

# Multi-level Alignment of Regional Approaches to Critical Infrastructure Resilience by Learning from Experience

## Deliverable 2.3: Guidelines for the Development of Regional CIP-R Programmes

Project N.:	
Document Type:	Public
Document ID:	2.3
WP:	2
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Last modified:	12/06/2015
Version 1.0	12/01/2015
VRK revision:	18/02/2015
Version 2.0	
Revisions from partners:	
Final Version:	10/06/2015



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## Executive summary

MIRACLE is an ambitious project and aims at supporting regional Critical Infrastructure Protection and Resilience (CIP-R) strategies, in order to improve existing capacities of the EU Member States to prevent, prepare and protect people against security related risks, including terrorist attacks.

Specific objectives of MIRACLE are:

- to increase awareness and knowledge about regional CIP-R strategies with focus on issues that are also of interest at national or EU levels;
- to stimulate, promote and support the exchange of regional CIP-R experiences, in order to establish best practices and related guidelines, with the view to enhance and develop existing capacities at regional level;
- to develop and promote a multilevel framework to align regional strategies with national or EU policies, in order to increase the efficiency and coherence of existing and future CI strategies.

The present deliverable aims to provide Guidelines for the development of Regional CIP-R Programmes giving a rational and a clear justification of the role and relevance of all the key elements that are needed for a successful and sustainable programme development – context factors, main principles, management models and good practices. It is based on empirical analysis of existing regional programmes and on a critical review of existing similar guidelines and recommendations.

The main audience for this deliverable are regional policy makers and both private and public CI managers dealing with Critical Infrastructures resilience on a regional level. Here they can find a framework and all the elements needed to design the best CIP-R Programme for their region and to develop it over time by leveraging on local available resources and capacities, while being flexible and dealing with contingent limitations. The present deliverable is meant to be a dynamic “living document”, enhanced over time with more good practices and lessons learned.



## 1. Aim and Scope of the Guidelines

Effective Critical Infrastructure Protection and Resilience (CIP-R) depends on numerous stakeholders collaborating at different institutional and operational levels and exchanging information by means of a variety of channels. In this regard, regional initiatives have emerged worldwide as one of the key strategies to deal with CIP-R issues in the context of Emergency Management (EM) and Community Resilience policies. Recent research has set the theoretical base of Public-Private Partnerships (PPP) and claimed their high potential for enhancing CIP-R that is vastly unexploited due to challenges in their establishment and management. It is now necessary to move forward to addressing the practical side of these regional programmes.

What is a region? For the purpose of present Guidelines, a *region* is an area that is recognised as such by its stakeholders. A region can be a single or multi-jurisdiction area, portion of a state (or province), or may span national borders. Regions have established cultural characteristics, and are cemented by common social and economic activities; as such, they are restricted by geographic boundaries and tend to coincide with the service area of the infrastructures that serve them.

We recognise that the emerging phenomenon of Regional CIP-R Programmes and related PPP is not homogeneous; in fact, different originating needs, opportunities and institutional backgrounds are apparent. Similarly, in their origin and continuous evolution, regional CIP-R programmes show widely different focus, scope and objectives; they range from pure CI interdependencies analysis to the full and systematic implementation of devolved responsibilities on CIP-R and Emergency/Disaster Management. The local PPP's supporting the programmes are radically different in size, composition and governance model.

Although the strong influence of contingent factors might be regarded as jeopardising the effectiveness of Regional CIP-R programmes, since this prevents the definition of a standardised “optimal” development plan, there is evidence that it actually represents a powerful element of flexibility and adaptability. Ongoing experiences and good practices, such as those reported in the following sections of this report, demonstrate that there are plenty of options for successfully leveraging on unique local opportunities and overcoming weaknesses in the social and institutional context. Whereas a national or continental top-down approach to CIP-R tends to be monolithic, to set common state-wide goals and requirements, a regional programme does not necessarily; it can be shaped by a bottom-up approach, adding a very powerful high-level resilience capability to the overall CIP-R strategy.

Here the need for identifying how to practically develop a balanced top-down and bottom-up approach, able to harmonise the advantages and benefits of both perspectives, clearly emerges. To avoid possible misalignments and incompatibilities of CIP-R programmes at different levels, enlightened governance uses a top-down approach to create a collaborative environment in which regional stakeholders can then be supported to develop solutions meeting local requirements. The paradox of creating a regulatory space (top down) in support of self-determination / subsidiarity (bottom up) is well addressed in many European



developments, and gains some support as an approach in PPP for CIP-R in our analysis (see section 5 et. seq.). In the Netherlands, for example, some regions (as recognised by the CI stakeholders) consist of multiple safety regions. The CI stakeholders do not want to deal with different approaches per Safety Region and therefore are happy with a national framework.

Guidelines, recommendation, and lists of best practices to support the development of CIP-R programmes are already available; some of them are specifically intended for regional applications. However, almost all suffer the limitation of proposing a unique, standardised, thus rigid, design and implementation process. Such an approach is in clear contrast with the wide differentiation of start-up and evolutionary processes of existing successful experiences. These Guidelines are grounded on the full recognition of the value brought by this heterogeneous landscape, and are the result of the attempt to understand and identify the key factors for a more contingency-driven approach to Regional CIP-R Programme development.

Local policy makers and CI managers need to understand how to design a Regional CIP-R Programme, to implement specific policies, and how to assure the long-term sustainability of the same to achieve the goal and the objectives agreed with local stakeholders (PPP).

Therefore, the aim of the present Guidelines for the development of Regional CIP-R Programmes is to provide a rational and a clear justification of the role and relevance of all the key elements that are needed for a successful and sustainable programme development. Legislation, PPP size and governance model, as well as CIP-R programme goal and objectives are considered as given context factors. As such, they influence the features of the programme and the most appropriate way of its implementation.

In addition, the guidelines offer an overview of some possible strategies for the start-up and, subsequently, the long-term development of a Regional CIP-R programme.

The ambition is to provide regional policy makers and CI managers with a framework and all the elements needed to design the best CIP-R Programme for their region and to develop it over time by leveraging on local available resources and capacities, while dealing with contingent limitations.

## 2. Terms and Definitions

**All-hazard approach:** a way of CIP-R development able to comprise all conditions, environmental or manmade, accidental or intentional, that have the potential to cause injury, illness, death, or loss of assets, service delivery, or other intangibles; or alternatively causing functional social, economic, or environmental harm.

**Critical Infrastructure (CI):** an asset, system or part of thereof (located in Member States) that is essential for the maintenance of vital societal functions, health, safety, security, economic or social well-being of people, and the disruption or destruction of which



would have a significant impact (in a Member State) as a result of the failure to maintain those functions.<sup>1</sup>

**Critical Infrastructure Protection (CIP):** includes the set of strategies, processes, resources and solutions to safeguard vulnerable critical infrastructure assets and assure the continuity of their vital functions.

**Critical Infrastructure Resilience (CIR):** the ways to guarantee the functional continuity of the services provided by infrastructures in time of stress and disaster, to limit the extent of losses and impacts in the urban area if a disaster strikes, as well as to ensure fast recovery of normal service conditions even when the infrastructure is severely damaged.

**Emergency Management (cycle):** the (continuous) process to prevent, mitigate, prepare for, respond to, and recover from disruptions and disasters induced by any type of threat (see All-hazard approach). It is generally divided into four main phases: prevention, preparedness, response and recovery.

**Good Practices (GPs):** any specific methods, procedures, tool or technologies to successfully address the management issues of Regional CIP-R Programmes, and to foster the achievement of their main objectives and goals, as demonstrated by real-life applications and related benefits.

**Public-Private Partnership (PPP):** describes a government service or private business venture, which is funded and operated through a partnership of government and one or more private sector companies. From an organisational theory perspective, PPP is a network, the prevalent form of multi-organisational governance<sup>2</sup>.

PPP has also become increasingly popular as a very effective way to deliver a range of different services, including security, disaster risk management, critical infrastructure protection or resilience. In this report, PPP is to be understood as the collaboration of stakeholders, e.g. government, public or private CI operators, responders, and communities, in order to increase the resilience of essential services that our communities rely on.

**Region:** an area that is recognised as such by its stakeholders. A region can be a single or multi-jurisdiction area, portion of a state (or province), or may span national borders. Regions have established cultural characteristics, and are cemented by common social and economic activities; as such, are restricted by geographic boundaries and tend to coincide with the service areas of the infrastructures that serve them.

