MEASURING THE CAPACITY OF LOCAL MUNICIPALITIES TO ADOPT AN URBAN E-GOVERNANCE POLICY USING A SMART SYNTHETIC MODEL

Karim **CHENIK**I[1], *Amel* **BAZIZ**[1], *Hocine* **BOUGDAH**[2]
[1]University of Science and Technology Houari-Boumédiène, Algiers, Algeria
[2]University of Westminster, London, United Kingdom

Abstract: One of the main problems of urban governance in Algeria is bureaucracy. Based on the experience of other countries, the concept of smart cities is becoming increasingly important, including urban e-governance which is considered as an important corner stone of smart cities. Hence, e-governance is proposed as a new tool to solve urban governance problems. Its main objectives are focused on strengthening credibility and accountability. This paper tried to assess the ability of Algiers bay municipalities to adopt urban e-governance policies and to see strategies to be deployed to solve urban related problems. To achieve this goal, the work presented in this paper describes the development of a Smart Synthetic (SS) model that could serve as a tool for policy makers to assess their policies and to identify ways to solve urban problems. This 'SS model' is based on the findings of relevant, locally based case studies from the bay area, to which the model is later applied. In order to achieve this, the authors opted for a Multi-Attribute Value Theory method. The application of the model revealed that of a total of nine municipalities, four are in a position to adopt an urban e-governance policy. However, the remaining ones have not yet been able to adopt such a policy due to several barriers which are mainly related to the governance policy. The advantage of this model is therefore its flexibility. It could even be adapted to evaluate urban e-governance in other cities.

Key Words: *urban policy, intelligent governance, smart city, mixed approach, ICT.*

Introduction

E-governance is one of the most important pillars of smart cities. It plays an important role in the coordination between different disciplines and stakeholders. Praharaj et al. (2018) state that the success of a smart city depends on smart governance capable of integrating the embedded political, social and economic aspects of a city.

Urban e-governance is based on the integration of ICT to improve government services. It plays a great role in bringing citizens closer to the administration. It is also a major player in curbing corruption, reducing costs and delays and in enabling transparency and efficiency of urban management, by opening up information to the public. Moreover, it plays a great role in "improving public services such as transportation, power, health, water, security, and municipal services" (Kundu 2017). E-governance plays a great role in involving citizens in new processes of co-creation, co-production and citizens supply (Meijer 2015). However, the role of government in creating a real e-governance is still limited, as it is mainly informative (Norris 2010, Meijer 2015).

Shiang (2009) argues that e-governance is based on multi-stakeholders' coordination and responsibility. He adds that the formation of the informational society requires new forms of solidarity, partnership and cooperation between different stakeholders. According to the same author, territorial actors must propose projects and evaluate their importance, effectiveness and impact. Then, they must implement the principles of global approach, partnership and participation.

Much of the published work relating to this kind of research uses surveys to analyze the e-governance process. Even those who use the multi-criteria analysis end up with a theoretical model based on a qualitative approach. This kind of approach has some limits, such as time-consuming and subjectivity, and even the difficulty in explaining the obtained results. In this work, the authors opted for a mixed-method approach that combine the qualitative and quantitative analysis with a view to improve what the previous methods offered. They, therefore, conceptualized a theoretical model that was evaluated and verified using the statistical analysis. The choice of the approach is justified by the need to develop a model that uses previously known qualitative data and yet capable of evaluating the decision-making process according to numerical data, in order to rank the municipalities' capability and readiness to adopt urban e-governance policies.

The most recent findings are those of De and Bandyopadhyay (2020), who develop a pro-citizen model for the optimum functioning of urban e-governance and of Jiang et al. (2020), who establish a framework that examines the impact of urban contexts on the sociotechnical interaction between urban technological innovation and urban governance in the realm of smart cities. Lopes and Farooq (2020) propose a smart city governance model for Pakistan cities while Mukherjee (2018) explores the use of GIS and other information and communication technologies in governance. Praharaj et al. (2018) attempt through their work to assess the ability of Indian cities to adopt more collaborative governance. Sharma and Kalra (2019) study the level of acceptance of the e-governance policy in the capital city of Uttar Pradesh, and Santos (2017) argues that the key to success is the collaboration of different stakeholders (administrations, agencies, citizens). Palomo-Navarro and Navío-Marco (2018) are conducting a study on the smart city network which takes into account the interaction between smart governance and public network studies. They attempt to assess the impact of the smart city network at local, national and international levels (Palomo-Navarro and Navío-Marco 2018). They discovered that the Spanish network of smart cities is able to configure "future policies in local administration, necessarily related to efficiency, digitalization and citizen centricity and with key topics to build the future" (Palomo-Navarro and Navío-Marco 2018: 872). Meijer and Bolívar (2016) explain that e-governance is not only a technological issue, and they add that it also requires institutional and political changes. Castelnovo et al. (2016) propose a holistic approach for assessing smart city governance.

It is important to mention that many studies of urban e-governance are carried out as part of multi-disciplinary approaches to other topics such as trust, transparency, stakeholders, e-participation, etc. However, the assessment of urban e-governance using a 'Smart Synthetic Model' that evaluates its performance and identifies problems that could hinder its better performing systems using a mixed approach is scarce, especially when considering cities in African developing countries.

