

The role of city dashboards in managing public real estate in Italy.

Proposals for a conceptual framework.

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ABSTRACT

Public Real Estate Management (PREM) is at the core of the international debate concerning the theories of New Public Management and Public Governance. These principles have progressively led to a profound restructuring of the public administration system and to overcome several limits ascribed to public bodies in the PREM field. Among these, the lack of data and information on the PRE portfolio has been considered a common issue of pre-reform asset management until very recently. Deficiencies in building real property inventories are still today the norm in most places, also in Italy, where municipalities face many glaring challenges in developing information technology-based infrastructures. The main goal of this study is to define the conceptual framework of a city dashboard to support the public real estate management. The city dashboard is understood as a knowledge, managerial and participatory tool able to collect, map and catalogue, update and share property data; to support the integration of the PREM in urban governance policies; to involve citizens and private investors in urban regeneration projects.

Keywords: Public Real Estate, Public Real Estate management; City Dashboard.

1. INTRODUCTION

Public Real Estate Management (PREM) is an important issue at the core of the international debate and is gradually playing a prominent role in the implementation of public policy objectives (Kaganova et al. 2000; van der Schaaf 2002; Wills 2009; Abdullah et al. 2011; Manase 2015; Kaganova et al. 2018; Migliore 2019) which nowadays should be oriented towards the promotion of sustainable development models (UNGA 2015; Mazzette et al. 2015; EC 2019). The imperative to limit the indiscriminate use of land (Loures 2019; Honachefsky et al. 2019; ISPRA 2019) has brought attention to the compact city ideal (Finetti 2012; Cassetti 2016; Lehmann 2019), i.e. a city that grows mainly on itself recycling abandoned buildings and areas (Musco 2009) to address the needs of contemporary

31 society (such as the demand for social housing and welfare, for cultural and employment
32 opportunities, for coworking and Industry 4.0 etc.). The ideal of the compact city is both desirable and
33 realistic. As a matter of fact, the divestment phenomena of buildings and areas due to the
34 establishment of new economic models and the achievement of technological advances, together with
35 the definition of favorable geopolitical conditions, solicit national and local governments to face the
36 challenge of reusing a substantial amount of properties belonging to different public bodies (Imbesi
37 2012). Public buildings and areas often represent a significant asset in quantitative and qualitative
38 terms, by virtue of their evidential values (historical, cultural, architectural, landscape, economic etc.).

39 Over the past two decades PREM has been integrated into the international debate concerning
40 the theories of New Public Management (NPM) and Public Governance (PG) (Kaganova 2006; Marona
41 et al. 2018). These new paradigms have introduced the principles of efficiency, effectiveness,
42 decentralization, responsibility, transparency etc., aimed at fostering a profound restructuring of the
43 public administration system and overcoming several limits of public bodies in the PREM field.

44 More precisely, the NPM paradigm has been recognized as one of the main drivers of reforms in
45 property asset management emerged across central and local governments (Kaganova, 2006). The
46 need to improve the public administration performance (especially financial efficiency and cost-
47 effectiveness) and to apply the private-sector management approaches to the public sector has led to
48 a greater awareness of values and opportunities of the PRE asset. As a matter of fact, after a long
49 period of time that highlighted the gap between public bodies and the private sector in the real estate
50 portfolio management (Simons 1994), national and local governments have understood the
51 importance of adopting a strategic approach (Kaganova 2006; Manase 2015; Trojanek 2015;
52 Constantin 2018; Marona et al. 2018). PRE asset is now considered a resource for ensuring efficient
53 public service delivery, which represents a bedrock of good governance and administrative
54 performance (Manase 2015; Constantin 2018).

55 At the same time, the new frontier of the PG asks public administrations to adopt an integrated
56 approach in dealing with problems and to take on the coordinating role of different subjects in most
57 complex issues (Runya et al. 2015), such as the enhancement and the management of the PRE assets.

58 However, international studies identified the deficit of knowledge about the real properties as the
59 most critical factor behind this gap, drawing up guidelines and recommendations for creating PRE
60 inventories (Trojanek 2015; Randazzo et al. 2016). This is a necessary process which nowadays should
61 take advantage of all the opportunities offered by information and communication technologies (ICTs)
62 (Kummerow et al. 2005) to collect, update, share and generate knowledge.

63 The deficit of knowledge has been considered the main structural problem for an effective PREM
64 also in Italy (Falanga et al. 2013; Gaeta et al. 2013; Manzo 2015). Over the past two decades, public

65 bodies at national level have carried out important initiatives to tackle this issue, in order to improve
66 both knowledge and promotion of those properties belonging to the state. Despite these initiatives,
67 several issues persist at the local level (Ladu 2018a; Ladu et al. 2019): some municipalities don't know
68 all their assets and essential data and information on properties, and don't have technological tools for
69 managing the PRE knowledge framework. Yet, ICTs play an important role in ensuring that properties
70 are handled with great efficiency (Haynes et al. 2017). In particular, the use of geographic information
71 system (GIS) for property management functions in a local government allows a shift from static
72 inventories to dynamic, integrated property management systems, thus supporting a wide range of
73 public decisions (Ralphs et al. 2003, p. 125; Deakin 2019).

74 Considering that deficit in terms of knowledge, transparency and strategic approach represents a
75 structural problems for effective PREM, especially at the local level, and that this issue should take
76 advantage of the opportunities offered by technological progress, the present study aims to define a
77 set of data and information on public properties and a conceptual framework of a city dashboard to
78 support effective management in the long term. In this research work, the city dashboard is
79 understood as a knowledge, managerial and participatory tool able to collect, update and display
80 property data; to support the integration of the PREM in urban governance policies; to involve citizens
81 and private investors in urban regeneration projects (Hasegawa et. al 2018; Lubbers et al. 2019; Ladu
82 et al. 2019; Lock et al. 2020).

83 After introducing the relevant topics in the research field, the article is structured as follows:

- 84 - the second section analyzes the role of urban data and city dashboards in managing
85 contemporary urban systems;
- 86 - the third section focuses on the long-standing debate concerning the PREM in Italy;
- 87 - the fourth section is dedicated to the methodology adopted to define a set of data and
88 information on public properties necessary to develop a conceptual framework of a city dashboard to
89 support PREM at the local level;
- 90 - finally, the fifth section discusses the results of the present study, while the sixth section
91 illustrates the conclusions and introduces future research development perspectives.

92

93 **2. MANAGING CITIES THROUGH URBAN DATA AND CITY DASHBOARDS**

94 The growing complexity of urban and territorial changes that makes twenty-first century cities as
95 complex systems has led to the transition from government to governance in order to integrate the
96 different social, economic and environmental dimensions (EU 2011; Indovina et al. 2015; Nel-lo et al.
97 2016). To assist this condition, since the 90s several performance indicators have been developed and
98 adopted by cities to monitor the dynamics of multiple aspects of the urban systems (Kitchin et al.

99 2015) and, consequently, to orient decision-making processes towards global sustainable development
100 goals. The definition of the most desirable features and benchmarks for cities represent the result of a
101 growing cultural awareness about environmental and sustainable development issues and a first
102 attempt to implement the principles of new public management introduced to pursue higher levels of
103 efficiency, responsibility and transparency in public administration (Kitchin et al. 2015). More recently,
104 many of the performance indicators for cities and nations have been developed into an International
105 Standard (ISO 37120:2018).