**Regional CIP-R Programme:** planned and coordinated set of activities for achieving better Critical Infrastructure Protection and Resilience at regional level, jointly undertaken by public and/or private organisations without a predetermined time limit.

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<sup>1</sup> European Council, Directive 2008/114/EC on the identification and designation of European critical infrastructure and the assessment of the need to improve their protection, Brussels, December 2008.

<sup>2</sup> Petrenj. B. 2013 “Understanding the role and contribution of inter-organisational information sharing and collaboration to Critical Infrastructure resilience : a multidimensional investigation”. PhD Thesis.



**Resilience:** the capacity of a system, community or society exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase this capacity for learning from past disasters for better future protection and to improve risk reduction measures.

**Resilience core functions:** resilience, as a property or capacity of a complex socio-technical system, comprises five broadly set core functions: sense, build, reconfigure, re-enhance, and sustain. *Sense* core function is related to how the system tries to improve visibility and early detection of threats. *Build* signifies a set of activities carried out to acquire and enhance proper capacities enabling proactive and/or reactive response. *Reconfigure* relates to high-level functions to, temporarily or permanently, change system's structure, assets, as well as service mix and delivery processes (*adaptation* can be seen as a lower-level reconfigure function, executed for withstanding with minor events). *Re-enhance*, encompasses both the ability to recover from disruptive events and to take advantage from any opportunity for improvement they might lead. Finally, continuing to perform in one manner or another is an important feature that reduces the unwanted long-term consequences of stopping and later recovering, that is the essence of *sustain* core functions.

**Vulnerability:** the susceptibility of a system, community or society to the damaging effects of hazards and threats.

### 3. Background knowledge and study methodology

These guidelines represent one of the main results of the MIRACLE project, which aims to support regional Critical Infrastructure Protection and Resilience (CIP-R) strategies, to improve existing capacities of the EU Member States to prevent, prepare and protect people against security related risks, including terrorist attacks. Specific objectives of Miracle are:

- to increase awareness and knowledge on regional CIP-R strategies with focus on issues, that are also of interest at national or EU levels;
- to stimulate, promote and support the exchange of regional CIP-R experiences, in order to establish best practices and related guidelines, with the view to enhance and develop existing capacities at regional level;
- to develop and promote a multilevel framework to align regional strategies with national or EU policies, in order to increase the efficiency and coherency of existing and future CI strategies.

Thanks to the achievements of MIRACLE's research activities, the present Guidelines are rooted in a rich ground of multifaceted knowledge, including:

- the professional experience of the experts that directly contributed to the project (belonging to the partner organisations of MIRACLE or involved, as external experts, in focus groups, workshops and assessment exercises);



- an international survey on Regional CIP-R Programmes, covering: concepts, governance models, aim and scope, processes and activities (main findings are reported in Deliverable 3.1.1);
- a review of the state of the art of existing guidelines and good practices for CIP-R;
- an in-depth analysis and comparison of some relevant international cases on Regional CIP-R programmes;
- a selection and assessment of Good Practices (GPs) for the implementation of Regional CIP-R Programmes.

The following sections report a summary of the most relevant background knowledge, and the description of the methodology adopted in the study, respectively.

### 3.1. State of the art review

#### 3.1.1. Guidelines and recommendations for CIP-R programme development: international overview

##### *ENISA's Good practice Guide on Cooperative Models for Effective Public Private Partnership*

The effort of ENISA (the European Network and Information Security Agency) in this field focuses on trying to analyse understand and promote the models of PPPs at national and pan European levels. In 2009, ENISA issued its Good Practice Guide (GPG) on Information Sharing aimed at assisting Member States and other relevant stakeholders in setting up and running Network Security Information Exchanges in their own countries. In 2011, ENISA's *Good Practice Guide* [2] classified PPPs for security and resilience and revealed the main five components addressing Why, Who, How, What and When questions associated with creating and maintaining PPPs. It mostly contains general advice for PPPs, helping stakeholders to easily choose those aspects that will add value to their endeavours in setting up and running PPPs. ENISA here discusses and offers high-level recommendations on principal questions on how to build successfully PPPs (for resilient IT security in their context) such as:

- 'Why is a PPP needed?'
- 'Who should it involve?'
- 'How should it be governed?'
- 'What services and incentives should be offered?'
- 'When action should be taken to start it and maintain sustainability?'

These aspects are a good basis and all very important to guide high-level decisions. Still, when it comes to practical implementation and solving problems at hand, GPs that have proved to be successful can save practitioners many time and troubles, offering solutions that are (near) ready to apply. Of course, the question of transferability has to be considered.



*FEMA’s Attributes which identify a successful partnership*

Participants of the first national conference on “Building Resilience through Public-Private Partnerships” in 2011 discussed the set of essential attributes to assess/measure ‘state-of-practice’ of PPPs in emergency management and came up with the PADRES model (**P**ublicly **A**ccessible, **D**edicated, **R**esourced, **E**ngaged, **S**ustainable) [1].

Table 1. Fundamental attributes of a successful PPP - PADRES [1]

<b>Publicly Accessible</b>	<i>“...the contacts, leadership, skills, information, resources, and capabilities of the collaborative partnership are recognized, available and accessible by the general public. This ensures that before, during and after an incident, the general public has trust and confidence in the partnership to provide accurate and timely information and meaningful services in support of protecting life and property.”</i>
<b>Dedicated</b>	<i>“...successful partnerships have identified a full-time liaison or other organizational structure to staff and manage the public-private partnership, and implement the partnership’s strategic plan.”</i>
<b>Resourced</b>	<i>“...resourced partnerships have funding, facilities, tools, and staffing available to support partnership efforts.”</i>
<b>Engaged</b>	<i>“...there should be active support, participation, and two-way communication by public and private sector leadership and members in a successful partnership. The partnership trains, exercises, prepares, responds, recovers and mitigates actively.”</i>
<b>Sustainable</b>	<i>“...sustainable partnerships are supported by strategic plans, funds, and resources necessary for long-term viability. Activity takes place around the year, and throughout the emergency management cycle.”</i>

The PADRES model has subsequently been used to evaluate maturity levels and capabilities of different PPP levels/sizes across the US.

*BUCOPCI’s Business Continuity and Security Plan Best Practices*

The main results of BUCOPCI project (Business Continuity Planning for Critical Infrastructures) are distilled into the Business Continuity Best Practices Report [3] and Security Plan Best Practices Report [4]. They were based on responses of six Critical Infrastructure Operators on Spanish territory, through surveys processed anonymously.

SUBSECTORS	QUESTIONNAIRES RECEIVED
Air transport	2
Road Transport	2
Rail Transport	2
Maritime transport	0

Figure 1: BUCOPCI questionnaire responses [3][4]



The aim of the project was primarily focused on showing the percentage of compliance to the *BCM* principles/standards [3] and the level of compliance to the *Operational Security Management* among CI Operators [4]; thus, it does not provide very detailed information on existing best practices for the proper implementation of the standards.

### *Recommended Elements of Critical Infrastructure Protection for Policy Makers in Europe (RECIPE)*

RECIPE's *Good Practice Manual on CIP Policies* [5] brings a set of GPs for covering areas of interest in CIP policies. Those include:

- Identification of Critical Infrastructure
- Dependencies
- Public-Private Partnerships
- Information Sharing
- Risk Management and CIP
- Crisis Management and CI

Three dimensions that have a strong influence on the attainability of a large part of the practices have been considered. These dimensions are:

- Involvement of private parties
- Mandated or voluntary co-operation structure
- Required CIP maturity

The Good Practices were given in form of high level principles or theoretical approaches (i.e. policy level). A number of principles have been supported by references on where this kind of principle has been used. But still, not dealing with the practical way in which a practice/approach had been applied.

It is very useful for having an overview on how to think about different issues before selecting an appropriate practical tool/technique to cope with it.

### *TISP Regional Disaster Resilience Guide*

The 2011 edition of The Infrastructure Security Partnership (TISP) Regional Disaster Resilience Guide for Developing an Action Plan (or RDR Guide) is a roadmap that describes a step-by-step process that can be customized to develop a cross-sector, multi-jurisdiction strategy to improve capabilities to deal with any major incident or disaster. The RDR Guide is designed for use by any practitioner or expert who wishes to improve the capabilities of their organization or community to withstand major incidents or disasters. For those who want to build a PPP in their community or region to enhance resilience, the RDR Guide provides a blueprint for them to follow. It is designed to be complementary with United States federal infrastructure protection and disaster preparedness/management policies, directives, and programs, such as the 2010 National Security Strategy; National Infrastructure Protection Plan; and the National Response and National Recovery Frameworks.

