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Equity, land register and government of the territory. A methodological proposal to support the Public Administration

Keywords: **Property market Analysis, Territorial Information Systems, Reform of the land register, Fiscal fairness, Interoperability, Government of the territory.**

Abstract The paper presents a research project submitted to the MIUR (Ministry of Education, University and Research), in response to the Notice of PRIN (Scientific Research Programmes of Relevant National Interest) for the year 2012. The "Fairness, Land register and territory government" project addresses the core of property taxation and, in particular, how such fairness can be guaranteed in Italy only through a process of revision of the land register estimates. In Italy, in fact, land register values have been completely disconnected from the real market values of the assets and, therefore, from their characteristics and quality. The project aims to define the most appropriate methodology for the revision of land register values of the entire national heritage, which satisfy the requirements of scientific rigour and which are also applicable. It considers the timing of the estimate of the values as a specific step in a broader methodology, which includes the node of technological infrastructures and databases. In fact it conceives the land register, with its databases, as the heart of Lis (Land Information System) and also considers the process of reviewing the estimates from the perspective of providing the basis for more modern property taxation, able to recognise and delimit territorially the dynamics of values and, in particular, those that manifest themselves in the form of exogenous monetary factors produced by public interventions, whether they are large projects and/or infrastructure developments.

INTRODUCTION

The project presented in this paper aims to be an example of how academic scientific research is becoming less self-centred and more attentive to the outside world. The project “Fairness, Land register and government of the territory” was presented to MIUR (Ministry of Education, University and Research), in response to the Notice of PRIN (Scientific Research Programmes of Relevant National Interest) for the year 2012, with the aim of contributing to the theme of fiscal fairness, one of the most debated issues in Italy.

It is considered, in fact, that scientific research developed in the academic environment can be a useful support for the policies of the Country, thanks to its ability to engage differentiated qualified expertise and by the fact that academic institutions can respond to the concerns of the nation, regardless of the political tendencies. Currently, property taxation is at the centre of government policies; it is treated in financial terms only to meet the objective of helping to replenish the state budget and to help the Country overcome the economic and financial crisis. The project is aware

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that the issue of property taxation cannot be seriously addressed without confronting the question of the reform of the Italian land registry (land register), which has been discussed for more than twenty years but until now it has not yet found an adequate and concrete solution.
Unfortunately, property tax is now considered in contingent and reductive terms as regards IMU (Single Municipal Tax), which was introduced with the reform of fiscal federalism to replace the previous tax of ICI (Municipal Property Tax), the abolition of which has previously produced evident distortions both in terms of local finance and on that of land use. The lack of any form of local taxation has, in fact, forced municipalities to leverage their infrastructure expenses to respond to the lack of collection and has thus produced a state of oversupply in the property market (which will have contributed to its collapse) and together with it overuse of land. The IMU was supposed to be an essential tool of fiscal federalism. Its introduction would have deserved a more careful consideration, and not least from the experience of other countries belonging to the European Union it should have been an occasion to deal with property taxation in the context of general taxation and, above all, to redefine it in conceptual terms starting from fiscal federalism in relation to the issue of local government finance and the potential to be supportive to construction, territorial and environmental policies.
It must be remembered that up to 2006-2007 there was an exponential growth in sales and property values combined with the development of residential housing, thanks to the availability of cheap credit. It is also necessary to recall that the municipalities have pursued policies of territorial marketing focused on large-scale projects, often supported by public funding, in the presence of absorption capacity of the property markets which was not always adequate to the offer. In the case of Turin, for example, the general development Plan approved in 1995, which provided for the conversion of residences in a huge amount of disused industrial buildings, would have been implemented through national funds made available with specific and significant funding. The resulting offer would be placed on the property market and would have regenerated the segment of new housing, with an immediate effect of controlling prices in the secondary market. It is clear, however, that the implementation of the regulating plan would result in an increase in the residential market, the reflection of which can be noticed in the contraction in sales today, certainly due in large part to the economic crisis and the cost of money, but also to a condition of “oversupply”.
Property taxation must therefore be associated with the housing policies and related to local finance, taking on the principle according to which the proper development of the city can only be based on the equilibrium conditions of the property market, as well as on construction and territorial policies increasingly based on retrofits of existing assets and sustainable urban regeneration, rather than on the major expansion projects that remove land. Fiscal and construction policies, however, should also be focused on the issue of fairness and equalisation as instruments of social stability, economic growth as well as territorial and environmental redevelopment. The development of local economies on an urban scale passes through the guidelines of the Public Administration not only in the form of tax policies, but also in terms of investment in innovation of processes and product. All this is in perfect harmony with the attention paid to the “smart cities” and even more so with the new European Framework for Research and Innovation - “Horizon 2020 ‘(http://ec.europa.eu/research/horizon2020/index_en.cfm).
Starting from this premise, the project presented to the Ministry of Education stems from the awareness that the imposition of property, no matter the form, cannot be separated from the revision of land register values, otherwise a further worsening of the current iniquity of the Italian system is expected, due to the fact that in Italy the land register values bear no relation with the actual market value of the property units and their characteristics, positional and typological qualities. The same IMU has indeed highlighted how their generalized re-evaluation ends by exacerbating the unfairness

of taxation: reconciles asset values to market values of the properties of lesser value, which represent a very high percentage of the assets, while leaving anyway a still very high differential between the market values of the assets of higher values and respective land register values, with clear redistributive effects.

