FP7 Grant Agreement N° 312450

CIPRNet

Critical Infrastructure Preparedness and Resilience Research Network

Project type: Network of Excellence (NoE)

Thematic Priority: FP7 Cooperation, Theme 10: Security

Start date of project: March 1, 2013 Duration: 48 months

D5.1 Formal Requirements Specification

Due date of deliverable: 31/08/2013
Actual submission date: 10/10/2013

Revision: Version 1

University of Technology and Life Sciences (UTP)

Project co-funded by the European Commission within the Seventh Framework Programme (2007–2013)		
Dissemination Level		
PU	Public	**X**
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

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Approval Date	20/09/2013
Remarks	No issues. Keep dissemination level as in DoW.

The project CIPRNet has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 312450.

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1 Introduction

In this deliverable general user requirements and needs for the CIPRNet Decision Support System (DSS) are gathered and specified. It is the first document of WP5 "Integration Activities 3: End-user support". It will be used in WP6/WP7, where more detailed requirements will be specified and the CIPRNet DSS will be developed.

CIPRNet requirements described in this deliverable originate from:

- the project goals and objectives defined by Description of Work [4],
- stakeholders/end-users and domain experts opinions (via questionnaire and face-to-face meetings),
- consortium knowledge and experience.

Requirements identified in this deliverable will be mainly used by WP7 ("Decision Support System with consequence analysis") as the guidelines for further work, such as final system specification and particular DSS components development and for WP6, complementing the description of requirements for cross-sector simulation environment and including the end-user perspective into development of application scenarios and realisation of a demonstrator. However, it should be mentioned, that CIPRNet general requirements are focused on decision support front-end, rather than back-end, comprised of models and simulations that provide input information for the CIPRNet DSS.

The examples of Decision Support Systems applications are commonly known for about 50 years in different domains, however, there is still no clear consensus on its definition or which functionalities it should contain [1].

The general definition of DSS, can be found e.g. in [2], where DSS is described as *"a type of interactive computer-based information system that supports decision-making activities and helps decision makers identify and solve problems, using different types of technologies, data, knowledge and/or models"*.

However, different researchers define DSS from their different perspectives. Thus, for the purposes of CIPRNet, we adopt the DSS definition as a compilation of different views, as it is provided in [1] and [3]. According to these sources, DSS can be defined as interactive computer-based system, that uses data and models to support rather than replace decision makers, and that has decision-making supporting capabilities.

Requirements collected and described in this document should be considered as the initial set of requirements, driving future technical work, rather than final checklist or early specification for the CIPRNet components development.

This document is structured as follows:

- Section 2 shortly describes the role of end-users within the CIPRNet project and their involvement in the process of requirements collection.
- Section 3 includes an overview of the end-user requirements collection process, including the plan for requirements gathering.
- Section 4 analyses the returned the CIPRNet end-user questionnaires.
- Section 5 includes a formalisation of collected user requirements (obtained through the interaction with experts) and presents the list of general CIPRNet DSS requirements in the form of tables.
- Section 6 concludes and discusses the results presented in this document.

2 End-users role in CIPRNet

2.1 Background of end-users involvement, means of inclusion and incentives specification

In order to establish a successful engagement of relevant end-users, the plan for inclusion and providing incentives was developed. It is expected that a wide spectrum of identified stakeholders relevant to the project will represent the following domains:

- Public,
- Private,
- Research and Academia.

First of all, the benefits of end-users involvement in CIPRNet for all above groups (private sectors, the public sector, and research and academia) have to be clearly articulated, and should be built upon the concepts of:

- increased awareness,
- cooperation, and
- improved effectiveness in the field of CI crisis management.

Secondly, it is important to define strategic engagement goals that will allow for drawing the attention of the CIP community. For each goal, means of inclusion and methods for providing incentives are listed in Table 1.

Table 1: End-users engagement goals and methods for inclusion

Goal	Action	Means of inclusion	Incentive method(s)
Draw attention of high-level (policy and strategic level) representatives (among others establish network of trust and common ground for discussion)	Show that the consortium is a trustworthy partner and has something to offer.	Roundtable/ workshop(s) for public and private sector representatives. Meeting end-users and their associations	Supranational and national bodies will increase their capability to handle and respond to CI crises impacting citizens Give a possibility to establish common ground for discussion and cooperation.
Draw attention at tactical level **(e.g. first responder, crisis response services)**	Show that CIPRNet effort is going to formalise a joint action plan that aims at increasing effectiveness of CIP across intra and cross-sector dependencies and starting collaboration in that matters.	Conferences, workshops, brochures, CIPedia.	Individual end-users would benefit from mutual assistance/cooperation agreements.
Draw attention of CIP experts	Show that CIPRNet is addressing rele-	Project webpage, CIPedia.	CIPRNet end-results will have impact on

	vant problems impacting CI crisis management and decision-making process.	CIP-related forums. Electronic communication channels such as FB, Twitter or YouTube. CIPRNet demonstration and training activities.	current and future research areas in CIP and it is up to the community to raise problems to address.
Draw attention of research and academia	Show that research centres and academia are key partners for sustaining further improvements of technology.	Conferences and workshops for researchers and industry.	Possibility to establish cooperation that will be reflected in the CIPRNet solutions and services.
Draw attention of citizens	Show that protection of CI is a crucial and underestimated problem.	Project webpage, Internet, press releases, press articles, podcasts, interviews, and CIPedia.	Possibility to articulate doubts and problems relating to CIP.

Moreover, the following incentives can be provided for all the groups:

- early access to the project results,
- influence on project direction and usability of the results for one's own purposes,
- invitation to the project workshops and other dissemination events,
- invitation to conferences such as CRITIS, ESREL, etc.,
- invitation to CIPRNet lectures and training,
    - to attend,
    - to present one's own expert view/give lectures.

2.2 Contacted end-user groups

2.2.1 CIPRNet Advisory Board and end-users associations

Members of CIPRNet Advisory Board and different organisations associating possible future end-user entities supported contacts with end-users and distribution of the CIPRNet questionnaire.

In particular, representatives of following organisations actively participated in the questionnaire distribution:

- DKKV, Germany (German Committee for Disaster Reduction),
- Dutch Ministry of Security and Justice (includes contacts with the Dutch regional crisis management centres),
- Austrian Ministry of the Interior,
- The European Corporate Security Association – ECSA,
- Italian association of CIP experts,
- Deutscher Feuerwehrverband e. V. (German Fire Service Association),

- Vereinigung zur Förderung des deutschen Brandschutzes e.V (German Fire Protection Association),
- Bundesamt für Bevölkerungsschutz und Katastrophenhilfe (Federal Office of Civil Protection and Disaster Assistance).