Like the original version published by TISP in 2006, the updated RDR Guide contains:



- basic information, such as key definitions and fundamental principles underlying the need for, and how to achieve regional resilience;
- background on infrastructure interdependencies and potential impacts;
- a comprehensive list of focus areas and priority issues that should be considered, and
- a checklist of typical preparedness gaps with recommended activities to address them.

The new RDR Guide significantly expanded, thanks to new information and insights gleaned from the past five years of the lessons learned from disasters and major disruptions, exercises, workshops, studies and assessments.

Most importantly, the new RDR Guide outlines a multi-step approach to develop a regional resilience Action Plan (Figure 2) through identifying and bringing together in partnership the necessary broad stakeholder base of public, private and non-profit organizations; conducting workshops, a baseline assessment of capabilities and needs; an interdependencies exercise; and other activities to develop a resilience roadmap. The approach outlined in the updated RDR Guide is essentially a holistic, systematic multi-step process that provides a baseline of stakeholder-validated regional resilience needs and activities covering preparedness through long-term restoration.

Lastly, the RDR Guide addresses the challenges facing Action Plan implementation and offers practical ways to organize, maintain, and sustain continued stakeholder collaboration and interest and obtain necessary funding and expertise to move towards regional resilience. To supplement the RDR Guide, a web-based RDR Guide Toolkit of resources is available at the TISP website ([www.tisp.org](http://www.tisp.org)). The toolkit provides examples, templates, and information on plans, procedures, tools, technologies, case studies and other “best practices” with useful links to websites of government, private sector, and non-profit organizations for additional information, as well as access to TISP member expertise.

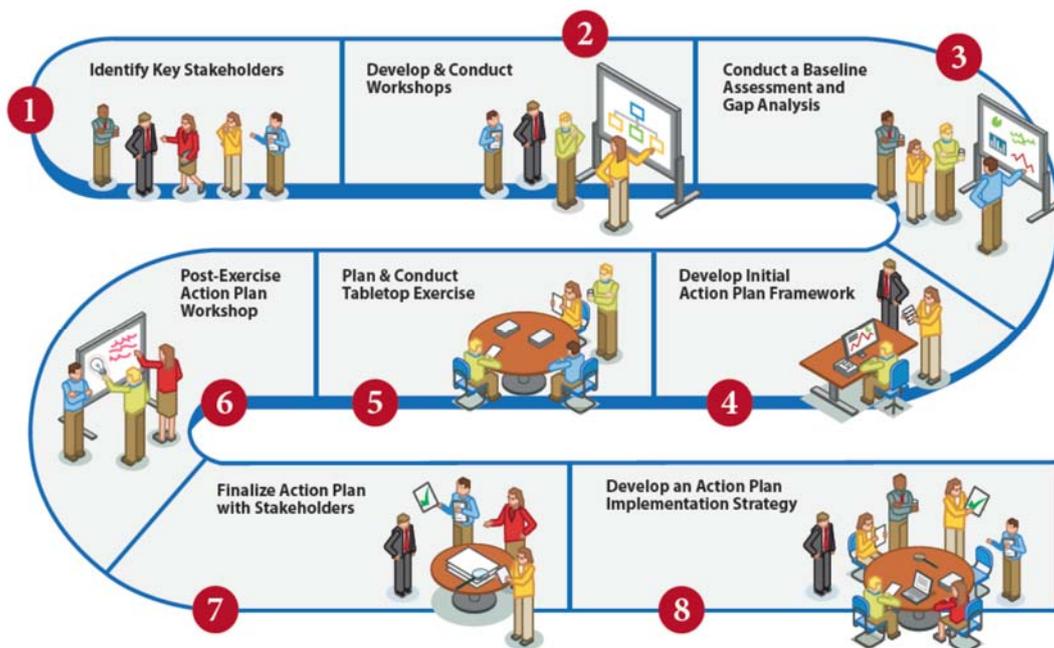


Figure 2. Multi-Step Regional Resilience Guide Action Plan process.



### 3.1.2. International cases of Regional CIP-R programmes and related PPPs.

One of the key activities within MIRACLE project was to identify active regional CIP-R programmes and select representative cases for a detailed case description – on top of the three case studies of the project participants (Kennemerland, Scotland and Lombardy). The primary source of data was the MIRACLE project online survey aimed to review the existing Public-Private collaboration schemes (applied to address CIP-R issues) and to characterise the main features and modes of collaboration for further assessment and gap analysis. Leveraging on the 159 survey responses, it was possible to identify active regional CIP-R programmes and collect additional information such as *references* – public documents, reports and web-presentations, and *direct contacts* of the people involved in existing regional programmes. The secondary source of data was digging into scientific and professional literature and Institutional websites. More detailed information about identified existing PPP cases and GPs (both from the survey and from the secondary sources) were then collected through available public information or direct contact with people involved in these practices, mainly through focus groups and/or interviews.

The detailed description and analysis of the seven cases are reported in Deliverable 2.2, whereas Table 2 reports a summary of the main characteristics of six (out of seven) cases that are grounded on a Public-Private collaboration and, as such, are more relevant for the objectives of the present Deliverable.

Despite all the cases refer to a local dimension, they differ a lot in terms of institutional context and size of the Public-Private collaboration. It may also be noted that goals and objectives are largely heterogeneous, ranging from enhancing Emergency Management coordination to the development of a fully integrated regional resilience strategy.

Additional relevant findings that emerged by the in-depth analysis of the case studies are:

- The continuous improvement strategy implemented in most of the cases is based on a sequence of small but touchable win-win achievements; there are no cases of large programmes fully financed over a long time horizon;
- Activities and implemented technological or organisational solutions are largely focused on EM cycle; resilience functions are not emphasised as core dimensions to develop the contents of the programmes;
- Collaborative and qualitative approaches to solution design are dominant;
- Understanding/modelling and documenting interdependencies are issues addressed by almost all the programmes as part of the key prevention activities;
- Enhancing information sharing among all the public and private stakeholders is regarded as one of the key success factors and is deserved of specific support platforms and reference agreements;
- Exercises are the most common practice used to enhance awareness, trust and to build inter-organisational collaboration culture between public and private stakeholders.



Table 2. Summary of the main characteristics of the reviewed Regional CIP-R Programmes and related PPPs

Characteristics	Kennemerland Safety Region (The Netherlands)	Lombardy Region (Italy)	Louisiana (US)	Montreal Metropolitan Community (Canada)	Pacific Northwest Economic Region (US and Canada)	Scotland (UK)
<b>Origin</b>	Improving EM capabilities for key regional infrastructures	Evolution of current Emergency Management policies and strategies at regional level	Lesson Learned from Katrina on Emergency Management	Understanding and management of CI interdependencies	Inclusion of EM and CIP-R issues within a wider cross-border cooperation framework	Implementation and harmonisation of devolved responsibilities on CIP policies and strategies at national level
<b>Focus</b>	Emergency Management	Emergency Management	SME business continuity. Community resilience	CI Interdependencies identification, assessment and mitigation	Cross-border Emergency Management	Critical National Infrastructure Protection and Resilience
<b>Institutional context</b>	Safety Region	Administrative	State	Metropolitan area	Economic region	Country with separate jurisdiction
<b>Partnership</b>	A safety region is a mandated cooperation of the local and regional public authorities to address and manage critical events and disasters within that region.	Partnership between Lombardy Region Administration and 16 operators of energy and transport infrastructures, regulated by a public ToR	Joint partnership between Louisiana Economic Development (LED), the Governor's Office of Homeland Security and Emergency Preparedness (GOHSEP), the National Incident Management Systems & Advanced Technologies (NIMSAT) Institute at the University of Louisiana at Lafayette and the Stephenson Disaster Management Institute (SDMI) at Louisiana State	Initiated by owners and operators of seven Critical Infrastructure Systems in Montréal and public safety representatives of the city	Public-Private non-profit created by statute by the States of Alaska, Idaho, Oregon, Montana and Washington, the Canadian provinces and territories of British Columbia, Alberta, Saskatchewan, Northwest Territories and the Yukon	A sector and cross-sector multi-level partnership between UK Government, Scottish Government and local authorities with private sector in complete accordance with the UK National Security Strategy

(continue)



