

# Urban Security Dashboard

Maurizio FIORENTINI<sup>1</sup>, Mario SECHI<sup>2</sup>, Barbara MORRA<sup>1</sup>,  
<sup>1</sup> *CSI-Piemonte, Corso Unione Sovietica, 216 – 10134 Torino*  
*Tel: +390113168398, Fax: +390113168877*  
*Email: maurizio.fiorentini@csi.it, barbara.morra@csi.it*  
<sup>2</sup> *CITTA' di TORINO, Via Corte D'Appello, 16 – 10100 Torino*  
*Tel: +3901144222948, Email: mario.sechi@comune.torino.it*

**Abstract:** The Urban Security Dashboard was developed to support decision-makers on Urban Security. The application is developed with web technology to browse a decisional database, to give a snapshot of urban phenomena. The project aims at acquiring, elaborating and displaying data and information of different nature, from different sources. The final outcome of the project will be a data warehouse of objective data that will be used to keep the different aspects of the phenomenon under control: crime-related, territorial, social, social and demographic, housing-related and economic, which will be integrated with the periodic and structured collection of subjective data, on citizens' security perceptions and their levels of victimisation. The indicators are displayed through a normal easily exportable tabular representations and they are also displayed through dashboards and through growth trends. Data can also be displayed in cartographical mode: it is possible to have a dynamic interface to the GIS world.

**Keywords:** urban security, dashboard indicators, data warehouse analysis, GIS, cartographic display

## 1. Introduction

The issue of Urban Security is, undoubtedly, very topical for large cities. The political tools with which the Local Institutions, such as municipal administrations, can act to safeguard or improve citizens' security are a potentially effective instrument, if they are applied promptly, without scattering resources.

The evident strategical nature of the issue, together with the complexity of the phenomena underlying it, highlight the need to set up an instrument to provide substantial support to the decision-making process. The issues connected to Urban Security are, indeed, quite wide ranging and they go beyond those typically faced by the Human Resources, Organization and Municipal Police department, the institution that is competent with regard to Urban Security for the Municipality of Turin. The tool that the Municipality wishes to set up, hence, should somewhat cross all the competences of the institution, drawing on the data managed by many other organization departments (perhaps all of them). Moreover, the Municipality wishes to activate mechanisms to share the information resources among the relevant institutions, so as to increase the potential to read and interpret the security conditions of the territory of the Turin. In addition to the data of the various municipal departments, the tool will also include information collected in other data banks of the Piedmont Region Information System, as well as other information collected by institutions that are not part of the Piedmont Public Administration: ATC (Territorial Housing Agency), GTT (Turin Transport Group), INPS (Social Welfare National Institute), among others.

In this framework, the Municipality of Turin will set up a dynamic and geo-referenced survey system for insecurity phenomena to support urban security policies, consisting of an IT tool that will collect, integrate and elaborate data (data warehouse), and which will be

integrated with periodic monitoring of citizens' perceptions of lack of security (public-opinion survey and media monitoring) and with territorial consultation instruments (quality survey focus). CSI-Piemonte, as a result of its competences in the setting up of high technology services and products and to the availability of versatile and innovative working tools (Internet technologies, portals and multimedia solutions, authorization, profiling and authentication systems, data warehouse, e-procurement, e-commerce and e-learning platforms) can support the Human Resources, Organization and Municipal Police department to reach this objective. The "Urban Security Dashboard", hence, aims at acquiring, elaborating and visualising data and information of different nature, provided by different sources.

This requirement will lead to the setting up of a homogeneous database, including objective data from heterogeneous sources, to try and keep the different aspects of the phenomenon under control (crime-related, territorial, social, social and demographic, housing-related, economic, etc...). This structure will then be integrated with the periodic and structured analysis of subjective data that will record from the point of view of quality and quantity, citizens' perceptions and the levels of victimisation, so that their input is integrated into the process. A permanent monitoring system, that can provide a dynamic and complex snapshot of in security phenomena and conditions, will hence be able to provide support for the interpretation of these phenomena, to identify their areas of competence and the intervention priorities.

The phases for the implementation of the monitoring activity can be identified in:

- Definition of the survey variables
- Elaboration of the survey questionnaire
- Completion of the survey
- Reading and analysis of the public-opinion survey

## **2. Objectives**

The Municipality of Turin already has a great wealth of data on different areas of interest for the Municipal Administration. They are stored on many data banks, that differ in terms of technology and organization structure. The analysis of such data is hence effective when it is carried out promptly, that is for data detailed analysis, but it is somewhat less immediate, instead, when it is carried out from a statistical point of view, aggregating appropriately the values to be analysed. It is even more complex to analyse simultaneously more variables in the same context, for example to find a correlation between the different urban phenomena. Therefore, even if all the necessary data are available, it is often difficult to produce correct and interesting information from them.

