Smart Cities and new professional opportunities:
the Geographic Information Manager

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Abstract

The *prosumerism* of a territory represents its capability to provide consumers with information, and use information from producers, with both activities addressed to create synergies among different planning strategies. As a matter of fact, large amounts of data from multiple sources are available and represent a significant potential for a territory that has to be properly managed so that it evolves into a resource. This actualization requires the involvement of multidisciplinary competences capable of both acquiring and using knowledge extracted from a territory / community, and integrating a proper usage of available technology within evolving scenarios. The paper describes an Italian proposal addressed to the establishment of the professional profile of geographic information manager. Such a profile is built in terms of skills and competences and is properly embedded in a scenario where smart communities play a relevant role in realizing the systemic process started by the Open Government paradigm. The GIM commitment is mainly focused on issues related to the spatial enablement, i.e., the capability to benefit of spatial data, both in terms of its availability and as a skill achieved for its exploitation. The GIM profile is described as presented to the UNINFO committee that is in charge of regulating profiles concerning computer science technologies, at national level.

Keywords: Geographic information, open government, smart cities and communities, digital competences, spatial literacy, spatial enablement.

1 Introduction

When investigating the concept of smart city, different meanings can be found for it. In a recent work, Albino et al. cite 23 definitions [2]. In general, a smart city evokes an abstract projection of a future city that reflects the cultural evolution and the social tensions of the present era. Carlo Ratti from MIT proposes an explanatory definition where the smartness of a city depends on its technology and interconnection capability. A smart city should be clean, appealing, efficient, open, collaborative, green and even more [7]. From the EU point of view, the smartness of a city can be evaluated through six main dimensions used to classify them, namely smart economy, smart mobility, smart environment, smart people, smart life and smart governance [3]. Each axis contributes to the goal of sustainability and improvement of life quality and all of them share the concept of territory as playing a twofold role. A territory provides consumers with information, and a territory uses information from producers, with both activities addressed to create synergies among different planning strategies. Such a *prosumerism* is to be taken into account when designing smart services and applications for territories and citizens addressed to the achievement of sustainability, liveability and social equity [8]. As a matter of fact, large amounts of data from multiple sources are available and represent a significant potential for a territory that has to be properly managed so that it evolves into a resource. This actualization requires the involvement of multidisciplinary competences capable of both acquiring and using knowledge extracted from a territory / community, and integrating a proper usage of available technology within evolving scenarios.

The need of embedding such competences within a unique professional profile is still a dismissed goal due to the implicit complexity of the above mentioned skills. On the other hand, the geodata is as a warp to weave a city "smart" and the geo-ICT is flooding the smart city ecosystem of a huge amount of applications.

The Geographic Information Manager (GIM) represents a solution. It is an expert in the field whose main task is promoting the quality level and technical expertise growth within the network addressed to build an intelligent community. Her/his commitment is mainly focused on issues related to the capability to benefit of spatial data (spatial enablement), both in terms of availability of this information and as a skill achieved for their exploitation. In this paper, we describe the Italian initiative addressed to recognize the GIM as a new professional profile within the ICT sector by the UNINFO regulatory agency. The paper is organized as follows. Section 2 describes the GIM profile in terms of tasks and competences. The rational underlying the proposal and relationships with other project outcomes are also discussed. In Section 3, initiatives carried out for the GIM regulation are described and the final version of the proposal is detailed. Final remarks are drawn in Conclusions.

2 The Geographic Information Manager Commitment

The GIM mission is supporting a city to organize geographic information (GI) by both taking into account production costs and promoting its employment within sustainable processes. Based on this approach, a GIM should be able to

- trace the GI production and usage by a city / community;
- observe temporal evolution of GI flows and acknowledge recommendations for the activities planning;
- evaluate and contribute to the capability of spatial enablement of a city / community;
- foster the participation and encourage the collaboration among different city / community components;
- focus the attention on disadvantaged, unmotivated and disinterested components of a city / community;
- promote networking initiatives and maintain relationships with institutional bodies and organizations;

– get all her/his task results to match the geo-aware community needs, by processing feedback and suggestions.

The rationale underlying the definition of a GIM profile is to catch foundation of the systemic process started by the Open Government (OG) paradigm. The three basic OG principles (transparency, participation and collaboration) affect both public administration (PA) and civil society due to the need by PA of re-organization processes to which citizens participate in order to adhere to the OG paradigm. In such a scope, an intelligent community network could benefit from the important role a GIM can play when promoting digital competences. As a matter of fact, her/his efforts have to be devoted to understand the existing supply chains of geospatial data within a smart community, in order to evaluate their quality, quantity and profit produced during inner and outer activities. This commitment easily integrates with a wider role within a steering committee for general-purpose smart processes. As an example, the process of "spatial enablement" of a smart city represents a context in which a GIM should be profitably involved due to the need of evaluating the ability of PA, citizens and businesses in the use of spatial data to organize their activities and ways of communicating. Becoming aware of the strengths and restrictions should allow the needed actions to be defined. A GIM could be the playmaker of the whole methodology addressed to track their implementation and take action to correct any deviations from the expected results.