106 Within this context, the quantity and quality of available and potential urban big data is producing
107 new forms of evidence-based policymaking (Cairney 2016) and of data-driven urbanism (Kitchin 2018).
108 Evolving from traditional methods for building and gathering data, based on censuses, surveys and
109 observations, technological advances today provide cities with new technical possibilities to
110 automatically collect and produce detailed and dynamic data, often in real-time (McArdle et al. 2016;
111 Barkham 2018), thus implementing the Smart City paradigm (Murgante et al. 2015; Dameri 2017; ISO
112 37122:2019).

113 In addition to these aspects, effective visual communication of data and outputs represents
114 another challenge for the future (Few 2006; Vasudavan et al. 2019): provide viewers (policymakers,
115 stakeholders, citizens) with the information they need quickly and clearly is a precondition for effective
116 government action and greater accountability and transparency in public administration. In this sense,
117 in recent years dashboard has been recognized as one of the most powerful technological tools for
118 communicating important information in a simple and immediate way (Few 2006). Key data referring
119 to city trends are now increasingly displayed via city dashboards open to citizens, city users, public and
120 city workers, in order to redirect future policies and take appropriate actions (Mattern 2015; Balletto
121 et al. 2018). In a city dashboard, multiple sets and streams of indicators and big data are collected into
122 one system, constantly updated, monitored and displayed on a screen in order to formulate effective
123 policies and improve the quality of life. Users can often interact with the informative contents by
124 means of tools to visualize, overlap, query and analyze data provided and understand their
125 relationships (Kitchin et al. 2016). This aspect is fundamental not only to manage cities in ordinary
126 conditions but also to deal with extraordinary events, such as the current health emergency. In fact, it
127 clearly emerges that analytical dashboards are proving to be powerful tools (Koubaa 2020) for the
128 scientific world committed to understanding the causes underlying the spread of the coronavirus
129 pandemic through the analysis of data relating to human health, environmental conditions and their
130 direct relationships (Setti 2020; Roussel 2020; Conticini 2020).

131 Over the past decade, various dashboard apps have been set to monitor how different aspects of
132 urban systems are performing at a particular point in time. At the same time, several models of open

133 access city dashboards have been developed to provide a comprehensive city overview using both
134 static and real-time data (Kitchin et al. 2015; Usurelu et al. 2017; Stehle et al. 2020) (Table 1).

135 **TABLE 1.** Types of visualization and content in international Dashboard apps and City Dashboard

136

137 It is possible to make a first distinction between analytical dashboards, which aim to show the
138 urban system in a comprehensive way, and performance driven dashboards, used especially for
139 benchmarking services against specific targets (McArdle et al. 2016). Moreover, the disciplinary debate
140 highlights two main graphical user interface styles adopted in developing this kind of tool (Jing 2019):
141 the first is the single one-page design, typical of those dashboards that focus on performance
142 monitoring, such as the London City Dashboard; the second is the drilldown style, used to visualize and
143 make sense of numerous layers of interconnected data, as in the case of the Dublin City Dashboard.
144 The latter is an analytical dashboard launched in September 2014 to provide an overview of the city
145 through a mix of real-time data and more traditional indicator visualizations (such as public
146 administration datasets) (Kitchin et al. 2015; Usurelu et al., 2017). As a matter of fact, it is considered
147 one of the most comprehensive internationally (Kitchin et al. 2016). This web application consists of 11
148 modules and several webpages which collect, analyse and display data from a variety of sources,
149 through interactive maps, graphs and applications. Different tools and visualizations show an overview
150 of the city at a glance, with information automatically updates about transport, environment, industry,
151 employment, housing, health and crime. Furthermore, the dashboard provides a series of performance
152 reports to explain the results of governance practices in public sectors, a comprehensive set of maps
153 and links to other services and external applications (McArdle et al. 2016).

154 Within this framework, the present study recognizes the management of public real estate assets
155 as an important issue to be considered in developing a city dashboard as it plays a key role in assessing
156 the performance of the city in social, economic and environmental terms. At the same time,
157 dashboards offer a great opportunity to deal with those structural problems that have hindered
158 effective PREM for a long time. In Italy, where the deficit in terms of knowledge, transparency and
159 strategic approach has clearly emerged in recent decades, the development of technological tools
160 represents a significant challenge for local governments still today. City dashboards are innovative
161 tools to collect, monitor and display data and geographical information about the characteristics of
162 each property, and to return outputs related to the overall real estate portfolio. An interactive
163 dashboard capable of providing a constantly-updating data on the PRE assets conditions in terms of
164 architectural characteristics, state of use, state of conservation and economic value represents a useful
165 tool for local governments not only to plan and manage more effectively the public resources for

166 future interventions but also to match information concerning the amount of available properties with
167 the growing demand of spaces to pursue the main public policies objectives, thus generating social,
168 economic and environmental benefits for cities and their communities. As a matter of fact, PRE assets,
169 especially those underutilized, represents a great opportunity to address a range of social needs, to
170 promote economic growth, to limit the land consumption and protect the environment, in line with
171 the sustainable development goals and targets of the 2030 Agenda.

172 The city of Los Angeles has an interactive map to manage in a more strategic way the publicly-
173 owned properties within its boundaries (see Table 1). Here, underutilized real estate assets were
174 considered as a resource to face affordable housing problems and to promote education and economic
175 development programs. The properties dashboard helps to understand the potential of each property
176 with reference to the neighborhood characteristics and, therefore, to propose future scenarios, also
177 through the local community involvement. In other urban contexts, some scholars propose dashboards
178 to monitor the real estate market value profile (Baiardi et al. 2019) and to estimate the annual budgets
179 needed for future short and long-term interventions in buildings, thus allowing a more effective
180 programming of resources (Mathieu et al. 2019).

181 The possibility to display information about the condition of the entire real estate portfolio at a
182 glance and interact with several informative contents by means of links to other services and external
183 applications, allows to understand direct relationships between public assets and urban and
184 environmental aspects of contemporary cities. In this sense, city dashboards are conceived as powerful
185 cognitive tools to support PREM and, more generally, sustainable urban governance (Kitchin et al.
186 2015; Gray et al. 2016; Lock et al. 2019; Engin et al. 2019). As a matter of fact, effective monitoring
187 schemes prove to be a priority also in governing urbanization dynamics and soil sealing processes,
188 especially in Italy, where an increasing land conversion for urban development has occurred in the
189 most recent period (Munafò et al. 2013). Up-to-date information on land use changes might inform
190 planning strategies and environmental policies (Pileri et al. 2010; Munafò et al. 2013).

191 However, although city dashboards represent powerful tools to know and manage cities, a
192 number of technical, epistemological and political limitations have been highlighted with respect to
193 (Kitchin et al. 2016a; Kitchin 2018):

194 - the data themselves and the analytics used, as it is often difficult to judge the veracity and
195 quality of big data processed and analysed by "black-boxed" algorithms, as well as to interpret the real
196 meaning when it is shaped by the visualisations displayed;

197 - the data generated, as they are not objective and neutral but produced by a selected field of
198 view which return particularised and partial set of spatial knowledges about the city;

199 - the smart city approach, as it may led to promote a technocratic and top-down form of
200 governance, ignoring the fact that dashboards are the product of human decisions and has direct
201 influence on all aspects of urban systems.