The Human Resources, Organization and Municipal Police department highlighted its need for an application that is able to act as a sort of "lithmus paper" on urban security in the Municipality of Turin, for which the department is competent, providing specific indicators of interest. The specific objectives of the project are of different nature:

- Descriptive, analytical and monitoring objectives. The project follows a theme that underlies a first *ex ante* phase, dedicated to the analysis of the phenomena and of the territory, and consequently a dynamic measurement phase, to evaluate the factors that concur to the increase of the citizens' perception of in security. Lastly, the theme also underlies an *ex post* phase aiming at anticipating some situations that may generate social discomfort.
- Process and orientation objectives. The project will offer decision makers an effective knowledge tool, to orientate their choices coherently with the actual conditions of the territory. Simultaneously, it is necessary to make the data accessible to all operators

that are potentially interested (not only at political level) and to stimulate a greater awareness on the potentials of the instrument.

### 3. Methodology

The following steps have been adopted to answer the needs highlighted by the Municipality and to provide a key for a centralised interpretation of the collected information:

1. The starting point is a set of thematic data mart, that are heterogeneous both from the technological and structural point of view. The ETL processes (extraction-transformation-loading) [1] will make it possible to create a data warehouse that will be able to integrate them, to enable users to browse through them with a coordinated approach on the whole set of information available (see Figure 1). The added value is that of recreating data, using data quality techniques, so as to bring all the information to a minimum generalised detail level, both with regard to the time and geographic frames. Considering the territorial conformation of the Municipality, a decision has been made to use the geographical reference that was adopted for the census surveys (Census Sections). Thus the Municipality is divided into a set of some 3,800 micro-areas, that can be easily recomposed according to the survey needs. The setting up of a structured data warehouse will make it easier to implement a true data drill through various territorial references (such as District, Constituency, etc...) consisting of the most appropriate grouping of more Census Sections.

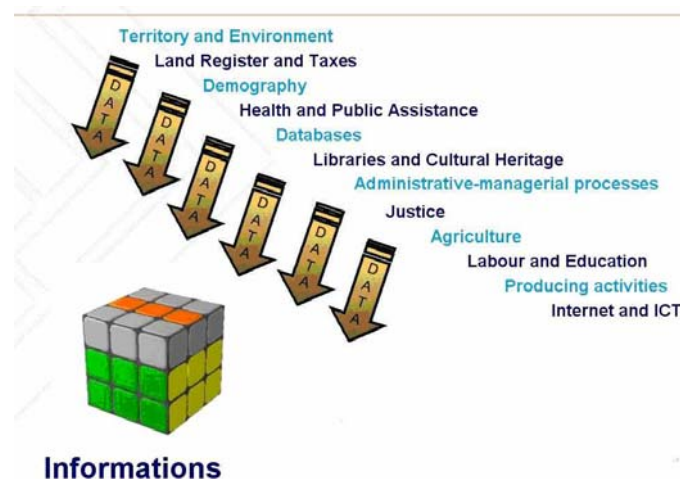


Figure 1 : From Data To Information

2. In addition to the database, a metadata structure is designed to give more dynamic character to the front-end browsing operations. Therefore, this architecture offers different possibilities, enabling work in progress definition and modification of the parameters, such as the territorial reference parameters, without any impact on the back-end loading process.
3. An infrastructure called IRIDE was used to manage system accesses and to profile users, as it is the enterprise standard on IT security in the framework of the Piedmont Region. This infrastructure makes it possible to comply with the new data security code (Italian Legislative Decree of 30<sup>th</sup> June 2003, n. 196 – Code on personal data protection) and it satisfies the different needs and competences of those carrying out the queries (from decision-makers to public security staff, up to those dealing with information).
4. A web oriented [2] application was set up to display the calculated information in the territorial sub-dimensions that compose the Municipality (Constituencies, Districts, Statistical Areas). The tool, which is characterised mainly by its user-friendly and rapid interface, makes it possible to display the selected information in more than one format

simultaneously. The first display form is the tabular format. The essential nature of data is safeguarded, also so that they can be ported to other statistical or graphic analysis applications. The second format is that of a dashboard (Figure 2).