2.2.2 CIPRNet end-users

Moreover, the following groups of the project end-users were contacted directly (by sending questionnaire or through face-to-face meetings) in order to involve them in the process of the CIPRNet DSS requirements collection:

- Polish Government Centre for Security (RCB),
- City councils (Poznań),
- Voivodeship offices (Poznań, Opole, Łódź, Warszawa),
- Police organisations (Police Academy in Szczytno, Polish Police Headquarters),
- Critical Infrastructure solutions providers, CI operators, research and consultancy (e.g. CIS Institute SA, Electrabel GDF Suez, ENEA, TERNA, GIZ, UNU-EHS).
- German Red Cross

The CIPRNet end-users have been also contacted at domain workshops / conferences (such as the 2nd International Scientific Conference "Safety Engineering and Civilization Threats - Challenges for Safety" in Częstochowa, Poland).

Moreover, CIPRNet WP5 (D5.1) team took a part in Joint Research Centre workshop: "Testing Security: the Critical Infrastructure Operators' View" to validate and discuss requirements with European CI operators.

3 Requirements collection process

3.1 Plan of requirements gathering

The process of defining the end-user requirements for the CIPRNet project is shown below in Figure 1.

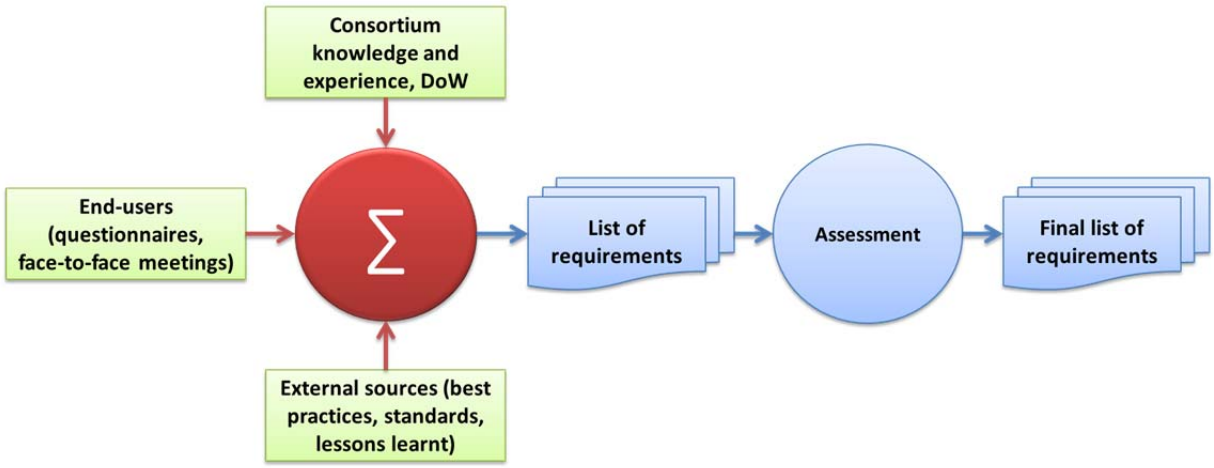

Figure 1: Process of defining end users' requirements

The methods for gathering user requirements in the CIPRNet project are: face-to-face meetings, remote user interviews and the CIPRNet questionnaire, filled in by the project end-users and domain experts.

The questionnaire has been prepared by the Consortium partners taking advantage of partners' knowledge and experience, and review of the earlier work such as completed EU projects. Additionally, questions are focused on the aspects needed in the future project results development. Outcomes of those questionnaires will be a starting point in requirements specification process and to be helpful in CIPRNet solutions design specification. The questionnaire is presented in Section 3.3.

3.2 Methodology for requirements specification

The requirements specification process, including gathering, classification and assessment should follow a common methodological approach. A common approach also helps in management of requirements, providing the means to trace the identification, definition, assessment, formalisation and, if necessary, improvement of the gathered requirements. The modified and adapted (to project needs) Volere methodology[1] has been chosen as a guideline and used for the CIPRNet project. Such common methodology for requirements specification guarantees formalisation.

The Volere methodology divides requirements for the design of software tools into two general groups:

- Functional and data requirements - specify the detailed functional requirements to be carried out by the product, the fundamental or essential capabilities of the product. They describe what the product has to do or what processing actions it is to take.
- Non-functional requirements - specify the properties such as performance and usability, which the functions must have.

[1] http://www.volere.co.uk/index.htm, last visited 15.07.2013

As presented in Figure 2, CIPRNet requirements are focused on decision support front-end, rather than back-end, comprised of models and simulations that provide input information for the CIPRNet DSS. This means, that the CIPRNet questionnaire and the majority of end-user requirements focus on the DSS functionalities, interfaces, information presentation and visualisation aspects.

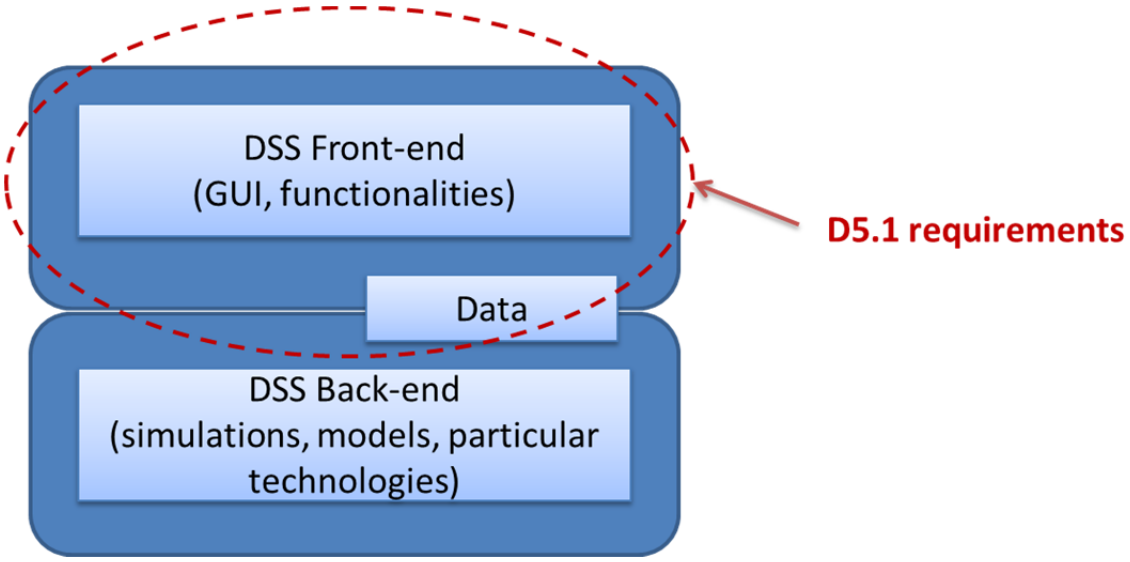

Figure 2: Conceptual framework for requirements specification

3.3 CIPRNet questionnaire

For the purposes of CIPRNet requirements collection, the CIPRNet Consortium distributed questionnaires to the various project end-users. The information about their selection is provided in Section 2.