A further task a GIM could perform is to keep under control and propose actions to improve the ability of the INSPIRE directive implementation [6], in line with the INSPIRE Maintenance and Implementation Framework set up by the European Commission. The work of the GIM can ensure that the city -as a "living thing" – learns how to organize GI and ensure its use whenever needed, to each user, committing her/himself -and engaging the city- to create sustainable cycles of GI.

Finally, an interesting contribution to the GIM profile definition comes from the *in progress* outcomes of the *GI-N2K* project, funded by the EU Erasmus Lifelong Learning Program [5]. Generally speaking, the aim of *GI-N2K* is to answer the question on how the education and vocational training in the domain of *GI Science and Technology* (S&T) can match with the actual job requirements in the job market. In particular, *GI-N2K* builds upon the existing GI S&T Body of Knowledge (BoK) developed by the American University Consortium for Geographic Information Science and published in 2006 by the Association of American Geographers. The 'BoK' is going to be updated and brought into line with the new technological developments and the European perspective (e.g. importance of INSPIRE in Europe). A first set of activities highlighted two interesting issues. The former is a clear distinction between the expected competences by future professionals, namely, technology-oriented expertise to realize GI services, and design-oriented expertise that needs a deeper knowledge about founding concepts and domain requirements. The latter issue is that it turned out a meaningful mismatch between education in GI S&T and the current job market requirements about competences aligned according to this distinction.

In order to contribute to bridge this gap a GIM should devote efforts to realize multidisciplinary solutions for those initiatives where interoperability of data and processes represents a basic requirement. Moreover, she/he has to essentially move the attention from the primary data acquisition to the management of large amounts of data, as well as to the semantic Web and SDI - Spatial Data Infrastructure (e.g., INSPIRE).

The following Section describes the still ongoing process to standardize the GIM profile. The final proposal embeds all suggestions and contributions received from both public and private bodies, professionals, academics and GI fans during various initiatives carried out.

3 Standardizing the GIM profile

As an initial step to the definition of a GIM profile, a *social* presentation was done where the embryonic idea of GIM was described. Then, a survey was produced through a public questionnaire. It posed the following 3 questions whose answers ranged from *almost nothing* to *a lot*.

1. Do you think that the GIM role could be useful for a public administration?
2. Do you think that the role of the GIM could be useful for cities and communities?
3. Is there anything that you would like to add to contribute to our idea of GIM?

More than 100 public and private GI technicians contributed to such a survey and the flattering outcome of this first investigation stimulated promoters to organize a virtual space and *vis-a-vis* meetings where GIM competences and working environments could be discussed and shared. As an intermediate result of the online debate, a position paper on this new professionalism was drawn up, by taking into account comments and proposals collected so far.

A crucial drive was given by AgID (Agenzia per l'Italia Digitale), the Government Authority responsible for implementing of the Italian Digital Agenda [1]. The interest exhibited by AgID turned into the invitation to submit the GIM profile following the eCF schema, within the public consultation by UNINFO on the project regarding the norm: "Attività professionali non regolamentate *(Not regulated Professional Activities)* - Generation 3 European ICT Professional Profiles: Web Skills Profiles [9].

The GIM profile proposal schema has been prepared on the basis of the project documentation UNINFO E14D00033, available at [10] and by consulting the documentation on the European e-Competence Framework 3.0, available at [11].

Following an AgID suggestion, the initial proposal was extended from a smart city governance point of view to a wider range of bodies that could be interested in becoming more spatial enabled.

The final version of the proposal can be found at [4]. A summary is depicted in Annex 1.

The UNINFO commission has appreciated the proposal for the new GIM profile, also on the basis of a separate analysis of such a profile compared to the "Professional Web" ones, hypothesizing, for instance, a declination with respect to the eCF second generation profile "Business Analyst".

On December 18 2015, the UNINFO committee decided to establish a working group who, starting from the GIM profile,

will have to identify and define the main professional profiles concerning GI. The kick-off meeting will be held on March 1st 2016 in Rome. The main goals of the initiative are:

– to identify and characterize the main professional profiles working in the GI domain;
– to establish the appropriate relationships with the main national and international regulations;
– to define GI skills, abilities and competences and integrate them with UNI 11056 ones;
– to extend deliverables and KPIs (Key Performance Indicator) linked to GI professional profiles in order to provide market with a definite reference and a proper quality;
– to identify further improvements and refinements items;
– to provide legislator with a useful means to counterbalance the technical regulation and the mandatory field.

The original idea of GIM arose from thinking of progress of intelligent communities and envisaging what they will represent in the near future: hybrid spaces where both people, devices and objects shift between physical locations and places on the Web; hybrid spaces where spatial and temporal dimensions take on new values, different from those related to the description of the territory in terms of its natural and antrophic characteristics. In this challenging context, by many different stakeholders, a GIM and other GI professional profiles can find their most ambitious and successful placement in contributing to the evolution of geospatial data management, more and more based on the interconnected data infrastructure and according to distributed and smart models, that is, efficient for the production and for a rational use of geospatial data themselves.