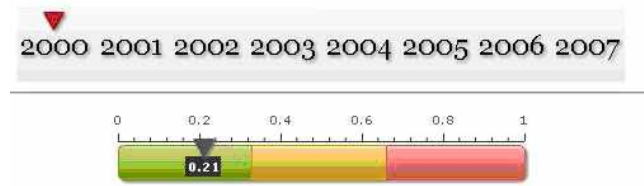


Figure2: Dashboard

This mode makes it possible to display phenomena and to compare them over different territorial areas at a glance. The appropriate definition of the reference limits, then, highlights critical areas as well as excellence areas immediately. The third format is that of trends (Figure 3).



Figure 3: Trend

This solution is particularly useful to monitor phenomena before and after a specific intervention on the territory.

5. Some indicators (crimes that produce social alarm; areas and structures such as stations, post offices, health centres) can be displayed both through statistical maps and through GIS (Geographic Information Systems) tools. In the first case (Figure 4) the indicators presented in a map that highlights the areas of the Municipality, Constituencies or statistical areas, where the value is higher.

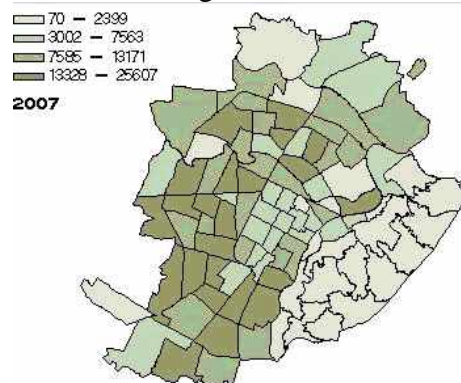


Figure 4: Map of the Municipality divided into statistical areas

In the second case, instead, the phenomenon that is studied is localised over a precise area of the town (Figure. 5) that can be identified with street name and number. It can also be further contextualised with other geo-referenced information that provide more added-value to the events that are represented (for ex. car theft associated to the presence of commercial activities, street lamps, etc...)

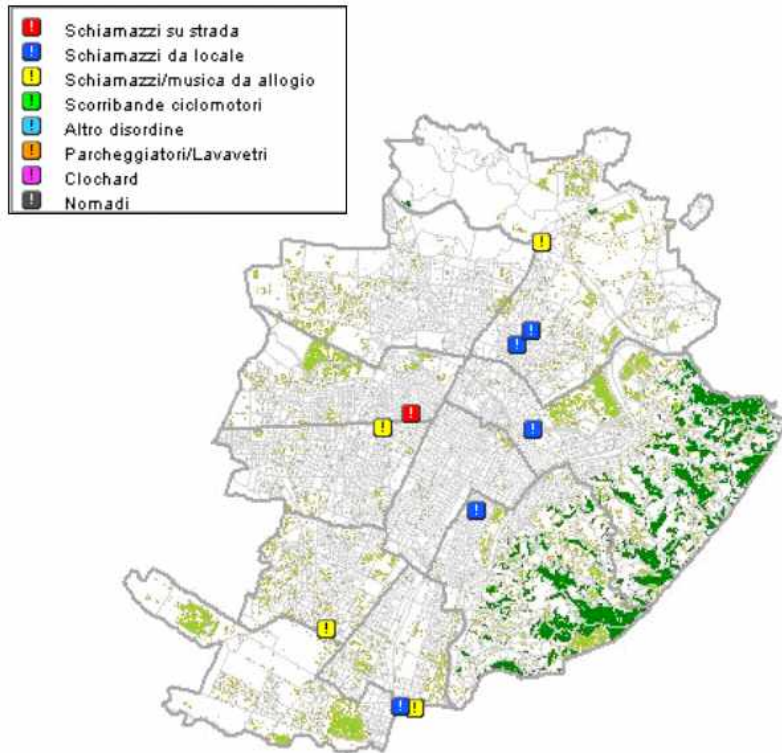


Figure 5: GIS Map

Moreover, the tool that is under development makes it possible to design customised areas of the Municipality (for example the projects called ‘Spina’ or Urban Recovery Plans, that design areas involved by urban transformations) that are of greater interest, to verify whether the changes that have been put in place caused or reduced critical situations. The two types of representation are produced in different environments that use different technologies. However, they have been connected through the reciprocal transfer of parameters, thus guaranteeing transparency for the user who needs to study a phenomenon of interest contextualising both representation modes.