The questionnaire was designed in order to provide a broad view on current end-user problems, limitations and expectations. The most questions are open or semi-open. Therefore, respondents were neither limited in expression of their opinions, nor biased by pre-defined options to choose.

Generally, the questionnaire has been divided into four blocks of questions, namely:

- General information about the respondents, particularly their organisations, range of activities, matter in which he/she acts,
- Questions related to accessing the information, particularly concerning availability of information about CI coming from private and public sectors and used during CI-related crisis,
- Questions about using DSS during respondent duties, providing information about decision support mechanisms and tools, their limitations, data exchange, standards, etc.,
- Questions about simulation and modelling for CI crisis management purposes.

The analysis of the CIPRNet questionnaires filled in by the CIPRNet end-users can be found in the next section. The template of the questionnaire can be found in Annexes A (English language version) and B (Polish language version).

4 Analysis of CIPRNet questionnaires

Respondents who filled in the questionnaire, represent various organisations – from local and regional CI-related organisations to Pan-European agencies, and from academic and applied researchers to CI-operators. However, the majority of respondents are representatives of organisations that operate within nationwide range, and usually as public emergency management centre.

4.1 Accessing the information

The respondents assessed availability of various information related to CI from various sectors and sources and gave them ratings. According to respondents ratings, generally there are **no significant differences between levels of availability of information**, when comparing public and private sectors. The average ratings for public vs. private CI information availability (e.g. geo-localisation data, operational data and sensitive data about these infrastructures) are at the similar level. Considering information about CI dependences, it is noticeable that such information during normal operation is significantly easier accessible than during non-normal state of CI functioning.

The questionnaire analysis shows that the hardest categories of information to be accessed include:

- **Operational data** of private sector CI,
- Information about CI **across the national/regional borders,**
- Information about CI **across public-private sector borders,**
- Information about CI dependencies **during non-normal operation.**

In addition, respondents indicated that reliable data of CI financial aspects and CI failure status are also not easy to obtain from CI management entities.

According to end-users,

- **climatic and weather information for specific (emergency) area**, and
- **geo-location information** about public / private sector CI,

are described as the relatively easiest to obtain.

Concluding, most of the categories (excluding e.g. mentioned climatic/weather data) of information considered in the questionnaire were assessed **as relatively hard to obtain**, since the average rate for these categories is below 3, and often below 2,5 (in the scale ranging from 1 – the hardest, to 5 – the easiest accessible information). This observation indicates a serious problem related to information accessibility, and what is worth noticing, challenges related to acquisition of necessary information exist **regardless of the CI functioning sector** (i.e. private versus public).

4.2 Decisions Support Systems

About 40% of respondents reported that they **do not use any ICT-based support** for their decisions. The majority of remaining 60% of respondents stated that they (or their organisations) use internally developed tools for specific purposes of their organisation, or alternatively, that they use various loosely coupled data sources (such as GIS resources, the weather data, etc.) to support decisions. Considering specific DSS tools used by CIPRNet end-users, examples such as C3M, IPCR or WebEOC have been listed. These systems are exploited for the crisis response planning, reporting, procedure and policy creating, resource allocation and tracking.

When asked about the analytical capabilities, as well as about usefulness and effectiveness of these systems during crisis-related decision-making, respondents presented different views. About half of them admitted that the used (DSS) systems **do not meet their needs** and that these systems **are not tailored to the specific needs** of their operation. As respondents emphasised, the main weakness of these systems is **the need for advanced customisation** (costly in terms of time, efforts, financing, etc.). Other drawbacks include:

- lack of **interconnectivity** with the other systems (e.g. used by entities cooperating with stakeholder's organisation during CI-related crisis),
- lack of possibility to **integrate the data** from other entities/systems, hampering the cooperation between various organisations,
- limited capabilities of **spatial visualisation of threats**, and
- lack of capabilities to **support comparison** of the current situation to earlier forecasts.

Cross-border decision-making is another open gap of the used systems, impacting end-user operation.

The CIPRNet interviewees listed also various kinds of the information sources that are used for building the situational awareness in the emergency response efforts. These include mainly external sources such as cooperating entities and agencies involved in emergency response, which provide hydrological data, the weather forecasts and the information about CI (including geo-location). Other sources of information are the direct reports from the field/emergency area. Usually, such information is **not publicly available**. However, end-users **can access that information in real-time** or near real-time.

Considering the open sources of information, respondents indicated the media and citizens.

4.3 "What-if", consequence and CI dependencies analyses

Respondents stated that the primary need for simulation models relates to **consequences of CI object failure**, employing e.g. **cascade models** of infrastructure failures. End-users indicated different **scales of such consequences**, varying from impact on another single system, up to consequences for national security, societal impact, national economy, etc.

Moreover, respondents noticed lack of models supporting estimation of **CI restoration time, identification of critical nodes** (supporting CI objects prioritisation) and simulation models relevant to a **given, specific sector** (e.g. applicable for health care services during CI failure).

Asked for what should be improved in relation to decision-support for emergency management, respondents identified four main areas of interests:

1) **Simulation and modelling**, in particular development of threat modelling and forecasting tools, e.g. for simulation of the consequences of possible decisions.
2) **Estimation of crisis impact**, both on low level (e.g. impact of CI object failure on e.g. hospital functioning), as well on higher level – for example estimation of CI failure costs including national economy losses.
3) Emergency **communication**, namely:
    - information/data sharing,
    - timeliness of received information,
    - exchange of information among cooperating agencies and organisations in real-time,
    - compatibility of data formats,

- mechanisms to support informing about hazards, etc.

4) **Cooperation** and **training** between solution providers and emergency management teams

According to the respondents, closer **public-private cooperation** also could improve the current situation in decision-making.