With respect to this framework, the issue of both spatial literacy and professional skills working in the GI field has to be considered in perspective, tying it to the wide use of geospatial data in the context of rapidly developing technologies. Then, it will be important to refer to scenarios that today can be imagined invoking emerging paradigms – as the Internet *of everything* and the *connected car* -, focusing on how they occur in real life, taking action to contrast handicaps related to the geodigital competences, that may otherwise rapidly amplify. In other words, it is necessary to limit the gap between those with and those without the ability to access and use geospatial data; between those who are able to reap the benefits and those who remain relegated to the margins of a smart community.

4   Conclusions

Once the regulation is established, the GIM work will have extremely positive side effects. On one hand, it may generate a strong demand for new skills related to the GI world, thus prompting the definition of specific training programs both in academia and postgraduate. On the other hand, the solutions found by GIM could act as a driving force, stimulating great opportunities for the Geo-ICT market growth.

Finally, starting from the dictionary definition of music, Sergio imagined a kind of similar expression for GIM. Music is the art to create and produce the sounds successions and it shows itself as a form of cultural expression integrated with various social activities, contributing to the link between knowledge and expression, to the social and ethnic cohesion and cultural transmission. Let smart communities provide her/him with geo-notes that she/he could use to create well-tuned operas:

– DOcumenting GI production and consumption by city / community;
– REcording the time evolution of produced and consumed GI flows, and applying the instructions for activities planning;
– MInding measurement of the geodata capacity use (spatial enablement) by contributing to improve knowledge and sharing of this value;
– FAcilitating the community participation and encouraging cooperation between and within various components and categories;
– SOLiciting the attention and the involvement of members from disadvantaged, unmotivated and disinterested communities;
– LAying relationships with organizations and "smart" projects at all levels on networking initiatives;
– SIft constantly her/his behavior to make sure it is in tune with the needs of a geo-aware community, acknowledging feedback received from the community itself;
– The eighth note: Silence. Pauses are essential to listen to "sounds" from geo-aware communities.

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[10] UNI - Ente Italiano di Normazione www.uni.com
[11] European e-Competence Framework.
www.ecompetences.eu

Annex 1

Profile WSP-G3	Geographic Information Manager
Summary	Professionalism to include within the governance bodies of an organization to support and rule an aware usage of geodata and technologies available for its collection, management and sharing.
Mission	A GIM identifies the existing supply chains within an organization, she/he coordinates geodata collection and validation, and finally she/he analyses data contents both to extract information useful to generate values, and create knowledge to provide territories with.
Documentation to produce	Accountable - Flow schemata of produced and consumed GI, focusing on important characteristics, such as openness and quality. - Reports of GI needs and requirements, and activity planning for its acquisition and employment. Responsible - Measurements of the spatial enablement by contributing to improve knowledge and sharing of this value; Contributor - Management of the Quality System - Activity planning meant to facilitate the community participation and cooperation between and within the various components and stakeholders - Activity planning addressed to the involvement of members from disadvantaged, unmotivated and disinterested communities (digital divide) - Checklist arrangement meant to verify actions suitability.
Main tasks	- Integrating professionals and technicians who express needs about geodata analysis and information production - Requirements eliciting and collecting - Identifying significant data and its sources inside and outside the organization - Collaborating with IT structure to define modalities for data collection and management - Designing and preparing data analysis suitable for requirements satisfaction - Disseminating indications come to light from analyses - Collaborating with the business component and addressing its needs - Collaborating to the analysis of the training needs for a geodigital literacy - Collaborating with the management auditing to develop analyses and reports supporting decision making processes.
E-CF Competences	A.7. Technology Trend Monitoring: Level e-4. A.9. Innovating: Level e-4, Level e-5. D.10. Information and Knowledge Management: Level e-4 and e-5. D.11. Needs Identification: Level e-3. E.4. Relationship Management: Level e-4. E.5. Process Improvement: Level e-3. E.7. Business Change Management: Level e-3.
Skills and competences	Technical - wrt GIS&T-BoK Knowledge Areas: Area: Geospatial Data Area: Data Modeling Area: GI S&T and Society Area: Organizational and Institutional Aspects - Knowledge of organizational analysis models and project management.

	Information Technology - Complete vision on technologies and applications available on the Internet and on the Web, with a focus on emerging technologies. - Vision of technologies and tools for storing and retrieving data. - Knowledge of the most common methods for the extraction of information, the management of large amounts of data and the integration of heterogeneous data (e.g. Data mining, data integration). - Knowledge of software solutions related to the most widespread geographic data on the market. About enhancement - Organization processes including decision-making structures, budget and management. - Impacts of business changes on human and organization resources.
KPI area	• Number of re-engineered processes initiated and completed • Number of new set up and completed processes.