

THE INTEGRATED CYCLE OF WATER SUPPLY: AN EUROPEAN OVERVIEW

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INTRODUCTION

The full title of Upsidedown project is “Spatial Data Protection for the Underground Critical Infrastructures”. The emphasis on spatial data with respect to the security of underground infrastructures makes sense. In fact, to manage security effectively is essential to have good data on underground networks: reliable, up to date, but also interoperable and consistent. The last two attributes refer to the fact that there are several people who manage underground infrastructure networks (and in given contexts they are quite a huge number). Therefore spatial data are normally produced and managed by various subjects, but it is essential to effectively use together these data : they must be managed and delivered in formats that allow such joint use, i.e. spatial data must be interoperable. The inherent complexity of spatial data implies that the goal of interoperability is not trivial.

Consistency means that the geometric quality of data must be adequate and they shall be topologically correct: eg. if the water pipe (ignoring connections) runs underground, its cartographic representation must not intersect private spaces or buildings.

For the ordinary management of the networks but also for security management, data have to be shared between different operators and they have to be accessed quickly when needed: therefore data access is a matter to be managed very carefully; there are potential contradictions between the easy access and the protection of critical data.

As known, the focus of Upsidedown Protect project is the integrated water supply’s cycle (which includes the water uptake and extraction, purification, treatment and distribution and the waste water collection, treatment and disposal).

THE SURVEY ON COMPANIES OF WATER SUPPLY’S CYCLE

In order to map how the issues of spatial data (data quality, details, accessibility, technical solutions and standards adopted...) and of security are handled in each companies, we developed four questionnaires : on the company, the water production and distribution, the waste water network, the laws and more relevant regulations.

These questionnaires were filled by “expert users” identified in different countries by the Project’s National Contact Partners: they attended Expert User Groups held in different locations. Altogether the indicators identified were 87, that can be grouped into 4 groups:

- indicators on company’s overall ICT technological level;
- indicators on geoICT technological level (production and management of spatial data);
- indicators on overall security;
- indicators on security of data.

¹IAMFM is a non profit association founded in 1990 whose purpose is to spread the culture of geographic information. Its members are national institutions, local authorities, geoICT SME, geo-technology providers, professionals, researchers.... Among its members there are some utility companies.

A fifth group of indicators deals with company's and networks' size (extension and inhabitants of served area, company's employees, extension of networks, number of customers...) Information collected by these questionnaires has been organized in a database: however this detailed information (at company level) has a character of confidentiality and in our opinion it should not be made public in an uncontrolled manner (any interested party may contact the authors of this paper).

THE COUNTRIES' REPORTS

The companies included in the survey, because of the method with which they were identified, are not a statistical sample: it is reasonable to state that they are at least "good practices" even if not all of them may be labeled "best practice".

It should be noted that the sector of water supply's cycle is very complex: some companies are entirely public (sometimes of small size); the sector includes companies with highly differentiated size, technological level etc. and also legal status. The largest companies are very large and often publicly traded.

On the other side, the number of companies included in the survey is limited.

So, at some point, the need to complement this survey at company level with summaries at country level has become clear. In order to address this need experts for each country were identified and were asked to prepare a "Country Report". A common pattern for preparing these reports was defined: it includes seven sections (presented after).

We have to take into account that each report is a summary of very articulated processes, often uneven in the different parts of the same country. Therefore each of these country reports is a simplification, largely influenced by the experience of its author.

All "Country Reports" are available here <http://www.upsidedownprotect.eu/index.php/documents-2>

However, the attempt to make comparisons at European level is unavoidable in a European project. Accordingly, for this purpose, the following Overview Table was produced.

In the following paragraphs the "titles" of the Country Reports' sections and some comments relating to the table are given.

The overall organization of water supply (columns 1-4 in the table)

The issues are: are companies mainly public, private public-owned or private? Are companies growing in size and in served area? There are processes of merger or establishment of holding companies? The situations and the trends are homogeneous across the country?

The table shows that in all countries (apart from Estonia) there is a presence of public providers, at national or city level.

