M O T I A

*Modelling Tools for Interdependence Assessment
in ICT Systems*

(JLS/2009/CIPS/AG/C1-016)

Activity 6

Exploitation to European Union Context and Dissemination

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Introduction

The European Area and the developed countries in general share the advanced technologies that allow our standards of life. Any innovation from any side widespread all over the world in months. The ICT sector does not represent an exception to the rule and in fact the devices employed all over Europe are produced by the same vendors and provide full compatible services.

The Motia consortium is composed by all Italian partnerns and this, in principle, could lead to some bias on the approach to the problem of interdependencies. Nevertheless, due to the universality of devices and technical implementation of the services and the European perspective of the authors the results achieved in the project and presented in the reports are expected to be free of such biases.

Moreover all technological partner of the project belong to European organizations (such as the Eur-IX for the XP's) and have continuous interactions with the rest of Europe. There are also European organizations of ISP's such as EurISPA that influence the National and European legislation in the ICT sector. Most of the ISP belong to EurISPA and share common needs.

Finally, there are several IPS that now provide services in more than one country an the trend is that all IPS will possibly cover the whole European territory by means of legal agreements, fusions and acquisitions. In other words the European marked for ICT services is already unified even beyond Euroland.

Therefore, the results of the project are expected not to be confined to an Italian perspective, but have a general character.

Not only the infrastructures are similar in Europe, but also asset owner configuration. In the majoriy of countries the physical infrastructure mostly originated from former national monopolistic operators and the proliferation of new operator is a result of the antitrust laws enforced by the State Members. Generally speaking, the largest of the new ISP's own their backbone and employ the "last mile" of the former monopolistic operator to provide access to the customers. Some of the ISP have also supported the cost of cable laying to cover also last mile by means of their own assets. Moreover during last years the wireless communication have experienced a huge development and now, for several people, it represents the primary means to achieve access to the communication networks.

This is the situation in Europe and it is perfectly reflected in Italy. The use of the technological tools and their penetration in the different countries may be different, but the general picture is the same. Due to basically logistic problems the exploitation and the consequent project assessment has been achieved by direct interaction with the Italian public and private organizations. Due to the former considerations the results are expected to export at European scale.

Exploitation

Interdependency among critical infrastructures has been investigated by several disciplines with the use of a wide range of methodologies [1], [2], [3], [4]. Most of the studies have been realised with the support of quantitative methods and approaches and techniques derived from several different scientific fields: complexity science, modelling, networking, graph theory, simulation approach. Very few studies have been realised by investigating Critical Infrastructure using a "qualitative research" approach and focussing on the more social and human factors related issues. In this chapter we present the results of an empirical research study realised by using qualitative techniques - brought from social science

methodologies - to investigate the *"end user experience"* of the critical infrastructure in the context of Information and Communication services and technologies (including telecommunication services, broadcasting systems, software hardware and networks for internet service delivery).

Background

Apart from being a technical system composed of many technological components, an information critical infrastructure is also a *social and organisational system* built on the attitudes and behaviour, choices and strategies, expectations and needs of the organisations and the people that are part of such infrastructures. This means the system operates not only according to technical provisions and system performance happenings, but also according to constraints imposed by the social and organisational environment [5]. For instance, the delivery of internet-based services by a bank requires, not only a well-built ICT infrastructure, but also a number of related issues that have impact on the ICT infrastructure behaviour as well as the bank service provision itself: the compliance with the national (and if the case international) regulation; the know-how of the technical personnel in charge infrastructure to the set-up and maintenance from the Internet Service Provider side, as well as the technical personnel working in the bank; the characteristics of the service level agreement between the telecom operator or other services provider (e.g. cloud hosting services); type and characteristic of the strategies that the bank has decided to implement to recover the system in case of failure (no strategy, redundancy, quick time recovery, etc.), and many other aspects that might affect the interdependencies characteristics, behaviour, performance of the Critical infrastructure.