Moreover, these studies ideally explore the concept of e-governance and its relationship with the stakeholders and the coordination between them. The study of different cases of cities that have adopted the e-governance policy revealed that it is difficult to control the balance in decision-making between different stakeholders (Bovaird 2005). Such a process will be in the hand of some stakeholders; be it government departments or businessmen. In most cases, there are businessmen who take it over from other stakeholders. It is important to mention that it is impossible for ICT to be accessible to all citizens because, on one hand, some citizens are not smart enough to live in a smart city and to deal with its intelligent governance. On the other hand, the cost of ICT may exclude some poor people who could not buy new technological tools. This leads to the marginalization of a certain social strata, which is considered a kind of discrimination.

To fill this gap, the authors chose to conceive a model that expects the problems that could hinder the implementation of urban e-governance. In addition, it rates the municipalities that are

in a position to adopt an urban e-governance policy. This model was evaluated and verified through its application to the case of the municipalities of the bay of Algiers.

This model takes into account important factors such as the balance in decision-making, citizens' participation, the barriers that could hinder the implementation of urban e-governance and other factors extracted from the literature.

The literature reveals that many problems and barriers could hinder the adoption of the e-governance policy. The introduction of ICT into governance policies can be hampered by the inability of many stakeholders to adopt this type of technology (Dougherty 1992, Meijer 2015). A number of barriers can be identified under the following two headings:

- Government barriers that can be divided into: personal capacity, technical capacity, financial capacity, legal issues (lack of political support and management), lack of leadership (Eynon and Margetts 2007, Meijer 2015), lack of coordination (Eynon and Dutton 2007, Eynon and Margetts 2007, Meijer 2015), and, finally, inter-organizational (Sørensen and Torfing 2011, Meijer 2015).

- Technical barriers related to hardware and software, interoperability (Eynon and Margetts, 2007, Meijer 2015), and the ability to maintain confidentiality and security (Gilbert et al. 2004, West 2005, Meijer 2015).

Citizen-related barriers, such as motivation and skills to cooperate with the government, represent the so-called "digital divide" that is mentioned as a key barrier (Van Deursen and Van Dijk 2011, Meijer 2015). It is also suggested that staff may resist to e-governance for the fear that technology may replace the people. Another obstacle is that ICT cannot be integrated into the daily routine (they are not domesticated). It is important to mention that even the mental image that citizens have of the government could be an obstacle, especially if they do not trust the government, so they will never interact with the government using ICT (Margetts and Dunleavy 2002, Meijer 2015) and, finally, structural and cultural barriers are mentioned by Schwester (2009) and Meijer (2015).

Shiang (2009) explains that ICT is not a neutral tool. He explains that the use of ICT to maintain democracy is important, but it can also have a negative effect in the case of cities where democracy is fragile. He argues that ICT can make power more concentrated through information control. This situation can give powerful stakeholders the opportunity to be even more powerful by controlling the information and by excluding the citizens from the decision-making process. He adds that ICT can contribute to producing a democratic society, but they can also produce autarky.

Finally, Chadwick and May (2003), Torres et al. (2006) and Shiang (2009) argue that ICT in developing countries strengthens management without creating opportunities for citizen participation in policy making.

Shiang (2009) argues that ICT can lead to the emergence of new forms of segregation between the information rich and the information poor; the latter will therefore be excluded from the political life, while coordination between different stakeholders is strongly recommended in the e-governance policy as it plays an important role in improving the delivery services (Kunstelj and Vintar 2004, Špaček 2014). Špaček (2014) argues that coordination through e-governance is considered a key factor for effective governance at the national level. Shiang (2009) explains that an information society needs new forms of solidarity and cooperation between different actors.

In addition, the development of ICT within the government can play an important role in improving the efficiency of the government's administrative body (Heeks 2001, Ismail 2010). This work has the particularity of providing a model based on the study of problems and

barriers that could hinder the better performance of the e-governance policy. The study is based on tried and tested methods by different scholars.

Moreover, the authors tried to use this model to solve problems that already existed in previous experiences in order to establish an intelligent system capable of predicting problems and trying to solve them automatically, taking into account the specificity of Algiers (a city located in a developing African country with an unclear governance system). In addition, this model attempted to integrate citizens into the political process using ICT, and, also, it could predict the proportion of citizens who could be marginalized due to the ignorance of ICT tools or the inability to buy them to facilitate integration in the political process.

The aim of this work is to demonstrate the application of the e-governance policy in the bay of Algiers using a "Smart Synthetic Model", composed of several attributes and variables. This work will help decision makers to identify any potential problems that could hinder the performance of such a policy and to enable it to be inclusive towards the citizens. Given that the model is based on data from the local municipalities, it helps decision-makers to decide on the kind of operations to adopt, in order to reduce the gap between the aspirations, needs and practicalities of the governance system in Algiers.

The paper presents a model for assessing and ranking the ability of Algiers' bay municipalities to adopt the urban e-governance policy and to identify the problems and barriers that could hinder adopting such a policy. Through this work, the authors were able to assess and rank the municipalities of the bay of Algiers in terms of their potential to adopt an urban e-governance policy.