The respondents also indicated problems related to the current assessment of CI dependencies. The most significant examples include:

- Limited capabilities of simulations, particularly in terms of simulating **interrelations between various CI** and **analysing the threats** based on such relationships.
- Organisations and CI operators **isolation**. In other words, organisations often do not effectively take into account consequences of their infrastructure failures, exceeding beyond their organisations and impacting other sectors, companies, etc.
- Lack of systematic **planning of CI protection and restoration after a crisis**, as well as lack of procedures supporting such protection.
- Problems with identification of **contact points** that in a case of crisis should be immediately available for responsible entities.
- International **standardisation** in the CIP area.
- Information **accessibility.**
- Data **validation** and **reliability.**

5 User requirements

5.1 Requirements description template and interpretation

The CIPRNet requirements are specified using the template presented in Table 2 and consist of the following fields:

- **ID** - is a unique identification number of the requirement, that is a combination of the type and number of requirements.
- **Priority** (MoSCoW) – is determined by the importance of the requirement for end-users. Importance is determined by M(ust), S(hould), C(ould) or W(ould) priorities.
- **Source** - indicates the origin of a given requirement (e.g. DoW, Consortium experience, end-user/stakeholder).
- **Version** - shows the evolution of the requirement.
- **Description** – provides explanation of the requirement.
- **Comment** – additional, relevant information can be placed here, e.g. reference requirements, comments, examples, etc.

Table 2: CIPRNet requirements template

ID		**Priority (MoSCoW)**	
Source		**Version**	
Description			
Comment			

5.2 Formalised requirements

All requirements gathered in this section are formulated using the imperative form, and **concern only the CIPRNet DSS with consequence and "what if" analyses** (to be developed in WP6/WP7). In other words, statements such as "provide something", "use something", "be applicable", etc., should be considered as e.g. the CIPRNet DSS should (or must - depending on the requirement priority) be applicable, the CIPRNet DSS must provide, etc.

Requirements are gathered and divided into the five sub-sections. IDs describing the requirements correspond to these sections, namely:

- GEN_req#xx – general, high level requirements,
- FUNC_req#xx – requirements on the CIPRNet DSS functionalities, setting the direction for further development of the DSS and describing what should be included in the DSS, and how it should/must work,
- DATA_req#xx - requirements on data/models used in the CIPRNet DSS, indicating what input data should be used for modelling and simulation purposes and how the data should be processed in the DSS,
- DATA_req#xx – the CIPRNet DSS front-end requirements, taking into account end-user wishes regarding the interaction between an operator and the DSS, user interface design, and the DSS usability,
- OA_req#xx – other aspects of the DSS functioning.

5.2.1 General requirements

ID	GEN_req#10	Priority (MoSCoW)	S
Source	CIPRNet consortium expertise DoW End-users	Version	V3
Description	Be applicable in various crisis scenarios.		
Comment	I.e. be applicable during both man-made crises, as well as crises caused by natural forces.		

ID	GEN_req#20	Priority (MoSCoW)	S
Source	CIPRNet consortium expertise DoW	Version	V3
Description	Provide support for the following phases of the incident-response cycle: • pro-action (awareness demo), • prevention (“what-if”), • preparation (exercises, (“what-if”) scenario walk through), • incident response (“what-if”), • recovery (“what-if”, selecting course of action) and • aftercare (incident reply).		
Comment			

ID	GEN_req#30	Priority (MoSCoW)	M
Source	End-users	Version	V2
Description	Be efficient and effective.		
Comment	With regard to situation without the CIPRNet decision support system. Provide added value for end-users.		

ID	GEN_req#40	Priority (MoSCoW)	M
Source	CIPRNet consortium expertise DoW	Version	V4
Description	Be reliable and fault tolerant.		
Comment	End-users are afraid that the CIPRNet DSS may be down just in the situation when it is mostly needed. Therefore, fault tolerance must be ensured.		

ID	GEN_req#50	Priority (MoSCoW)	M
Source	CIPRNet consortium expertise DoW End-users	Version	V4
Description	Take into account both the national and European ethical frameworks.		
Comment			

ID	GEN_req#60	Priority (MoSCoW)	M
Source	CIPRNet consortium expertise DoW End-users	Version	V3
Description	Take into account both the national and European legal frameworks.		
Comment			

ID	GEN_req#70	Priority (MoSCoW)	M
Source	CIPRNet consortium expertise DoW	Version	V3
Description	Provide decision support during international (cross-border) crises.		
Comment			

ID	GEN_req#80	Priority (MoSCoW)	S
Source	CIPRNet consortium expertise DoW	Version	V2
Description	Include CI organisational aspects (procedures, dependencies) in analyses.		
Comment			

ID	GEN_req#90	Priority (MoSCoW)	S
Source	CIPRNet consortium expertise DoW End-users	Version	V3
Description	Have high performance.		
Comment	E.g. quick response and short start time.		

ID	GEN_req#100	Priority (MoSCoW)	S
Source	CIPRNet consortium expertise DoW End-users	Version	V3
Description	Use relevant open standards wherever feasible in order to provide an extensible access to/with the DSS for other applications, data sources and visualisations.		
Comment	E.g. open standards for communication (e.g. use of web service technologies to allow CI operators to fill in the status of their CI) and data formats, open standards for data exchange mechanisms, mobile applications environment.		

ID	GEN_req#110	Priority (MoSCoW)	M
Source	CIPRNet consortium expertise DoW End-users	Version	V4
Description	Provide security (e.g. safe storage and transportation, integrity, availability and confidentiality) for data used within the CIPRNet DSS system.		
Comment	Not all data will require the same security level (e.g. open versus sensitive data).		

ID	GEN_req#120	Priority (MoSCoW)	S
Source	CIPRNet consortium expertise	Version	V3
Description	Be scalable in order to maximise the number of simulators (e.g. based on parallel threads).		
Comment	Models shall run independently of the DSS (either as a multiplexed process on the same hardware, or (remotely) connected via a communication channel on another piece of hardware).		

5.2.2 Requirements on the CIPRNet DSS functionalities (analysis, decisions)

ID	FUNC_req#10	Priority (MoSCoW)	M
Source	CIPRNet consortium expertise DoW	Version	V3
Description	Incorporate “what-if” analysis into the CIPRNet DSS system.		
Comment	Two different modes of usage of the DSS should be available: “What-if analysis” and “Real-time monitoring” modes which allow the execution of tests and the real-time support in case of natural disasters events, respectively.		

ID	FUNC_req#20	Priority (MoSCoW)	S
Source	CIPRNet consortium expertise DoW	Version	V2
Description	Allow for exploring various possible courses of action through consequence analysis.		
Comment			

ID	FUNC_req#30	Priority (MoSCoW)	M
Source	CIPRNet consortium expertise DoW End-users	Version	V4
Description	Estimate CI, social, economic, and environmental impact for use in consequence analysis.		
Comment	Using infrastructure simulators (e.g. I2Sim, federated simulation), factor analysis, etc. The DSS will incorporate socio-economical and other suitable models (e.g. factor analysis based models) for consequence analysis addressing the cross-cutting criteria of the ECI directive. According to decisions taken by CI operators and to the state of CIs, those may have impact on society as well as on economic activities.		

