

French smart cities: which factors are key to manage a sustainable development?

Igor ALVAREZ, Eurydice BLED, David CARASSUS and Jacques JAUSSAUD

Université de Pau et des Pays de l'Adour, 64 000 Pau, France

E-mail: eurydice.bled@gmail.com

I. INTRODUCTION & RESEARCH QUESTION

Local authorities and especially cities are affected by this principle of sustainable development which was launched in 1987 by the Brundtland Report. Local authorities are supposed to be the institutional relay in their territory. That is why the United Nations established their first local action plan programmed for continuous improvement, in 1992: the local Agenda 21 [1].

Despite the interest of cities for this problematic issue, with 6 200 local Agendas 21 in 2002 distributed in 1 00 countries [2], the overview of local Agendas 21 placed until this days is disappointing: « *carried out actions (...) have not succeeded in reversing the trend of the global deterioration until now* » [3].

Furthermore, the challenge of sustainability for local authorities has to be articulated and for that purpose we need to develop a set of performance indicator base on innovation requirements set up by the New Public Management (NPM). The NPM calls for increased efficiency in the public sector worldwide, including at the local levels [4]. The sustainable development challenge, however, leads to consider differently the efficiency requirement, as economic efficiency only is no more to be looked for, as it should be looked for under condition of sustainability. The same as far as private firms are concerned indeed, as they implement in this perspective new management control indicators and systems [5]. Among cities, according to Emelianoff, some 20% of cities have developed an environmental management system, and 60% have implemented indicators relating to sustainable development [6]. In that sense, Boutaud identifies several academic contributions in this field [7].

One of the main aim of this research, is the development, designed and tested an evaluation tool of public policies relating to the local Agenda 21, we expect that this tool should be useful in identifying implementation factors. That tool has been developed in the French context, with the aim to adapt it in a near future for international comparisons.

This research intends to situate the intentions of the management of territorial organizations, not only by a reversal of the top-down bureaucratic approach [8]. It is also not a simple stakeholder participation in the decision [9], but evenly, and above all, a recasting of management tools [10]. So that purpose we consider necessary first to study all the organizational levels, on which are stacked different management tools. This approach will allow us to perceive the balance of power and pressure factors, in

order to clearly articulate the stakes of power related to these devices.

This is for instance what researchers on social accounting are trying to do. Accounting principles broadling implemented up to now do not fit to the objective of sustainability. They encourage court term approaches [11]. They might however be adapted in order to modify the relationship between people, businesses and the environment [12].

II. ACADEMIC BACKGROUND & THEORY

Therefore, the characterisation of local sustainable development, and the assessment of its results seem to be essential to « *get a better idea of current context in terms of sustainable advances* » and spotlight « *advances and obstacles on the way of sustainable development* » [13]. Trying to solve this problem the academics should apply theory, methodologies and methods to explore and study this realty, in order to develop new knowledge that helps the local authorities to implement this kind of political tools in more efficient way [14].

Therefore, this research contributes to the literature in the field trying to map the different factors that influence the adoption of sustainable practices by cities and EPCI (public institutions for inter-municipal cooperation). In other words, our paper should help local authorities understanding why some policies fail where other succeed, and what is more, what kind of factors are key for those results, human or institutional.

Trying to answer this question, we have designed an analytical framework of local sustainable practices, those of municipalities, the territorial level in charge of living environment of citizens, and subject to specific issues, which requires innovation and participation [15]. Our framework describes pressures that constrain organizations in sustainable innovation, and force to become « smart cities ».

This framework has been designed according to the four dimensions of local sustainable development that are environmental, social, economic and governance [16] at both local and global levels with « *two background movements* » [17].



FIGURE 1: DIAGRAM OF LOCAL SUSTAINABLE DEVELOPMENT [16]

Our framework is drawn from an analysis of « *list of actions taken in the framework of local Agendas 21, list of prize-winners of 'good practices' which can be taken as examples by others places* » [13] and a deep analysis of behavioural factors [18] or environmental and local, internal factors [19], and institutional ones [20] or environmental and global ones.

Our literature review is based mainly on the contingency theory and new institutionalism. However, we are going to carry out a broad literature survey in order to understand the problem from a wide perspective, as sociologists, architects, territorial civil servants, researchers in geography and political or managerial sciences, contributed to the characterization of local sustainable development and its origins.