Methodology

Many researchers chose for qualitative research when studying a decision-making process (Table 1). In order to realize the objective of this work, the authors opted for a mixed-use approach. The Multi-Attribute Value Theory, or MAVT for short, is a mixed method, based on numerical representations in order to help decision-makers to choose between alternative decisions. It is largely used by many researchers such as Ferretti et al. (2014), Da Cruz and Marques (2017), and Cheniki et al. (2019). It relies on using a multitude of attributes which are different in the type and scale of measurement. It is generally used to measure and rank the performance of a service or an activity. MAVT can use qualitative and/or quantitative descriptions in order to measure the performance of an objective. Moreover, the experts' judgment can substitute quantitative data if it is not available. According to Ferretti et al. (2014), the objective of MVAT is to find a way to associate a real number to each alternative to establish an order of preference for the alternatives consistent with the value judgment of the decision-maker.

Using such a method, all alternative values could be transformed into one simple value by aggregating the values for all attributes. The alternatives with the highest values are ranked the highest. The use of the methodology is through two distinct stages. The first one consists of a conceptualization that involves fixing the appropriate objectives to be evaluated. Those objectives are defined using a set of attributes. This step was undertaken using a literature review that helped to fix the suitable alternative attributes. The second one, that of application, was realized by moving from abstract concepts into measured attributes. According to Ferretti et al. (2014), such attributes can be directly derived from the definition of objectives, constructed to measure the degree to which any objective is met or indirectly related to the defined objectives. The performance of any of the attributes may be described either qualitatively or quantitatively.

Table 1

Advantages and disadvantages of a qualitative approach

Qualitative approach	
Advantages	**Disadvantages**
• It describes in detail the feelings, opinions, and experiences of the interviewees and it explains their significance (Denzin 2001). • It explains the participant's experience in specific settings. • Ideographic research. • It permits to study and understand the interviewees' feelings and experiences, and to figure out how meanings are shaped through culture (Strauss and Corbin 1990). • Collected data are subjective and detailed. • Flexible framework so it can be built and be readapted in order to obtain a greater extent (Maxwell 2012).	• Focus on meanings and experiences (Cumming 2001, Silverman 2016). • Decision-makers may refute results obtained by using the qualitative approach. • In order to analyze a phenomenon, stakeholders usually use the quantitative approach (Sallee and Flood 2012). • The problem of generalizing the findings to the whole population of the research using a few number of samples (Thomson 2011, Harry and Lipsky 2014). • Analyzing data and discussing results is more complicated comparing to quantitative approaches (Richards and Richards 1994). • It consumes a lot of time.

Source: the authors, based on Rahman (2017)

Case study applications

The bay of Algiers (Fig. 1) is considered as the most important urban area in Algeria, due to several variables such as: strategic location, history, heritage, social and cultural situation, economy and port activity (1st commercial port in Algeria).

From an administrative point of view, the study area is made up of nine municipalities with 54.43 km², covering 6.7% of the surface area of Algiers with approximately 574 880 inhabitants, and representing 18.2% of the population of the capital. These municipalities are different in terms of area, population density (which varies between 35 949 inhabitants/km^2 for Casbah and 3294 inhabitants/km^2 for El Marsa), density of blocks, land use categories, proportion of different activities in urban areas and socio-economic importance.

Urban governance in Algiers

Algiers' governance system is characterized by precarious institutions. Icheboudène (2009) explains that the problem of governance in Algiers is linked to incoherence between the conception and the use of this policy and the adoption of inadequate objectives and tools of governance. In addition, he argues that there is a lack of coordination between the government institutions. Hence, the relationship between the government and the urban society is already conducted through a failed policy. The author adds that in the case of Algiers, the regional authority (Wilaya) controls the municipalities by misusing the law to the point of forbidding municipalities from carrying out their main functions. He argues that there is a contradiction between the legislative instruments and what is actually happening in the municipalities. He goes on further to state that the city represents a contradiction between government policy and

Fig. 1 – **Presentation of the bay of Algiers**

citizen's action. He adds that Algiers represents a special case of cities that try to retain political power and to be the sole center of decision-making.

The decision support process. Structuring the model framework

In order to realize the Smart Synthetic Model's tree, the authors used a top-down approach. This model was realized from the definition of the concept of urban e-governance and the objective of this work (Fig. 2).

The analysis of the development of the concept of urban e-governance and the problems that could hinder its better application led the authors to build a model for a successful urban e-governance. In order to achieve this, the authors adopted an MAVT approach to put forward a "Smart Synthetic Model" conceptualized on the basis of the definition, characteristics and objectives of an urban e-governance policy. The model is able to predict problems and it tries to mitigate against their negative impact before they happen. In other words, it was based on a critical analysis of the urban e-governance policy.

This model outlined two main priorities: preserving the obligation to integrate the citizens into the political system, and to maintain a balance between the stakeholders in the decision-making process in order to keep the equity between the priorities and obligations of different stakeholders. The model is capable of measuring the degree to which the objectives of the urban e-governance policy, such as accountability, transparency, efficiency and economic benefits, were realized.

