Proceedings of the 21th Conference of the Environmental and Sustainability Management Accounting Network (EMAN), Liège, 2017

Smart City concepts: from perception to acceptability

Schelings, C. and Elsen, C.
University of Liège, BE-4000
Clementine.Schelings@ulg.ac.be

***Extended abstract*: This paper studies the sustainability of the Smart City from the acceptability perspective. Assuming that there is a possibility for end-users to reject some of the Smart City principles and, consequently, to jeopardize its perenniality, we argue that studying how citizens perceive some of the Smart City concepts is a prerequisite for the assessment of the Smart City sustainability scheme. In this paper, we test the acceptability of the Smart City by confronting the theoretical concepts generally mobilized in the literature with the people's actual perceptions. To this end, a short survey was distributed on the occasion of three Smart City events. This article analyses the obtained results in regard of three demographic factors (age, gender and professional background). It thus repositions chore concepts of the Smart City in regard of acceptability, and particularly in relation to the associated risks for its sustainability.**

I. CHALLENGE

The worldwide population nowadays keeps increasing, resulting in faster urbanization and larger energy consumptions [1], [2]. Those demographic and environmental challenges constitute tremendous risks for the urban sustainability and call for new ways to design the city. The Smart City model envisions a city made more sustainable particularly through technology deployment [3]. Although higher connectivity might indeed help addressing a wide range of issues, researchers largely agree that such techno-centric model mainly depends on citizens' adoption of these technologies on a daily basis [4]-[6]. The perenniality of the Smart City, i.e. its stability over time and thus its sustainability, is consequently heavily dependent on the citizens' perceptions. Their acceptability is crucial: citizens have a decisive influence on the potential success/failure of the Smart City global model, as they have the power to decide which concepts or technologies they accept/reject, this way either enhancing or endangering the sustainability of the model [5], [7].

II. METHODOLOGY

In order to test the acceptability towards the Smart City main concepts, we built a short questionnaire distributed in the context of three Smart City events. Out of the 627 participants who took part to those independent events, the 125 respondents were either simple citizens or professional stakeholders (officers of various public services or economic actors), but more importantly their presence to those events suggest that all of them were sensitized to the Smart City topic.

Besides the basic demographic information, the survey included three questions. The first one consisted in ranking Smart City concepts by order of importance (from one to six, one being the most important, six the less important in the participants' view). The six chosen concepts correspond to Giffinger's Smart City axes, i.e. economy, people, governance, mobility, environment and living [8], as we wanted to confront the respondents' perceptions with one of the most widespread definition in the literature. The second question aimed at defining the Smart City on the basis of several qualifiers presented two by two on a five-point Likert scale. The goal of the third open-ended question was to collect the participants' opinions about the areas of their daily life inside which they would, or would not, be ready to integrate some smart component.

As far as modalities are concerned, one of the events was a free conference open to the general public, while the other two were forums (with paid registration) including exhibitions of technologies. As the conference was part of a larger cycle usually attracting various citizens' profiles, and as we could not collect information about participants' familiarity with the Smart City model, we opted in that case for a double-sided questionnaire, the front side being filled before the lectures and the back side during the break. This two-step questionnaire helped us assess the speakers' impact on the participants.

III. RESULTS

A. *Ranking of the Smart City concepts*

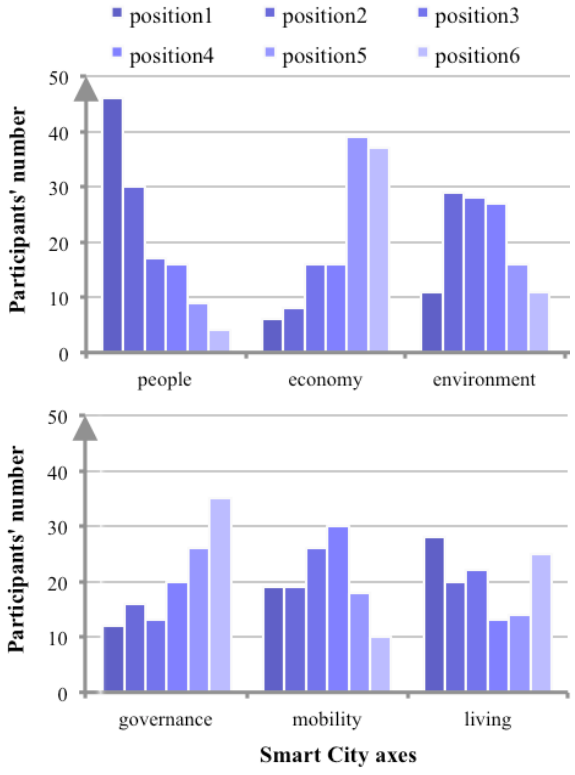

FIGURE 1: RANKING OF THE SIX SMART CITY CONCEPTS DEPENDING ON THEIR IMPORTANCE LEVEL (POSITION 1 BEING THE MOST IMPORTANT, POSITION 6 THE LESS IMPORTANT).