In this view the MOTIA project has fulfilled the need for a holist approach in the investigation of Critical Infrastructures by developing a number of methodologies that consider the Critical Infrastructures Interdependencies from different perspectives [6], [7]. The work was designed according to the representation of the Critical Infrastructure as a social-technical system (Fig. 1) and taking this view to assess the Infrastructure characteristics; in particular in this chapter we have report on an activity pondering the end user experience – considering as end users organisation that make a significant use of the ICT internet based services and systems – in relation to the Social system, the technical system as well as the Human Actor aspects (see Table 1) as main elements of the social-technical model.
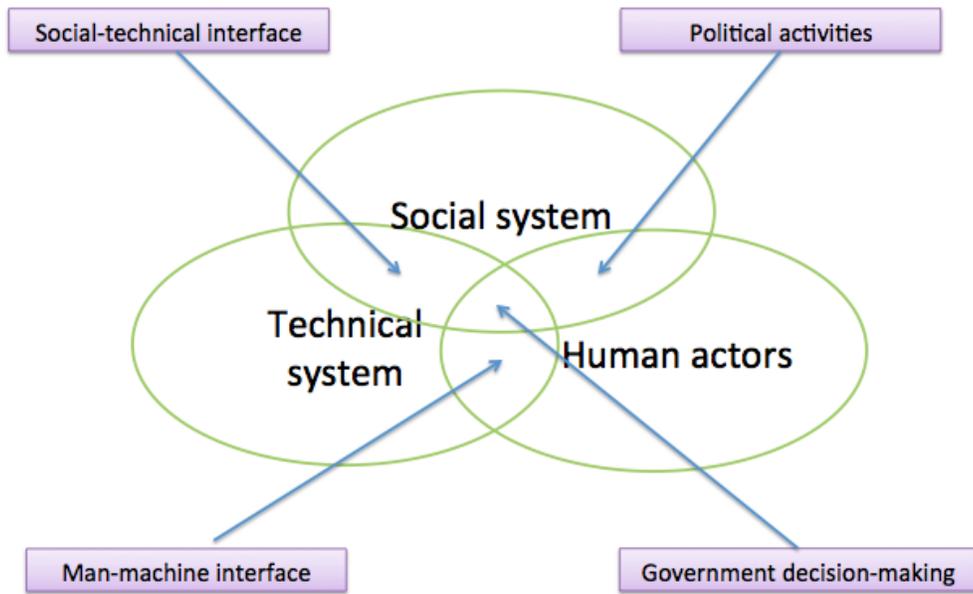
Fig. 1: The typical scheme to represent a critical infrastructure as a socio-technical system (Little, 2004 [9])

Running the interviews

Methodology

The qualitative research activity has been designed to collect, investigate, analyse and define the needs and characteristics of the MOTIA potential target groups (end-user of the ICT infrastructure) in order to better define the MOTIA project objects and to support the on-going R&D activities. The work - realised and coordinated by CASPUR with the support of ENEA – has been performed through the realisation of a number of qualitative in-depth interviews with experts and representatives of selected organizations. The criteria for selections was the extensive and massive use of the ICT infrastructure for deploying their services to internal structured personnel or to external clients.

Profile of the users and target groups

The qualitative methodology (in-depth interviews) employed within the MOTIA project has been used to support and improve the development and implementation of the MOTIA methodology as well as developing hypotheses for future research in the area of Critical Infrastructures by analysing users needs and feedbacks on technologies, services with regard to Information and Communication Technologies infrastructure.

The participants involved in the qualitative research and interviewed (usually lasting for 1,5 - 2 hours) have been managers and decision makers belonging to organisations and companies (from both private and public sector) that make an extensive use of the ICT infrastructure, technologies and services. During the interview they have provided their view (at both personal and high level) on the project and methodology, and ICT infrastructure "usage experience".

The data obtained through the in-depth interviews has been gathered and analysed to identify the impact, reaction, needs, and overall behaviour of the end users while experiencing the ICT interdependencies.

Five main target groups relevant for the project have been identified, thus the field of the research has been composed as follows:

1. Public administration
2. Service providers (in particular IT services providers)
3. Civil security and emergency services
4. Banks and large companies
5. SMEs (in particular operating in the e-business and e-commerce)

Overall 16 in-depth interviews have been with managers, decision makers and experts from the above organisations. The landscape selected has been **Italy** (as all interviews have been realised in Italy and with Italian organisations/companies).

Items investigated

We tried to understand better what use of ICT services and systems of the end users, their Critical Infrastructure experience. In designing our study and especially the interview schedule we also expected to obtain suggestions for improving the MOTIA methodology and concept. To collect such information a list of issues was set up to understand in depth user needs and to inform about the project

initial results. The list of issues has been used to conduct the interviews with the participants and to design the so-called interview schedule. Main objectives of the work have been set as follows:

- Realising an extensive study on the impact of Critical ICT Infrastructure in a number of different the application (with particular focus on the domains envisioned in the project)

- Studying and evaluate the impact of Critical ICT Infrastructure use on the considered application domains

In addition, the work has been also performed by involving Italian experts to increase their awareness about the project results and activity and collect from them advices, suggestions and recommendations for the project activity and future work.

Italian landscape: adoption of information and communication technologies and services

Italy has made visible progress in recent years in communication infrastructure (e.g. mobile) and in some sectors of eGovernment. It is, however, lagging behind in using and exploiting the full potential of the Information Society. This is noticeable in the low use of the internet among the population, although Italian enterprises, despite their small size, have made remarkable progress in using ICT as a business tool. The public administration provides online services, but interaction with citizens could still be improved.