Characteristics	Kennemerland Safety Region (The Netherlands)	Lombardy Region (Italy)	Louisiana (US)	Montreal Metropolitan Community (Canada)	Pacific Northwest Economic Region (US and Canada)	Scotland (UK)
<b>Distinctive features</b>	<ul style="list-style-type: none"> <li>Nationally developed EM information system (LCMS) – a net-centric, web-based data system</li> <li>Partnership not convened as a single entity – operates through working groups</li> <li>Bottom-up development, driven by concerns of front line organisations who wish to collaborate</li> <li>Crisis response structure covering Strategic, Tactical, Operational levels and On-site Command</li> <li>Sharing of resources – reduces costs, provides access to scarce requirements</li> </ul>	<ul style="list-style-type: none"> <li>Systematic identification of information needs and missing information flows in EM</li> <li>Focus on interdependencies information with regard to service delivery at node level, not proprietary and sensitive business or asset data</li> <li>Collaborative web platform for cross-sector information sharing and collaborative EM</li> <li>Thematic Task Forces for collaborative discussions and bringing actors together</li> </ul>	<ul style="list-style-type: none"> <li>BEOC as a single contact point between the government and businesses</li> <li>BEOC serves as filter for information between businesses and the state government</li> <li>Establishing B2B communication without government’s involvement</li> <li>Reliable situational awareness information provided to businesses by the government</li> </ul>	<ul style="list-style-type: none"> <li>Establishment of ‘give-and-take’ relationship. Each stakeholder senses benefits right away</li> <li>Flexible cartography approach to preserve the confidentiality of information</li> <li>Ways for only temporary pooling of information and limiting number of recipients</li> <li>Keeping only the necessary actors at the table</li> </ul>	<ul style="list-style-type: none"> <li>Blue Cascades Exercise Series as well as numerous table-top exercises and roundtables</li> <li>Northwest Warning, Alert and Response Net (NWWARN) for cross-sector information sharing</li> <li>Gatekeepers are the trusted sources of information within an infrastructure</li> <li>Focus on interdependencies information, not proprietary and sensitive business data</li> <li>Working with organisations’ emergency managers only</li> </ul>	<ul style="list-style-type: none"> <li>Preparing Scotland, set out as a ‘hub and spokes’ model – the hub, including philosophy, principles, governance structures, regulatory and good practice guidance</li> <li>Support by the Government, providing Leadership, Enabling Partnerships and reviewing Outcomes</li> <li>Principles of Integrated EM – All hazard approach</li> <li>Government Protective Marking Scheme for exchange of information</li> <li>Operation Estrela – infrastructure resilience exercise programme to threat from insider attack</li> </ul>



### 3.2. Methodology for the development of the guidelines

The development process of present Guidelines comprises the following steps:

- Desktop revision and harmonisation of several sources of knowledge, including key findings from other related activities carried out under MIRACLE project;
- Identification of high-level core elements and context-factors for the design and development of CIP-R Programmes and Plans, with emphasis on regional dimension, and their subsequent organisation into a coherent framework;
- Description of the core elements and justification of their role and relevance by means of examples of real applications;
- Case-based description of the influencing role of context factors.
- Identification of some alternative successful strategies for the long-term development of CIP-R Programmes, through critical review of the literature and of the in-depth case studies carried out under MIRACLE project.

A first draft of the Guidelines will be circulated and commented by experts selected among the managers of the institutional partners of MIRACLE project. A second public revision process will take place during the 5<sup>th</sup> International Workshop on Regional Critical Infrastructure Resilience, that will be held in Milan (Italy) on the 22<sup>nd</sup> and 23<sup>rd</sup> of June 2015.

## 4. A reference framework for Regional CIP-R Programme development

The MIRACLE reference framework for the Development of Regional CIP-R Programmes provides the list and the relationships between the key elements that are needed for a successful and sustainable programme design and implementation (Figure 3).

The framework comprises four types of elements: the fundamental *principles* for a successful CIP-R programme development, the components of the *management model*, the set of *practices* that can be used to implement the programme, and the relevant *context factors* that influence the programme over its entire life cycle.

The fundamental principles are.

- Subsidiarity “in action”;
- Continuous improvement process;
- Balanced benefits;
- All-hazard approach;
- Risk-informed approach.

The key components of the management model of a Regional CIP-R Programme are:



- Contents development matrix (Emergency Management cycle vs Resilience core functions);
- CIP-R Programme design and implementation process;
- CIP-R Programme long term development strategy.

The practices can be classified into two main categories:

- Activities and processes;
- Tools and technologies.

Finally, four different context factors influence the contents and the management model of a Regional CIP-R Programme in its start-up and evolutionary process phases:

- Legislation (national and local);
- Characteristics of the Public-Private Partnership which leads the programme;
- Scope of the Programme as set by the leading PPP;
- Main goals of the Programme as set by the leading PPP.

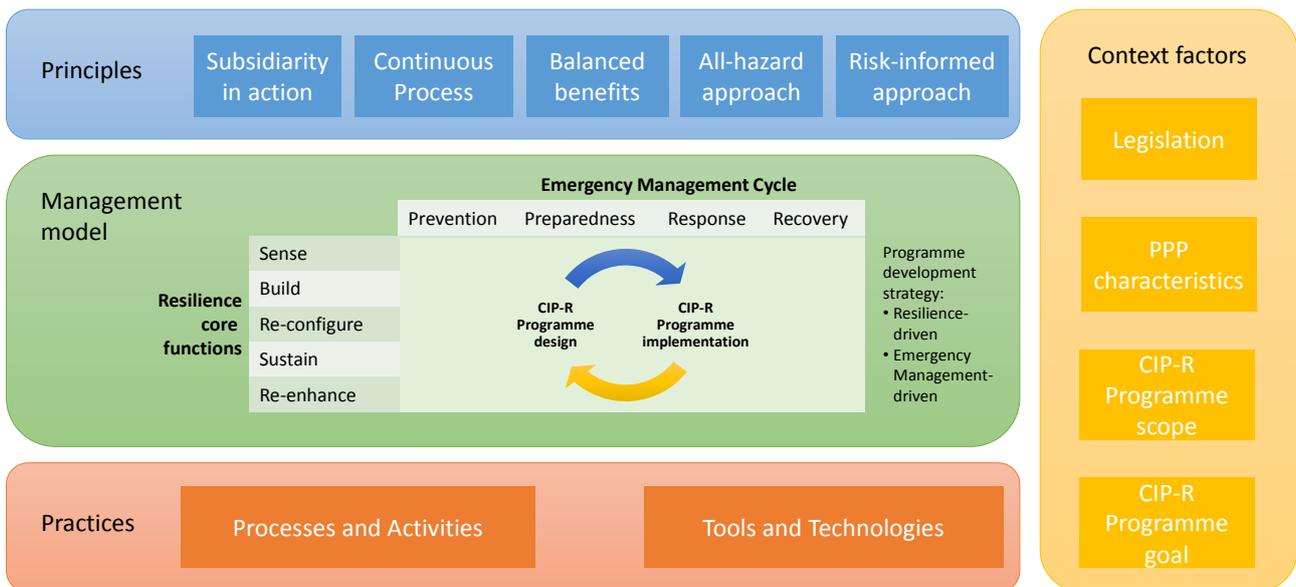


Figure 3. MIRACLE Framework for the development of Regional CIP-R programmes

## 5. Context factors

### 5.1. Legislation

In addition to EC legislation on CIP (EC Directive 2008/114/EC) and the related European Programme for Critical Infrastructure Protection (EPCIP), national legislation in single Member States plays a crucial role in shaping regional initiatives on CIP-R. Among other



country specific arrangements, the following should be taken into consideration when developing a CIP-R Programme:

- National CIP Legislation;
- Emergency and disaster management regulatory framework;
- Homeland security regulatory framework;
- Devolution regulatory framework;
- Liberalisation regulatory framework for infrastructure, utilities and other vital services.

Indeed, relevant national and local legislation and regulation represent the reference for a number of key elements that shape a CIP-R programme or that have to be managed within the programme itself. Among others, the following are worth to be mentioned:

- The prevailing perspective between protection and resilience in developing national and/or local strategies;
- The scope of resilience objective: infrastructure, community, societal, ...
- Responsibilities and Command-and-Control mechanisms for emergency response;
- CI sectors for which specific protection or resilience objectives and related requirements are set forth;
- Information security requirements and constraints.

All these elements strongly affect the set up and evolution of CIP-R programmes at local level. Primarily, by promoting or enabling them. Indeed, in several EU countries, opportunities for engaging stakeholders in the development of a local CIP-R programme might be found directly in extant legislation:

- thanks to awareness and concern of CI operators induced by responsibilities and enforced requirements for action (e.g. in Scotland and Italy);
- well established culture and standards at national level thanks to a coherent regulatory framework (e.g. The Netherlands);
- resources – financial, technological, skills and knowledge – made available at national level (e.g. in the Netherlands and Denmark);
- full or partial devolution of CIP-R responsibilities with clear interfaces with national and EC levels (e.g. Scotland).