The attributes of the SS Model can be described as follows:

(A) ICT: it measures the ability of stakeholders in each of the municipalities of Algiers' bay to be connected to internet, taking into account the ability of the citizens to own ICT tools and the citizens' ability to be integrated into an intelligent atmosphere. It takes into account the presence of ICT tools and ICT infrastructures, even of technology literate citizens who could use ICT without any problem.

(B) Participatory and digital democracy: it measured the degree of participation of different stakeholders in an urban e-governance process.

(C) Infrastructure: this attribute has not been taken into consideration in developed countries; however, it seems that it is important to consider in the case of cities located in developing countries because there were many municipalities that didn't have enough infrastructures (decision-making infrastructure or public services).

(D) Transparency and public accountability: measuring this attribute was more complicated than that of other attributes, because its evaluation is more qualitative than quantitative. Hence, to measure this attribute, the authors used a binary variable by answering the following questions:
- Is the municipal budget's information posted on the Internet?
- Is the budget's information for the operation posted on the Internet?
- Does the municipality provide open information and public assessment works to strengthen the citizens' voice and exit?
- Is there a mandatory referendum on major projects?

(E) Efficiency: the authors considered two main attributes (e-administration and e-voting); both were qualitative attributes.

(F) Local economy: the assessment of this attribute was based on the measurement of three main variables (structural projects, land for sale on local markets and land prices in each municipality).

(G) Rule of law: this attribute measured the degree of respect for the law in each municipality of the bay of Algiers. In order to achieve this objective, two main attributes were proposed (number of uncorrupted mayors, information on corruption published on the Internet), this information was based on the collection of information published on the Internet, including information published in the different daily newspapers.

(H) Political stability: This attribute was based on measuring citizens' satisfaction with their executive mayors. For this paper, the measurement of this attribute is based on:
- The number of executive mayors serving more than one mandate, so that full stability will be represented by the same mayor for all these years (Swianiewicz 2001). In the case of Algiers' bay municipalities, the mayoral mandates taken into account were those of 2002, 2007, 2012, 2017 (twenty years).
- Pluralism in decision-making, by counting the number of political parties involved in the decision-making process.
- Percentage of votes obtained by the winning political parties.

Measuring the raw values

There were two kinds of attributes, quantitative and qualitative ones. Measuring the former was easier than the latter. Quantitative attributes were measured using different sources such as surveys, counting and using different android applications for mobile phone, such as "Speedtest", for calculating signal force for mobile internet (2G, 3G, and 4G), and software such as ArcGIS for measuring infrastructures and services (Table 2). However, qualitative attributes were measured using different methods. In the case of our model, attributes such as transparency, public accountability and efficiency, were measured by the means of questionnaires using a series of Yes/No questions.

Source of the database used in measuring the "SS model" of Algiers' bay municipalities

Attributes		Variables	Source of information
ICT	ICT tools	Internet users	DPTIC (2017)
		Home phone	DPTIC (2017)
		Computer users	DPTIC (2017)
		Smart phone users	–
		Signal force 2G, 3G, 4G	Measured by the authors using the "Speedtest android" application on mobile phones (2018)
		ICT infrastructures	DPTIC (2017)
	Human ability to use ICT	Citizen's literacy	ONS (2011)
Participatory & digital democracy	Social participation	Civic societies	GIS of Algiers (2018) realized by the authors
		Voters	DALE (2017)
	Companies	Public companies	GIS of Algiers (2018) realized by the authors
		Private companies	GIS of Algiers (2018) realized by the authors
Infrastructure		Decisional infrastructure	GIS of Algiers (2018) realized by the authors
		Public infrastructure	GIS of Algiers (2018) realized by the authors
Transparency & public accountability		Municipalities' budget information posted on the internet	Information published on the internet (2018)
		Operation's budget information posted on the internet	Computed by the authors from information published on the internet (2018)
		Open information and public assessment works to strengthen the citizen voice and exit	Calculated by the authors from information published on the internet (2018)
		Mandatory referendum on large projects	Calculated by the authors from information published on the internet (2018)
Efficiency		E-administration	Calculated by the authors from information published on the internet (2018)
		E-voting	–
Local economy		Structural projects	DAUC (2016)
		Land for sale	Computed by the authors from OuedKniss (2018) consulted in 2018
		Land's price	Computed by the authors from OuedKniss (2018) consulted in 2018

Rule of law	Uncorrupted mayors	Calculated by the authors from information published on the internet (2018)
	Corruption information published on the internet	Computed by the authors from information published in internet (2018)
Political stability	Pluralism in decision making	D.G.L.P.A.J. (2017)
	Number of executive mayors occupying a position in different years	Calculated by the authors from information published on the internet (2018)
	Successful political party	D.G.L.P.A.J. (2017)

Normalization (standardizing scores)

Raw scores of different attributes can't be used as they are and they needed to be standardized in order to be compared. This operation was done by transforming the raw scores into normalized scores, by using the Z-score, which are represented as standard deviations from their means. So, the Z-scores have zero as mean value and the standard deviation is equal to one (Abdi 2007). In order to realize that operation, it is necessary to use a multitude of samples that have different raw scores to be compared and transformed into Z-score values (Abdi 2007), using Equation 1:

$$Z = \frac{Y - M_Y}{S_Y}$$

Equation 1. The Z-score formula

It is important to mention that raw scores are represented in positive and negative values; when 0 is considered as medium level, positive scores mean that the objective is highly realized in those municipalities and negative values mean that the performance objective is low.