202 In this sense, the disciplinary debate identifies key challenges for successful implementation of
203 dashboards within governments (Bartlett et al. 2017; Barns, 2018).

204 With regards to the first limit, Dobraja et al. (2018) propose the concept of "adaptable
205 dashboard", a solution consisting of three levels of knowledge - information content, user interface,
206 and graphical representations - in order to get insights into origin-destination data.

207 Moreover, with respect to the other two issues, Bartlett et al. (2017) argue that the main factors
208 to develop effective dashboard projects are: identify purpose and use of the tool - i.e. which aspects
209 need to be measured and why; which indicators desire attention -, but also select the right framework
210 of analysis and understand limitations. Basically, considering that dashboards are the product of
211 human decisions, a full awareness of limitations allows users to critically engage with big data,
212 avoiding abstract interpretations. Data should be read beyond their apparent simplicity and related to
213 the urban context to guide operational choices through a strategic and long-term approach. At the
214 same time, these powerful tools capable of collecting, analyzing and acting on large data sets should
215 be aligned with government objectives (Barns 2018) to prevent the risk of technocratic forms of
216 governance but, rather, to guide effective democratic and place-based policies.

217 In light of these considerations, the present study takes into account the main issues discussed to
218 propose the conceptual framework of a city dashboard for managing PRE assets in Italy and adopts the
219 concept of circular dashboard, defined by some scholars as "the process of data gathering, processing
220 and organization of decision makers and users for planning purposes. In this domain the information
221 obtained from the dashboard is used to evaluate urban performances and calibrate further and future
222 city actions" (Balletto et al. 2018, p. 656).

223

224 **3. PUBLIC REAL ESTATE MANAGEMENT IN ITALY. A LONG-STANDING DEBATE**

225 PREM is a matter of political, institutional, civil, entrepreneurial and academic interest (Ladu
226 2018a). What animates this attention is the shared wish to ensure a rational and effective use of the
227 so-called "common goods" and to promote their enhancement in order to generate positive effects for
228 entire areas and communities (Balletto et al. 2020). A significant amount of unused public real estate
229 assets, frequently of historical and cultural interest (Gastaldi 2014), is spread all over the national
230 territory (Campagnoli 2014) and asks the State and the other public bodies to define new uses
231 responding to the demands, needs and aspirations of contemporary society.

232 The PREM issues are closely connected to those of urban sprawl, a real emergence for the
233 country. The diffusion of low-density settlements beyond city borders impacts on rural lands by
234 triggering land cover changes (LCCs) (Salvati et al. 2012). More precisely, some scholars proposed the
235 "Sprinkling" approach to describe a specific modality of land take widespread in Italy and characterized
236 by small quantities falling in drops or scattered particles, especially with reference to vast tracts of
237 rural and hill areas (Romano et al. 2017). Environmental implications and negative effects caused by
238 this type of urbanization dynamics on the land management are difficult to face in the short term. In
239 this sense, an efficient management of existing buildings, especially public ones, represents a
240 significant opportunity to pursue a compact city model, which is opposed to that of dispersed urban
241 form, thus limiting the consumption of land. However, this is an arduous task, which sees as main
242 obstacles not only the impact of the 2008 economic crisis on the financial resources of governments
243 and private investments, but also structural problems affecting the Italian political system, including
244 (Falanga et al. 2013; Gaeta et al. 2013):

- 245 -the deficit of knowledge about the public assets belonging to the State and to other public
246 bodies;
- 247 - the difficulty of applying a regulatory framework which is often redundant and contradictory;
- 248 - the lack of a clear long-term strategy for managing PRE assets, because of the frequent
249 alternations of political parties in government.

250 Both central and local administrations have encountered difficulties for a long time in finding and
251 organizing in a systemic way not only the data relating to the intrinsic features of the asset, but also
252 the information on the relationships that public buildings and areas establish with their urban and
253 territorial context (Magistà 2007).

254 An important turning point occurred firstly with the introduction of territorial information systems
255 (TIS) to support public administration activities, and successively with the establishment of the State
256 Property Office (Agenzia del Demanio), a government-owned enterprise to manage, rationalize and
257 enhance the state properties. The Office promotes and coordinates important projects of cataloging
258 and georeferencing of the state asset to formulate coherent management and urban regeneration
259 policies. In this sense, the policy of Italian Federalism, distinguished in ordinary and cultural, allows
260 local and territorial bodies to become owners of state properties located in their territory, abandoned
261 or not used at best, in order to guarantee new functions in line with the local community needs and
262 the objectives of place-based urban redevelopment schemes (Legislative decree 28 May 2010, n. 85).

263 Another considerable step forward has been taken with the project *Asset of the P.A.*, launched in
264 2010 by the Department of the Treasury (DT) (see methodology section) to set a centralized database
265 of the publicly-owned properties, and the successive Legislative Decree no. 33 of 14 March 2013 which

266 obliges public administrations to publish the list of properties in their possession (owned or used) and
267 the management policies adopted. This is considered a precondition for achieving greater
268 administrative transparency and accountability. The Legislative Decree does not dictate a set of
269 parameters for collecting information on public assets but, since 2010, public administrations must
270 communicate annually to the DT specific information relating to the properties (buildings and areas)
271 owned or used, as required by the project *Asset of the P.A.*

272 Despite these initiatives, several problems persist at local level (Vermiglio 2011; Ladu 2018a; Ladu
273 et al. 2019). It is possible to state that:

274 - although most Italian municipalities have published the public properties list on their official
275 website, in line with the legal obligations (L.D. 33/2013), many others still don't know all data required
276 for each property and important information to inform long-term planning and effective asset
277 management;

278 - most municipalities publish their PRE inventory using Excel, Word or PDF format files, while only
279 some cities adopt more advanced technological tools for collecting, georeferencing, analyzing,
280 updating, monitoring and displaying the PRE knowledge framework.

281 That's a real problem when you consider that municipalities are responsible for planning and
282 managing a specific territory. For these reasons they should know information concerning the
283 maintenance status of the properties, the presence of any constraints and easements, the
284 management costs, the economic value, the potential of each asset within its urban and territorial
285 context. All of these are fundamental data to manage the PRE asset within a clear vision of the city of
286 tomorrow (EU 2011; Ferracuti 2015) and to develop any project, whether it is aimed at preserving, re-
287 using, enhancing or disposing a real estate property, through a constant dialogue between public
288 bodies, local communities (LC) and private investors (PIs), key players in the PREM process. More
289 precisely, PIs are usually involved in urban transformation and regeneration schemes, according to the
290 procedures indicated by the public bodies for investing in PRE assets. At the same time, the LC, which
291 includes active citizenship, voluntary associations and organizations in the third sector, often pursue
292 educational, health, cultural or other social goals into public spaces, in compliance with specific
293 Regulations (Iaione 2012; Campagnoli 2014; Labsus 2017; Mangialardo 2017; Mangialardo et al. 2018;
294 Ladu 2019a; Ladu 2019b). It is just the occasion to remember that the several difficulties encountered
295 by public administrations in defining new uses for spaces are stimulating cities around the world to
296 launch innovative calls to give designers, investors, companies and artists the possibility to rethink and
297 reshape the way that people live, work, and play, to propose new urban facilities and lifestyles for the
298 modern complex society (Cottino 2017).