The third column indicates the presence of private providers, public private partnership, or situations where the legal status of the provider is "private" (for example a limited company) but the property is in fact public since the shares are held by public bodies. For example in Italy the property of the companies must be public for at least 60% by law

Regarding the trends, we can highlight the following (column 4):

- A: companies are growing in size and in served area, merger of companies...;
- B: separation between ownership and service provider, a type of externalization;
- C: there is an ongoing process of centralization at state level. This is happening in one country only, Ireland. We know the situation of Ireland is very peculiar (see Ireland Country Report).

Laws and regulations (columns 5-7 in the table)

The question is: what are the most relevant existing laws and regulations at national and/or sub-

national level and the main topics covered? Laws and regulations are mainly at national level, only in one case they are only local, in 4 cases at both levels.

Laws and regulation concern (column 5):

- A: prices;
- B: quality and safety of water supply;
- C: sewage services;
- D: spatial data standards.

All countries have rules on quality and safety of water supply. The number of countries that have rule on prices is perhaps higher than you might suppose. Only a few countries have rule on spatial data standards.

Governance of the water supply cycle (columns 8-9)

The question is: are there agencies, institutions and other bodies at national and/or sub-national level in charge of managing or controlling the overall process or some its parts?

Obviously the governance issue arises only in the countries where a variety of subjects are operating. An authority at the local level is given only when there is a national authority as well.

Management of spatial data on water supply cycle's infrastructures (column 10)

The questions are: what kind of technologies and what formats are most used by companies for the collection and management of related spatial data? Different companies are likely to be using different technologies and manage data in different ways (CAD, GIS, paper maps...), what are the typical solutions in place? Are specific standards in place? Is the INSPIRE directive considered? Are there differences among various areas in the country?

Given options are (columns 10):

- A: geoDB with structured DBMS;
- B: GIS data without structured DBMS (shape files...);
- C: CAD;
- D: no IT instruments are used.

Options are listed in a descending scale in relation of the technological development. Obviously in most countries various technologies at different level are simultaneously in use.

Spatial data on underground utilities integration (column 11-12)

The questions are: is there any body (public or private) in charge of the collection, integration and management of spatial data about the integrated water supply cycle on a specific area (sub-regional, regional, national)? With reference to the overlay and the integration of spatial data concerning all kind of underground infrastructure. i.e, is there any body (public or private) in charge of managing and maintaining what is sometimes called "cadastre" of all underground utilities?

The request makes a distinction between integration of the water network data and integration among data related to various underground infrastructures (likely managed by various bodies): the second issue is crucial for the management of significant interference between different networks. In several Country Reports this distinction has been little focused.

In most cases, the integration of the data is at the national level, in a few cases at the local level (regional or municipal), in one case at both levels.

Spatial data on underground utilities access (columns 13-14)

The first question is: who is allowed to access the spatial data on the integrated water supply cycle?

Is there a security procedure in place to access these data?

Given options are (column 13):

- A: network data are basically secret information;
- B: for digging to assessed persons only;
- C: free access (apart explicitly classified data);
- D: clear definition of several permissions' level.

The second question is: taking into account the different existing parties and bodies that, at various levels, have to deal with underground infrastructure, is there a procedure for the secure exchange of information between private companies and public bodies?

Given options are (column 14):

- A: there are specific procedures defined in general;
- B: procedures are defined case by case.

Acts of vandalism and terrorism (column 15)

The questions are: are there records of serious act of vandalism or terrorist attack to the water supply underground infrastructure in your country? If yes, what happened, when, what pollutant was involved, consequences?

Given options are (column 15):

- A: serious acts of terrorism were reported;
- B: serious acts of vandalism were reported (thefts of materials are not included);
- C: security regulations prevent communicating this information.

This information comes from the memory of the report's author, or was collected by consulting newspapers and by Internet searches. No real acts of terrorism or vandalism with serious consequences are reported. Some minor vandalism are reported and, often and widely, theft (of manholes and other materials).