The question of the revision of values is therefore more urgent than ever; it can no longer be postponed and must be designed in a real project of reform of the land register, of which the time of the estimate of the values represents one of the stages, which, even if being in itself delicate and complex, should be placed within a methodological framework which also includes the more general issues not least those related to databases and technology infrastructure. Precisely the databases of the Land Registry Office - built in the Agency of Revenues (Land register, Land Registry Conservatories, Real Estate Market Observatory) - may constitute the "heart" of the LIS (Land Information Systems), as a means of support for the policies of protection, development and territorial government also in adherence to the logic of "smart cities".

The project therefore has as its focus the identification of a methodology to be implemented in subsequent stages, so as to gradually reduce the differences between land values and market values and therefore make possible a more equitable property taxation. Unlike the general allegation that the revision of the values would require many years, at least five, the draft provides that the Reform is anticipated by short-term measures if not immediate, organically linked with the same general design and able to approximate the land register values with the real market values, thereby sensibly decreasing the degree of unfairness of the current system before the overall process of revision can be accomplished.

SCIENTIFIC BACKGROUND AND OBJECTIVES

As already mentioned, taxation, regulated by appropriate devices based on principles of fairness, may represent not only a foundation of modern democracy but also a factor of development, if properly connected to the local finance and construction and territorial policies, especially in the case of absence of policies and national financial resources.

The aim of this work is to provide a theoretical and methodological contribution in order to redress some blocks of the current system of property taxation, addressing the complexities of an actual implementation.

To date, in fact, the discussion is focused on IMU municipal tax, while it seems to pay little attention to the need for a revision of survey or, at least, consider it as a complex problem that can be solved only in the medium-long term.

However, by restricting the reflection - given the particular urgency - the issues of the IMU and the revision of survey, interconnected with each other, we believe that in the medium-short term it is possible to begin a process of reform able to gradually and significantly approximate taxable values to the real ones, thus reducing the current high margins of iniquity. The project obviously does not underestimate the complex implications that arise when it is necessary to estimate the market value of the entire assets of the Nation.

It is about the estimation of the entire property of the Country *i.e.* the property units of the 8,100 municipalities from across the Country. If we consider only the residential segment, there must be audited the land register values of 32.6 million property units, to which must be added those of the so-called special categories. The property to be estimated is not only huge, but it is also made up of highly differentiated assets for functional types, for construction, technological features, historic, architectural, landscape qualities and, a very delicate issue, for geographic-positional connotations. The complexity of the process is further amplified by the fact that in Italy the property market has not only a high degree of differentiation of traded assets in objective terms (*i.e.* due as stated to their

characteristics), but also subjectively and of economic values, incomes, symbols, capital that the properties are for buyers. The demand is, in fact, constituted largely by individuals who act according to preference regulating fields often influenced by cultural, social and psychological factors, while the supply itself is not at all that dissimilar from the demand itself, as it consists only minimally by enterprises and economic entities. The interaction of all these conditions, on the one hand, acts on the level of variability of property values making it very high and, on the other, produces an effect of further amplification of the factual stochastic components already of all markets. The overlap of meanings and values of use, income, fairness as well as cultural and symbolic ones would have an effect that is not secondary to interact in the mechanism of formation of property values.

Previous experiences and models for the analyses

The project, having set a goal to prefigure a concrete methodological proposal takes the experiences which to date have been gained through years of research. In particular, we consider still valid for the conducted experiments for the Land Agency in 2003[1] and, more importantly, the methodology laid down in 2004, always for Land Agency, as that already contained all the necessary scientific assumptions.[2]

In 2003, in 8 Municipalities - Aosta, Bologna, Cagliari, Florence, Milan, Naples, Rome and Taranto – there were tested models, functional forms and methods of multiple regression. The comparative results have led: to positively consider the use of statistical procedures for the selection of anomalous cases and, in particular, of the Progress software; to prefer the functional logarithmic form in comparison to the linear one, the Step Wise Method compared to Enter Method; to consider the use of the price per square metre as an explanatory variable indifferent with respect to the total price, the functions with constant compared to those without; last but not least, have allowed us to recognise the achievable potential with new methods of measurement of categorical variables. Together with the positive results, however, the analyses had revealed some problems, the high number of explanatory variables (9-10) and the need to operate on control samples with more detailed analysis of the stochastic error for the Model Calibration phase.

The methodology for the review of estimates, developed later in 2004, has overcome these problems, on the one hand, refining and detailing the different stages of the review process of estimates and, secondly, by introducing as a unit of estimates of reference the building instead of the property land register unit. This insight, which fully meets the principle of ordinariness (located at the base of the discipline of estimates), has allowed to simultaneously solve difficulties present in the estimates due to the inherent specific characteristics to the property markets, including the excessive variability in the values and too high level of differentiation of goods, both of which have been mentioned several times. The use of statistical samples consisting of property units, to be considered ordinary at the level of the building (for consistency, as regards floor level, overlooking, etc.), allowed, in fact, to identify functions of the logarithmic value consisting of 3-4 explanatory variables (represented by *microintorno*, type of building and conservation condition). Rather than from 9-11 of the previous experiments and to significantly improve the reliability of the estimates due to the contraction of the stochastic error, well documented by tests conducted on samples of control. During the revision of land register values the functions of the value identified as above could be applied to the units of the

1 See. R. Curto, Report on the review of estimates for cadastral purposes, Rome, 15th March 2003. The experiments were carried out with the collaboration of Professor Franco Pellerey of the Polytechnic of Turin on the basis of the data samples provided by the involved Land Registry Offices.