299 Starting from these considerations, the present study aims to go beyond the traditional and static
300 inventories adopted by the Italian municipalities, to develop a dynamic, integrated property
301 management system. The analysis of the types of data and information about the PRE portfolio which
302 this research considers strategic to ensure effective management represents the first step in
303 developing a conceptual framework of a city dashboard for the PREM.

304

305 **4. METHODOLOGY**

306 The research methodology adopted consists of three phases:

307 - the first is dedicated to the analysis and comparison of the main institutional projects launched
308 in Italy, at national and local level, to support the process of knowledge, management and
309 enhancement of the PRE assets owned by the State and by other public bodies;

310 - the second phase focuses on the definition of a set of attribute data which should be considered
311 by municipalities in drawing up their local property inventories;

312 - the third illustrates the conceptual framework of a city dashboard to support the PREM and
313 explains the main contents and web services that this innovative tool should provide.

314

315 *4.1 A comparison between institutional projects for the PREM in Italy*

316 The first phase of the research methodology analyzes and compares the main projects carried out
317 at national and local level to support the process of knowledge, management and enhancement of the
318 PRE assets. This study takes into consideration the following elements (Table 2, Table 3):

319 - the public body responsible for the administration of the project;

320 - the technological tool adopted, such as lists, databases, portals, geoportals etc.;

321 - the category of the PRE assets examined, with reference to the property owner;

322 - the types of data and information provided for each property, making the distinction between
323 intrinsic features (which refer to the inherent characteristics of the property) and extrinsic features
324 (which depend on the specific context of the property);

325 - the outputs provided with reference to the overall PRE portfolio and conceived as key
326 performance indicators (KPIs) by which the performances of public administrations in the management
327 of their PRE portfolio can be periodically assessed;

328 - the web services provided, which includes data visualization, consultation and interrogation
329 services, but also sections dedicated to the launch of calls for proposals.

330

331 The main projects examined at national level are (Table 2):

332 - *Asset of the P.A.* (Patrimonio della PA), a project launched by the Department of the Treasury
333 (DT) (Ministry of Economy and Finance - MEF), according to the Law n. 191/2009, art. 2, clause 222, to
334 set a centralized database at national level to collect and share information on the characteristics of
335 PRE assets in order to guarantee efficient management of the properties owned by central and local
336 public bodies (MEF 2018). Every year, public administrations provide datasets of their buildings and
337 areas (owned or used) to the DT, by means of a designed portal. The information required for each
338 property concerns: location, georeferencing, cadastral date, title of use/possession, ownership, type of
339 real estate, type of use and purpose, legal profile, dimensions, period of construction, landscape and
340 cultural constraint, uses. The DT allows open access to these data, which are available in Excel format
341 files, but there is no georeferenced schema that describe the situation of Italian municipalities.

342 - *OpenDemanio*, a portal launched by the State Property Office to set a database open source
343 dedicated to the buildings and areas belonging to the State. The portal provides an up-to-date
344 information on the real estate asset, especially as regards the amount of buildings and areas and their
345 total value. Moreover, it promotes several opportunities for investment in public real estates.

346 - *investitalyrealstate.it*, a portal launched by the State Property Office for presenting Italian and
347 foreign operators with opportunities for investment in PRE assets owned not only by the State but also
348 by other public bodies. It is a tool for promoting interaction between demand for professional
349 investments and remarkable opportunities selected from amongst Italy's most important public
350 properties in terms of location, type and size.

351 **TABLE 2.** A comparison between the main institutional projects developed at national level.

352
353 The comparison shows that the Portal "Invest in Italy" is the most complete and exhaustive
354 project among those analysed, both in terms of types of data and information collected and of web
355 services provided. PRE assets are described in detail with data relating to the intrinsic characteristics
356 and information concerning the urban and territorial context. Instead, the DT database and the Portal
357 "OpenDemanio" focus more on intrinsic features of each property than on extrinsic ones. Other
358 considerations can be stated for the outputs related to the overall PRE portfolio.

359 The DT aims to publish data relating to the total area, the total economic value and the state of
360 use of the overall PRE portfolio in a series of annual reports. However, the report is a tool which does
361 not support dynamic information: the last one, published in 2019, refers to the 2017 census.

362 *OpenDemanio* provides updated information on the number of state properties (buildings and
363 areas) and their economic value at the national and regional scale, while *Invest in Italy* does not

364 provide any output on the overall PRE portfolio because it has been launched to promote investments
365 on individual assets and not to develop a database for the PRE collection and management.

366 Other considerations can be made on the technological tools adopted and web services provided:

367 - the DT publishes the data gathered by each public administration on the official website, in excel
368 format files. The data are not yet georeferenced but are available in Excel format files and can be
369 viewed and downloaded.

370 - *OpenDemanio* provides a map of the georeferenced properties of the State, described by a set of
371 data available for download. This Portal also contains a section dedicated to calls for PRE enhancement
372 projects launched by the state.

373 - *Invest in Italy* allows the visualization of data for each georeferenced property and advanced
374 search options (property types, permitted uses, regions, risk profile, total area) to select and find
375 specific opportunities for investment in real estate.

376

377 The projects developed at local level and analyzed in this study are (Table 3):

378 - The *Local Property Inventory of the City of Cagliari*. The local property list published on the
379 institutional portal of the municipality is an Excel file containing minimal data on the intrinsic
380 characteristics of the buildings owned by the City. The municipality also has a Territorial Information
381 System (TIS) which contains an informative layer dedicated to the public buildings, where the main
382 properties are georeferenced and described synthetically.

383 - The *Charter of the Public City of Rome* and its TIS. This project is the result of an important survey
384 launched in 2014 to set a map and a comprehensive SIT of the PRE assets (buildings and areas) located
385 in the City and belonging to the State and to other public bodies (Municipality of Rome 2014 and
386 2016). The first aim was to build a geodatabase to support the implementation of the Government
387 Agenda. Although the objectives of the project were ambitious, the system is not yet open to the
388 public for the practical use of data visualization and interrogation.

389 - The *Local Property Inventory* and the *Map of the public real estate assets of the City of Milan*.
390 The *Local Property Inventory*, published on the official website, is the list of the properties (buildings
391 and area) owned by the city, containing minimal data on the intrinsic characteristics. The *Map of the
392 public real estate assets of the City of Milan*, within the Geoportal of the City, provides georeferenced
393 information on properties owned by the municipality, located in the metropolitan area.

394 **TABLE 3.** A comparison between the main institutional projects developed at local level.

395

396 The comparison shows that Cagliari and Milan have collected information relating to their
397 properties (owned or used), while only the City of Rome has launched an important survey on the PRE
398 assets belonging to the State and to other public bodies and institutions.

399 As regard the information collected for each property, the three cities mainly gather data on
400 intrinsic characteristics, less on extrinsic ones, and do not provide information which the present study
401 considers essential to inform long-term planning and effective asset management. Moreover, none of
402 the three cities provide outputs related to the overall real estate portfolio.