ID	FUNC_req#40	Priority (MoSCoW)	M
Source	CIPRNet consortium expertise DoW	Version	V3
Description	Allow for evaluation of mutual impact of CI, taking into account CI dependencies.		
Comment	The DSS analysis shall properly reflect first order CI dependencies taking into account physical aspects (disruption and recovery characteristics) and organisational & technical measures in effect. The DSS analysis shall reflect known second and third order CI dependencies due to changed mode of operation.		

ID	FUNC_req#50	Priority (MoSCoW)	M
Source	CIPRNet consortium expertise DoW End-users	Version	V4
Description	Allow for using real-time (or near real-time) sensorial data.		
Comment	e.g. weather forecast, weather now-casting, seismic monitoring, remote sensing imaging		

ID	FUNC_req#60	Priority (MoSCoW)	S
Source	CIPRNet consortium expertise DoW End-users	Version	V2
Description	Allow for using common geo-localisation data for analysed critical infrastructures.		
Comment			

ID	FUNC_req#70	Priority (MoSCoW)	S
Source	CIPRNet consortium expertise DoW	Version	V2
Description	Support decisions related to CI restoration activities after crisis.		
Comment			

ID	FUNC_req#80	Priority (MoSCoW)	S
Source	CIPRNet consortium expertise DoW End-users	Version	V3
Description	Support decisions related to evacuation management during crisis.		
Comment			

ID	FUNC_req#90	Priority (MoSCoW)	M
Source	CIPRNet consortium expertise DoW	Version	V3
Description	Support evaluation of vulnerabilities of different CI systems.		
Comment	E.g. when CI is particularly vulnerable to landslides, earthquakes, flooding, etc.		

ID	FUNC_req#100	Priority (MoSCoW)	S
Source	CIPRNet consortium expertise DoW End-users	Version	V2
Description	Support decisions related to resource allocation and their management during a crisis.		
Comment			

ID	FUNC_req#110	Priority (MoSCoW)	S
Source	CIPRNet consortium expertise DoW	Version	V3
Description	Enable DSS "what-if" analysis based on different time scales of a crisis.		
Comment	e.g. from seconds to several days		

ID	FUNC_req#120	Priority (MoSCoW)	S
Source	CIPRNet consortium expertise DoW End-users	Version	V2
Description	Enable analysis of scenarios within different geographical range.		
Comment	e.g. from single building (micro-scenarios) to large areas covering several countries		

ID	FUNC_req#130	Priority (MoSCoW)	M
Source	CIPRNet consortium expertise End-users	Version	V3
Description	Forecast damage scenarios involving components of critical infrastructures.		
Comment	The evaluation of a damage probability of CI component should be conducted for a specified Risk Assessment Forecast Interval (RAFI) time frame. The out-come will be a damage scenario describing the affected CI components.		

ID	FUNC_req#140	Priority (MoSCoW)	M
Source	CIPRNet consortium expertise	Version	V2
Description	Respect Risk Assessment Forecast Interval (48 hours).		
Comment			

5.2.3 Requirements on data/models used in the CIPRNet DSS

ID	DATA_req#10	Priority (MoSCoW)	S
Source	CIPRNet consortium expertise DoW End-users	Version	V3
Description	Enable quick access (minimising necessary time) to requested information.		
Comment	Access to e.g. information from sensors, historical data, etc.		

ID	DATA_req#20	Priority (MoSCoW)	M
Source	CIPRNet consortium expertise DoW	Version	V3
Description	Model CI data at appropriate level of fidelity, adapted to the goal of simulation.		
Comment	I.e. balancing between performance issues and usefulness of such models in the real crisis situation.		

ID	DATA_req#30	Priority (MoSCoW)	S
Source	CIPRNet consortium expertise DoW End-users	Version	V3
Description	Provide analysed information (e.g. besides the raw data), however be able to provide the raw data, whenever it is needed.		
Comment			

ID	DATA_req#40	Priority (MoSCoW)	M
Source	CIPRNet consortium expertise DoW End-users	Version	V3
Description	Allow for integration of meteo-climatological data, predictions and simulations.		
Comment			

ID	DATA_req#50	Priority (MoSCoW)	M
Source	CIPRNet consortium expertise DoW	Version	V3
Description	Include historical data (e.g. hydrological, statistics, lessons learned) in analyses.		
Comment			

ID	DATA_req#60	Priority (MoSCoW)	M
Source	CIPRNet consortium expertise End-users	Version	V4
Description	Enable sensing natural phenomena (e.g., geo-seismic data and weather data)		
Comment	Examples of the raw data to be considered are as follows: • seismic monitoring network (to obtain data about earthquakes such as localisation and magnitude),		

	• meteorological satellites network, • now-casting radar monitoring network, • satellite images: multispectral and/or SAR (Synthetic-aperture radar), • geographic web services (via WMS, WFS, WCS protocols), • flood forecasting (e.g. EFAS).

ID	DATA_req#70	**Priority (MoSCoW)**	M
Source	CIPRNet consortium expertise	**Version**	V3
Description	Allow for data gathering and processing.		
Comment	This should engage push and pull models that will be capable of storing a sub-set of gathered data in the CIPRNet DB.		

ID	DATA_req#80	**Priority (MoSCoW)**	M
Source	CIPRNet consortium expertise	**Version**	V3
Description	Use data coming from various sensors (e.g. meteorological data, hydrological models, etc.) and monitoring networks to forecast natural hazards such as precipitation abundance, wind speed and to assess earth quake impact (unforeseeable event).		
Comment	Existing models, simulations tools and data sources will be used. Also (if possible for a specific region) existing regional flood forecasting services will be adapted.		

ID	DATA_req#100	**Priority (MoSCoW)**	S
Source	CIPRNet consortium expertise	**Version**	V3
Description	Adapt models for earthquake events data acquisition (epicentre location and estimated magnitude), wave propagation and impact assessment.		
Comment	The DSS must rely on the seismic identification of earthquakes performed by e.g. INGV (National Institute of Geophysics and Volcanology) and expected damage scenarios evaluation.		

ID	DATA_req#110	**Priority (MoSCoW)**	S
Source	CIPRNet consortium expertise	**Version**	V2
Description	Use expected geo-area and location information from CI owners about the level of disturbed / disrupted service when assessing future (and what-if) states.		
Comment			

5.2.4 CIPRNet DSS front-end requirements

ID	GUI_req#10	**Priority (MoSCoW)**	S
Source	CIPRNet consortium expertise DoW End-users	**Version**	V2
Description	Be able to provide local/global view according to current needs of the operator.		
Comment			

ID	GUI_req#20	**Priority (MoSCoW)**	M
Source	CIPRNet consortium expertise DoW End-users	**Version**	V3
Description	Be intuitive for operator.		
Comment	Simplicity is required by operators (e.g. at ERNCIP meeting).		