ITEM	2006	2007	2008	2009	EU-27
Total DSL coverage (as % of total population)	89.0	94.0	95.3	96.0	94.0
DSL coverage in rural areas (as % of total population)	50.5	81.7	82.0	85.0	79.7
Broadband penetration (as % of population)	14.5	17.1	19.0	20.6	24.8
% of households with an internet connection	40	43	47	53	65
% of households with a broadband connection	16	25	31	39	56
% of enterprises with a (fixed) broadband access	70	76	81	84	83
% of population using a mobile phone via UMTS (3G) to access the internet	2	3	3	4	4
% population who are regular internet users (using the internet at least once a week)	31	34	37	42	60
% of population using eGovernment services	16	17	15	17	30
% of enterprises using eGovernment services	87	84	82	83	71
% population ordering goods or services for private use	9	10	11	12	37
eCommerce as % of total turnover of enterprises	2	2	NA	NA	13
% enterprises selling online	3	2	3	4	12
Using applications for integrating internal business processes (all enterprises)	NA	NA	49	44	41
Using applications for integrating internal business processes (large enterprises)	NA	NA	82	78	71
% of persons employed with ICT user skills.	18.9	19.4	18.9	17.9	18.4
% of persons employed with ICT specialist skills	2.9	2.8	2.9	3.1	3.2

Table 1: Outline on Italy's indicators on ICT technologies adoption and usage and EU-27 average [European Commission, 2010]. DSL stays for Digital Subscriber Line, it represent the most widespread large band technology.

Broadband population penetration is lower than the EU average, while DSL (Digital Subscriber Line) coverage is somewhat above. Only 53 % of households have an internet connection, but 74 % of the connections are broadband, which is a significant improvement compared to the previous year's 66 %. For enterprises, the situation is much better: penetration is 84 %, above the EU average of 83 %. In

wireless broadband, Italy's performance is around the average for the EU. On the other hand, Italy has a well-established mobile market with encouraging developments in mobile broadband. The percentage of frequent internet users is close to the European average while the percentages of low users or no users at all are relatively high. However, the number of people online is gradually increasing. Concerning the take-up of internet services, the most popular activities are also the most common at EU level. For looking up information about education, training or courses, Italians approach the European average. The use of eCommerce by individuals is still very low, although train eTicketing is becoming quite widespread.

Overall, Italy remains an average performer on most eGovernment indicators. The availability of public services for citizens and enterprises has been constant since 2007, at 58 % for individuals and 88 % for enterprises. Take-up is relatively good for enterprises but quite low for citizens, set at around 17 %. Italy has embarked on a comprehensive and ambitious strategy of administrative reform, putting eGovernment at its core. eGovernment is explicitly seen as a way to improve the efficiency and client-friendliness of government, to strengthen coherence between all levels of government, and to develop shared services. In setting its strategies, Italy has aligned with EU policy frameworks such as i2010. A typical feature of its eGovernment approach is its decision to give eGovernment solid legal backing to ensure compliance. Italy is an active contributor to EU projects and programmes in this area [8].

Results of the study

Characteristics of the target groups

The feedback collected during the interviews has allowed us to outline more precisely the characteristics, needs and behaviour of the five target groups considered. In particular our findings were the following:

1.   **Public administration.** First of all it is important to remind that this target group is characterised by a heterogeneous use, needs and behaviour in regards to the ICT services and technologies. There is evidence of different behaviour in particular considering the geographical belonging, the size and the type of services provided by the considered administration. In general the awareness in regard to the Critical Infrastructure topic is quite low, and lower than awareness in regard to the Security issues (that is somehow a "keyword" more widespread than the CI one). Nevertheless there is a general and strong will to be involved in IT adoption/improvement activities and policies, and on activities for improving Public Administration services enabling also business continuity and overall improvement of the Quality of Service. In most cases personnel of Italian Public Administration are still more focussed on the ICT internal service rather than the external ones: this might be due to the very low pressure that the citizens exert on local and national public bodies while asking for services. Finally municipalities involved in e-government are usually larger, carry out more in-house ICT activities and are more likely to have intranet infrastructures than Public Administrations that do not offer front-office digitized services.

2.   **Service providers**. In general the know-how is quite high, in particular in respect to the other target groups and considering the limited amount of resources that these organisation can spend in training and R&D activities. Many of these organisation have a relevant role in the Italian business; IT services providers have also important relations/connections with the national and international telecom company operating in Italy. In many case they play a fundamental role in bridging between other SMEs and other major companies (see target group 4). Some of them are "new and innovative companies",

with flexible organisational structures. Awareness of the ICT services and opportunities at international level is high and there is usually a clear vision on the cost vs benefit issues in regard to ICT.

3. **Civil security and emergency services**. In all cases the organisations have relevant security constrains. They play an important role not only at national level and frequently participate to several European and Italian boards and funded projects. The ICT systems they own (or rent) are of good quality (although heterogeneous and ad-hoc developed in most cases). They have a very high interest in web-based and mobile based applications and personnel know-how is generally highly competent in technologies. There is evidence of willingness to pay for more expensive services if needed. Awareness of Security and Critical Infrastructure is relevant but has low impact on the decision making. Relation with the telecom operator is usually quite satisfying.