2 R. Curto, The methodology for the review of estimates of real estate units belonging to the categories of Ordinary Cadastre, Rome, 15th March 2004, pp. 112, typescript. The methodology was defined on the basis of the observations and internal contributions to the Land Registry Office (Eng. Antonio De Santis, Dr. Ing. Cannafoglia and Dr. Gianni Guerrieri). It was also experienced by the Land Registry Offices involved in the case studies with the coordination of Eng. Barbarisi.

building considered as ordinary, while the values of the others would have to be subject to adjustments, using appropriate coefficients always deducted from the market. Advantages that the intake of the building as a reference unit for the revision of estimates are obvious, not only with regard to the phase of the identification of the functions of value - based on less numerous and more homogeneous statistical samples - but also and above all as regards the time of their extension to the entire national heritage, considering that the models are based in most cases on three explanatory variables (*Microintorno*, typology and state of preservation of the building). The quantitative dimension is in itself a significant simplification of the process of reviewing of the estimates if you consider that in front of 50,000,000 property land register units there are 10,000,000 of buildings estimated on the basis of 3 to a maximum of 4 explanatory variables.

It should be emphasised that the methodology of 2004 was structured in analytical form for all stages of the review process of estimates: from identification of functional and territorial segments until the method of selection of the value (market, income and cost) and of the appropriate procedures on the basis of the specificities of functional and territorial segments, of the dynamism of markets and of regulatory and economic-legal conditions of goods, going well beyond the specific time of the testing of functional forms and methods of application of multiple regression. The methodology is presented therefore as still valid, given its level of detail (particularly for residential units) and in accordance with the provisions of the Presidential Decree 138/98 endorsed in 2012 by Delegation to the Government - DDL 15/06/12.[3]

In terms of modelling, finally, the international literature provides a solid background in addition to the literature produced by the research team: from the former emerges with particular empirical evidence the importance of the spatial component of prices,[4] which led to the introduction of models of spatial statistics in property[5] and to the development of hedonic models, which could include the spatial component through the sub segmentation of the property market in geographical areas.[6] In addition, the experiments undertaken on data from the Property of the City of Turin are assumed, the same being commonly found in previous issues of this Journal. Finally, it incorporates the foundational literature developed from semi-parametric multivariate techniques and models that use regular functions of smoother type.[7]

3 The methodology defined on the basis of experimentation has thus responded more than positively to different realities on the geographical, building and market plan, particularly in cases in which the land microzones represented actual territorial segments of the real estate market. In cases in which this condition was not met, the methodology presupposed their redefinition. It was based on the assumption of a cadastre based:
- on Geographic Information Systems, Interoperability and georeferencing;
- on market values (other than income taxes), a prerequisite for a cadastre that wants to respond to the principle of fairness;
- on the square metre as the unit of consistency, to overcome iniquities due to the use of the compartment register;
- on municipal microzones, designed as homogenous territorial segments of the real estate market, in order to simplify the process and in particular to solve the problem of the treatment of the space components;
- on cadastral Categories, as sets of homogeneous goods in terms of functions and typological and constructive features as well as on that of the mechanism of price formation;
- the use of value functions of stochastic nonlinear type deducted from the mass appraisal;
- on the building, in order to operate according to the principle of ordinariness and in order to use samples of goods as homogeneous as possible, including by addressing the crux of the treatment of categorical variables.

4 See Basu S., Thibodeau T. G. (1998), Analysis of Spatial Autocorrelation in House Prices, *Journal of Real Estate Finance and Economics*, 17.1, 61-85.

5 See Peace R. K., Barry R., Sirmans C. F. (1998), Spatial Statistics and Real Estate, *Journal of Real Estate Finance and Economics*, 17, 1, 5-13.

6 See Bourassa S. C., E. Cantoni, M Hoesli. (2007), Spatial Dependence, Housing submarkets, and House Prices, *Journal of Real Estate Finance and Economics*, 35,143-160.

7 See, for example: D. Ruppert, Wand M. P., Carroll R. J. (2003), *Semi-parametric regressions*, Cambridge University Press; H. Bao, Wan A. (2004), *On the use of spline smoothing in estimating hedonic housing price models: empirical evidence using Hong Kong data*, Real Estate Economics, American Real Estate and Urban Economics Association, 32, 3, 487-507, 09; Brunauer W. A.,. Lang S, Wechselberger P., Bienert S. (2010), Additive hedonic regression models with spatial scaling factors: an application for rents in Vienna, *The Journal of Real Estate Finance and Economics*, Dordrecht, Springer, 41, 4, 390-411.

Databases, Geographic Information Systems, ICT

The project considers thus acquired the already tested scientific methodology. It provides its review, design and development, in the light of the progress achieved to date in terms of estimation and in terms of the potential offered by ICT related technologies, which have already led to a reorganisation and updating of these land register databases. In addition, it implies the empirical verification on emblematic and representative studies of the Italian context that does not end in the testing of the models, but considers the same model experimentation as one of the key steps in the process of revising the estimates in a logical progression. Given the quantitative dimension, variety and complexity of the variables involved (endogenous, exogenous, observable, latent, quantitative and qualitative) and, in particular, considering the weight of the space components, the methodology should make use of specific Spatial Data Infrastructure, will be automated, "dynamic" and linked to a specific software that is accompanied by appropriate guidelines, to reduce the scope for subjectivity of the evaluators involved and ensure the greatest possible uniformity of estimate for the whole Country.

Lecturers and researchers of the local Operating Units involved - Politecnico of Bari, Università di Napoli "Federico II", Politecnico di Torino and Università di Trieste - allow on the basis of curricula and maturated experience the tight integration between different scientific, cost-estimation, modelling, planning, technological, Geomatic components.[8] From an operational point of view the proposed methodology envisaged by the Ministry of Education is based on the involvement of a team of research groups belonging to Italian university academic institutions located in different spatial positions - Bari, Naples, Trieste and Turin - capable of capturing and representing the different construction, regional, geographical and landscape perspectives, in which the assets are located, in order to respond to the high degree of differentiation of the construction and territorial layers in Italy. The involvement of several universities, therefore, is useful not only to integrate diverse scientific expertise, but also to experiment on case studies that reflect, when viewed in their social and economic context, markets that are very different as regards goods, applications, prices systems and securities.