Weighting values

There are many ways to calculate the weights of different attributes. In this work, the Analytic Hierarchy Process (AHP) method seems to be an adequate method to be used. It is a theory based on the pairwise comparison of different judgments of experts in urban governance in order to obtain the priority scale (Saaty 2008). This is undertaken in two steps.

First, a scale is set, which indicates the importance of each element to another with respect to the type of element (attribute or variable). The authors used a 1 to 9 scales for all attributes: 1 – equal importance, 2 – weak or slight importance, 3 – moderate importance, 4 – moderate plus importance, 5 – strong importance, 6 – strong plus importance, 7 – very strong or demonstrated importance, 8 – very, very strong importance, and 9 – extreme importance (Saaty 2008).

The second step involves building a pairwise comparison matrix based on the experts' opinions (35 experts were asked) to form a qualitative judgment with different alternatives. Each attribute was compared with another one in the same level in order to obtain its weight using the AHP scale explained above. Table 3 presents the pairwise comparison of the weighted attributes of urban e-governance of Algiers bay municipalities. The same process was carried out in order to compute the weights for the variables (i.e. the attributes were compared with each other and the variables were compared with other variables which are related to the same attribute).

It is important to mention that judgement matrices information could be obtained from different methods; it may be interviews, decision conferencing, web-based questionnaires and surveys. In this work, we have used web-based questionnaires to obtain the information quickly.

Table 3

Standardized matrix

Attributes	A	B	C	D	E	F	G	H	Weight
A	0.37	0.57	0.23	0.44	0.26	0.21	0.36	0.30	0.34
B	0.12	0.19	0.20	0.33	0.23	0.19	0.29	0.25	0.22
C	0.09	0.03	0.03	0.02	0.01	0.07	0.01	0.01	0.03
D	0.09	0.06	0.17	0.11	0.19	0.16	0.22	0.20	0.15
E	0.07	0.03	0.09	0.02	0.04	0.09	0.02	0.02	0.05
F	0.12	0.02	0.01	0.02	0.01	0.02	0.01	0.01	0.03
G	0.07	0.05	0.15	0.04	0.15	0.14	0.07	0.15	0.10
H	0.06	0.04	0.12	0.03	0.11	0.12	0.02	0.05	0.07

CI=0.009; CR=0.01
Source: the authors, based on the experts' evaluation
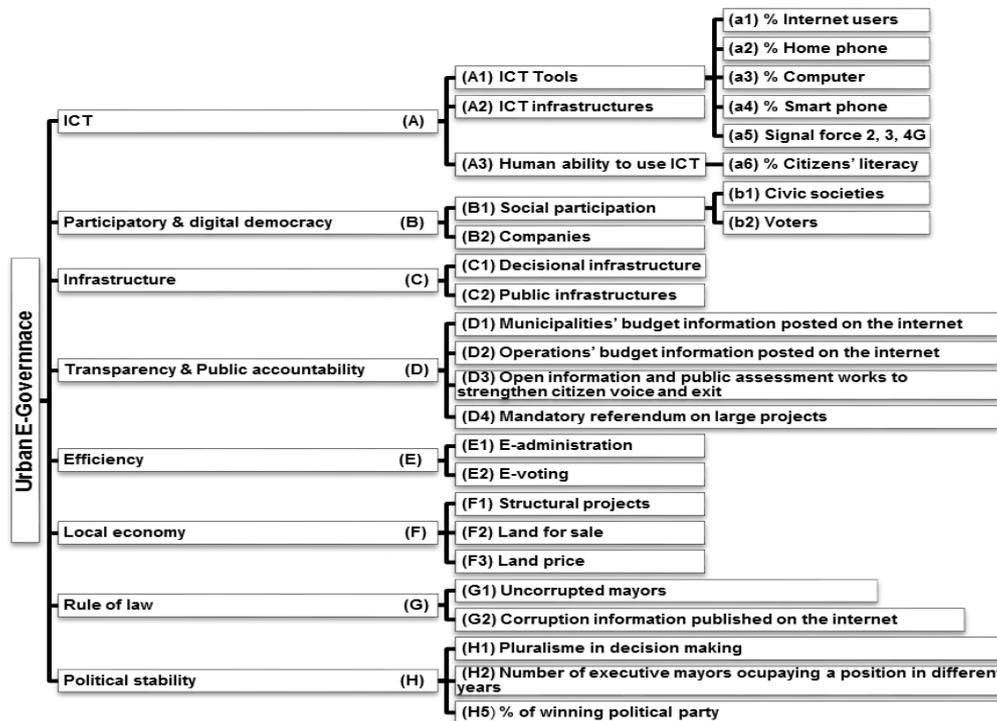
Fig. 2 **– Synthetic Smart model tree (Attributes and variables)**

Results

The Algiers' bay municipalities database was conceived using different sources of information. The collection of such data was time-consuming. Once this was achieved, the variables and attributes defining the "SS model" were measured. The verification of the model yielded a Cronbach Alpha coefficient of 0.7, which is considered as "good". The key findings of this study are presented under the following two main headings.