4. **Banks and large companies**. This user groups experience quite high pressure from customers. This is also due to the fact that in many case such organisations provide services that represent an important backbone for the national economy. ICT networks for banks and large companies are of course one of the most important assets and consequently the amount of investments is relevant. Due to the number of different services provided, there is also a wide and heterogeneous ICT service provisioning for each of these organisation. Finally for some of these companies it is true that despite the complex offer, the variety of services provided (postal, commercial, banks,…), and the competitive market they need to face, still many negative characteristic of the Italian public bodies are present. Finally it seems that for most of these organisation the role played in IT boards regulation and policies it's felt as a benefit.

5. **SMEs (in particular operating in the e-business and e-commerce)**. SMEs role and presence in Italy is highly relevant: they represent almost the 40% of the Italian economy. Nevertheless due to their "small size" SMEs have a weak positional in the relation with the operators: in particular participants have experiences about a lack of strength concerning the preparation of agreements, cost and services definition. SMEs also experience high constrains from budget allocated to the ICT services they employ, that in some cases can be low quality. These are the main barriers that are perceived by SMEs especially in comparison with enterprises of large size. On the other side they share with large organisations a strong push from the customers: in particular SMEs customers expect more than a "standard quality of service" (that is somehow what is expected from a large organisation) and they generally look forward to SMEs services being appealing, up-to-date, flexible and innovative.

Resilience matrix

Following examples provided in the literature, in regard to the analysis of the behaviour of CI end users from a socio-technical point of view [10], [11] we have evaluated the resilience response of the different user groups encountered during the study. In particular for each of target groups above outlined different levels of resilience capacity have been identified in the following matrix reported in Table 2 and considering 3 main aspects of their behaviour in the case of a critical event happening to the ICT infrastructure: a) absorptive capacity, b) adaptive capacity, c) restorative capacity as main component of the resilience. In this context, the absorptive capacity represents the ability to recognize new outstanding conditions and apply measures to preserve performance. The adaptive capacity represents the ability to adopt prompt decisions to deal with novel or contingent conditions. The restorative capacity represents the capability to recover the full functional state upon dwelling conditions or udesired events. In particular the following findings have been collected thought the end user feedback:

Resilience Matrix			
End user	Absorptive capacity	Adaptive capacity	Restorative capacity
Public administration	L	L	M
Service providers (in particular IT services providers)	M	H	M
Civil security and emergency services	H	M	H
Banks and large companies	M	M	L/M
SMEs (in particular operating in the e-business and e-commerce	M	H/M	H

Table 2: Qualitative Evaluation of MOTIA target groups capacities in relation to Resilience capacities (High, Medium, Low)

6. **Public administration**
   – Absorptive capacity: low, as for most of the Italian administrations systems with the aim to avoid failures and other critical events have not been extensively adopted by all bodies. In many cases systems to support identification of and critical event management have not been fully designed yet.
   – Adaptive capacity: low, due to the large size of the organisations considered, and the complexity of the services to be provided adaptation is a very critical issue for public Italian administrations.
   – Restorative capacity: item is strictly correlated to the kind of services that the public administration needs to provide. Generally is medium/high, as in case of a critical event the local bodies might be provided with additional resources to manage the situation; on the contrary in case of a service that has low impact in the local body administration, financial resources available will be lesser and so the restorative capacity might become lower as well.

7. **Service providers (in particular IT services providers)**
   a) Absorptive capacity: medium, as facilities and system features tend to be redundant, and thus lower the impact of the critical event.
   b) Adaptive capacity: high, as the organisational flexibility and the high level of know how of these organisations can improve the adaptation to critical events in particular considering a short/medium-term timeframe.
   c) Restorative capacity: medium, as in addition to the redundancy guaranteed by facilities and systems, these organisations have available personnel, professional and financial resources to be used in such cases.

8. **Civil security and emergency services**
   d) Absorptive capacity: facilities and system features tend to be redundant (as the quality of service need to be very high). This strongly lowers the impact of the critical event. This is similar to what happens in the case of service providers, although civil security and emergency services operators might have greater financial resources available.
   1. Adaptive capacity: know-how of the personnel and high level of technologies adopted

can guarantee a good level of adaptive capacity. However in some cases legal constrains and rules that these organisation need to follow both at national and EU level might lower this flexibility.

    e) <u>Restorative capacity:</u> as for the service providers redundancy is guaranteed by facilities and systems, but also very well supported by these organisations than can count on high level of personnel, professional and resources.

9. **Banks and large companies**

    a) <u>Absorptive capacity</u>: these organisations have adopted a large and heterogeneous number of systems and strategies to avoid failure and critical events, nevertheless the number of transactions and the kind of services offered, can in few cases lower the this specific capacity.

  – <u>Adaptive capacity</u>: similarly to the public administration this capacity might be low due to the large size of the organisations considered and, as well as the complexity of the services to be provided. Nevertheless the strong pressure from the customers and the market competition can increased this capacity to medium level.

    b) <u>Restorative capacity</u>: the time constrains (pressure from the customers and citizens) as well as the complexity of the services to be provided, can lower the perception of the restorative capacity of these organisation. Nevertheless in many cases the size of the business and the financial resources can improve this capability.