Starting from a base of mature knowledge and experience of the members of the research team, the proposal tends to a more modern - at least for Italy - conception of taxation and Land register, opening up new courses of research interrelated between them.[9] The Land register - the values and incomes - with its mapping and alphanumeric type data banks must be, as mentioned, reconsidered as the "heart" of Geographic Information Systems, in order to support a variety of activities, such as:

- the amplification of knowledge;
- the application of advanced statistical analysis procedures and data mining approaches;
- monitoring of market values, in relation to building, planning or infrastructure works, while considering environmental aspects of energy;
- the simplification of administrative procedures with a view of taking on the interoperability of the European Directive INSPIRE (acronym of Infrastructure for Spatial Information in Europe), which marks the

8 The overall research team is composed by teachers and researchers of the Universities mentioned above, in particular: for the Polytechnic of Turin, Rocco Curto (national coordinator), with Cristina Coscia, Elena Fregonara, Mario Grosso, Fulvio Rinaudo, Patrizia Semeraro; for the Polytechnic of Bari, Pierluigi Morano (Local Unit Coordinator), with Benedetto Manganelli, Carmelo Maria Torre, Francesco Selicato; for the University of Naples, Vincenzo Del Giudice (Local Unit Coordinator), with Antonella Batà, Giovanni D'Alfonso, Antonio D'Ambrosio, Fabiana Forte, Roberta Siciliano, Francesca Torrieri; for the University of Trieste, Paolo Rosato (Local unit coordinator).

9 We refer to the work of the DPR 138/98, in particular for the detection of the methodology and subsequent definition of cadastral micro-zones in the city of Turin. This work led to the subsequent establishment of the Turin Real Estate Market Observatory - TREMO (www.oict.polito.it), active since 1999 thanks to the collaboration of the Municipality of Turin and the chamber of commerce, agriculture, industry and handicrafts of Turin, institutional partners of the Polytechnic. Within the framework of the Observatory studies and specific projects have been conducted, including - central to this work - two studies on the nodes "Class and real estate taxation", and "operative proposals".

establishment of an Infrastructure for Spatial Information in the European Community, in force since 15th May 2007 (http://eur-lex.europa.eu/LexUriServ/site/it/oj/2007/l_108/l_10820070425it00010014.pdf);
- fairness at the base of taxation;
- fiscal policies reconceived as true instruments of construction and territorial policies as well as social, however, able to perceive the exogenous monetary factors produced by the same public interventions, projects and infrastructure.

Simultaneously with the scientific background of the already outlined research, the project is particularly attentive to the issues of interoperability and simplifying administrative procedures, for which the experiences of the Polytechnic of Turin and the City of Turin are taken in consideration, which have already been the subject of specific contributions on Rivista Territorio Italia, to which we refer.[10]

PROPOSED METHODOLOGY: APPLICATION POTENTIAL AND IMPACTS

The proposed methodology considers the reform as a process timetabled into phases, which might give obvious positive effects on the fiscal fairness plan even before the 5 years assumed by the Revenue Agency. It provides, in fact, a succession of steps, which, implemented from time to time, can right now start the process of a gradual updating of land register incomes to property market values. In a sort of so-called "zero" phase, the first measures may already be taken aiming at having immediate effects and absolutely significant ones in reducing inequities at the base of the gap between market values and asset values. In this connection, it should be pointed out that, after the DM 338 of 1988, paragraphs 335 and 336 of Law No. 311 of 30th December 2004 (2005 Finance Act) allowed operations (albeit partial) of adjustment of land register values, which should be evaluated according to their outcomes where they have been applied.

The methodology as a first prior step intends to explore the possibility of undertaking immediate procedures or in the near future, aimed at anticipating the revision of land register values, in order to overcome the most obvious effects on the fairness plan from undifferentiated revaluation of the 160% of land register values for all properties, a revaluation carried out regardless of the actual values and the positional, physical, and construction characteristics of the building units. Among the activities of the revision and updating of databases, it is worth mentioning that the Office has taken steps (for most of the national heritage) to define the outstanding properties in terms of square metres. Having done appropriate controls, the land register income could be redefined in a unit value per square metre instead of a space to be applied to the amounts of property units recalculated in terms of square metres. This might allow - and it is not a small thing - to eliminate the distorting effect on the values from taking the land register space.

In addition to intervening in reducing the unfairness produced by land register space it could be eliminated much of that determined by the use of Land register Zone, "given that" the whole Country was divided into micro-zones, designed as territorial segments of the property market. This would be immediately possible in case the municipal microzones would respond to actual territorial segments of the property market of several municipalities. In this case, the databases of OMI - Real Estate Market Observatory, could be used to overcome the major distortions between real market values and land register values inherent to the component of the location, which as we know, has a high incidence in determining market values. And in fact the possibility of using data Microzone OMI has already been the subject of the first experiments, considering them in relative terms, to isolate and significantly

10 See. C. Coscia (2011), The project "I Vincoli" (Constraints) of the Polytechnic of Turin. Aspects of technological and digital innovation to support the process of reform of the Public Administration, *Territorio Italia*, 1. L. Mandrile (2012), The MUDE Piemonte - unique digital model for the construction industry: an organisational plan, *Territorio Italia*, 2.

reduce the unfairness produced by the fact that the census areas do not reproduce the effect of the territorial component in the formation of values. Turin is a case in point, already the subject of the first experiments, since the Taxable Area 1 includes territorial segments of the market and then municipal microzones opposed as regards values, *i.e.* valuable areas with areas of physical and functional deterioration. The average property values, therefore, of the municipal micro-zones, could be considered in relative and weighted terms in order to determine differential rates of increase in land register values related to the location of the property units. This important and significant task of revision of values obviously implies the verification of local micro-zones defined by the municipalities and their possible revision, whose general outlines had already been defined by the methodology developed in 2004.