403 Other considerations can be made on the technological tools adopted and web services provided.

404 The city of Cagliari publishes a list of public buildings and areas owned or used by the municipality
405 in its official website. The data gathered have not yet been georeferenced. The geoportal of the city
406 provides an informative layer dedicated to only some of the public buildings located in the city, which
407 have been georeferenced and described by a synthetic data sheet. The system does not allow to cross
408 PRE data with other informative layers (Local Plan, Public Policies, etc.) to guarantee an effective
409 management of the territory and of the public properties themselves. The geoportal allows data
410 visualization but not to make spatial queries.

411 In considering the case study of Rome, although the objectives of the *Charter of the Public City* are
412 ambitious, the system is not yet open to the public for the practical use of data visualization and
413 interrogation. The only outputs available are those dating back to 2016, when the first results of the
414 survey showed that the total area of public properties (buildings and areas) located in the city
415 represents approximately 26% of the municipal area (Municipality of Rome 2014).

416 The city of Milan publishes a list of public buildings and areas owned or used by the city in its
417 official website. The data collected have been georeferenced in a specific map of the PRE asset of the
418 Municipality, within the Geoportal of the City. The georeferenced properties are described by a
419 synthetic data sheet. The system does not allow to cross PRE data with other informative layers (Local
420 Plan, Public Policies, etc.) to guarantee an effective management of the territory and of the public
421 properties themselves. The geoportal allows data visualization but not to make spatial queries.

422 Starting from these considerations, the successive phase of the methodology focuses on the
423 definition of the attribute data to be considered by municipalities when building their Local Property
424 Inventories. This is the first step to set a geographical database of the PRE assets, which is understood
425 as a new informative layer of a more complex city dashboard able to collect, analyze, display, update,
426 monitor and share the knowledge framework in the most efficient way.

427

428

429

430 *4.2 Proposals for a set of attribute data: intrinsic and extrinsic features of the public real estates*

431 The analysis and comparison of the main projects carried out at national and local level
432 highlighted different types of data and information collected by central and local institutions to
433 promote knowledge, enhancement and management of the PRE assets in Italy. Starting from these
434 datasets, the present study proposes other types of information to be considered in designing and
435 building a geographic database of the PRE, as they are strategic to inform enhancement and
436 management policies in the long term (Figure 1).

437

438 **Figure 1.** Proposals for a set of attribute data of each property and outputs for the overall PRE portfolio.

439 All the projects examined provide an exhaustive set of data concerning the intrinsic characteristics
440 of the property. In this regard, the present study proposes to consider also the data concerning the
441 level of energy efficiency of each building (classes from A to G) in order to achieve full awareness of
442 the energy performance of the overall PRE portfolio. This output is important to inform government
443 objectives according to the EU's 2030 Climate and Energy Framework (EC 2014).

444 As a matter of fact, in a future dashboard, the set of outputs should be implemented as well: in
445 addition to the Total surface area (mq), the Total economic value (€), the State of use (% of properties
446 used, not used, temporarily used, under-used) and the Level of energy efficiency (% of building in class
447 A, B, C etc.), it is necessary to monitor the State of maintenance (% of properties in a good state, to be
448 refurbished etc.) of the entire portfolio, which is a key indicator in planning public expenditure.

449 The comparison also shows the lack of information on the extrinsic characteristics of each
450 property. Yet, the urban and territorial context of the property provides strategic information to
451 implement investments in public real estates. In this regard, the Portal "invest in Italy" is the most
452 complete project among those examined. It provides data concerning the location, the setting of the
453 urban and territorial context, the presence of any kind of policies and planning schemes relating to the
454 specific site. The first two data are considered among the extrinsic characteristics also by the present
455 research, while the data relating to urban policies and urban transformation and regeneration
456 schemes which directly or indirectly involve the property is removed from the list. As explained in
457 subsection 4.3, a specific operational layer may be dedicated to this issue as the city dashboard allows
458 to overlap, query and analyze multiple data sets and understand their relationships with that of the
459 PRE.

460 The present research proposes the Urban Attractivity index (UAI) as a new extrinsic feature able to
461 inform about certain relationships that the property establishes with its immediate physical, economic

462 and social context. The UAI helps to understand the values and potential of public properties and
463 guides the decision-making processes for the definition of future uses.

464 4.2.1 *The Urban Attractivity index*

465 The urban attractivity index (UAI) has been defined in several international studies. The research
466 carried out by Dekkers et al. (2009) on the relevance of spatial factors for housing prices defines the
467 UAI as an index «expressing availability of cultural, catering and retail facilities on 0 to 1 scale in 500 m
468 grid cells» (p. 116). More specifically, other authors state that «The Urban Attractivity Index gives the
469 degree of urban attractivity based on the weighted sum of the amount of shopping services, meeting
470 and accommodation services, and monumentality in the vicinity per hectare» (Claassens et al. 2018).
471 Similarly, Öner O. (2017) argues that retail access is very important for place attractiveness, urban
472 growth and development. In addition to the availability of urban facilities, the public transportation
473 service is a relevant factor in defining the attractiveness of the real estate assets and, consequently, its
474 economic value (Cordera et al. 2019). Some scholars have also identified the main variables to be
475 considered in determining the attractiveness of neighborhoods (Reid 2017). The set of complex
476 indicators concern: intrinsic characteristics of a dwelling, population characteristics, employment,
477 distance to geographic entities and buildings and environmental factors.

478 However, considering that the present study aims to define a methodology for calculating the UAI
479 for each public building and area, the set of variables to be considered concern three main aspects of
480 the property: attractivity, accessibility and connectivity. More precisely, the calculation of the UAI
481 involves three factors and the related ranges and weights (1 to 3) (Table 4):

- 482 - Attractivity: No. of urban facilities within the buffer of 500 m from the property (public
483 services; retail and commercial activities, tourist accommodation) (W_f);
- 484 - Accessibility: No. of public transport lines, bust stops and parking areas within the buffer of
485 500 m from the property (W_a);
- 486 - Connectivity: degree of traversability of the property (the building/buildings and its/their open
487 space) (W_c), expressed as the ratio between the number of existing entrances and the total
488 surface area of the property.

489 **TABLE 4.** Calculation of the Urban Attractivity Index of each property.

490

491 Therefore, the UAI is given by the sum of the weights attributed to the individual factors (W_f ; W_a ;
492 W_c), which can vary from a minimum of 5 to a maximum of 15 (1):

493

$$UAI = \sum_{W=5}^{15} Wf + Wa + Wc \quad (1)$$

494

495 The Wc reveals the grade of connectivity of each property in the urban context.

496 The reasons for this methodological choice lie in the awareness that a significant part of the PRE
 497 asset is characterized by large-scale building complexes that appear as enclaves, isolated nodes in the
 498 city, although often located in central areas. This is mainly due to their original function (hospitals,
 499 convents, prisons, barracks, military sites, railway yards etc.) which had no reason to establish direct
 500 relationships with the context.