10. **SMEs (in particular operating in the e-business and e-commerce)**

    a) <u>Absorptive capacity</u>: strong impact on the system might be experienced by these organisation due to the limited number and quality of strategies and technologies put in place to prevent failures. This is basically due to the limited amount of resource allocated to the purpose.

    b) <u>Adaptive capacity</u>: the small size of the organisation and its internal flexibility usually make the adaptation capacity pretty high. Nevertheless the limited amount of resources available to the organisation might, in some cases smooth this capability.

    c) <u>Restorative capacity</u>: the good collaboration established with the IT service providers is, in general, adequate to guarantee a quick recovery and service reinstatement.

User group feedback

While performing the analysis of the interview content, we have realised a gathering of the user feedback according to three main items, relevant from the attitude and behavioural point of view of each of the target group. The three considered items, a) needs and expectations, b) level of satisfaction, c) awareness and know-how, have been investigated in relation to the response provided by the end users. A content analysis has been achieved by quantifying the response as negative or positive according to a 'min=0, max=5' scale. We finally found evidence of the following issues summed up in Fig. 2:

Needs and expectations

Target Groups:

- Bank and postal services
- Civil security and emergency services
- Public Admin
- SMEs
- Service providers

Level of satisfaction

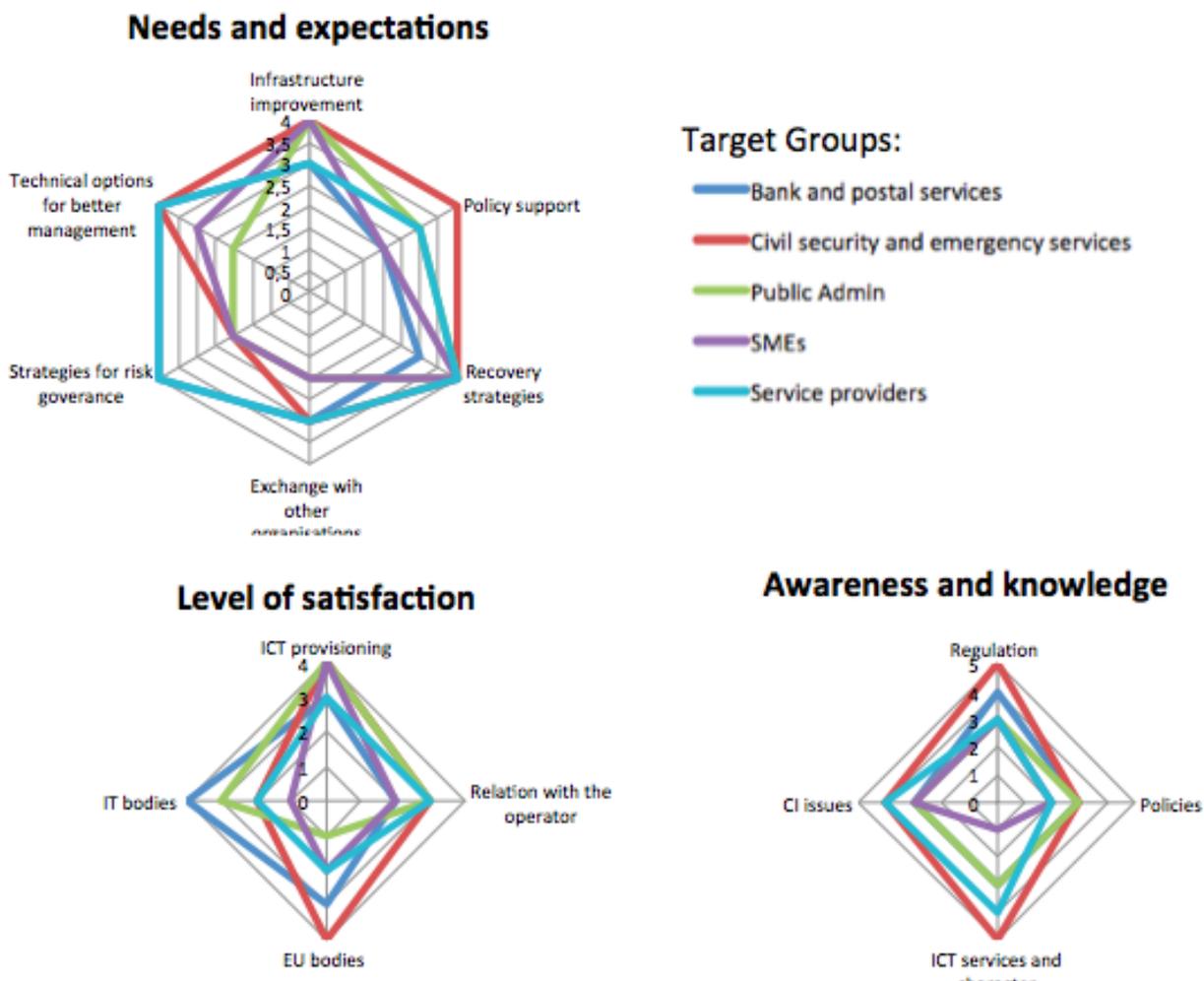## Awareness and knowledge

Fig. 2 Interview content analysis. The emerging most relevant needs and expectation, satisfaction level and awareness and know-how in regard to the Critical Infrastructure experience (per target group)