The land register values could therefore be revised, reducing the gap with market values, i.e. correcting existing distortions due both to the land register space and the land register Zones. Headcount and location are indeed, in many cases, proxy variables of architectural and construction qualities. It could be proceeded in a short time to a first and significant revision of land register values, able to eliminate at least the more macroscopic distortions. Compared instead to the time needed to complete the whole process of revision of land register values, the project considers that the potential - not inconsiderable - should be considered as given from technological advances registered in the latter years in the ICT sector, both in terms of knowledge, and in terms of the need to ensure the dynamism of the same land register. On the latter aspect, it is worth to emphasise that the real problem in the process of revising the estimates is not only to identify the value functions of stochastic type but how to apply it to the entire national heritage. Once again there emerges the quantitative dimension implicit in the revision of estimates, given the fact that the value functions of stochastic type once identified (through the techniques of mass appraisal and/or through geospatial statistics) must be applied to the entire national heritage, town by town, building to building, unit by unit, for different functional, construction and territorial segments of the regional property markets. This implies that the essential characteristics of *microintorno* and building (typological, structural, architectural, conditions, etc.) are known for each manufactured property unit and building, where the marginal coefficients should be applied, as already experienced.

This is perhaps an even more complex operation of the identification of the same value function, as it requires the availability of an updated property registry office, which should be achieved through the interoperability of databases already existing in all PAs that have territorial jurisdiction. And there is no doubt, as we shall see later, that the project will have to consider the most advanced technological infrastructure needed to implement the process of revision of land register values, of which probably the Inland Revenue Office is already in possession.

Consistent with this framework, we need to consider issues related to estimation, including the need to resort to the use of mass estimates, but within a scientific and operational methodology that considers all the steps, starting from verification of mathematical-statistical models used in the mass appraisal (by the construction of the sample according to error calculation) for use in the production of estimates of the value of property for tax purposes. The methodology should allow, on the one hand, the exploration of advanced statistical models, also of geospatial type and data mining techniques, on the other hand, tools for testing the quality of data and, again, tools for containment the degree of subjectivity in the estimation.

Scientific advancement: the detailed aspects

Looking more specifically and synthesising the scientific advancement can be prefigured by assuming three possible courses, to be considered in comparative terms:

1) the development and refinement of some already tested hedonic models, among which we mention

the "exponential regression models in the coefficients";

2) the progress in the application of spatial statistical models whose predictive ability is compared with the hedonic models, which treat the position using dummy variables to specify the micro-zones, with the intention of verifying the extent to which spatial statistics are able to lead us to overcome, however, unlikely in the legislative, the municipal microzones. Also in this second address is placeable the development of spatial models and mixed effects (hierarchical models), based on the introduction of multiple levels of spatial aggregation for the predictive analysis, even in the presence of spatially inhomogeneous data;
3) development of data mining techniques, of even greater importance, could be made possible through the use of land register databases and property advertising and, in particular, of the data inferred from the acts of buying and selling that in accordance with L. 248/2006, also reported, in addition to land register value, the market price, subject to the verification of reliability. It is not secondary for the purposes of estimates review process to consider the potential information given - from 2005-06 – from the extension of the so-called Unique Model to Estate Trading.

On the economic-estimate plan, together with the potential given by the availability of data from the Unique Model, we must also consider the profound changes that will take place in the mechanism of formation of values as a result of the transfer process in construction technology, borrowed from the energy sector –related to facilities and environmental sustainability. If compared to other European countries, the property market does not yet seem at the moment to monetize the technical-energy quality of buildings, especially with regard to the segment of the second-hand market, it is possible to think that they will take in the coming years an important role in the buyers preference regulating fields as well as at the level of supply. The project considers the innovative approaches for the evaluation of qualitative components related to the environment and is fully placed in a European perspective of strategies to reduce greenhouse gas emissions and energy consumption, set out in the SET Plan 2020 (http://ec.europa.eu/energy/technology/set_plan/set_plan_en.htm) and the European Energy Roadmap and Roadmap and Low Carbon Europe 2050 (http://ec.europa.eu/clima/policies/roadmap/).

In particular, the project presented to the Ministry of Education considers at the methodological level the development and implementation of estimation techniques closely related to the current Agency's information system and given potential, at a time when technological advances made in the ICT sector were fully vested on the level of technological infrastructure at the system level.