ID	GUI_req#30	**Priority (MoSCoW)**	M
Source	CIPRNet consortium expertise DoW	**Version**	V2
Description	Have a user-friendly interface.		
Comment			

ID	GUI_req#40	**Priority (MoSCoW)**	S
Source	CIPRNet consortium expertise DoW End-users	**Version**	V2
Description	Provide visualisation of the threats.		
Comment	e.g. by visualising threats on the maps, using alert colours, etc.		

ID	GUI_req#50	**Priority (MoSCoW)**	M
Source	CIPRNet consortium expertise DoW End-users	**Version**	V3
Description	Support maps with multiple on/off critical infrastructure layers including indication of their state.		
Comment	Examples of considered layers include:		

	• street map/transportation layer, • energy grid layer • map view and a satellite view • augmented map view and a satellite view • impact layers (e.g. flood level; prediction +x hours). • scenario layers • map layers with impact estimation (e.g. socio impact, economic impact, etc.) • localised screens with key information on CI state and expected +x hour state for mobile local crisis response (e.g., app interface).

ID	GUI_req#60	**Priority (MoSCoW)**	C
Source	CIPRNet consortium expertise DoW	**Version**	V2
Description	Use visualisation based on a suitable WebGIS interface, in order to view and query maps, territorial data, CI information and others (e.g., events data, satellite images, etc.).		
Comment			

ID	GUI_req#70	**Priority (MoSCoW)**	C
Source	CIPRNet consortium expertise DoW End-users	**Version**	V4
Description	Show the current status of system the operation and visualise how it works.		
Comment	E.g. show in what step of the processing it currently is, e.g. by icons representing that the system is busy, processing progress 37/100%, etc.		

ID	GUI_req#80	**Priority (MoSCoW)**	S
Source	CIPRNet consortium expertise DoW	**Version**	V2
Description	Minimise the number of required clicks per action.		
Comment			

ID	GUI_req#90	**Priority (MoSCoW)**	S
Source	CIPRNet consortium expertise DoW End-users	**Version**	V2
Description	Provide all the necessary information in a form facilitating making right decisions in a short time.		

Comment	

ID	GUI_req#100	**Priority (MoSCoW)**	C
Source	CIPRNet consortium expertise DoW	**Version**	V3
Description	Provide consequence analysis results (in terms of elements such as economic loss/impact, loss of lives, etc.) in a printable form.		
Comment			

ID	GUI_req#110	**Priority (MoSCoW)**	C
Source	CIPRNet consortium expertise DoW	**Version**	V4
Description	Provide "what-if" analysis results (in terms of elements such as economic loss/impact, loss of lives, etc.) in a form facilitating extraction for inclusion in a MS Word-based (or other necessary) report.		
Comment			

ID	GUI_req#115	**Priority (MoSCoW)**	S
Source	End-users	**Version**	V1
Description	Use standard and widely understandable icons.		
Comment			

5.2.5 Other aspects

ID	OA_req#10	**Priority (MoSCoW)**	S
Source	CIPRNet consortium expertise	**Version**	V3
Description	The DSS should be supplied with manuals and tutorials to learn its proper usage.		
Comment	An operator course and its associated material should be supplied by the developer.		

ID	OA_req#20	**Priority (MoSCoW)**	S
Source	CIPRNet consortium expertise	**Version**	V3
Description	The DSS should be well integrated within processes and flows of organisations.		
Comment			

ID	OA_req#30	**Priority (MoSCoW)**	W
Source	CIPRNet consortium expertise	**Version**	V2
Description	Visualisation shall take into account the relevant standards for supporting visual handicapped people (red-green, small print, etc.)		
Comment			

6 Conclusions

This document reports work done in the Task 5.1 and provides general user requirements for the CIPRNet Decision Support System.

Requirements identified and formalised in this deliverable will be mainly used by WP7 ("Decision Support System with consequence analysis") as the guidelines for further work, such as final system specification and particular DSS components development.

Moreover, more detailed requirements will be specified provided by D7.1.

The document contains:

- **about 50 formalised general end-user requirements**,
- definition of end-user roles in the CIPRNet project,
- identification of the specific end-user groups that were contacted during the Task 5.1,
- description of the requirements collection process (including rationale for the CIPRNet questionnaire structure and scope), and
- analysis of end-user views on problems related to decision making process during CI crises.

The above mentioned analysis can be found in Section 4, and it is one of the main inputs for requirements formalisation process (together with the consortium expertise and Description of Work document).

The most important (and also the most common) issue raised by respondents through the project questionnaire is a lack of ICT-based support for decision making related to CI management. Approximately, about a half of respondents reported that they do not use any ICT tools for CI management, but some of remaining 50% stated lack of adjustment to specificity of their work and that used tools do not meet their requirements and needs. End-users reported also difficulties related to accessing the necessary information, insufficient (or ineffective) inter-agency cooperation, and lack of capabilities to model and simulate crisis consequences, as well as dependences between critical infrastructures.

7 References

[1] Bello-Dambatta, Aisha. The Development of a Web-based Decision Support System for the Sustainable Management of Contaminated Land. Diss. University of Exeter, 2010.

[2] Power D. J.. A Brief History of Decision Support Systems. DSSResources.COM, available online at http://dssresources.com/history/dsshistoryv28.html, accessed 12.08.2013.

[3] Eom, Sean B.. Decision Support Systems, International Encyclopedia of Business and Management." International Thomson Business Publishing Co., London (2001).

[4] Annex I – Description of Work (Annex to the Grant Agreement of CIPRNet).

Annex A: CIPRNet questionnaire (English version)

CIPRNet

Critical **I**nfrastructures **P**reparedness and **R**esilience Research **Net**work

CIPRNet Questionnaire
on
Decision Support Systems
for Emergency Management
involving Critical Infrastructures

Reply e-mail address: chorasm@utp.edu.pl

Project background: The Network of Excellence CIPRNet

The Critical Infrastructure Preparedness and Resilience Research Network or CIPRNet establishes a Network of Excellence in Critical Infrastructure Protection (CIP) R&D for a wide range of stakeholders including (multi)national emergency management, critical infrastructure (CI) designers and operators, CI branch organisations and associations, policy makers, manufacturers, and the civil society. CIPRNet is a project within the Seventh Framework Programme (FP7) of the European Commission, addressing Theme 10: Security.