Urban e-governance ability (ranking of municipalities)

In order to measure and rank the ability of Algiers' bay municipalities to adopt an urban e-governance policy, the authors attempted to build and use the "SS model". Hence, measuring the attributes defining that model yielded the following results (Fig. 3).

Algiers Center was ranked as the best municipality that is able to adopt the urban e-governance policy followed respectively by Hussein Dey, El Marsa, Sidi M'hamed, Mohammadia, Bordj El Kiffan, Casbah, Belouizdad and Bordj El Bahri.

Algiers Center and Hussein Dey were ranked as the best by obtaining the highest scores (+1.1582, +0.1711), followed by El Marsa and Sidi M'hamed with average scores (+0.0511, +0.0123). However, five other municipalities were ranked as being the worst (with negative scores).

It is important to mention that Algiers Center is the only municipality that obtained positive scores for all the attributes of the "SS model".
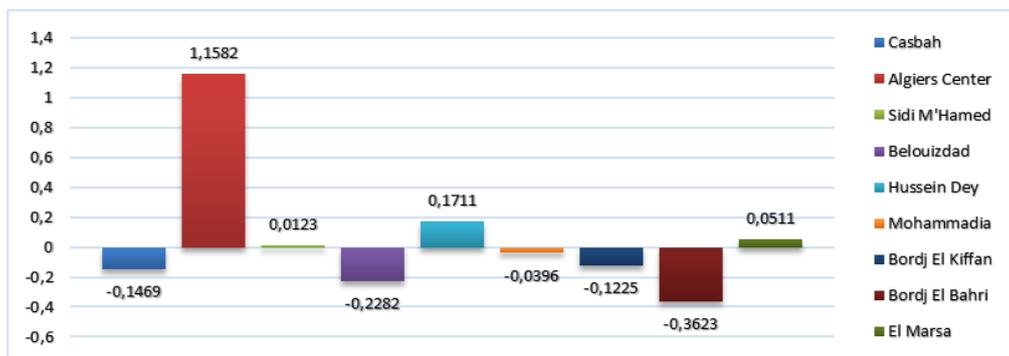

Fig. 3 – **Urban e-governance ability (Ranking of Algiers' bay municipalities)**

Barriers into adopting the e-governance policy

After measuring all attributes related to the urban e-governance policy in nine different municipalities, Fig. 4 demonstrates the different scores obtained by measuring each attribute of the "SS model". This showed that Algiers center was the only municipality that obtained positive scores by measuring all attributes. For the rest of the other municipalities, there are two kinds of problems. First, problems related to the urban governance. Secondly, problems related to information and communication technologies.

Referring to the barriers related to urban governance, the "SS model" revealed the following Information:

- 4 out of 9 municipalities under study failed to involve the citizens and the civic society into the urban governance policy (Belouizdad, Mohammadia, Bordj El Bahri, El Marsa).
- 4 out of 9 municipalities have not provided their citizens with the necessary infrastructure for their well-being (Casbah, Mohammadia, Bordj El Bahri, El Marsa).
- 6 out of 9 municipalities failed to be more transparent and more accountable (Sidi M'hamed, Belouizdad, Hussein Dey, Mohammadia, Bordj El Bahri, El Marsa).
- 8 out of 9 municipalities failed to be more efficient in responding to the citizens' requests (Casbah, Sidi M'hamed, Belouizdad, Hussein Dey, Bordj El Kiffan, Bordj El Bahri, El Marsa, Mohammadia).
- 5 out of 9 municipalities failed to develop their local economy (Hussein Dey, El Marsa, Bordj El Bahri, Belouizdad, Casbah).
- 3 out of 9 municipalities failed to apply the rule of law in their municipalities (Casbah, Bordj El Kiffan, El Marsa).
- 4 out of 9 municipalities were politically unstable (Hussein Dey, Mohammadia, Bordj El Kiffan, Bordj El Bahri).

The results revealed that the most important barriers are related to urban governance and not only to the integration of ICT in that policy. So that, the barriers related to the information and communication technology were that 5 out of 9 municipalities failed to integrate ICT into their decision-making process (Casbah, Sidi M'hamed, Belouizdad, Bordj El Kiffan, Bordj El Bahri).

Discussion

This paper discussed the ability to adopt the urban e-governance policy using the "SS model" and the Algiers' bay municipalities' database which played a great role in realizing the purpose of this study by building a "Smart Synthetic model" and by using it to evaluate and rank the ability of these municipalities to adopt the urban e-governance policy. Also, we tried to extract the factors that can hinder the adoption of this policy in the case of Algiers' bay municipalities.