These are summarised in the following elements:

- The development of Spatial Data Infrastructure (SDI) related to specific software and the development of a computerised procedure for estimating the value of property. The automated software designed to be transferred to the operators of Public Administrations can provide an estimate of values as much correct and uniform as possible nationwide;
- The undertaking of interoperability, assessed on the basis of the estimative methodological requirements, in relation to the implementation of the INSPIRE Directive and the Legislative Decree No. 32/2010 implementing the Directive itself, paying particular attention to the study and implementation of procedures for collecting geographic data for the creation of an Infrastructure for Spatial Data, with all the ontological implications that this shift involves;
- The construction of web services and informatics applications aimed at the investigation of the data (through metadata), consultation (e.g. through Web Map Service), download and conversion of different formats. And again, at the development of protocols for data validation using expertise in the field of construction of Spatial Data Infrastructures even flexible and dynamic ones (for example

in CLOUD environments) that refer to the nodes of the OpenData and BigData. Decisive factors are the ability to operate in typical GIS software environments (e.g. ArcMap) or commonly used web-based systems (for example, applications in Google);

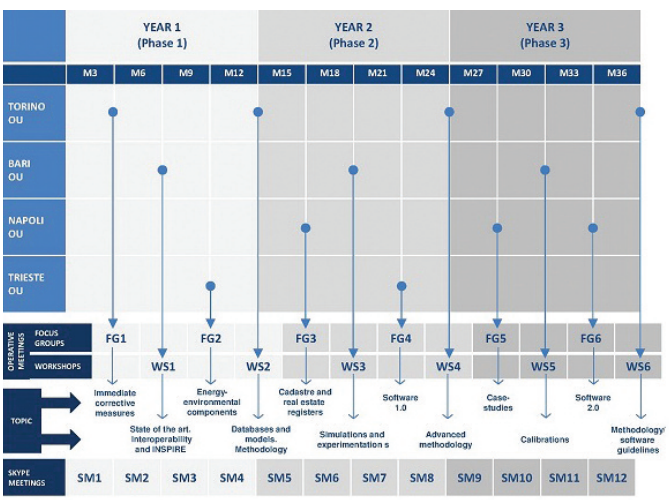
- The identification of correctives directly put in function in the process of revision of land register values, evaluating the potential advantages in terms of cost reduction (economic benefits), achieved with the automation of land register operations, even assuming, from the assumptions of the cost-benefit analysis, the effects that the renewal of the land register system could produce in the form of intangibles and economic, productive and social externalities, pecuniary and non-pecuniary ones;
- The potential inherent in the implementation of an innovative property taxation even in relationships with the local government and with the construction and territorial policies, when the land registry databases would become the basis for a real LIS - Land Information System. In fact, the opportunities provided by the availability of geo-referred databases should not be underestimated also with respect to the concrete possibility to re-envision property taxation in a more modern context, capable of circumscribing such exogenous monetary factors, i.e. the increase in property values due to the implementation of infrastructure and/or public projects.

THE WORK-FLOW AND LOGICAL FRAMEWORK OF THE PROJECT

The complexity of the issue addressed requires the integration of different disciplinary expertise as well, resulting from both theoretical–methodological and application experience gained by different research groups related to the proposal. The project is designed according to a precise articulation of tasks and contributions shared among the participants in the working group: specific activities linked by a comprehensive strategy and a methodological cohesive course. Spread over different territorial contexts, as mentioned above, the working groups of the universities involved in the project are the optimal locations for the verification and validation of the methodology, which designed to be applied at the national level, needs to be tested on specific cases.

The logical framework of the work assigned to the group of the Polytechnic of Turin, the competence of project management, from the care of the effective interoperability of the various contributions, facilitated, however, by the limited number of content seats. The project, lasting three years, is designed in three main phases of one year each (Figure 1).

Figure 1: Workflow of the project, with emphasis on stages, working groups, audits temporalisation

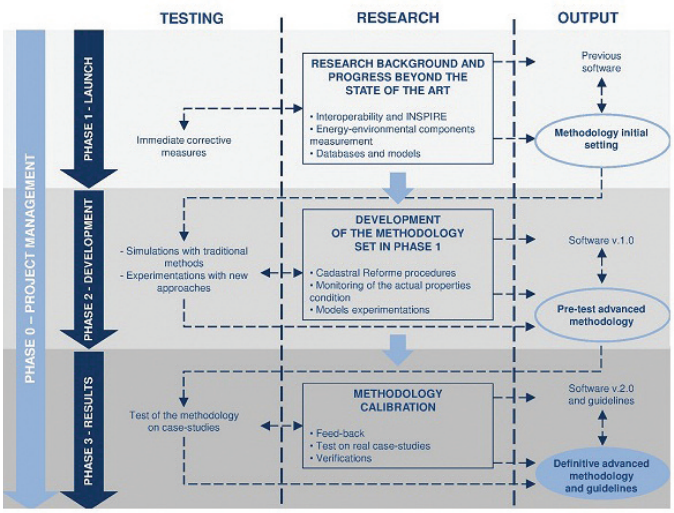


The workflow provides moments of confrontation among the seats from the beginning and throughout the duration of the project, scheduled to run on a quarterly basis and rotate among each seat - Operating Unit (OU) - on the basis, too, of a principle of relevance between carried out activities and seat assigned to organise the event of presentation and comparison.
As a general premise, the moments of comparison are provided in three forms:

1) Workshops (WS), organised by the rotating seats. Given the nature of plenary meeting given to this first form of comparison, the proposal provides for the maximum participation of members of the working group to the seats and interior, considered the function of the WS as the time of verification of the results, of the external parties involved: between these, it should be stressed that the focus is on the active presence of the Inland Revenue Office and subjects of the involved Public Administration;
2) Focus Groups (FG), conceived as moments of presentation of partial results and discussion on specific topics, in reference to the individual stages of work;
3) Skype Meetings (SM) periodic. The temporalisation of the project presented in Figure 1 is designed in such a way as to place an initial kick-off meeting in the city of Turin and, again in Turin, a workshop at the end of each year and at the conclusion of the entire project. The Focus Groups are scheduled to run in rotation between the seats, corresponding as much as possible the Focus Group with the headquarters of the direct competence in relation to specific topics and sub-phases of work (which will be briefly mentioned below). The number of Workshops and Focus Groups is calibrated with respect to the number of members of the working groups.