Furthermore, legislation requirements and the more general regulatory framework applicable at local level also influence or contribute to shape the key elements of a CIP-Programme:

- Scoping and goals setting;
- Governance model and characteristics of the Public-Private collaboration;
- Management model adopted to run the programme;
- Requirements for and constraints to processes and activities.



## 5.2. Characteristics of the Public-Private Partnership

Networks have become prevalent form of multi-organizational governance since they are seen as superior way to deal with malefic problems. Networks consist of legally autonomous organizations that work together to achieve not only their own but collective goals as well. However “*some form of governance is necessary to ensure that participants engage in collective and mutually supportive action, that conflict is addressed, and that network resources are acquired and utilized efficiently and effectively*”<sup>3</sup>**Errore. L'origine riferimento non è stata trovata.**

As protecting and ensuring the resilience of Critical Infrastructure became a shared responsibility of government and private sector, networks offer enhanced learning and planning, and enough resources and knowledge available to deal with complex problems. Indeed, the growing complexity and interconnectedness of CI, the uncertainty of the emerging risk landscape, and limitations of individual organisations to address certain risks all underscore the need for collaboration between the public and private sectors to strengthen infrastructure resilience. No single organisation has all the necessary resources, relevant information and competence to cope with complex inbound and outbound interdependencies under different accident scenarios. It requires engagement of all stakeholders in order to cope with CI interdependencies and improve resilience.

Since the beginning of 2010 there has been a boom of Public-Private Partnerships (PPPs) with a goal of Critical Infrastructure Protection and Resilience (CIP-R) and Emergency Management (EM) in North America and partly in Europe and Australia as well. PPP is the main approach for today's practitioners around the world to deal with CIP-R issues. Strong steps are being taken in all the CI sectors to bolster coordination and information sharing across the government-business border, and even more attention should be placed on growing and nurturing PPPs in CIP-R.

PPPs hold great promise to provide resounding value for both government and businesses, but also face significant obstacles that will need to be overcome. Indeed, PPPs come with challenges in their establishment and management so they sometimes fail to perform and bring benefits as expected, a phenomenon that may lead to a fracture between the appearance and the reality of PPPs on CIP-R.

This is why the characteristics of the PPP that runs a specific Regional CIP-R Programme have strong influence on the scope, objectives, activities, and also on the quality of achievements of the programme itself.

The scientific literature addressing CIP-R emphasises three PPP governance models (Table 3): self-governance, governance by a lead organisation and governance by a network administrative organisation (NAO). The successful adoption of a particular form of governance is seen to be dependent on four key structural and relational contingencies: trust, size (number

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<sup>3</sup> K. Provan and P. Kenis, Modes of Network Governance: Structure, Management, and Effectiveness, *Journal of Public Administration Research and Theory*, Vol. 18, Issue 2(2008), pp. 229-252.



of participants), goal consensus, and the nature of the task (need for network level competencies). Each of the approaches has its advantages and drawbacks. Scholars are aware of how the governance form impacts on the network functioning and effectiveness, as well as on crisis response, but further analysis should be conducted for a better understanding and assessment of the impact on the information sharing and collaboration forms within CIP-R PPPs.

Governance by a Lead Organisation is the most common form of governance for PPPs addressing CIP-R issues, where the leading organisation is a public body with specific responsibilities for CIP-R at national or regional level. There are some examples of shared governance where private CI operators are more directly engaged in defining scope and goals of the collaborative network, such as the case of Montreal Metropolitan Community (Canada). In this case, the PPP is collectively led by CI operators and technically supported by the Ecole Polytechnique de Montreal, scope and goal of the partnerships is however limited to the understanding and assessment of interdependencies among CI in the area. Public authorities receive the results of the assessment and are only involved in the evaluation of potential win-win solutions for the removal of most critical dependencies or their better management. These types of PPPs are characterised by a few number of member organisation, a narrow and well-focused goal but with a high level of consensus

Table 3. Key predictors of Effectiveness of Network Governance forms

Governance forms	Trust	Number of Participants	Goal consensus	Need for Network-Level Competencies
Shared governance	High density	Few	High	Low
Lead Organization	Low density, highly centralized	Moderate number	Moderately low	Moderate
NAO	Moderate density, NAO monitored by members	Moderate to many	Moderately high	High

Source: K. Provan and P. Kenis, *Modes of Network Governance: Structure, Management, and Effectiveness*, *Journal of Public Administration Research and Theory*, Vol. 18, Issue 2(2008), pp. 229-252.

When the PPP is a direct result of a public policy for involving the private sector in the development and/or implementation of CIP-R programmes, such as in The Netherlands where “Security Regions” are mandated to do so, the size is generally larger, and the scope and objectives are predominantly set by public authorities. This highest potential for impact on the region is balanced by the challenges brought by a relatively lower level of trust and goal consensus. As an example, it may happen that in practice not all the involved CI operators are willing to commit themselves to implementing collaborative plans, containing additional responsibilities or the mobilisation of additional resources, put in place under the strong leadership of public authorities.



### 5.3. CIP-R Programme scope and goal

Characteristics of a Regional CIP-R programme strongly depend on the scope of the programme and on the goals that the leading Organisation or PPP want to achieve through the programme.

The most important scoping factor is the policy/strategy background set for the programme, that is: protection-centred vs resilience-centred programmes. Table 4 reports the main differences between key elements of Regional CIP-R programmes depending on the prevailing political/strategic perspective.

Other elements that influence the overall scope of a Regional CIP-R Programme are:

- The set of CI sectors covered by the programme, generally aligned with the sectors represented in the leading PPP;
- The type of regional dimension of the programme, i.e. regional boundaries related to: a regional administration, a metropolitan area, an economic region ...
- The Phases of the Emergency Management cycle covered by the programme; for example a programme may focus on local prevention and preparedness and then fully integrate with national system for response and recovery, or may only cover preparedness and first response phases.

Main characteristics of a Regional CIP-R programme	Prevailing perspective	
	Protection	Resilience
<b>Subject focus</b>	Asset-driven	Services-driven
<b>System coupling</b>	Loose	Tight
<b>Type of disturbance</b>	Destruction	Destruction / Disruption / Degradation
<b>Priority</b>	Terrorist and natural threats prioritised	'All-hazards'
<b>Value proposition</b>	Cost-centred	Benefit-centred
<b>Activities directed to</b>	Hardening Structures	Redesigning processes
<b>Mitigation</b>	Reactive approach	Proactive approach
<b>Risk Concept</b>	Concept of 'risk' rooted in engineering	Concept of 'risk' embracing social perceptions and public choice
<b>Control mechanism</b>	'Command and control'	Shared responsibility
<b>Technology</b>	Search for technical fixes	Socio-technical innovation



Strategy	Aligned toward 'criticalness'	Aligned toward 'brittleness'
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Table 4. Main characteristics of Regional CIP-Programmes depending on the prevailing perspective: protection vs resilience.

Different goals or priorities are also possible for Regional CIP-Programmes:

- Improvement of Emergency and Disaster Management (also cross-border);
- Identification and assessment of CI interdependencies;
- Contribute to a better protection and resilience of National Critical Infrastructure;
- Business continuity of different private sectors, CI operators, SMEs;
- Community resilience;
- ...

## 6. Principles

The Guidelines for the Development of Regional CIP-R Programmes and the CIP-R planning approach it outlines are based on the following five fundamental principles.

### 6.1. Subsidiarity “in action”

Subsidiarity and complementarity principles are at the roots of the EPCIP Programme. Regional strategies and programmes for CIP-R represent the best existing examples of a bottom-up approach to the subject and, as such, the most promising opportunity for a deeper and more effective deployment of the subsidiarity principle in the CIP-R domain.

The quality of relationships, collaboration and coordination among stakeholders shown by ongoing Regional CIP-R Programmes is apparently of higher quality and effectiveness than those reached by national or continental actions. This situation is clearly observable both in USA and in Europe.

As National Critical Infrastructure are concern, involving stakeholders at regional level does not mean involving ‘regional’ CI operators only, but more precisely establish collaborative processes with relevant/national CI operators at a level that is closer to the field, thus closer to the implementation arena.