Where the acts of vandalism and theft are registered with more accuracy (e.g. in Sweden) you obviously could have a perception of less security. Significant recent actions to increase security are mentioned in some countries.

SOME FINAL REMARKS

It has been extremely difficult to outline, in the Overview Table, overall operating procedures of various companies and bodies, and trends in the various countries. A wide variety of behaviors, even within the same country, has emerged, to the point that it was difficult to summarize all in few options. Perhaps the options considered in the table, that have been identified through the comparative reading of Country Reports, are the most interesting part of the table itself, which seeks to provide an overall picture, to grasp what are the prevailing trends, to stimulate reflection.

We can see that a common tendency is the aggregation in groups of companies and the establishment of holdings companies that are conscious that they can not define their optimal management models without information systems that enables them to communicate with the various actors in their territory.

Connections between different operators and public authorities and other bodies, are more and more important and need to become easier and more robust to increase efficiency and effectiveness of the overall system, in view of the proper use and preservation of water resources.

If these are the trends (identification of shared data models, linked or federated databases, common procedures among various public and private bodies operating in the same territory), we must think about the nature of the security of data and information concerning the provision of water services, correctly identified as a common vital asset.

Overview Table

| COUNTRY | OVERALL ORGANIZATION | | | | LAWS/REGULATIONS | | | GOVERNANCE | | MANAGEMENT OF SPATIAL DATA ON WATER SUPPLY CYCLE'S INFRASTRUCTURES | SPATIAL DATA ON UNDERGROUND UTILITIES INTEGRATION ("CADASTRE") | | SPATIAL DATA ON UNDERGROUND UTILITIES ACCESS | | ACTS OF VANDALISM AND TERRORISM |
|----------------|------------------------------|-------------------------------|--------------------|-------------------------|-----------------------|---------------------------|-----------------------|---------------------------|---------|--------------------------------------------------------------------|----------------------------------------------------------------|---------------------|----------------------------------------------|------|---------------------------------|
| | Providers | | Present trends (4) | Laws and regulation (5) | At national level (6) | At sub-national level (7) | At national level (8) | At sub-national level (9) | (10) | At national level (11) | At sub-national level (12) | Who is allowed (13) | Secure data exchange procedures (14) | (15) | |
| | Public at national level (1) | Public at municipal level (2) | | | | | | | | | | | | | |
| Austria | | x | | B | x | - | x | x | A-B-C-D | - | - | - | B | - | |
| Bulgaria | x | x | A | A-B-C | - | - | x | x | - | - | x | - | - | - | |
| Cyprus | x | | - | B-C | - | - | x | - | - | x | - | - | - | - | |
| Czech Republic | x | | B | A-B-C | x | x | - | - | B-C-D | x | - | - | - | - | |
| Estonia | | | - | A-B-C | x | - | - | - | B-C | - | - | - | - | - | |
| France | | x | A-B | B | x | x | x | x | B-C | x | - | - | B | C | |
| Finland | | x | A | B | - | x | - | - | B-C | - | - | - | - | - | |
| Greece | x | x | - | B | x | - | x | x | B | x | - | - | - | - | |
| Ireland | x | | C | B-D | x | - | - | - | B | x | - | - | - | - | |
| Italy | | x | A | B-C-D | x | x | x | x | A-B-C-D | - | x | D-B | A | - | |
| Lithuania | x | | A | A-B | x | - | - | - | B-C | - | - | A | B | - | |
| Netherlands | x | | - | B-C | x | x | - | - | A-B-C | x | - | D | A | - | |
| Poland | | x | - | B-D | x | - | - | - | B-C | x | x | C | B | - | |
| Slovakia | | x | - | B-C-D | x | - | x | - | B-C | x | - | - | B | - | |
| Slovenia | x | x | - | B | x | - | x | x | B | x | - | C | B | - | |
| Spain | | x | - | A-B | x | - | - | - | B-C | x | - | B | B | - | |
| Sweden | | x | B | B-C | x | - | - | - | A-B-C | - | x | A-B | A | - | |
| UK | | x | B | A-B-C | x | - | - | - | B | x | - | - | B | - | |