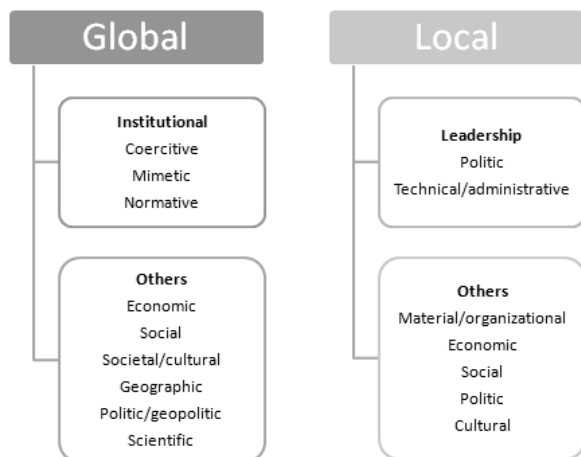


FIGURE 2: DIAGRAM OF FACTORS WHICH ARE KEY TO MANAGE LOCAL SUSTAINABLE DEVELOPMENT

III. THE HYPOTHESIS

We have drawn four hypotheses:

H1: Political and administrative leadership positively influence the implementation of local sustainable development.

H2: Other local factors positively influence the implementation of local sustainable development.

H3: Institutional factors of isomorphism positively influence the implementation of local sustainable development.

H4: Other global factors of isomorphism positively influence the implementation of local sustainable development.

IV. METHOD AND RESULTS

We test empirically this model, using a quantitative method [21]. The sample of the study is based on more than 300 French cities and EPCI registered with an Agenda 21. We collect information from those local governments by questionnaire survey, adapted to our variable set and to the size of our sample.

The study reaches a response rate of 40%. This high level of answer also represents the majority of the biggest cities in the population in France (in number of citizens). We conducted univariate, bivariate and multivariate analyzes, with SPSS software.

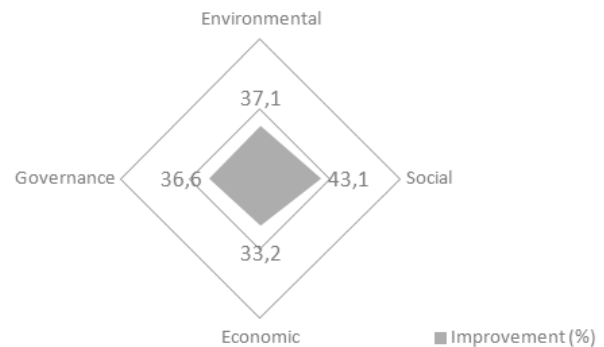


FIGURE 3: OVERVIEW OF LOCAL SUSTAINABLE DEVELOPMENT IN FRANCE

This chart summarizes the rather disappointing results our survey reveals on the different dimensions of local sustainable development. We measured to which extent actions that were planned in the local Agenda 21 have been actually implemented, and found that it was less than 40% on most dimensions, with an imbalance in favor of social issues.

A more detailed analysis is available, with for instance 12 sub-variables of the dimension *Environment preservation*, a field where some much remains to be done according to Emelianoff [6].

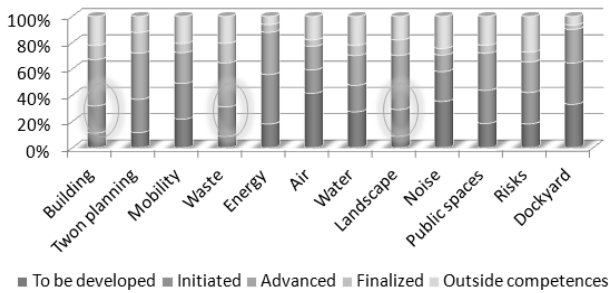


FIGURE 4: OVERVIEW OF LOCAL ENVIRONMENTAL PRACTICES IN FRANCE

The analysis of correlations and linear regressions and variances of our variables confirms, on the one hand, the significance of some of our factors, namely technical leadership, and its relation to several dimensions of local sustainable development.

Récapitulatif des modèles et ANOVA							
Modèle	R	R-deux	R-deux ajusté	Erreur estimation	Durbin-Watson	ANOVA	
						F	Sig.
1	0.128a	0.048	0.040	0.98221	1.586	5.991	0.016b
2	0.297a	0.088	0.081	1.15309	1.897	11.639	0.001b
3	0.174a	0.030	0.022	0.87696	1.882	3.730	0.056b
4	0.238a	0.056	0.048	1.10209	1.632	7.116	0.009b
5	0.251a	0.063	0.055	1.10127	1.760	8.101	0.005

a. Prédicteur : (Constante), Leadership technique
 b. Variable dépendante : 1. Déplacements, 2. Eau, assainissement, 3. Paysages, biodiversité, 4. Espaces publics, 5. Risques et pollutions