Participant main barriers in the use of ICT infrastructures

The interview analysis revealed that the users feedback was mainly focussed on different areas, and in particular the **main barriers identified by the participants for an effective use of the Critical Infrastructure** were related to the following items: 1) Technical aspects and ICT implementation; 2) Provisioning of ICT services; 3) Regulatory and political aspects; 4) Organisational issues.

1. In regard to the **technical aspects and the ICT implementations,** the feedback from the companies that we have interviewed was mainly addressing the following issues:
   a) Concerning the strategies to prevent failure: Redundancy (organisations operating in the area of security and/or emergency services), prevention (banks), and early warning (postal services and

large organsations).
   b) Very high constrains (customers, national provisioning of services, security and safety)
   c) System do not support traceability of events
   d) "…The ICT system is a "black box" in the house of the telecom operator!"
   e) Testing and verification are crucial and need to be repeated each time a change is implemented
   f) Strong need of high level guidelines and methodology

2. Concerning the **provisioning of ICT services** the feedback from the companies that we have interviewed was mainly outlining the following needs and expectations with respect to the relation with the operators:
   g) Collaboration, exchange of information and more transparency
   h) Need for improved and increase consultancy services (in particular during the maintenance phase of the ICT infrastructure)
   i) Telecom Operators are seen as "Critical Operators"
   j) Customization and personalization of services
   k) Availability in supporting during the testing and during the other crucial/critical activities
   l) Disaster recovery is almost not fulfilled at all and needs to be addresses by the service providers

3. In regard to the **regulatory and political aspects** the feedback from the companies that we have interviewed was mainly addressing the following needs and expectations:
1. Improvement of National and European legislations; need of clear directive at IT and EU level
2. Relation and lobbying at EU level
3. Each sector should have its own regulation
4. Specific regulation in regard to the operators and ICT providers obligations

4. In regard to the **organizational issues** the feedback from the companies that we have interviewed was mainly addressing the following needs and expectations:
   • Lack of transparency and collaboration
   • No clear information on the actual services provided
   • Low level knowledge of the "failure chain" and its evolution
   • Strong need of collaboration at all level of personnel
   • Finally critical infrastructures are coupled with social and collaborative vulnerabilities

Gathering the feedback collected from a quantitative point of view (by assessing the response provided by the participants with a value from 0=min to 5=max) for each of the target groups identified it is possible to outline overall feedback provided during the interviews as reported in Fig. 3.
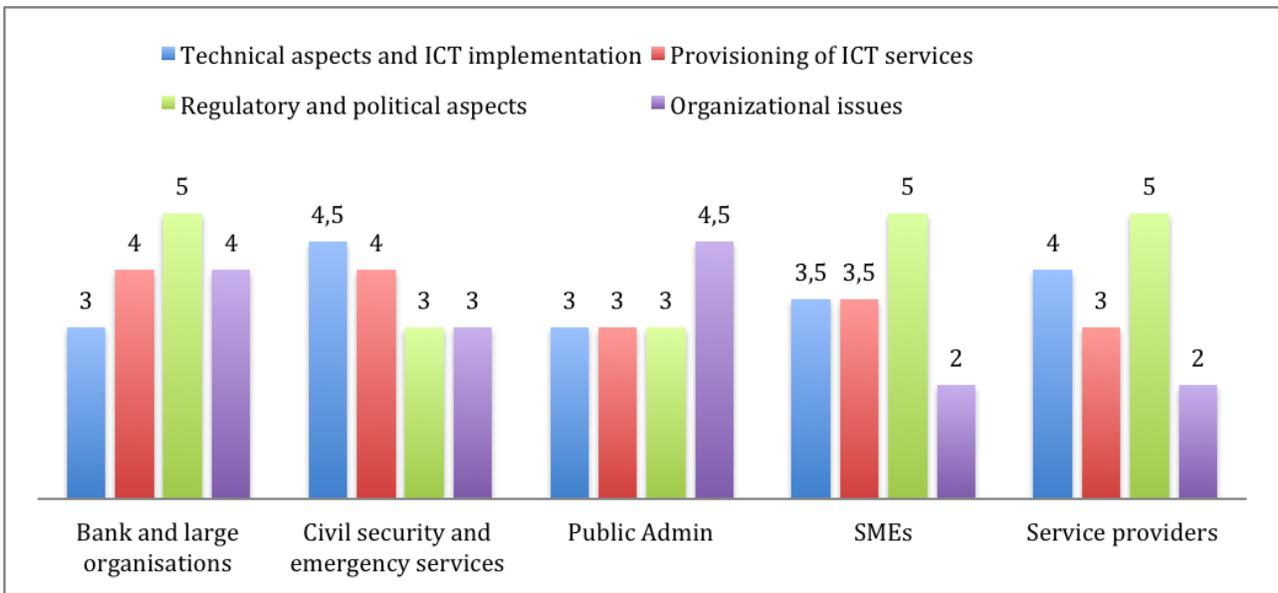
Fig. 3 Most relevant items and barriers in relation to Critical Infrastructure end users experience (per target group)