501 The connectivity factor represents an element of innovation both in the calculation of the UAI and
 502 in the implementation of the PRE assets knowledge framework. It represents also an important data to
 503 develop reuse and regeneration projects within major schemes aimed at reconstituting a spatial
 504 continuum of public spaces in the urban environment (Ferrari 2011; Gambino 2012; Rolando 2014;
 505 Ladu 2018b), thus increasing the porosity of the city and the urban walkability (Blečić et al. 2015).
 506 Moreover, higher levels of connectivity increase the investment opportunities for urban regeneration
 507 and economic development.

508 The UAI is a strategic component of the Local Property Inventory that municipalities should
 509 implement to ensure an effective PREM. It is a dynamic data which constantly changes according to
 510 the transformation dynamics of urban contexts. The shift from static inventories to dynamic,
 511 integrated property management systems such as the city dashboard allows to collect and update this
 512 kind of data, to monitor all the information provided and to produce outputs/KPIs for the public
 513 administration.

514

515 *4.3 Toward the definition of a City Dashboard for the PREM*

516 As discussed in previous sections, the present study highlighted the importance of developing a
 517 city dashboard for the PREM in order to:

- 518 - fill the deficit of knowledge about the PRE assets at local level and standardize the methods
 519 adopted by municipalities to build their local property inventories;
- 520 - replace the existing tools with innovative dynamic, integrated property management systems to
 521 support effective PREM in relation to the contemporary challenges and the government aims.

522 The conceptual framework proposed consists of 3 main sections: Data, Call-Forum, Outputs/KPIs
 523 (Figure 2).

524

525 **Figure 2.** Conceptual Framework of a City Dashboard for the PREM.

526 DATA: this section collects and organizes data relating to the intrinsic and extrinsic features of
527 each property owned by public bodies. Some of these have already been considered by the case
528 studies analyzed, while others such as the level of energy efficiency of each property and the UIA have
529 been developed in the context of the present research. Most of the intrinsic and extrinsic
530 characteristics of each property are described by static data. Once all the information has been
531 collected, the public administration itself will update the dataset contextually to the Public Works
532 Strategic Plan and to any future maintenance work or technical changes on the property. On the other
533 hand, links to external applications and services are essential to ensure the gathering and the constant
534 updating of dynamic data such as the economic value (according to the bulletin of the real estate
535 market) and the UAI. The future steps of the present research work will focus on these aspects.

536 The dataset is a fundamental component of the proposed city dashboard project because if a
537 municipality is fully aware of the characteristics of the publicly-owned properties within its boundaries
538 and of their relationships with the urban and territorial context, it would be able to maximize the
539 potential of this asset by defining future uses in line with the architectural characteristics, the
540 population's needs and the government objectives (Manzo 2015).

541 OUTPUTS/KPIs: a monthly update of the set of data concerning the intrinsic and extrinsic features
542 of each property allows this section to provide information on the total PRE portfolio. This section is
543 the most representative of the ideal of city dashboard under construction because the outputs are
544 conceived as KPIs by which the performance of public administrations in the management of their PRE
545 portfolio can be periodically assessed. All the outputs considered in this framework are strategic to
546 support an effective PREM and, therefore, to guide municipalities towards the adoption of sustainable
547 urban development models.

548 CALL: this section informs about calls for proposals and calls for tender launched by municipalities
549 to discover ideas of reuse and scenarios coming from the local community (LC) and the private
550 investors (PIs), key players in the PREM process. Essentially, it is intended to get residents, associations
551 and investors thinking about how to maximize the potential of these properties. This section may also
552 provide a discussion forum to promote public participation, as well as the possibility for citizens to take
553 part in the data collection process using an app with a simple form to fill out. In this sense, the present
554 study conceived the city dashboard as a knowledge, managerial and participatory tool.

555 Moreover, an interactive dashboard capable of collecting, updating and displaying data relating to
556 the PRE asset owned by several public bodies and institutions can also represent a technological tool
557 able to improve transparency in public administration and the coordination among various levels of
558 government, directly or indirectly involved in the implementation of development projects that could
559 require the disposal of some assets, the transfer of existing functions, the alienation of the property, as

560 well as the concession or grant for permanent or temporary use. This kind of management approach is
561 a precondition to optimize public expenditure and generate social, economic and environmental
562 benefits for cities and their communities.

563 The three sections described represent only a part of a more complex conceptual framework. As a
564 matter of fact, the city dashboard is understood as a technological tool for collecting, updating and
565 monitoring, displaying and sharing dynamic data and information about the PRE assets (Ladu et al.
566 2019), capable of returning outputs related to the overall real estate portfolio condition, as well as
567 those generated by the intersections of multiple layers dedicated to other aspects such as Public
568 Policies (Social, Cultural, Economic, Urban, Environmental), Local Plan, saturation values of the
569 homogeneous areas of the city, environmental conditions etc. The goal is to match information
570 concerning the amount of available properties with the demand of spaces needed to pursue public
571 policies objectives, in respect of the local plan regulations. Moreover, the proposed framework allows
572 to relate urban data with the environmental ones in order to better understand and manage the
573 complex dynamics of the territories and to pursue a smart and sustainable urban governance (UNGA).
574 According to this renewed approach, PRE assets could represent extraordinary opportunities for
575 growth and development of cities and their communities.

576 This kind of management approach is supported by the proposed city dashboard framework which
577 provides an overview of the city trends within a global frame of reference in order to guide decision-
578 making processes and to redirect future policies under ordinary and extraordinary conditions. In this
579 sense, city dashboards are conceived as powerful cognitive tools to manage twenty-first century cities,
580 understood as complex systems.

581

582 **5. RESULTS**

583 Public Real Estate Management (PREM) is a matter of extraordinary importance in public
584 governance. It plays a relevant role in achieving high levels of governments performance and
585 sustainable development objectives. The disciplinary debate recognizes knowledge as a precondition
586 to ensure effective management of the public real estate assets.

587 The present study has illustrated the Italian long-standing debate on the PREM, which reveals
588 glaring deficiencies at the local level. They concern not only the deficit in terms of knowledge and
589 public administration transparency about the PRE portfolio but also the delay in setting information
590 technology-based infrastructures which should be adopted to manage data and to drive political
591 choices.

592 Considering the important role played by city dashboards in managing contemporary cities, the
593 present work adopted a research methodology to define the conceptual framework of a city

594 dashboard to collect, analyze, display, update, monitor and share data on public properties conditions,
595 in order to support effective PREM. The comparison between the main institutional projects
596 developed at the national and local level highlighted several types of data and web services provided
597 by the public bodies. Starting from these datasets, the research work proposed a set of attribute data
598 to be considered by municipalities when building their local property inventories, increasing the
599 existing types of intrinsic characteristics of each property and the outputs relating to the entire
600 portfolio. The level of energy efficiency of each property is a new data proposed in the context of the
601 present research. Moreover, the greater attention paid to the data concerning the intrinsic features of
602 each property, less to the extrinsic ones, has led this study to define a methodology for calculating the
603 UAI, a dynamic data which reveals the relationships between the property and its urban and territorial
604 context. The UAI represents a strategic information to develop reuse and regeneration projects within
605 major schemes aimed at increasing the porosity of the city and the urban walkability.

606 As regard the outputs, the State of maintenance and the Level of energy efficiency are two key
607 performance indicators (KPIs) that the present study considers strategic to support an effective
608 management of the overall PRE portfolio and to pursue sustainable development goals.

