they are from the common political, economic, social, and cultural backgrounds. This might suggest that it would be possible to establish an area-based development strategy for smart sustainable cities, but might not be feasible to develop a common model of smart sustainable cities globally. Speaking from the South Korea s context, t development smart sustainable cities requires institutional and political instruments to facilitate collaborative efforts in practice. It seems that there is a potential to facilitate the collaborative practice in South Korea, as there are common understandings on a wider perspective of sustainability and the need of holistic approach in the development of smart sustainable cities. Those mutual understandings among practitioners may act as a catalyst in establishing a suitable institutional arrangement for further collaborations and prevent many difficulties that may arise later.

5.2.2 Discourse B: Marketing-specific perspectives

The statistical analysis shows that, in this discourse, the respondents have particularly: agreed on Statement [5], [7], [11], and [24]; however, disagreed on Statement [3], [15], [21], [28], and [29]. There are two respondents who have been loaded in this discourse, and they are working in the ICT business area of marketing and sales in the development of smart sustainable cities. Both respondents have global work experiences in different countries. One possible implication of this is that their views could differ from Discourse A, as the respondents in Discourse B are more business-minded and working globally. As the marketing and sales professionals often face their clients closely, this discourse may also reflect the perspectives of their clients, public and private developers of smart sustainable cities. This may explain the reason why this discourse has strongly emphasised the linkage between smart cities and the city s sustainability vision [7]. The marketing background of th respondents might be also influential in Statement [11]. This discourse has most strongly agreed that there is no dominant model for smart sustainable cities, while Discourse A has expressed a neutral view on this. This is because South Korea has developed a uniform U-City domain, although the respondents in this discourse may stress the diverse approaches for smart sustainable cities by reflecting the city s particular economic dynamic, political priority, and cultural legacy. These results would also seem to support the idea that it is possible to define a specific model of smart sustainable cities in a domestic practice, however, impossible to create a worldwide standardised model. However, this discourse also shares the same view with Discourse A that green and renewable energy technologies may not be at the heart of many smart sustainable city developments [3].

Comparing with Discourse A, this discourse shows different opinions in the following five statements in particular ([5], [15], [24], [28], and [29]). Although Discourse A disagrees (scored -2) on Statement [5], A key aspect of smart cities should be a new way of living sustainably, rather than conveniently , Discourse B agrees (scored +3) on this. This may mirror the global trend on smart sustainable cities emphasising more on sustainability in everyday life, although the South Korea s practice may prioritise on the aspect of people s convenience. Similarly, Statement [15] for a succe sustainable city, the integration of the city s diverse systems is essential is agreed b respondents in Discourse A, while Discourse B expresses strong disagreement on this statement (scored -4). As discussed earlier, despite the fact that South Korea has developed the integration-oriented approach in the development of smart sustainable cities, it seems South Korea s U-City model is not applicable to many other countries. Another strong disagreement (scored -4) in this discourse is on Statement [29], a smart sustainable city is a very good instrument to link people, an therefore increase local democracy participation . Considering this discourse marketing-specific perspectives, the local democracy participation issues may not be seen as an important value in promoting smart sustainable cities comparing with other values such as improving sustainable living environments [5] and delivering the city s sustainable visi interesting view on the people s willingness of paying for the smart sustainable services. discourse has strongly agreed (scored +4) on Statement [24], people would not be willing to pay extra money for intelligent services making their lives more sustainable , while Disco (scored -3). A possible explanation for this might be that citizens in South Korea are more willing to pay for the smart sustainable services, than those in other countries. However, from the marketing professionals point of view, the paid-services may not be easy to implement in practice.

5.2.3 Discourse C: Conflict views

Unlike the previous discourses, the statistical analysis of Q sorts has identified that there are two respondents who expresses conflicted views distinctively on the statements presented. The analysis result on this discourse shows that the conflict opinions between the two respondents are stressed particularly on Statement [1], [3], [6], [8], [14], and [25]. Those are related to the issues of: the government leadership [1]; primary work scope [3]; stakeholder s roles [6]; priority on su [8]; outcome evaluation [14]; and public participation [25]. As Q methodology deals with the subjectivity of individual s perspectives, it is expected that people may have statements. However, what stands out from this discourse is that the conflicted views of the two

respondents are mainly from the consensus building aspect in the development of smart sustainable cities. As explained earlier, this research developed a concourse matrix (Table 1) to reflect wider perspectives of smart sustainable cities using the three key aspects of sustainability delivery: consensus building; facilitation; and open participation. Four out of the above six statements are mapped on the consensus building aspect (Statements [1] to [12]), and the three are particularly on the strategic making category of the consensus building aspect (Statements [1] to [6]). This result may show that there are more significant conflicts and tensions between stakeholders in building consensus in the strategy making process, particularly on the issues of: who should lead; what should be prioritised; and who should do what.

6. Conclusion

Learning from the participants in this research, the practitioners on smart sustainable cities have shown particular attitudes and perspectives based on their work backgrounds. It seems that the practitioners share common views if they work in the same geographical or business areas. This subjective landscape on smart sustainable cities can be valuable to understand the existing debates in practice and implement projects more efficiently by mapping possible conflicts in advance. Initial observations in this study suggest that it would be practically difficult to define a dominant model for smart sustainable cities. There would therefore seem to be a definite need for an area-based approach in the development of smart sustainable cities by reflecting local political landscapes, economic dynamics, and cultural identities. The evidence of this can be clearly seen in the case of South Korea. The results of Q analysis suggest that the development strategies of smart sustainable cities in South Korea should pay more attention to the institutional arrangement for collaborative efforts in order to integrate not only the city s core systems but also wider stakeholders involvements 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 practitioners that may influence on the implementation of smart sustainable 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 standing point of the observed participants, rather than generalise the results of the statistical aggregation from the anonymous data.

7. References

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