Coefficients					
Modèle	Coefficients non standardisés		Coefficients standardisés	t	Sig.
	B	Erreur standard			
1 Constante	3.737	0.399		9.374	0.000
Leadership t.	-0.310	0.126	-0.218	-2.448	0.016
2 Constante	4.334	0.468		9.255	0.000
Leadership t.	-0.507	0.149	-0.297	-3.412	0.001
3 Constante	3.754	0.356		10.546	0.000
Leadership t.	-0.218	0.113	-0.174	-1.931	0.056
4 Constante	4.092	0.466		8.778	0.000
Leadership t.	-0.393	0.147	-0.238	-2.668	0.009
5 Constante	4.020	0.447		8.992	0.000
Leadership t.	-0.404	0.142	-0.251	-2.846	0.005

Variable dépendante : 1. Déplacements, 2. Eau, assainissement, 3. Paysages, biodiversité, 4. Espaces publics, 5. Risques et pollutions

TABLE 1: LINEAR REGRESSIONS OF SEVERAL LOCAL SUSTAINABLE DEVELOPMENT VARIABLES AND TECHNICAL LEADERSHIP FACTOR

Our main results reveal several findings. Firstly we can establish that French cities expose a mixed picture of the local sustainable development: some themes are more developed (Building, Waste, Landscape) than others (Water, Mobility) and achievements are imbalanced as far as the four dimensions of local sustainable development are considered. In fact, less than 40% of all our sustainable practices are implemented on average, and there is a wider emphasis on social and environmental variables. This complements the theories on the hygienist practices of municipal services [22] in the field of urban ecology. Secondly, we found that the leadership of the local administration is the most influential factor in order to develop this kind of activities. Indeed, only this variable is significant, in particular the sub-variable of technical and administrative leadership obtained the highest values. This analysis

leads to the inversion of our H1 hypothesis, as there is a negative influence: a barrier to change induced by local leaders. This result confirmed some assumptions whereby « *professional culture of civil servants (could be) more or less die-hard* » on the themes of sustainable development [23]. This also confirms that the behaviour of individuals internal to the local administration plays an influential role in the dissemination of a managerial culture and propensity to change [24], even in the case of sustainable development. This bears out for France the fact that « *officials and elected representatives are well placed to give the strategic overview and general policy context for local sustainability initiatives* » [25].

V. CONCLUSION

Like most of the authors who contributed to our literature review, we were aware that the recommendations and expectations of the 1992 Rio Summit were not being met and that it is still too early to be delighted in the realization of the Agendas 21 more than 20 years after their official launch. In France, the measure of this failure has not yet been constructed or scientifically realized in a global way. Yet, it is by this step that a critical approach to urgently evolving this situation seems to begin. Once this has been established, the origins and influence factors diagnosed by our research can act as levers of action at different scales.

This research allows us to perform an « *interscalar diagnosis* », which isn't limited to an observation of global constraints, but enable the emergence of local lever of action, although identifying other levers for « *global operators* » [26].

In fact, we have carried out an original approach outside the pre-established geographical and organization frameworks, from advices of some authors: « *It's clear that the environmental problems and conditions of their treatment are now deeply affected by the dynamics of globalization under way (...)* For NGOs it requires the action of multi-levels networks; for public environmental organizations, by the interlocking of the politico-administrative levels. The diagnosis of each problem of environment (mis)management refers to an analysis that mobilizes different geographical and organizational levels. However, care must be taken not to introduce into the analysis a bias which could focus on « *higher level* » influences (which we have called « *global* ») than lower ones (« *local* »). (...) We would go against a true strategic analysis, attentive to reduce possible leeway for real actors » [26].

Our study, however, revealed the prevalence of only one factor out of the four, which of leadership, often mentioned by researchers in public management [27], but it also made it clear that technical leadership, that is to say the role of the civil servant, had a negative influence on five sub-variables of local sustainable development. Therefore, the theory of contingency, whereby each entity is differentiated by its own local environment, is predominant here [19], with a majority of behavioural factors [18].

Indeed, the administrative leaders act to motivate the agents [28] on the one hand, and to realize coalitions to silence the oppositions [29], on the other hand. The involvement of these leaders over the long term crystallizes "a memory of the project, which should in particular guarantee good performance in relation to the initial objectives" [30]. In an organizational context that inhibits or is unfavourable to change [31], sustainable development does not seem to be an exception [25]. It is also possible that administrative decision-makers use the opinion of citizens in order to avert the political decision towards a technical decision, avoiding the general debate.

So, some concerns are addressed to local actors of change in our conclusion, to those who do not « give in to scepticism or inaction » [32], but are planning to overcome obstacles between them and the « smart city ». These leaders must want to change local public policies from the inside, even if he is inevitably a minority [33], and prepare to encounter obstacles without demobilization, and to speak with actors, sometimes violent, responsible for ecological damage [34].

Key words: sustainable development, smart cities, Local Agenda 21, new institutionalism, contingency

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