The development of research in three annual steps, taken in the logical framework outlined in Figure 2, provides methodological advances (output) supported by suitable moments of verification (testing).

Figure 2: Logical Framework of the project, with emphasis on the temporal phases, the development of the research as regards expected results and ongoing audits



It is important to emphasise that each working group, in this logic, appears jointly engaged in all three phases of the research, even with distinguishable contributions, divided into sub-phases as shown in Figure 3 (which notes where more specific contributions arise by the part of the individual operating units).

Figure 3: Time schedule of the three-year research project, with emphasis on the commitments of the Operating Units

ACTIVITIES	OOUU	DURATION (months)	YEAR 1				YEAR 2				YEAR 3			
			M 3	M 6	M 9	M 12	M 15	M 18	M 21	M 24	M 27	M 30	M 33	M 36
PHASE 1 – LAUNCH														
1a. Immediate corrective measures	TO	6	■	■										
1b. State of the art	ALL	9	■	■	■									
1c. Interoperability and INSPIRE	TO/BA	6		■	■									
1d. Energy-environmental components	TS	6		■	■									
1e. Databases and models	TO/NA/BA	6		■	■									
1f. Methodology	ALL	3				■								
PHASE 2 – DEVELOPMENT														
2a. Cadastre and real estate registers	TO	3					■							
2b. Simulations with traditional methods	ALL	6					■	■						
2c. Experimentations with new approaches	ALL	6							■	■				
2d. Software v.1.0	BA/TO	6							■	■				
2e. Advanced methodology	TO/NA/BA	6							■	■				
PHASE 3 – RESULTS														
3a. Case-studies	ALL	9									■	■	■	
3b. Calibrations	TO/NA/BA	6										■	■	
3c. Software v.2.0	BA/TO	6										■	■	
3d. Methodology/software guidelines	ALL	6											■	■
3e. Conclusions	ALL	6											■	■

PHASES OF THE PROJECT: START, DEVELOPMENT, RESULTS

The temporalisation expected in the first year is entirely devoted to the development of the **first phase** of the project; it embodies all the preparatory activities deemed useful for setting and start of work. As anticipated above, the first stage involves a cascade sub-stages articulation that, always with reference to Figure 3, are as follows:

a) "Immediate amendments". Dedicated to the start of the research, this *sub*-phase is bound to the identification of immediate remedial, achievable according to the objectives of fairness, incorporating the results of previous research experiences mentioned above: they propose, for example, direct amending intervention on current land register values in order to eliminate the unfairness produced by the use of land register space, passing to the square metre in line with the dictates of the DPR 138/1998 referred to above. This first action is purposefully underlying the transition from a system based on classes and rates to a system founded on the values of the properties. A central contribution has been given by the central group of the Polytechnic of Turin;

b) "State of the Art". *Sub*-phase destined, with the involvement of all working groups, to the recognition of the state of the art on the subjects starting from the international/national literature, in particular through the study of significant market realities preliminarily selected as best practices. When identifying the benchmark of reference it is critical to detect and report relevant cases (among these, we can right away report the Dutch case as an example of important structuring of a computerised land registry based on values). Furthermore, this could be done through the study of the regulatory framework that governs property taxation, models of Land register and methods of taxation of exogenous monetary factors, including those relating to environmental aspects, in significant European realities. Still, it is possible through the identification of examples of disequilibrium between fiscal policy between and in the Member States of the European Union. A final but crucial piece is represented in this sub-phase, by the preliminary activity of survey on traditional/advanced procedures used to estimate the value of property, to be organised in accordance with an overview of tools;

c) "Interoperability and INSPIRE". In the optic of interoperability, this *sub*-stage is a preliminary survey on databases, in particular to verify the current status of the land register, municipal and Finance databases. The key issue is the selection of Italian databases that are usable considering the actual level of interoperability offered by the same. This accomplishment goes through a thorough

conceptual design, logical and physical that takes into account the different scales of the databases to be connected, identifying mismatches and strategies for distinguishable solutions for the purposes of compliance with the principles of the INSPIRE Directive, concerning - among the rest - the non duplicability of data in the transition between different scales. The latter concept is particularly delicate, since it implies the possibility to propose a hierarchy of information to be processed: information which is often generated by various Entities in accordance with, at times, conflicting principles. Therefore, the research issues, indirectly, also a proposal at the level of laws and regulations that the implementation of the INSPIRE directive requires from central governments that have adopted it;

d) "Energy-environmental Components". This *sub*-phase is devoted to the identification of the parameters relating to the valuation of externalities related to environmental costs, influential on the formation of the land register value of a property, as well as to its method of calculation. Centrality is placed on the territorial- environmental and architectural-construction components, to set the construction and monitoring of energy and environmental characteristics;
e) "Databases and models". This *Sub*-phase first involves the definition of the tool for estimating the value of the property, considering in particular the advanced statistical and spatial models; therefore, the study and comparison - even empirical - of the identified models and their ability to improve the estimate of market prices. The project intends to focus on the development of spatial statistical models that allow to measure the spatial component of the price - Kriging and reticule-type models (such as GWR models) - and hedonic models, making it possible to measure the component of the price that the micro-zones are able to explain, in order to quantify the role of land register micro-zones in price formation and, consequently, on the value of the property. The comparison between the prediction of prices through the use of techniques of spatial statistics and the approach of geographic segments allow verifying if the micro-zones are able to explain the spatial variation of prices and, therefore, to identify corrections of value dependent on position, aimed at the principles of fiscal fairness. This sub-phase incorporates an initial analysis produced to estimate the incidence of micro-zones on the values of the residential segment, which led to consistent results with the empirical evidence found in the international literature: results that represent a useful basis for the massive development of procedures for the estimation of property assets. The project also proposes the semi-parametric multivariate testing techniques and innovative approaches, such as techniques that use spline smoothing approaches;
f) "Methodology". From the achievable information structure (point e) and the results of the previous steps, the latter sub-phase involves, involving all branches of research, setting up of a methodology and definition of the final framework of the statistical procedures to be used.