CIPRNet builds a long-lasting, durable virtual centre of shared and integrated knowledge and expertise in CIP and CI MS&A (Modelling, Simulation and Analysis) by integrating part of the resources of the CIPRNet partners and their R&D activities in CIP. This centre will form the foundation for the European Infrastructures Simulation & Analysis Centre (EISAC) by 2020.

More on CIPRNet: see www.ciprnet.eu

Data policy

The CIPRNet consortium - particularly all those organisations involved in gathering, processing and analysing end-user needs - fully understand the sensitive nature of the subject and will not include any information in their publications that is not suitable for the public domain.

At the same time, all responders' personal details will remain anonymous and protected. Data and information obtained from the filled questionnaires will be exploited only for the project purposes (as defined in the CIPRNet description of work) and within the project duration.

We will store the data you provide with the questionnaire on internal computers of the CIPRNet partners for the purpose of building up an inventory of CIP expertise and experts that could be consulted for the research-related tasks of CIPRNet. All use of your personal data is confined to the purposes stated above, and is only undertaken to the extent necessary for these purposes. Personal data will not be transferred to third parties for any other purpose. You have a legal right to inspect any stored data concerning your person, and also the right to demand their correction or deletion, and to withdraw your consent for their further use.

Questionnaire context

This questionnaire is a part of the requirements collection phase of CIPRNet (Joint Activity 5.1: "End-user needs and requirements gathering"). The purpose of this questionnaire is to better understand stakeholders' requirements and needs related to the scope of CIPRNet. Particularly, the questionnaire is intended to collect end-user requirements contributing to improved decision-support capabilities for civil emergencies.
Our goal is to understand current gaps, challenges and requirements for improvements related to decision-support systems for emergency management (used during actual crises).

Personal data *[optional]*:

Name	
Organisation	
Position	
Country	
Email	

Organisational data *[mandatory]*:

Organisation type
- ☐ multinational
- ☐ pan-European
- ☐ national
- ☐ regional
- ☐ local / communal

Type of operation
- ☐ Public policy-maker
- ☐ Public emergency management
- ☐ Private / CI operator policy maker
- ☐ CI operator
- ☐ Manufacturer
- ☐ Emergency management response organisation
- ☐ Academic researcher
- ☐ Applied researcher
- ☐ Other

CIPRNet Questionnaire • Page 3 of 7

Questions

1. What important information related to Critical Infrastructure (CI) are the hardest to obtain for emergency management (during an actual emergency)?
   Please rate the various kind of information (1 for the hardest to obtain information, 5 for the easiest)

Sensitive/secret information about public sector CI	rate
Geo-location information of public sector CI	rate
Operational data of public sector CI operator	rate
Sensitive/secret information about private sector CI	rate
Geo-location information of private sector CI	rate
Operational data of private sector CI operator	rate
Information about CI dependencies during normal operation	rate
Information about CI dependencies during non-normal operation	rate
Information about CI across the national/regional borders	rate
Information about CI across public-private sector borders	rate
Climatic / weather information for specific (emergency) area	rate
Other _____	rate
Other _____	rate
Other _____	rate

2. What decision support system(s) (DSS for flood risk assessment, crowd management, etc.) for emergency/emergency support do you currently use, or plan to develop or obtain? Please fill in the table.

Full name of the system (reference the manufacturer if possible)	Area and objective of system operation

3. Are these DSS tools effective enough in emergency situations?

○ Yes ○ No

Why? Please justify your choice. Describe their strong and weak points.

4. Do you use any exchange standards or interfaces between the DSS and other information and data sources? Please fill in the table.

Data exchange mechanism	Communication between	Description of standard(s), interfaces and their use

5. What kind of information sources are used for situational awareness by the emergency response centre? Please fill in the table.

Information source (type/name)	Information provider	Openly available (Y/N)	Real-time (Y/N)

6. Do you miss any models and/or simulations about the state of CI, their dependencies, etc., which might be helpful for emergency management?

7. What should be improved (e.g., information availability, data exchange, simulation models, effectiveness, usability, …..) in relation to decision-support for emergency management?

8. Please indicate what aspects related to CI and their dependencies (e.g. models, simulations, etc.) are missing in the current emergency management operations.

9. Do you use „what if" or consequence analyses to analyse possible course of actions and to evaluate possible decisions related to a potential or actual CI failure?

○ Yes ○ No

If "Yes", please list what elements of such analyses require modifications and improvements. If "No", please list what elements of such analyses would be useful and might assist your emergency management.

10. Do you have a link to experts in CIP (who could support your actions related to CI preparedness and resilience)?

○ Yes ○ No

If "Yes", can you provide us with contact details for further follow-up?

No	Expert name	Email	Organisation	Kind of expertise
1				
2				
3				
4				

11. Would you like to establish contacts and to use knowledge and experience of experts from the CIPRNet network of experts?

○ Yes ○ No

If "Yes", what kind of expertise do you look for?

Annex B: CIPRNet questionnaire (Polish version)

CIPRNet

Critical **I**nfrastructures **P**reparedness and **R**esilience Research **Net**work

Ankieta CIPRNet

Systemy wsparcia decyzji (DSS)
dla zarządzania kryzysowego i
ochrony infrastruktur krytycznych

Adres zwrotny e-mail: chorasm@utp.edu.pl

Kontekst projektu: sieć doskonałości CIPRNet

Projekt CIPRNet (The Critical Infrastructure Preparedness and Resilience Research Network) ma za zadanie stworzenie sieci doskonałości dla szerokiego audytorium ekspertów w obszarze ochrony infrastruktur krytycznych (CIP). W kręgu zainteresowań CIPRNet są eksperci i organizacje międzynarodowe oraz lokalne z zakresu zarządzania kryzysowego, operatorzy oraz projektanci infrastruktury krytycznej, organizacje oraz stowarzyszenia z obszaru CI, organa regulujące i sprawujące nadzór oraz społeczeństwo. CIPRNet jest inicjatywą działającą w ramach Siódmego Programu Ramowego (FP7) Komisji Europejskiej (Temat 10 dotyczący bezpieczeństwa).

Dodatkowo, w ramach projektu CIPRNet zbudowane zostanie wirtualne centrum wiedzy i umiejętności oraz modelowania, symulacji i analizy na potrzeby CIP poprzez zintegrowanie części zasobów, którymi dysponują uczestnicy projektu. Centrum CIPRNet będzie podstawą do stworzenia EISAC (European Infrastructures Simulation & Analysis Centre) – Europejskiego Centrum Symulacji i Analizy w 2020 roku.