The results of the first question (Fig. 1) clearly reveal two trends: a large proportion of participants rank the "people" concept in first place in terms of importance, while "economy" and "governance" are systematically ranked lowest. The three other concepts have more variable positions, but stay relatively well ranked.

The double-sided questionnaires collected from the 43 conference participants inform us about the sensitization impact on the participants' perceptions. Indeed, before the lectures, the concepts "people", "living" and "environment" were all in first position without clear demarcation. After the break, the ranking became: 1) people 2) living 3) mobility 4) environment, with the human capital concept clearly moving up in the ranking.

The next paragraphs present each concept perception according to three influence factors: gender, age (18-25, 26-35, 36-45, 46-55 and 55+) and professional field. We delineate four professional areas from the respondents' answers: participants active in technology related fields (the "techies", n=50), participants active in public services (n=32), in education fields (n=13) and in an "other" category, regrouping professionals from various other backgrounds.

For each age group, the "people" concept is seen as very important: at least 60% of the participants give it a high position (1, 2 or 3). This proportion even reaches 95% among the 18- to 25-year-olds, and then decreases with age, except for the last age group (people over 55), right behind the 18-25 age group when it comes to ranking the "people" concept.

The "economy" concept is slightly more important for women than men, but it remains a rather secondary axis from the respondents' perspective. It is ranked in low position (4, 5 or 6) for at least 75% of the participants from any professional field (Fig. 2), except for the "other" category (including people active in the finance area) attributing it a little more importance.

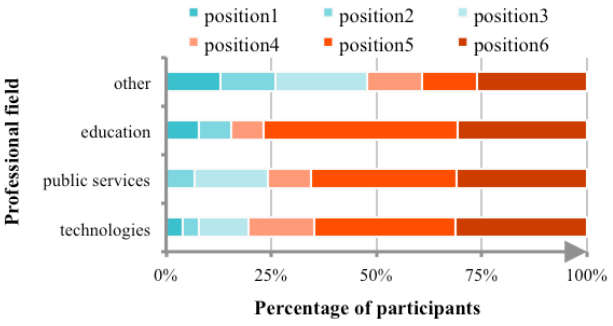

FIGURE 2: RANKING OF THE CONCEPT "ECONOMY" ACCORDING TO THE PROFESSIONAL FIELD.

The "environment" is a topic that mainly concerns both the youngest and the oldest participants. While 70% of the people over 55 and 55% of the 18-25 age range give it a high position in the ranking, 55% of the 36- to 45-year-olds place it on a low position.

The "governance" concept is generally ranked in low position, but we still observe a higher or lower interest depending on the professional field. Indeed, only 15% of the "education" group put this concept in high position, while the proportion moves coherently to 40% for officers of public services.

Generally, the importance assigned to the "mobility" concept decreases with age (Fig. 3). Indeed, this concept is ranked in high position by 60% of the 26- to 35-year-olds, while 60% of the people over 55 rather give it a low ranking. However, the 18- to 25-year-olds rather join the opinion of the 55 and older. This variation might be explained by the evolution of family and professional rhythms, involving different mobility issues all along one's lifetime.

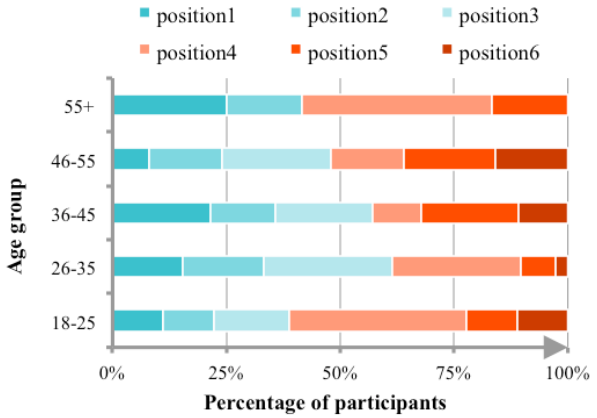

FIGURE 3: RANKING OF THE CONCEPT "MOBILITY" ACCORDING TO THE AGE GROUP.

"Living" is the concept that was obviously the hardest to rank for the participants, since it collects nearly as many votes in last as in first position. Nevertheless, some light tendencies appear such as a greater importance for men, for youngest people and for techies.

B. Smart City qualification

The Smart City is globally well perceived by the respondents, who find it really welcoming (vs. threatening, 80%), very sustainable (vs. ephemeral, 80%), very innovative (vs. "gadget", 90%) and realistic (vs. utopian, 55%). Their choice is less obvious regarding the propositions "a way to control me" vs. "a way to make me creative", but the balance is more in favor of a creative city.

Thanks to the use of the double-sided questionnaire, the impact of sensitization on participants' perceptions is clearly visible. After the lectures, the Smart City gains reputation and becomes a little more welcoming, sustainable, realistic and creative. However, it seems a bit less innovative than before.

Some of the duos of qualifiers would moreover vary according to the three demographic factors. Looking first at the "welcoming vs. threatening" dichotomy, results suggest that the Smart City is always considered as welcoming, but surprisingly, officers from public services are the ones that find it the less welcoming.