Secondly and most important, a bottom up approach can leverage on existing local experiences to design and implement an effective CIP-R programme. This subsidiarity ‘in action’ is made of recognition, support, involvement, harmonisation and sometimes devolution to single stakeholders or group of stakeholders that brings distinctive capabilities for building the programme.

According to this principle, the best way for developing a Regional CIP-R Programme is not to follow a standard procedure and assume pre-established goals, typical of a top-down approach; conversely, an effective programme stems from the ability of the leading PPP of:



- understanding local resources, capabilities and past experiences to cope with local threats and emerging scenarios;
- designing harmonised interfaces between the local programme and higher level CIP-R policies and plans, so as to assure alignment and leverage on synergies and complementarities.

In support of the challenge of ensuring a “regional” imperative on CIP-R, especially when the CI in question has a significant National interest (e.g. major international airport, petro-chemical facility, hydro-electric, etc.), there is a realistic necessity to balance shared interests. The analysis carried out on existing good practices identified the use of careful regulatory approaches at National level designed to ensure initial focus and scope of PPP, so as to fulfil the National responsibility while ensuring maximum freedom at regional level (e.g. Dutch “Security Regions Act”<sup>4</sup>). Such approaches require that regional PPPs also recognise and acknowledge National imperatives (collaboration with National stakeholders when appropriate).

Thus, subsidiarity “in action” can ensure that regional knowledge and expertise can fully address CIP-R through PPP where the bottom-up approach is regionally focused yet responsive to, and connected with, relevant national concerns. A clear example is offered by existing local CIP-R programmes, since they are not meant to replicate (or replace) national CIP or Emergency Management plans at local level. Conversely, their goal is to better integrate CIP-R issues and engage CI operators in the Emergency Management set up, by ensuring those value added activities that demonstrate to be achievable and more effective when established at local level.

## 6.2. Continuous improvement process

Existing successful experiences demonstrate that many local CIP-R Programmes rapidly evolved over the time, thanks to the virtuous cycle of:

- gaining commitment of some key stakeholders on relevant disruption scenarios;
- fixing achievable and win-win objectives in the short term;
- communicating tangible results to all stakeholders to involve them in the programme and expand the PPP;
- revising and enhancing scope, goals and objectives of the CIP-R programme thanks to the new entries.

In other words, do not wait for a perfect PPP composition and programme design; rather, gain momentum and expand your PPP and programme over time thanks to tangible achievements and well-communicated results. In this regard, the planning cycle – design and implementation process – should not exceed two-three years of duration, and it should be conceived as a continuous improvement process (Plan-Do-Check-Act, or PDCA cycle).

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<sup>4</sup> The Government of The Netherland and its Queen: “Act of 11 February 2010, containing provisions for the fire services, disaster management, crisis management and medical assistance (Security Regions Act)”.



In terms of programme content, given the role of interdependencies and cascading effects in dramatically increasing the complexity of disruptions or disasters when CI are involved, investing on prevention and preparedness first is advisable. It also means to start by working with CI operators and other stakeholders at the interfaces of their systems (and not within each single system), and by developing inter-organisational mechanisms enabling a better exploitation of existing capacities (instead of requiring additional intra-organisational ones).

### 6.3. Balanced benefits

A Regional CIP-Programme led by a local PPP is generally driven by a mix of different interests and needs: public authorities, responders organisations, CI operators and owners, businesses ... Normally, it also covers a mid-long term planning horizon. Hence, the prioritisation of different types of achievable results is a key issue.

From ongoing experiences and the case studies carried out under the MIRACLE project, it emerges that the strategy of pursuing balanced benefits – government vs business needs; short vs long term – is the most effective to assure long term sustainability of the programme and the achievement of tangible results. Recommendations are:

- To pursue concrete though limited results in the short term; they are better than promising outstanding results but only over a long planning horizon. The former builds consensus and sustains strong commitment, which is needed for challenging objectives;
- To only include objectives and practices that all the stakeholders feel are relevant. Alternatively, it is possible to select groups of stakeholders and set up specific task forces according to specific concerns and real interests.
- To give preference to win-win solutions, addressing both government and business interests, even when they seem less efficient; they pay out in the long term since they strongly contribute to strengthen the coalition, where all the stakeholders have the perception of a well balanced mix of giving and taking.

### 6.4. All-hazard approach

The term ‘All-hazard approach’ denotes a way of CIP-R development able to comprise all conditions, environmental or manmade, either accidental or intentional, that have the potential to cause injury, illness, death, or loss of assets, service delivery, or other intangibles; or alternatively causing functional social, economic, or environmental harm.

Three closely related factors necessitate the development of a holistic, all-hazards approach to regional CIP-R:

- infrastructure vulnerabilities and interdependencies. Infrastructure systems are vulnerable to a wide spectrum of hazards and threats mainly due to their complexity (e.g. nuclear power plant) and geographical dispersion (e.g. transport or electricity networks);



considering only a limited set of hazards may hinder some critical vulnerability mechanisms and interdependencies of the CI systems of interest;

- information sharing processes and solutions. A too high stratification of information and communication solutions, in function of system and hazard types, results in poor situational awareness and ineffective inter-organisational collaboration. Information sharing processes and solutions must be designed to channel and dispatch all relevant information, in a context-sensitive way, to cover all the relevant or plausible scenarios;
- public-private collaboration. CI are differently vulnerable to different hazards and threats (e.g. weather related events are highly critical for transport systems, less for gas networks); if the range of hazards covered by the CIP-R programme is too narrow, obtaining a proactive involvement of some CI operators could become difficult.

Typical features of the all-hazards approach<sup>5</sup>, in relation to the inclusion of CIP-R issues in the emergency management set-up, include:

- don't reinvent the wheel – use or adapt the experience of others and their existing resources, plans and strategies;
- recognise collective intelligence – the expertise required can be a combination of key stakeholder experts supported by their institutional backup (organisations);
- a team approach ensures joint ownership from planning through to practice;
- public and private stakeholders have a very practical role (task oriented);
- planning focuses scenarios and tests CIP-R capacity in realistic exercises.

## 7. Risk-Informed approach to Decision Making

A *risk-based* decision-making process provides a defensible basis for making decisions and helps to identify the greatest risks and prioritize efforts to minimize or eliminate them. It is based primarily on a narrow set of model-based risk metrics, and generally does not lead much space for interpretation. Considerations of cost, feasibility and stakeholder concerns are generally not a part of risk-based decision-making, which is typically conducted by technical experts, without public consultation or stakeholder involvement.

In contrast, *risk-informed* decision-making (RIDM) is a deliberative process that uses a set of performance measures, together with other considerations, to “inform” decision-making. The RIDM process acknowledges that human judgment has a relevant role in decisions, and that technical information cannot be the unique basis for decision-making. This is because of inevitable gaps in the technical information, and also because decision-making is an intrinsically subjective, value-based task. In tackling complex decision-making problems involving multiple, competing objectives, the cumulative knowledge provided by experienced personnel is essential for integrating technical and nontechnical elements to produce dependable decisions.

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<sup>5</sup> FEMA 1996 “SLG 101: *Guide for All-Hazard Emergency Operations Planning*”.



Some authors and practitioners claim that the resilience view is alternative to the risk view when it comes to the management of the unexpected. On the contrary, the adoption of risk models and metrics make the resilience view of a system more consistent, and risk management is a key component of resilience engineering and management.

In CIP-R, the adoption of a risk-informed approach helps to develop a better and more effective programme in at least two areas:

- A proactive mitigation of threats requires prioritisation of scenarios, and risk metrics are the most “fit for purpose”; more in general, a risk-informed approach is needed to improve protection and resilience throughout all the phases of the Emergency Management cycle;
- The development of a CIP-R Programme requires consensus between PPP stakeholders on priorities, as well as agreement on the most appropriate mitigation strategies to be implemented; experience demonstrates that the support of well-defined and grounded risk models and metrics – either qualitative or quantitative – is of help, and particularly when multi-objectives and trade-offs are at stake.

## 8. Management model

The core of the present Guidelines addresses explanations and recommendations concerning the general arrangement and the features of a management model for a CIP-R programme (Figure 1).

The management model comprises the key logic and processes needed to assure a successful CIP-R Programme, sustainable in the long run:

- The logic we rely on to develop, over the entire life of the programme, consistent and coherent objectives and activities (contents);
- The continuous process of programme design and implementation (process).