609 The first two phases of the methodology allowed to develop the conceptual framework of a city
610 dashboard to support the PREM. It consists of three main sections dedicated respectively to the data
611 on the intrinsic and extrinsic features of each property, to the outputs deriving from the update of the
612 latter, to the Calls for proposals and possible permanent forums to encourage the participation of the
613 local community (LC) and the private investors (PIs) in the PREM process. The comparison of the six
614 case studies carried out by this research reveals that the Calls - forums section represents a new
615 content in the scenario of the examined projects.

616 The three sections described represent only a part of a more complex conceptual framework of a
617 city dashboard capable of collecting, updating and monitoring, displaying and sharing dynamic data
618 and returning outputs generated by the intersections of multiple layers dedicated to several aspects of
619 the urban system such as PRE assets, Public Policies (Social, Cultural, Economic, Urban,
620 Environmental), Local Plan, saturation values of the homogeneous areas of the city, environmental
621 conditions etc. The possibility to match information concerning the amount of available properties
622 with the demand of spaces needed to pursue public policies objectives, in respect of the local plan
623 regulations, allows to manage PRE assets as an extraordinary resource for the development of cities
624 and their communities. Moreover, the ability to relate urban data with the environmental ones allow
625 to better understand and manage the complex dynamics of the territories and to pursue a smart and
626 sustainable urban governance (UNGA).

627

628 **6. CONCLUSIONS**

629 The main contribution of this research work lies in the conceptual framework proposed to develop
630 a city dashboard for the public real estate management (PREM). It aims to fill the deficit of knowledge
631 about the PRE assets at local level and to standardize the methods adopted by municipalities to build
632 their local property inventories, but also to replace the existing tools with innovative dynamic,
633 integrated property management systems to support effective PREM in relation to the contemporary
634 challenges and the government aims. In this sense, the city dashboard is understood as a knowledge,
635 managerial and participatory tool.

636 The research is related to an innovative approach in the PREM field, as until now little proposal
637 were carried on in terms of realizing a unique framework where storing the data and information
638 related to single properties (buildings and areas) and their relationships with the physical, economic
639 and social context. Such kind of approach is innovative both as a process, that implying the realization
640 of the framework, the data collection, integration and recursive update, and as an instrument for
641 potential users of different kinds for acquiring knowledge about the PRE asset and its potential
642 destinations of use.

643 The development of technological tools capable of collecting, updating, analyzing and displaying
644 the information on the entire PRE portfolio at a glance (in terms of area, economic value, state of
645 maintenance, state of use and level of energy efficiency) and its relationships with the socio-cultural,
646 economic, urban and environmental conditions of the specific context represents a great opportunity
647 for cities not only to implement ordinary policies but also to effectively deal with any extraordinary
648 events and the consequent economic transition. Among these, the current health emergency taking
649 place worldwide due to the coronavirus pandemic is generating significant challenges for central and
650 local governments. A general awareness is progressively emerging on some issues: the importance of
651 promptly identifying and selecting appropriate places where citizens and those operators who are at
652 the frontlines in the fight against the pandemic can spend the quarantine period; the need to rethink
653 spaces to host public functions and services of daily life according to future restrictions which,
654 presumably, will not be temporary in nature. Within this scenario, PRE assets, especially those
655 underutilized, will play a key role in governing future urban dynamics in line with the sustainable
656 development goals and targets of the 2030 Agenda. Building appropriate knowledge about the
657 intrinsic and extrinsic features of public properties within a more comprehensive city dashboard
658 project will be a primary aim for governments and their political agendas.

659 In the light of these considerations, the future developments of this study will cover the
660 implementation of the conceptual framework in a specific city. In particular, the research will set a
661 geographical database of public properties according to the set of data and information identified by

662 the present study to support the PREM process at local level. The creation of a geographical database
663 requires harmonizing existing structured and unstructured data of public properties, geo-referencing
664 existing datasets, obtaining linkable external data and distributing content through a WMS - WFS
665 service. Moreover, the research will develop the dashboard design, which consists in the choice of the
666 geographical engine database, in the definition of an appropriate layout, in the selection of links to
667 relevant external app and web services. In this regard, despite the gathering of the set of data is
668 primarily the responsibility of the public administration, an involvement of trained groups of citizens
669 could be foreseen, by developing fit for purposes apps that could be used, both by public bodies,
670 professionals and the general public for updating the information (popular platforms include
671 Epicollect, GeoODK or others). This web service could be part of the “Call Section” of the dashboard
672 conceptual framework proposed. Other external solutions will be selected for the calculation and
673 updating of the Urban Attractivity Index (UAI), which is closely related to the number and type of
674 available services and facilities in the specific urban context.

675 Finally, the definition of technical guidelines to standardize the data gathering, processing and
676 organization by each Municipality represents a future objective of the present research work. This
677 aspect is very important especially when PREM management becomes a strategic task of supralocal
678 government bodies, such as Metropolitan Cities, established in Italy by the Law 56/2014. The
679 implementation of city dashboards able to collect, update and display data about PRE assets and to
680 overlap and intersect several informative layers concerning multiple aspects of contemporary urban
681 systems represents a great challenge also for the new metropolitan entity.

682

683 **CONFLICTS OF INTEREST**

684 The authors declare no conflict of interest. The funders had no role in the design of the study; in the
685 collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to
686 publish the results.

687

688 **DATA AVAILABILITY**

689 Some or all data, models, or code that support the findings of this study are available from the
690 corresponding author upon reasonable request.

691 Some or all data, models, or code generated or used during the study are proprietary or confidential in
692 nature and may only be provided with restrictions.

693

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923 **List of figure captions**

924 **Figure 1.** Proposals for a set of attribute data of each property and outputs for the overall PRE portfolio.

925 **Figure 2.** Conceptual Framework of a City Dashboard for the PREM.

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930 **TABLE 1.** Types of visualization and content in international Dashboard apps and City Dashboard