Więcej szczegółów na temat projektu dostępnych jest pod adresem www.ciprnet.eu

Polityka prywatności

Konsorcjum CIPRNet, a w szczególności organizacje, które bezpośrednio zaangażowane są w zbieranie, przetwarzanie i analizę opinii użytkowników projektu, są w pełni świadome poufności zebranych danych oraz przedmiotu badań. Dlatego też Konsorcjum zobowiązuje się do nieupubliczniania żdanych informacji (np. w formie publikacji naukowych), które nie powinny trafić do szerokiego grona odbiorców.

Wszystkie dane personalne respondentów pozostaną zabezpieczone oraz anonimowe. Dane oraz informacje uzyskane z wypełnionych ankiet zostaną wykorzystane tylko i wyłącznie na potrzeby projektu CIPRNet (zdefiniowane przez Konsorcjum i zaakceptowane przez Komisję Europejską) oraz podczas trwania projektu.

Kontekst ankiety

Niniejsza ankieta jest częścią procesu zbierania wymagań na potrzeby projektu CIPRNet, w ramach zadania JA5.1 ("End-user needs and requirements gathering"). Celem ankiety jest uzyskanie lepszego zrozumienia wymagań oraz potrzeb użytkowników i wszelkich interesariuszy rozwiązań proponowanych w projekcie.

W szczególności ankieta pomoże sformalizować wymagania na system wsparcia decyzji dla zarządzania kryzysowego oraz ochrony infrastruktur krytycznych. Naszym celem jest poznanie wad, ograniczeń, wyzwań i rekomendacji dla zmian obecnie wykorzystywanych systemów wsparcia decyzji oraz metod modelowania i symulacji w zarządzaniu kryzysowym.

Dane respondenta *[opcjonalnie]*:

Imię i Nazwisko	
Organizacja	
Stanowisko	
Kraj	
Adres e-mail	

Dane na temat organizacji:

Typ organizacji

- ☐ międzynarodowa
- ☐ działająca w ramach Unii Europejskiej
- ☐ narodowa
- ☐ regionalna
- ☐ lokalna / miejska

Typ działań

- ☐ Publiczna organizacja ustawodawcza / regulująca
- ☐ Publiczne centrum zarządzania kryzysowego
- ☐ Operator infrastruktury krytycznej
- ☐ Wytwórca / producent infrastruktury krytycznej
- ☐ Działalność akademicka/naukowa
- ☐ Inne

1. Jakie kluczowe informacje związane z infrastrukturą krytyczną jest najtrudniej pozyskać na potrzeby zarządzania kryzysowego?
Oceń wyszczególnione rodzaje informacji (1 dla najtrudniej osiągalnych, 5 dla najłatwiej osiągalnych informacji)

Dane na temat publicznego sektora infrastruktur krytycznych	rate
Informacje o geolokacji infrastruktur krytycznych z sektora publicznego	rate
Dame operacyjne publicznego sektora infrastruktur krytycznych	rate
Dane na temat prywatnego sektora infrastruktur krytycznych	rate
Informacje o geolokacji infrastruktur krytycznych z sektora prywatnego	rate
Dame operacyjne prywatnego sektora infrastruktur krytycznych	rate
Informacje dotyczące zależności infrastruktur podczas normalnego działania	rate
Informacje dotyczące zależności infrastruktur podczas sytuacji kryzysowej	rate
Informacje dotyczące infrastruktur krytycznych poza granicami danego kraju	rate
Informacje dotyczące infrastruktur krytycznych spoza danego sektora	rate
Dane klimatyczne / pogodowe dla danego obszaru	rate
Inne	rate
Inne	rate
Inne	rate

2. Jakiego systemu(-ów) wsparcia decyzji dla zarządzania kryzysowego aktualnie używasz, planujesz nabyć lub stworzyć??

Nazwa systemu	Obszar zastosowań oraz cel użytkowania systemu

3. Czy wymienione systemy DSS są wystarczająco efektywne w sytuacjach kryzysowych?

○ Tak ○ Nie

CIPRNet Questionnaire • Page 4 of 7

Uzasadnij swoją odpowiedź. Opisz mocne strony oraz wady wymienionych systemów.

4. Czy używasz jakichkolwiek standardów wymiany danych lub interfejsów pomiędzy różnymi systemami DSS?

Mechanizm wymiany danych	Komunikacja pomiędzy	Opis standardu lub interfejsu

5. Jakie źródła informacji zwiększające świadomość sytuacyjną używane są przez organizacje odpowiedzialne za zarządzanie sytuacjami kryzysowymi.

Źródło informacji (typ/nazwa)	Właściciel informacji	Dostępne publicznie (T/N)	Dostępne w czasie rzeczywistym (T/N)

6. Jakie modele lub symulacje dotyczące aktualnego statusu infrastruktury krytycznej, zależności pomiędzy CI, itd., mogłyby być przydatne na potrzeby zarządzania kryzysowego?

7. Jakie aspekty / elementy procesu decyzyjnego na potrzeby zarządzania kryzysowego powinny być usprawnione lub ulepszone (np. dostępność informacji, mechanizmy wymiany danych, modele i symulacje, itd.)?

8. Wskaż jakich elementów związanych z infrastrukturą krytyczną i zależnościami pomiędzy różnymi infrastrukturami brakuje w obecnych działaniach organizacji związanych z zarządzaniem kryzysowym?

9. Czy używasz (lub kiedykolwiek używałeś) analizy konsekwencji lub symulacji typu "what-if" do testowania / symulacji hipotetycznych sytuacji lub do oceny możliwych decyzji podejmowanych na potrzeby aktualnego lub przyszłej sytuacji kryzysowej związanej z infrastrukturą krytyczną?

○ Tak ○ Nie

Jeśli "Tak", wskaż które elementy takiej analizy wymagają modyfikacji lub usprawnień.
Jeśli "Nie", wskaż jakie elementy takiej analizy mogłyby być przydatne i mogłyby skutecznie wesprzeć działania w zakresie zarządzania kryzysem.

10. Czy kontaktujesz się z ekspertami (spoza Twojej organizacji) z obszaru ochrony infrastruktur krytycznych (którzy wspierają twoje działania w zakresie przygotowania na wypadek sytuacji kryzysowej lub ochrony takich infrastruktur)?

○ Tak ○ Nie

Jeśli "Tak", czy mógłbyś przedstawić bardziej szczegółowe dane kontaktowe dotyczące tych ekspertów?

No	Imię i nazwisko	Email	Organizacja	Zakres wiedzy eksperckiej
1				
2				
3				
4				

11. Czy w przyszłości chciałbyś kontaktować się oraz wykorzystywać wiedzę i doświadczenie ekspertów z sieci doskonałości projektu CIPRNet?

○ Tak ○ Nie

Jeśli "Tak", jaki rodzaj wiedzy i umiejętności byłby dla Ciebie najbardziej interesujący lub przydatny?