Considering the overall population, in particular the barriers (and consequently the related needs) in regard to regulatory/political aspects, and the need for support during technical ICT implementation were the items more frequently reported as most relevant by the participant. It is important to report that the barriers for a optimal usability of ICT infrastructures has been, in most cases, lowered perceived when having a flexible IT service providers bridging between the telecom operator and the end users (see Fig. 4).
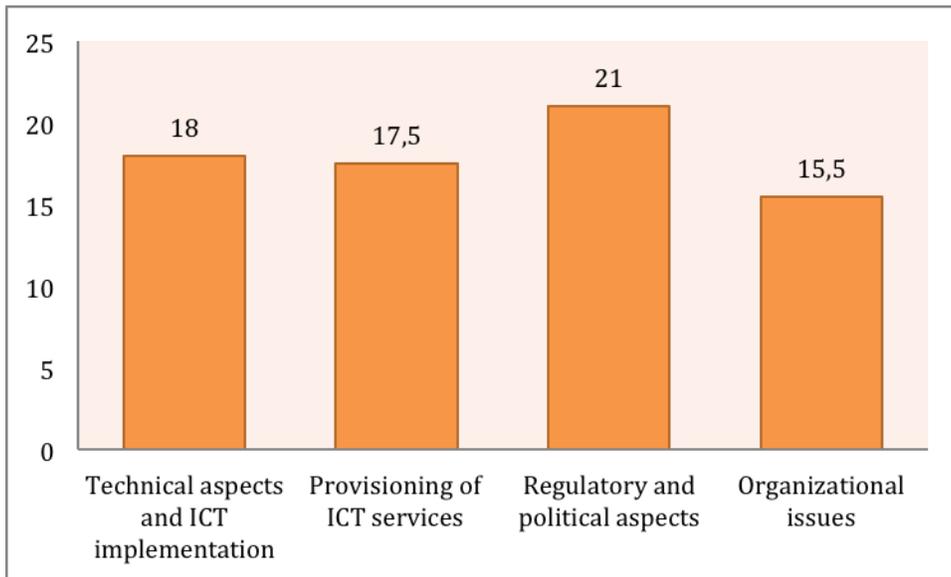

Fig. 4 Most relevant items and barriers in relation to Critical Infrastructure end users experience (overall population, max=25)

General reaction to the project and MOTIA concept

From a high-level point of view our findings were **very positive** for the project and gave us trust as well as suggestion for improvement on the work and on the project methodology. In particular for all the users interviewed the following points have been reported:

- The topic and the objectives are clear
- High interest and expectations towards the project
- Availability in supporting and participating to the project (also in providing representation at EU level)
- Willingness to pay for more expensive services if needed was evidenced
- Security and Critical Infrastructure have enormous impact on the business development. This may represent another reason for which MOTIA could have significant impact.
- Awareness of Security and Critical Infrastructure relevance is high but it does not significantly impact on the actual decision making inside the organisations

Also **some negative** point emerged during the interview and in particular the users reported to us about the lack of clarity in regard to:

- the methodology that MOTIA was willing to implement and the *concrete* results of the project
- potential impact on the "daily activities" of the end users

Dissemination

During the two years of the project development all progresses and results have been documented on a website (www.motia.eu) that has been maintained to allow documents sharing among the project partners and public deployment.

The site and the project activity have been constantly advertized to colleagues and sector experts at any opportunity by all the project participants. Moreover the Motia project has provided endorsement to some conferences such as Netonet2011, NetoNets2012 and ECCS2012.

The project Motia was not intended to perform original research, but to assess a methodology and to provide best practices; nevertheless (apart from the reports on the different activities) the consortium has published the following papers during the two years of work:

E. Gregori, et al: "The impact of IXPs on the AS-level topology structure of the internet". Computer Communications (2010).

Enrico Gregori, Alessandro Improta, Luciano lenzini, Lorenzo rossi, Luca Sani BGP and Inter-AS Economic Relationships 2011, 10th International IFIP TC 6 Networking Conference

E. Gregori, L. lenzini, S. Mainardi, C. Orsini FLIP-CPM: A Parallel Community Detection Method 2011, 26th International Symposium on Computer and Information Sciences (ISCIS 2011)

E. Gregori, L. lenzini, C. Orsini k-clique Communities in the Internet AS-level Topology Graph 2011, The Third Annual Workshop on Simplifying Complex Networks for Practitioners (SIMPLEX 2011)

E.Gregori, A. Improta, L. Rossi, L. Lenzini, L. Sani : "Inferring Geography from BGP raw Data"

INFOCOM NetSciCom 2012

A. De Nicola, A. Tofani, G. Vicoli G., M.L. Villani "Modeling Collaboration for Crisis and Emergency Management" COLLA 2011, Luxembourg June 19-24, 2011.