There are only a few works that attempt to assess the urban e-governance policy; most of them evaluate only the urban governance in the case of developing or developed countries. The most relevant work belongs to Da Cruz and Marques (2017), as the authors attempt to assess local governance indicators in the case of Lisbon (city located in a developing country). Besides, through this work, the authors tried to build a Smart Synthetic model (SS model) which was based on the context of an African developing country in order to assess the ability of their cities to adopt the urban e-governance policy by helping the decision-makers to take the appropriate decisions to solve the problems related to the urban e-governance policy. The results got from assessing the ability of Algiers' bay municipalities to adopt the e-governance policy were surprising.

Algiers Center is perfectly able to adopt the urban e-governance policy; the assessment using the "SS model" revealed that the scores obtained from measuring all attributes were positive. Hence, it was ranked as the first municipality to be able to adopt the urban e-governance policy compared to the other municipalities of this case study.

The scores obtained from measuring three other municipalities were also positive. It means that Sidi M'hamed, Hussein Dey and El Marsa have been able to adopt the urban e-governance policy. However, the rest of the other municipalities had negative scores. It means that they were not yet in a position to adopt the e-governance policy.
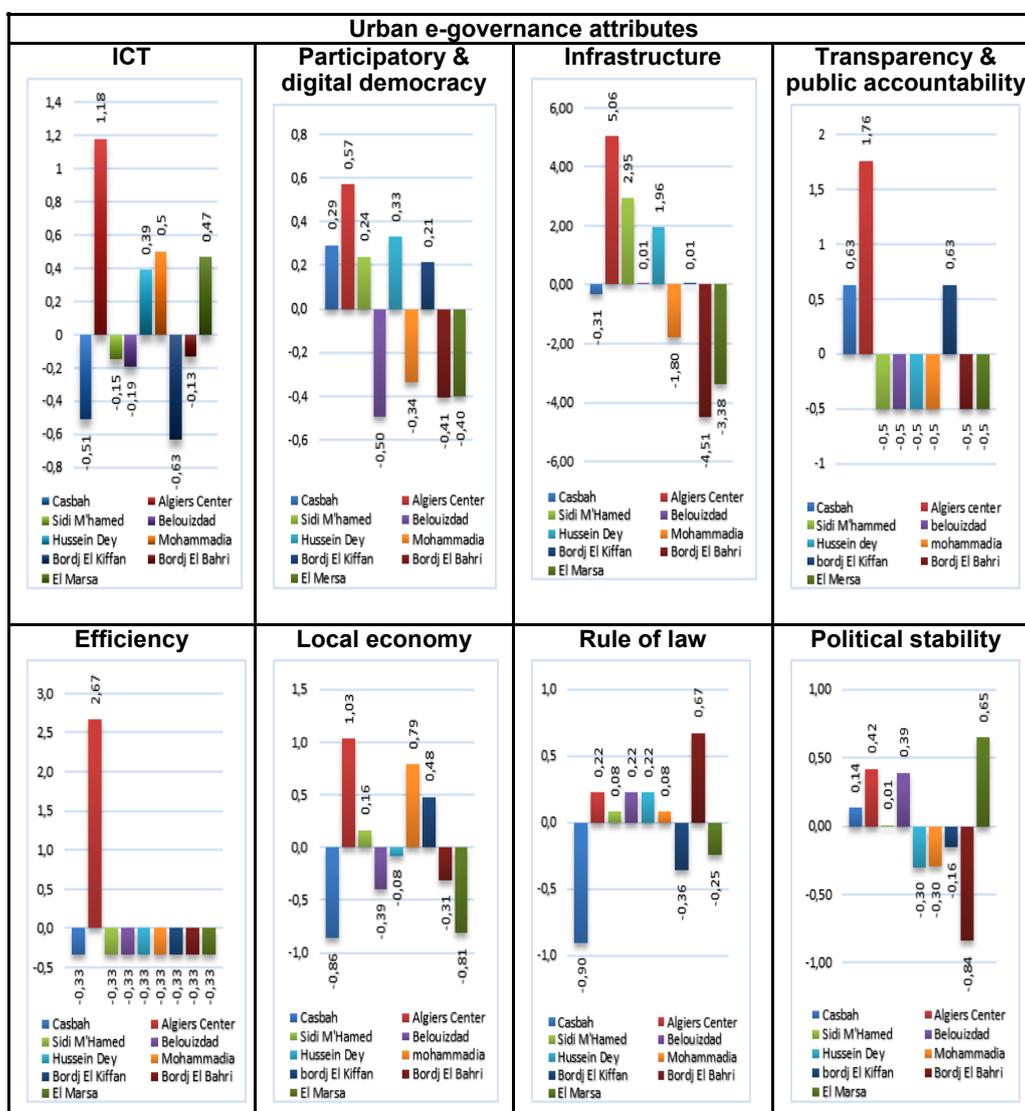
**Fig. 4 – Evaluation of urban e-governance policy in Algiers' bay municipalities,
by Attributes**

The most remarkable barriers were not only related to the ICT knowledge, but also to the urban governance policy which was not respected in most of the municipalities.

It is important to mention that the authors attempted to evaluate the ability of Algiers' bay municipalities to adopt the urban e-governance policy by using the "SS model". Fortunately, Algiers' bay municipalities' database played a great role in realizing this objective. However, some attributes were not used due to the lack of information (i.e. number smartphone users), or

the non-existence of a certain service (i.e. e-voting).