6. The issue of citizen security is one of the themes that is particularly sensitive for public opinion, and whose interpretation is not unequivocal. With a public opinion poll, presented every six months, to a sample representing the population resident in Turin, an attempt will be made at recording the perceptions and evaluations of the Turin population on the dimensions of the issue. The data resulting from the survey are of topical importance: the connection between general citizen concerns, mainly subjective, and data relative both to crime distribution and areas with greater social unrest (high concentration of elderly population and people supported by social services, high poverty rate), of objective nature, will make it possible to mitigate the extension of the feeling of lack of security. The concept of security or lack thereof, is strongly multidimensional and cannot be explained univocally; the answer to this problem need to be well considered and should not follow only self-evident criteria. The networking activity that will be carried out simultaneously so as to involve all the local actors that are interested in problems of lack of security so as to share and validate the design of the data warehouse and to analyze the results that are collected periodically.

## 4. Technology Description

The application architecture is structured over 3 logical levels according to J2EE standards (Figure 6.):

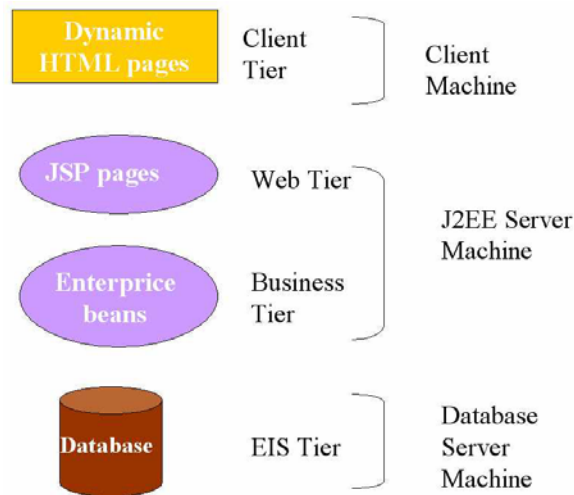


Figure 6: Application architecture

The application uses the 1.4 Java version and it was developed with the Eclipse 3.2 IDE. The classes have been developed with UML 2.0 technology. The APIs provided by SAS have been used to develop the BI applications for the communication between the Business Tier and the EIS Tier layer. Data transfer between these java and SAS components is possible due to spawners available on server side. The authentication system is a Single Sign On of IRIDE2 called SSOBart.

As far as graphic components are concerned, Flash and SAS technologies were used to develop the applications, taking into consideration the Italian Law on service accessibility for the Public Administration (Italian Law of 9<sup>th</sup> January 2004, n. 4).

The customisable webgis displayer was developed in html, javascript and [php](#). It makes it possible to display raster data from radex, mapservice catalogues and ArcView ims maps. It is possible to browse the map, interact with vectorial data and carry out all the main GIS operations (identify, measure, search, etc...). The map displayed is produced by an ArcView ims service and it interacts with the alphanumeric application exchanging parameters through the http protocol. The back-end component was developed with SAS Data Integration.

## 5. Developments

The present version of the application is already an instrument to support decision makers on Urban Security issues for the Municipality of Turin. Use made it possible to verify concretely its effectiveness and simultaneously its further potential, divided in three typologies:

- Territorial extension: the issue of Urban Security is surely not limited to the territorial borders of the Municipality, but rather it is related to the surrounding territory. The domain of the application might be extended to the areas of the first belt surrounding Turin;
- Generalisation: data, which are managed in modular mode on purpose, will certainly increase over time, according to future requirements;
- Dynamicity: it is possible to foresee the implementation of functionalities aimed at creating or managing indicators in dynamic mode, relating between each other pre-calculated thematic measures. Moreover, it will be possible for the user to draw,

directly on the map, parts of the town territory on which to carry out an in depth analysis or to monitor a situation. The result of this process is a set of indicators that will describe the quality of urban life as a whole.

## **6. Results**

The first nucleus of variables that have been included in the application is based on the information of the Observatory on Security [3], elaborated by the Prefecture of Turin and by the Municipality of Turin.

It consists, essentially, of data on social and demographic malaise, on social malaise and on the presence of services as the issue of Urban Security can be analysed through different thematic areas that reference potential risk factors, both in terms of greater exposure to personal fear (exposure to subjective insecurity), and in terms of greater territorial fragility (territorial exposure to insecurity). The first observations on the data from 2000 to today, relating to one of the historical areas of Turin made it possible to identify the variations of some indicators: for example, how the settlement of immigration populations varied over time, how this changed the presence of some typologies of sales activities, and how urban disorder and degradation phenomena moved over the territory. Indeed these are not true crime episodes, but they still determine an increase in the feeling of insecurity for citizens.