A De Nicola, G. Vicoli, M.L. Villani et al. "Rule-based approach for modeling behaviour in crisis and emergency scenarios" in Enterprise Interoperability V (Springer, 2012).

E. Casalicchio, A. Paoletti, S.Tucci, "DeDALO: A Framework for Distributed Systems Dependencies Discovery and Analysis", proc. of 26th ISCIS, pp 265-269, 2011, E.Gelembe, R.Lent, G.Sakellari eds

G. D'Agostino, A. Scala, G. Caldarelli, V Zladic. "Robustness and assortativity for diffusion-like processes in scale-free networks" Europhysics Letters 97 (2012) 68006.

G. D'Agostino, A. De Nicola, A. Di Pietro, G. Vicoli, M. L. Villani and V. Rosato, "A Domain Specific Language for the Description and the Simulation of Systems of Interacting Systems, Advances in Complex Systems", Vol. 15, Suppl. No. 1 (2012)

As can be seen, the project has stimulated (and at least partly supported) several works spanning from the analysis of the Internet to the conceptualization of complex ICT systems to more fundamental works on complexity science. Other papers are submitted for publication. The support from the EU Commission "Home Affairs general directorate" is acknowledged in all papers.

The final conference has also been an occasion to disseminate the results of the project. Some 70 people have attended the event that also benefit of contribution from European experts of different fields: Kurt lLindqvist from Euro-IX (the consortium of all XPS in Europe); Antonio Nugueras from Eurocontrol (the consortium of all flight controller in Europe); Bart Gijsen from TNO (Netherlands Organisation for Applied Scientific Research) a real expert of the DNS ans DNS-sec; and Piet Van Mieghen from the university of TUDELFT an expert of complexity science applied to technological networks.

The conference has also hosted a final round table on the future of ICT infrastructures and the role of interdependency.[1]

Acknowledgments

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1   http://www.motia.eu

References

[1] Wang, X.F. , Chen, G. (2003), "Complex Networks: Small-World, Scale-Free and Beyond", *IEEE Circuit and Systems Magazine*, p. 6-20, 2003

[2] Watts, D., Strogatz, S. (1998), "Collective dynamics of "small-world" networks", *Nature*, Vol. 393, p. 440-424, 1998.

[3] Zimmerman R., Restrepo, C.E. (2006), "The next step: quantify infrastructure interdependencies to improve security", *Int. Journal Critical Infrastructures (IJCIS)*, vol. 2(2/3), pp. 215 – 230, 2006

[4] Zimmerman, R. (2004), "Decision-making and vulnerability of interdependent critical infrastructures", *Proc. IEEE Conference on Systems, Man and Cybernetics*, vol. 5, pp. 4059 – 4063, 2004

[5] Chai, C-L., Liu, X., Zhang, W.J., Deters, R., Liu, D., Dyachuk, D., Tu, Y.L. and Baber, Z. (2008) 'Social network analysis of vulnerabilities of interdependent critical infrastructures', *Int. J. Critical Infrastructures*, Vol. 4, No. 3, 2008, pp 256-273

[6] Council Directive 2008/114/EC 8 December 2008

[7] European Commission (2010), 'ICT Country Profiles. Commission staff working document', *Europe's Digital Competitiveness Report'*, pp. 164-166

[8] Kroger, W., (2008), 'Critical infrastructures at risk: A need for a new conceptual approach and extended analytical tool', Reliability Engineering and System Safety, 93 (12), pp 1781-1787.

[9] Little, R.G. (2004), 'A socio-technical systems approach to understanding and enhancing the reliability of interdependent infrastructure systems', *Int. J. of Emergency management*, Vol. 2, Nos., 1-2, pp 98-110.

[10] Little, R.G. (2005), 'Organisational Culture and the performance of Critical Infrastructures: Modelling and simulation of Socio-Technological systems', *Proceedings of the 38th Hawaii International Conference on System Science*, pp. 1-8, Hawaii, USA

[11] Bagheri, E., Chorb, A. A. (2010) 'A Framework for the Manifestation of Tacit Critical Infrastructure Knowledge' in Gopalakrishnan, K., Peet, S., '*Sustainable and Resilient Critical Infrastructure'*, pp 139-158, Springer-Verlag Berlin Heidelberg

[12] European Commission (2010), 'ICT Country Profiles. Commission staff working document', *Europe's Digital Competitiveness Report'*, pp. 164-166

[13] http://www.motia.eu/, MOTIA Project, European Commission - Directorate-General "Home Affairs": JLS/2009/CIPS/AG/C1-016