	Graphical user interface styles	Type of data (<i>Real-time Data; Static and Dynamic Data</i>)
Dashboard apps		
Real-time		<i>Real-time Data</i>
Environmental Data Dashboard in Hong Kong*	Single screen dashboard	- Concentration of NO ₂ , O ₃ , SO ₂ , CO, PM _{2.5} , PM ₁₀ for past 24 Hours - Air Quality Health Index (AQHI) - Temperature and Temperature Chart
Housing Densities Dashboard in the City of Saratoga Springs, UT**		<i>Real-time Data</i> - Recorded residential units by year - Percentage of recorded units in relation to different family unit types - Total Recorded Units and Total Built Units - Available Single Family and Available Multi-Family
Property Development Explorer Dashboard in the City of Yakima, WA***		<i>Real-time Data</i> - Property Count by Zoning Category - In or Out of Floodplain - Property List Sorted by Acres - Property Statistics in Map View and Property Count Representing
Property Panel in the City of Los Angeles****		<i>Real-time Data</i> - Select District: Congressional District; State Senate District; State Assembly District; County Board of Supervisors District - Total publicly - owned properties (No.) and Total area (Acres) - Percentage of properties in relation to the Entity Ownership
City Dashboards		
London City Dashboard*		<i>Real-time Data</i> Weather; Traffic; Tube line status; London cycle hire; Air pollution; BBC London news; OpenStreetMap updates; Twitter trends for London; London news and events; London universities
Dublin City Dashboard**		<i>Real-time Data</i> 1 Module. DUBLIN OVERVIEW: Transport; Environmental Indicators; Industry, Employment & Labour Market; Housing Indicators; Health & Crime <i>Static Data - existing datasets & Dynamic Data – series data (temporal phase: monthly, quarterly or annually)</i> 10 Modules. HOW'S DUBLIN DOING?; DUBLIN REAL TIME; DUBLIN MAPPED; DUBLIN PLANNING; DUBLIN NEAR TO ME; DUBLIN HOUSING; DUBLIN REPORTING; DUBLIN DATA STORES; DUBLIN APPS; DUBLIN BAY DASHBOARD
Dashboard apps		
* http://opendata.esrichina.hk/datasets/d427c744001d4c6f969d0e3fd1a5a86e?fullScreen=true		
** https://sngis.maps.arcgis.com/apps/opsdashboard/index.html#/5bce1949b0c24f64a94d843a8ee05647		
*** https://yakima.maps.arcgis.com/apps/opsdashboard/index.html#/d0d0f868918e4684b7ae977386b0b991		
**** https://lacontroller.org/data-stories-and-maps/propertypanel/		
City Dashboards		
* http://citydashboard.org/london/		
** http://www.dublindashboard.ie/pages/index		

TABLE 2. A comparison between the main institutional projects developed at national level.

Elements of comparison		Asset of the PA*	OpenDemanio**	Investinitaly***
Institutional subject		DT - MEF (2010)	State Property Office (2015)	State Property Office (2016)
Technological tool		Database	Portal	Portal
Entity ownership	State	no	yes	yes
	Regions	yes	no	yes
	Municipalities	yes	no	yes
	Public Bodies, Offices	yes	no	yes
Intrinsic features of property	Type of property	yes	yes	yes
	Address	yes	yes	yes
	Entity ownership	yes	yes	yes
	Cadastral date	yes	no	yes
	Historical significance	yes	yes	yes
	Architectural features	yes	yes (mq)	yes
	State of maintenance	no	no	yes
	Urban planning policies and restrictions	yes	no	yes
	Occupation status	yes	yes	yes
	Economic value	yes	no	no
	Risk profile	no	no	yes
	Photo, video, floorplans	no	yes (only Photo)	yes
Extrinsic features of property	Location	yes	yes	yes
	Urban and territorial context	no	no	yes
	Urban policies	no	yes	yes
Outputs/KPI (for the overall PRE portfolio)	Total area of properties (mq)/ No. of properties	yes (Report 2018) (mq)	yes (No. of properties and % for Region)	no
	Total value (€)	yes (Report 2018)	yes (% for Region)	no
	State of use (%)	yes (Report 2018)	no	no
Web services	Data visualization	yes	yes	yes
	Data interrogation	no	no	yes
	Call section	no	yes	yes

* http://www.dt.tesoro.it/it/attivita_istituzionali/patrimonio_pubblico/censimento_immobili_pubblici/
http://www.dt.tesoro.it/it/servizi_online/open_data/
** <https://dati.agenziademanio.it/#/geolocalizzazione>
*** <https://www.investinitalyrealstate.com/>

TABLE 3. A comparison between the main institutional projects developed at local level.

Elements of comparison		List of the municipal real estate*	Charter of the Public City of Rome**	Map of the municipal real estate***
The City		Cagliari (2018)	Rome (2014)	Milan (2018)
Technological tool		List (Excel) and Map - Geoportal of Cagliari	Charter and TIS (not yet available)	List (PDF) and Map - Geoportal of Milan
Entity ownership	State	no	yes	no
	Regions	no	yes	no
	Municipalities	yes	yes	yes
	Public Bodies, Offices	no	yes	no
Intrinsic features of property	Type of property	yes	yes	yes
	Address	yes	yes	yes
	Entity ownership	yes	yes	yes
	Cadastral date	no	yes	yes
	Historical significance	yes (TIS - PRE)	no	no
	Architectural features	no	no	no
	State of maintenance	no	no	no
	Urban planning policies and restrictions	yes (TIS - urban plan)	yes	no
	Occupation status	yes	yes	no
	Economic value	no	no	no
	Risk profile	no	no	no
	Photo, video, floorplans	yes Photo (TIS - PRE)	no	no
Extrinsic features of property	Location	yes (TIS)	yes	yes
	Urban and territorial context	no	no	no
	Urban policies	no	no	yes (alienation plan)
Outputs/KPI (for the overall PRE portfolio)	Total area of properties (mq)/ No. of properties	no	yes (Report 2016)	no
	Total value (€)	no	no	no
	State of use (%)	no	no	no
Web services	Data visualization	yes	no	yes
	Data interrogation	no	no	no
	Call section	no	no	no

* https://trasparenza.comune.cagliari.it/portale/it/st01_piano_immobiliare.page

Cagliari Territorial Information Systems (TIS): <https://geoportale.comune.cagliari.it>

**<http://www.urbanistica.comune.roma.it/images/carta-citta-pub/relazione-ccp-2016.pdf>

<http://www.urbanistica.comune.roma.it/images/carta-citta-pub/pres-carta-citta-pubblica-2015.pdf>

***<https://geoportale.comune.milano.it/MapViewApplication/Map/App?config=%2FMapViewApplication%2FMap%2FConfig4App%2F417&id=ags>

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TABLE 4. Calculation of the Urban Attractivity Index of each property.

Urban Attractivity Factors	Type	Range	Weight	
Attractivity/ No. urban facilities (in a 500 m buffer) (Wf)	No. public services:			
	administrative			
	cultural			
	education			
	health	0-10	1	
	sport	10-20	2	
	public spaces	20-30	3	
	green spaces			
	No. retail and commercial activities			
	No. of tourist accommodation facilities			
Accessibility (in a 500 m buffer) (Wa)	No. public transportation lines	0-10 10-20 20-30	1 2 3	
	No. bus stops	0-10 10-20 20-30	1 2 3	
	No. parking areas	0-10 10-20 20-30	1 2 3	
	Connectivity (Wc)	No. entrances / MQ surface area	X-X X-X X-X	1 2 3



OPERATIONAL LAYERS



DATA SET SECTION - FOR EACH PROPERTY -

INTRINSIC FEATURES EXTRINSIC FEATURES

- Type of property, address
 - Entity Ownership
 - Cadastral data
 - Historical significance
 - Architectural features
 - State of conservation
 - Level of energy efficiency
 - Conditions of use, occupation status
 - Urban planning policies, restrictions
 - Economic Value
 - Property Photo and Video and Floorplans
- Location
 - Urban and territorial context
 - Urban Attractivity Index (UAI)



OUTPUTS / KPI SECTION - FOR THE PORTFOLIO -

- ENTITY OWNERSHIP (%)
- TOTAL SURFACE AREA (MQ)
- TOTAL ECONOMIC VALUE (€)
- STATE OF USE (%)
- STATE OF MAINTENANCE (%)
- LEVEL OF ENERGY EFFICIENCY (%)

CALL / FORUM SECTION - FOR EACH PROPERTY -