Looking then at the "control vs. creative" dichotomy, three trends tend to emerge. Although those qualifiers attract most of the neutral votes, we observe that women consider the Smart City as "a way to make me creative", while men are unable to decide. Second, the 36-45 age group is the one that feels the most controlled by the Smart City. Third, the techies clearly opt for the adjective "creative" rather than "controlled".

C. Daily life areas

Answers to the open-ended question have been aggregated by themes and presented as word clouds (Fig. 4 and 5). Generally speaking, it seems harder for the respondents to project themselves in some negative effects the Smart City might have on their daily lives (17 topic areas listed vs. 31 in case of Fig. 4). "Private data" nevertheless emerge as one key aspect participants would be reluctant to share, which underlines the delicate balance one has to reach between collecting large amount of data (essential to nurture Smart City initiatives) and insuring end-users' privacy and anonymity.

FIGURE 4: DAILY LIFE AREAS WHERE PARTICIPANTS WOULD BE READY TO INTEGRATE SOME SMART COMPONENT.

FIGURE 5: DAILY LIFE AREAS WHERE PARTICIPANTS WOULD NOT BE READY AT ALL TO INTEGRATE SOME SMART COMPONENT.

IV. CONCLUSION

The survey results highlight, on the one hand, how important the human capital is from the participants' perspective and, on the other hand, the rather positive image the Smart City model nowadays conveys. Besides, the participants demonstrate a very open-mind towards "smartness" introduction inside their daily lives.

Nevertheless, the results should be handled carefully since the representativeness of the sample is quite limited. Gender parity is not respected since women represent only 25% of the participants. The respondents moreover all demonstrate at least some interest for the Smart City model and, thus, it seems logical that they would give it a rather warm welcome. This trend, yet, could show as drastically different for "average" citizens, as previous research has demonstrated citizens' reluctance in regard of some Smart Cities' projects [9], [10]. Sensitization, our results suggest, might nevertheless ease perception of the Smart City concepts and perhaps, as a result, their acceptation.

Another limit of this questionnaire rests in the understanding of Giffinger's concepts. For instance, the "living" concept might have been problematic, since it is the most fluctuating one in the ranking. This trend could be explained by the respondents' various interpretations of this word: "living" could for instance refer to consumption behaviour (and responsibility in terms of some un/sustainable behaviour), or rather be associated with comfort and wellbeing.

Another limit is related to the third question, for which two fields were suggested as examples ("domotics" and "telemedicine"). Their influence is very clear since participants often mention both terms. Even if participants indeed seem in favour of introducing domotics to their daily lives, doubts remain for telemedicine, as it is perceived both negatively and positively.

These exploratory results underline the importance decision-makers should grant to the precise definition of what a Smart City is, given a specific context and given the public's profile, as each misunderstanding might jeopardize the sustainability of the model. Researchers, on the other hand, should be aware of how some theoretical concepts might distance themselves from end-users and field actors, as their understanding and interpretation are sometimes far from each other.

REFERENCES

[1] Gooch, D., Wolff, A., Kortuem, G. & Brown, R. (2015). Reimagining the role of citizens in Smart City projects. In: Adjunct Proc. of the 2015 ACM International Joint Conference on Pervasive and Ubiquitous Computing, ACM, New York, 1587-1594.

[2] Guelzim, T., Obaidat, M.S. & Sadoun, B. (2016). Introduction and overview of key enabling technologies for smart cities and homes. Smart Cities and Homes, pp. 1-16.

[3] Dameri, R. P., & Cocchia, A. (2013, December). Smart city and digital city: Twenty years of terminology evolution. In X Conference of the Italian Chapter of AIS, ITAIS (pp. 1-8).

[4] Ben Letaifa, S. (2015). How to strategize smart cities: revealing the SMART model. J. of Business Research 68, 1414-1419.

[5] Monfaredzadeh T. & Krueger, R. (2015). Investigating social factors of sustainability in a smart city. Proc. Eng. 118, 1112-8.

[6] Brown, H.S. & Vergragt, P.J. (2006). Bounded socio-technical experiments as agents of systemic change: the case of a zero-energy residential building. Technological Forecasting and Social Change 75, pp. 107-130.

[7] Chourabi, H., Nam, T., Walker, S., Gil-Garcia, J.R., Mellouli, S., Nahon, K., Pardo, T.A. & Scholl, H.J. (2012). Understanding Smart Cities: an integrative framework. Proceedings of HICSS, pp. 2289-2297.

[8] Giffinger, R., Fertner, C., Kramar, H., Kalasek, R., Pichler-Milanovic, N. & Meijers, E. (2007). Smart Cities: ranking of European medium- sized cities. Centre of Regional Science, Vienna University of Technology.

[9] Bartiaux, F. (2007). Does environmental information overcome practice compartmentalization and change consumers' behaviours? Journal of Cleaner Production 16, pp. 1170-1180.

[10] Bertoldo, R.; Poumadère, M. & Rodrigues Jr. L.C. (2015). When meters start to talk: the public encounter with smart meters in France. Energy Research and Social Science, 9, 146-156.