This work is different from the previous ones on the urban governance policy, because it included the possibility to integrate ICT into the urban governance policy in cities located in an African developing country. Two kinds of barriers were considered: urban governance barriers and ICT barriers.

The application of the "SS model" in the case of Algiers' bay municipalities led the authors to discover the following realities.

Despite the centralized urban governance system in Algiers, the results obtained by using the "SS model" attributes in the case of Algiers' bay municipalities revealed that each municipality presented itself a distinct case (the results are different from those of the other municipalities). The only similarity between most of them was that they all had urban governance barriers. Surprisingly, only Algiers center was highly able to adopt the urban e-governance policy because it fulfilled all attributes of good governance and ICT knowledge. Three other municipalities were considered the best (Hussein Dey, Sidi M'hamed, El Marsa), but they suffered from numerous barriers (i.e. in the case of Hussein Dey, lack of transparency and public accountability, efficiency, weak local economy, and weak political stability). This study demonstrated that urban e-governance in Hussein Dey municipality could be caused by many problems, mainly: low human capacity to use ICT, weak participation of civic society and citizens, lack of numerous infrastructures and transparency & accountability, poor efficiency, scarcity of constructible lands and structural projects, and finally, problems related to corruption and political stability. Decision-makers must therefore focus on solving these problems in order to then promote the urban e-governance policy; they only have to solve the problems that need to be solved first.

Therefore, the role of Hussein Dey's decision-makers was to fill these gaps in order to achieve an effective political system to be able to adopt a fully-fledged urban e-governance policy. However, the rest of the other municipalities were not able to adopt this policy, as they had to intervene in many parts to obtain a more efficient political system.

Broadly, this study led the authors to believe that the municipalities of the bay of Algiers suffer the most from governance problems. Thus, before trying to integrate ICT into a failing governance system, it is more beneficial to fill the gaps of the urban governance system in these municipalities before trying to integrate ICT into it.

It is important to mention that the used approach has many advantages, such as building and testing the theory at the same time (Malina et al. 2011). Although, it is able to produce a model that could save time, especially when developed into a software. This methodology makes use of two kinds of approaches (qualitative and quantitative) that were combined to better explain the obtained results. However, this kind of approach is time-consuming to implement because it requires building a theoretical model based on literature review and the collation of numerical information for its application. It also requires the knowledge of tools such as GIS tools and statistical tools. The reader is reminded that qualitative data is difficult to transform into numerical scores.

Concerning the SS model, it is important to mention that it has some limitations. It believed in the availability of information in many fields in order to achieve the objective under study. The lack of information was a barrier that hindered the realization of the underlined objective, especially in cities in developing countries where it was difficult to obtain information that is available, yet at times it did not even exist.

Moreover, the normalization of the same value in all municipalities led to ignoring some variables (variables that had the same value in all municipalities were automatically rejected during the normalization). In addition, the compensatory nature of the model revealed broadly the scores without taking into account the detailed information of each attribute (i.e. low scores were compensated by high scores).

Finally, this work will contribute significantly to the understanding of urban e-governance in cities located in developing countries. It will play an important role in helping decision-makers to make the best decisions. This model was built using different attributes that define urban e-governance in cities in developing countries. It is important to mention that there have been few works on the evaluation of urban e-governance in cities of African developing countries.

The "SS model" will serve as a reference for the assessment of the urban e-governance policy; it could be applied to many other cities, particularly in developing countries. It had the advantage of being useful for evaluating and ranking urban e-governance in municipalities. It is flexible, because it had the possibility to be adopted in other cities as it can be customized by adding or deleting certain attributes and variables that could be related to the study objective.

Conclusions

Research work on urban e-governance policy for cities in developed and developing countries is widely available. Studies on cities located in African developing countries are scarce. This paper puts forward a model to study urban e-governance in cities located in African developing countries. This study yielded two kinds of results. First, it revealed a model that measures urban e-governance in cities of developing countries. Secondly, it measured and ranked the capacity of the municipalities of the bay of Algiers. The results obtained while measuring urban e-governance by using the "SS model" revealed that there were two kinds of problems that could hinder the adoption of that policy (problems related to the governance policy and other problems related to their inability to adopt or use ICT technologies).

The "SS model" had the advantage of being more flexible, because it handles the addition or deletion of other attributes and variables for a better efficiency. Yet it could be adapted to evaluate urban e-governance in other cities too, particularly in the case of municipalities located in a developing country.

It also had the advantage of being more intelligent by transforming it into an android application that could be used by any stakeholder. This operating system could help the decision-makers to intervene quickly and surely. It saves more time and money. It also had the capacity to rank urban e-governance in cities and to predict the problems that could hinder the development of the urban e-governance policy in these cities.

It is important to note that the "SS model" will be a reference for the researchers when studying the applicability of the urban e-governance policy in cities of developing countries. The performance of the model relies heavily on the availability of information on the used attributes and variables.

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Correspondence: LREAU Laboratory, Faculty of Earth Sciences, Geography and
Territorial Planning, University of Science and Technology
Houari-Boumédiène, BP 32 Bab Ezzouar, 16111, Algiers, Algeria.

Email: kcheniki@usthb.dz