The system makes it possible to display how such phenomena from all over the territory are concentrated over time in smaller and limited areas, confirming that the interventions activated in some areas were successful. It has thus been possible to understand that some requalification interventions can become a model to export in other sectors, with similar conditions, rather than enforcing greater control and presidium over the territory. Similarly, it has also become possible to optimise the lighting plan of the town, something unprecedented, as the system connects the presence or absence of lighting with the presence or absence of critical or alarm elements. This immediately made it possible, simply opening a map and following the signs, to act promptly with greater efficiency and reducing expenditures.

## **7. Business Benefits**

The support provided to the Municipality of Turin by the “Urban Security Dashboard” is essentially to decision-makers. Consequently, it will likely lead to the improvement of the effectiveness of the Municipality in the allocation of its economic and human resources.

More concretely, the benefit for the users of the application can be calculated also in terms of risk prevention. Greater knowledge of crime-related phenomena, of their frequency and of the areas where they occur, as against the areas characterised by higher territorial fragility, would make it possible to implement actions aimed at improving citizens' security.

As highlighted in previous sections, the project is articulated over two components: one relating to the back-end, with the implementation of the data warehouse, and one relating to the front-end.

The front end technological tool, that can be accessed via Web, can easily be used also in other urban realities of similar size: the reuse of the model can occur adopting some necessary adjustments on the data and metadata that are used by the system.

- Organization of the source data. The wealth of information of the Municipality is well organised and structures, hence, any other municipality, in Italy or abroad, should be organized similarly. Data need to be structured on the basis of really small territorial areas: Turin is divided into 3,800 micro-areas and all the indicators have been calculated at this aggregation level.

- Data quality. Data quality processes have to be carried out not only to eliminate simple mistakes and redundancies, but also to ensure coherence among data sets that have been created at different times, following different collection rules or business needs. Without “cleansing” processes, these set of data are not useful when they are collected in a data warehouse. The laborious research and correction process to eliminate information that are not correct, complete partial information or erase duplicates is quite expensive and implies the introduction of new mistakes. Therefore it is necessary to use highly specialised tools that adopt complex algorithms to analyse, standardise, correct and integrate the information.
- Historical data. The interpretation of a phenomenon today cannot neglect its evolution over time, therefore it is essential to have historical data to make comparisons and contrasts.
- Population samples. The choice of stratification, on the one hand makes it possible to keep the sample size, but on the other could reduce the possibility to examine more in depth municipal micro realities. Therefore, it is necessary to correctly select samples of the resident population in terms of sex, age and territorial sub-areas.

More specifically, the Municipality of Turin will use this tool to monitor security conditions over its territory, but it could also be used, considering its flexibility, to monitor completely different, but equally complex issues, such as for example the results of public investments or education policies.

## 8. Conclusions

The present development phase, that can be considered as a prototype, highlighted the potential and effectiveness that one such instrument may imply for a Local Institution such as the Municipality of Turin, as treated data correspond to the critical issues that are perceived by citizens.

The advantage of repressive policies is that they yield immediate results, but over the long term the decrease in crime rate do not justify the economic investment. The innovative aspect of the project, hence, is that the classical concept of Security, connected to Infrastructures and Public Security Forces, will be evolved both with the support of the decisional application and with the direct involvement of citizens, through questionnaires, to provide their evaluations on the policies implemented over the territory.

Excellence figures involved in Security actions can implement this new action methodology through the information support that CSI-Piemonte can provide.

## References

- [1] Ralph Kimball: The Data Warehouse Lifecycle Toolkit, 2nd Edition: Practical Techniques for Building Data Warehouse and Business Intelligence Systems - John Wiley & Sons, 2008.
- [2] Stephen Few: Information Dashboard Design – O’Reilly, 2006.
- [3] U.T.G - Prefettura di Torino, Città di Torino - Ufficio di Statistica , “Osservatorio sulla Sicurezza” Rapporto 2003, 2004.
- [4] Regione Lazio – Osservatorio Tecnico Scientifico per la Sicurezza e la Legalità, “Indagine sulla percezione di sicurezza dei cittadini del Lazio”, Novembre 2007
- [5] Boisteanu Ch: Construire le vivre-ensemble: Aménagement urbain et politiques de sécurité, EPFL et UNITAR, Cahiers du LaSUR et de la Coopération, 2006