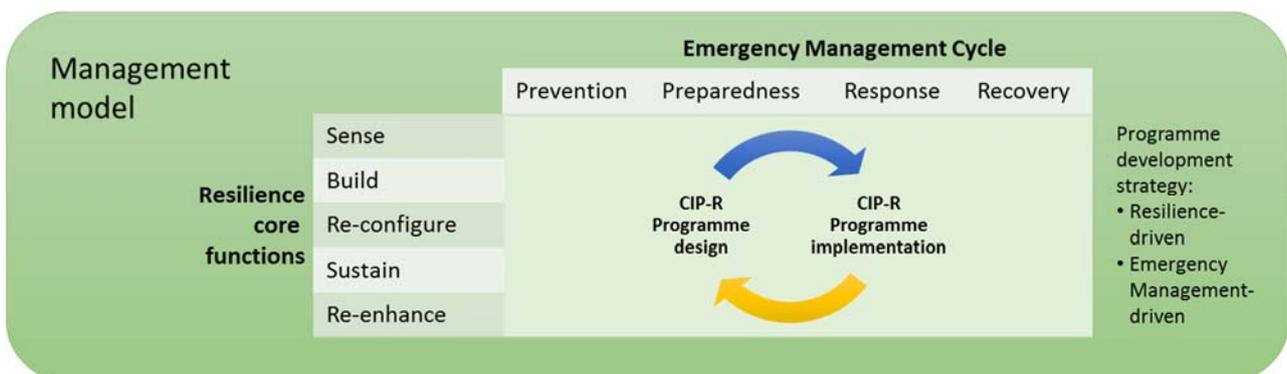


Figure 4. The Management Model of a CIP-R Programme



## 8.1. CIP-R Programme contents development

Given the scope and goal of a Regional CIP-R Programme, we may consider how to:

- assign specific objectives,
- define the sequence and timeline for their achievement,
- identify, select and plan the most appropriate set of activities to achieve those objectives.

When it comes to CIP-R goals and objectives, two perspectives (or logic) are equally important and complementary:

- The basic logic of the Emergency Management cycle;
- The set of core functions that collectively constitute the resilience property of a complex socio-technical system, such as Critical Infrastructure, and its deployment.

One of the key issues in developing successful CIP-R programmes is that these two perspectives are not completely overlapped, even though they share some common traits. Hence, a way must be found to assume both and harmonise them into a unique and consistent programme.

## 8.2. Emergency Management Cycle

CIP-R deals with the management of unwanted, unexpected and potentially hazardous events affecting the performance, service continuity and even the physical integrity of critical infrastructure. The deployment of this undertaking along the four EM phases – prevention, preparedness, response and recovery – is relevant to address some key assessment issues:

- Implementing a scenario-based identification of hazards, threats, vulnerabilities and interdependency exploitation as the main way to implement an all-hazard approach;
- Adopting both reactive and proactive approaches to consequence mitigation;
- Analysis and prioritisation of different mitigation options informed by risk modelling and resilience metrics.

Secondly, having a Regional CIP-R Programme aligned with the Emergency (or Disaster) Management cycle is also vital to check and assure the compatibility and full integration of the programme with the EM or Civil Protection system already in place in the region.

Furthermore, the EM system is conceived, and generally implemented, as a continuous improvement process (Figure 5), as such it can be assumed as the reference process for also assuring continuous improvement to the Regional CIP-R Programme. Lessons learned from



real events should be taken as the cornerstone to review and enhance scope, objectives, and contents of the programme, as well as its management model.

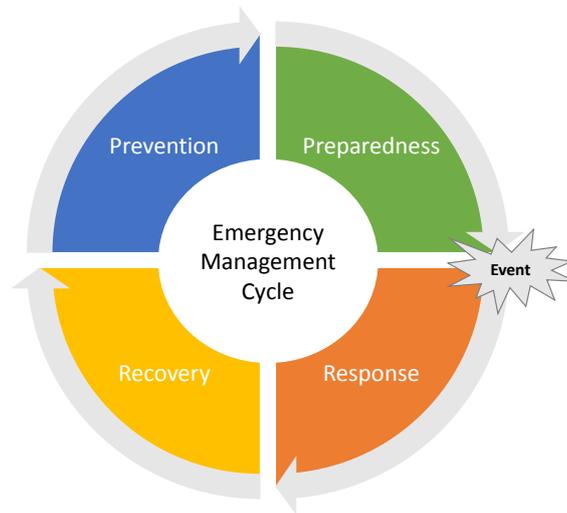


Figure 5. The Emergency Management cycle

Depending on the goal of the Programme, its scope can be limited to only some of the phases of the EM cycle, such as prevention and/or preparedness. This is the typical case when the PPP that manages the Regional CIP-R Programme is largely composed and led by private stakeholders (e.g. association, CI operators, etc.), which do not have any responsibility and power to directly manage emergency response and recovery. In Montreal Metropolitan Community CI operators and scientific institutions collaborate, through a well-established network, to investigate and analyse CI interdependencies. They share with policy makers the results of their analyses and recommendations for improvement, but at the end are the public authorities that, independently from the PPP, take the responsibility for the actual exploitation of results and for the implementation of recommendations.

More frequently, a Regional CIP-R Programme expands its scope and set of activities throughout the entire EM cycle over time. When protection of CI assets is the focus of the programme, the effort is primarily allocated to the prevention phase and only on a second stance it is expanded to other downstream phases (preparedness, response and recovery). On the other hand, resilience-driven CIP-R Programmes are generally more concerned with making quick advancement in preparedness and response, and subsequently redirect their attention to recovery and prevention phases, since they need more mature coordination, planning capabilities and stronger commitment within the PPP.

Finally, when the Regional CIP-R Programme is the natural evolution of existing local policies and strategies for community resilience and Emergency/Disaster Management, it is possible to set up a programme that addresses all the EM phases since its beginning. In this



case, organisational and operational capabilities already in place can be taken as the backbone for a further expansion of the capabilities of the region to better address emerging CIP-R issues.

### 8.2.1. Resilience core functions

Despite the numerous resilience definitions adopted in different scientific and professional domains (also when considering different branches of Emergency/Disaster management or Critical Infrastructure Protection and Resilience), it is generally agreed that resilience refers to the capacity of a system, community or society, exposed to hazards, to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. When specifically referring to critical infrastructure systems, resilience has to do with the ability to reduce the magnitude and duration of disruptive events, and so the effectiveness of a resilient infrastructure or organisation depends upon its ability to anticipate, absorb, adapt to, and/or rapidly recover from a potentially disruptive event.

This holistic view of resilience is easily understandable and largely endorsed. Problems and ambiguities can appear when trying to operationalize the concept. How to build, improve and measure resilience in practice?

Regional CIP-R Programmes can also be affected by this sort of ambiguity or difficulty to turn the resilience concept into real practice. To overcome this issue, the reference to resilience core functions can be of help, and it is recommended that a sound CIP-R Programme is able to explicitly refer to these core functions within its objectives, as well as the set of planned activities. In fact, the deployment of the resilience concept through its core functions makes it possible to identify related capabilities (resources, means and processes), and to define proper Key Resilience Indicators (KRI) to measure these capabilities and monitor their improvement over time as a proxy of resilience enhancement.

Hence, the management model of a Regional CIP-R Programmes should be set for tracking the design and implementation process along the core resilience functions: sense, build, re-configure, re-enhance and sustain.<sup>6</sup>

*Sense* core function is related to how the system tries to improve visibility and early detection of threats. Typical capabilities helping this function are, joint field monitoring systems, shared modelling and simulation tools for interdependencies identification and analysis, security systems, etc. that can be enhanced thanks to joint acquisition, development and interoperability strategies agreed on within the PPP and planned under the CIP-R Programme.