The second year is devoted entirely to the **second phase** of the project (Figure 3), in which the central focus is the development of methodology in the first phase. As previously, also the second stage is designed cascade in *sub*-stages:

a) "Property land register and registry offices". Assuming the steps planned for the reform of the Land register, the start of the second phase, through this first *sub*-phase, starts from the methodology already developed by the working group of the Polytechnic of Turin, accompanied by the recognition of the state of the art and by methodological approach outlined in Phase I. Since it is not enough to have the value functions, focus is placed on the node of the monitoring of the current state of the property with particular attention to their degradation. This implies that they have identified - again by the Operative Unit of Turin - the ways in which to use the value functions for land register purposes;
b) "Simulations using traditional methods". *Sub*-stage involving testing, through simulations of different contexts, of correctives for fiscal fairness identified in Stage I and the comparison of results. It also

provides applications with reference to the more traditional methodology for the adjustment of the market values: the objective is the identification and sharing of limitations and concerns raised by the applications produced by all seats;

c) "Experimentation with new approaches". From the results of the previous point, this sub-phase will experience advanced statistical models with particular reference to spatial models, which allow introducing corrections to the fiscal fairness component related to the location of assets. Crucial is the comparison among the results obtained by the different experimental sites;

d) "Software v. 1.0". This *Sub*-phase is dedicated to the computerization of the procedure for estimating the value of property, from the previously identified methodological steps. Its aim is to produce a first version of the software, which may be developed in Phase III;

e) "Advanced Methodology". This *Sub*-phase concludes the second year of operation with the definition of advanced methodology for estimating the value of the property - based on the availability of information assets deployed in an optic of interoperability - for the detection of increases in asset values;

The third year is entirely devoted to the closing activities of the project and the yielding of results. The articulation of the **third phase** into sub-phases is as follows:

a) "Case studies". From all locations, the sub-stage involves the testing of advanced methodology defined in the Phase II on local case studies. The case studies were developed by individual operating units and support computational simulations of urban environments belonging to different geographic areas. The taken territorial unit of reference is Microzone (as defined by Presidential Decree 138/98), while it is taken as information wealth on the values of the properties available at different locations. Central in this *sub*-phase is the comparison of the results obtained by the various working groups;

b) "Calibrations". This *sub*-phase proceeds with any corrective action on the methodology as a result of the experiments on specific cases, and with the verification of the feasibility of the proposal in the context of the process of land register revising in different local realities. Through the comparison of results obtained by different statistical techniques it is possible to identify the model that allows for the most robust empirical results in terms of capacity of estimating the value on which to base the final correctives;

c) "Software v. 2.0". This *Sub*-phase is dedicated to the computerization of the final procedure and the production of a specific software package, with drafting of its guidelines;

d) "Methodology/software Guidelines ". This *sub*-phase involves all units involved in the project, with the task of producing guidelines for communication and the use of the methodology and software;

e) "Conclusions". This is the final *sub*-phase and the start of programming devoted to dissemination of research results through comparison of occasions such as international/national conferences of presentation, international/national publications, etc. It is scheduled the powering of eventual websites related to the sites of involvement, including for example the website of the Property Monitoring Centre of the City of Turin.

CONCLUSIONS: RESULTS, VERIFICATIONS AND APPLICATIONS OF PUBLIC ADMINISTRATION

To conclude the presentation of the project submitted to the Ministry of Education it is important to focus on some issues, all related to the aim of developing a methodology to support the Revenue Agency and Public Administration called to deal with property taxation. Issues that encompass two premises:

1) the proposal, including its multidisciplinary nature, requires continuous monitoring and scientific evaluation to determine if the set goals are actually achieved and to suggest possible re-routings of the research, even during the development of the work. At the same time, it is necessary to check

the cost of implementing the same methodology on a national scale;

2) since the starting point of the research is the investigation of the status quo with regard to the national context and to the specific cases of the cities involved in the project, you need a constant monitoring of the transposition of the needs expressed directly or indirectly by the Public Administrations. Compared to the first point raised, the project provides for the dissemination of results - of course in accordance with the applicable rules of confidentiality of scientific and technological achievements -. For example, through the literature, mainly in the form of scientific articles in international/national journals, or via the updating of websites (for example, by creating a dedicated section on the website of the TREMO). In addition, this is done through the promotion of every opportunity to share a collective comparison of the product of the research, incorporating comments from the scientific community: participation during the course of research at conferences, seminars, workshops, etc.

Formally, to instruct the process of results verifying the project involves the production of a series of deliverables, in the form of research reports on a periodic basis (at the end of each Focus Group and each Workshop).

Compared to the second point, the project envisages the involvement of a panel of experts and scholars in related areas of science involved, invited on the occasion of the presentation of the results of the work. Those experts belonging not only to the academic world but also to the administrative, professional and business communities, are identified during the first half of Phase I.

Right now, however, it is expected the participation of the Revenue Agency, as well as mainly through an invitation to the Workshops - of the proactive individuals who are already part of the activities carried out by individual seats, in particular representatives of the Sectors/Divisions of Public Administrations. The involvement of these stakeholders from the earliest stages of project appraisal is intended to facilitate the acceptance of demands, to orient the more specific goals and objectives of the work, in the more general perspective of the streamlining of workflow and administrative interoperability among public subjects, through the principles of fairness.

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