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<sup>6</sup> Seyoum Eshetu Birkie; Paolo Trucco; Matti Kaulio, 2014. "Disentangling core functions of operational resilience: a critical review of extant literature". Int. J. of Supply Chain and Operations Resilience, 2014 Vol.1, No.1, pp.76 - 103



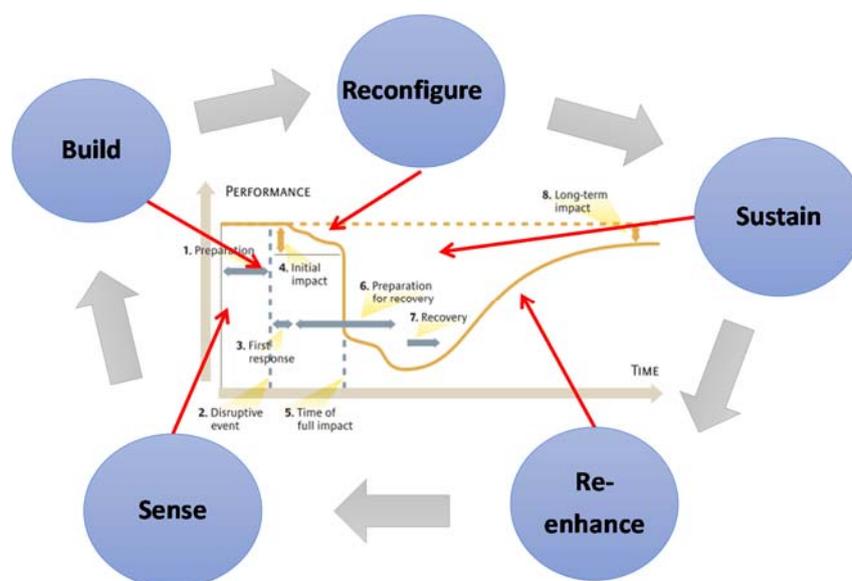


Figure 6. Five resilience core functions and their mutual relationships

The *build* function comprises a set of activities carried out to acquire and enhance proper capacities enabling proactive and/or reactive response; typical activities to build response capacities are: exercises, communication protocols and technologies, response plans, acquisition of shared contingency resources and means, etc. In current practices, these are the most common and well-covered aspects of Regional CIP-R Programmes, frequently also connected, or fully integrated, with corresponding activities of traditional Emergency/Disaster Management systems or Community Resilience programmes. A systematic inventory and mapping of existing response capacities in each single organisation partner of the PPP is a crucial and largely neglected activity, to be included in a successful programme. Many times, the response effectiveness granted by a comprehensive and shared picture of the location of existing capacities and the ability to find out opportunities for synergies and economies of scale, are quick wins that a Regional CIP-R Programme may achieve also under conditions of scarce additional resources. Some international cases studied under the MIRACLE project – e.g. Lombardy Region (Italy) CIP-R Programme, Amsterdam Airport Schipol PPP in Kennemerland Safety Region (VRK, The Netherlands) – clearly shows that:

- Leveraging on existing capacity to enhance overall protection and resilience of the region strongly influence, in a positive way, trust and level of commitment of private partners and thus their willingness to contribute to the PPP;
- Regional CIP-R Programmes are more effective on this aspect than the national ones, which are more prone to push for additional burdensome investments by CI operators, as the introduction of additional or tighter security requirements generally implies.

*Reconfigure* function relates to high-level functions and processes to, temporarily or permanently, change system's structure, assets, as well as service mix and delivery processes. In this perspective, *adaptation*, with subsequent bouncing-back, can be seen as a lower level reconfigure function, executed for withstanding events of minor impact. A valuable example



of resilience through reconfiguration capabilities comes from the effective disaster response in the aftermath of the great earthquake and tsunami that in March 2011 hit the east coast of Japan, considered one of the greatest catastrophes that ever occurred in the country. During at least 20 days after the tsunami, the most feasible and efficient means of transport to reach or leave Tohoku region was air transport. Bringing back *Sendai* airport to full operability was the priority of the Japanese authorities since the very first day after the catastrophe. Thanks to the men and the means provided by the U.S Army within the “*Tomodachi operation*”, the airport came back to its normal functionality just in 32 days. In the meantime, it was necessary to find alternatives for the civil air transport, also in the face of the unavailability of wide portions of the road and railway infrastructures. The solution was found by exploiting the exceeding capacity of some regional airports in *Tohoku* region; the overall regional air transport system was able to maintain its level of service substantially unchanged after the striking catastrophe. The airport of *Yamagata*, thanks to its proximity to *Sendai* city and not being involved by the consequences of the incident at *Fukushima* nuclear plant, increased its number of passengers fifteen-fold in the 20 days following the catastrophe. This change was extremely fast and finalised with a surprising degree of flexibility. It was made by activating inter-organisational operational coordination at regional and national level (with rapid relocation of available means and fleets), setting up streamlined air traffic management authorisation processes, and the concurrent reconfiguration of the local public transport system (buses and local railway lines) to assure capacity to serve passengers’ new departure airports. A part of the response phase, reconfiguration capabilities are extremely important also in the recovery phase, especially after major disasters or catastrophes, such as in the case of reconstruction after Hurricane Katrina in 2005 (Louisiana, USA).

*Re-enhance*, encompasses the ability:

- to restart service delivery and regain standard performance as faster as possible, in the view of full societal recovery from disruptive events;
- to take advantage from any opportunity for further improvement, beyond past conditions, envisaged in the aftermath of the emergency.

A typical example of the former is the strategy adopted at regional level to mitigate major electrical blackouts. If safeguarding critical assets and adding redundancies to the electrical grid are the most important mitigation options from a CI protection perspective (generally hold at national level), then from a resilience point of view, it is equally important to improve the agility of dependent networked infrastructure and other vital services for assuring faster recovery from blackouts. To this end, Regional CIP-R Programmes may include specific activities, such as the prioritisation of loads (e.g. large industrial facilities, hospitals, critical local government facilities and offices), the development of collaborative plans for the mitigation of those interdependencies induced by long lasting blackouts, the execution of exercises under different blackout scenarios, etc.

Examples of the latter are the long term integration in the regional context of contingent solutions and resources mobilised to respond to major events (e.g. control rooms, response strategies brought by external responders involved in a specific emergency), or the transfer



of coordination mechanisms between CI operators experienced under emergency into daily operations routines to manage normal interfaces and dependencies.

Finally, continuing to perform in one manner or another is an important feature that reduces the unwanted long-term consequences of stopping and later recovering, that is the essence of *sustain* core functions. Business Continuity Management and Contingency planning are typical capabilities developed by CI operators to sustain service delivery also under the effects of disruptions. Whereas the effectiveness of these processes within the boundaries of each single CI organisation is the responsibility of that company, and the compatibility and interoperability of these processes when concurrently executed within a certain geographical or economical area are only addressable by inter-organisational collaboration and better achieved under the umbrella of a regional PPP.

### 8.3. CIP-R Programme design and implementation process

The full deployment and operationalisation of the overall goals and objectives of the programme is granted by the design and implementation phases and their planning horizon (Figure 7).

As well as the setting of goals and objectives, also the design phase is collaborative in nature and managed directly the entire PPP. Specific workshops and/or task forces can be used as mechanisms for collecting contributions and drafting the programme; specific professional expertise or consulting services may support the completion of the design phase. However, is crucial that all the stakeholders have the opportunity to contribute to the design of the programme and eventually approve it entirely.

The implementation phase is generally more dispersed, since specific actions and activities can be allocated to different actors within the PPP or even outsourced. Here the role of the leading organisation is key, since it has in charge the continuous update and engagement of all the stakeholders on the progress of the programme at large, beyond the specific activities each member of the PPP is directly involved in. According to managers and professionals involved in Regional CIP-R programmes, keeping the programme together also during the implementation phase and do not let it break down into several disjoint actions is one of the most difficult challenges and a core element for the long lasting development of the programme itself.





Figure 7. The design and implementation cycle of a Regional CIP-R Programme

### 8.3.1. CIP-R Programme Design

The design of a successful CIP-R programme should be carried out by covering at least the following core steps:

- System specification and analysis;
- Organisational set –up;
- Programme outreach;
- Programme financing.

**System Analysis.** A sound CIP-R Programme that lead to tangible benefits has to be grounded on a clear understanding of the characteristics of the regional system of interest. To this end, adequate effort and time must be allocated in the design phase to the collection and analysis of relevant information and data, o arrive at a transparent and documented identification of resilience challenges and the prioritisation of the areas of intervention. This can be achieved by the following:

- Characterisation of the Regional natural and socio-economic environment;
- Characterisation of relevant Hazards and Threats (all-hazards approach);
- Characterisation of Infrastructure and vital services, their vulnerabilities a (inter)dependencies;
- Generation of relevant disruption/disaster scenarios and consequence analysis;
- Risk Assessment (qualitative or quantitative);
- Identification of response challenges at regional level;
- Identification of long-term recovery challenges.

**Organisational set-up.** According to challenges and prioritisation of actions identified in the previous step, the organisational set-up the will support the later implementation of the CIP-R programme can be fully deployed. If not already established by existing agencies or PPPs at different level, the organisational design of the programme should define or check for the following:



- Regional roles, responsibilities, authorities, and decision-making processes (the inter-organisational model);
- Alert and warning criteria and systems;
- Information and knowledge sharing model and processes;
- Interoperability of the business continuity management models of CI operators;
- Interoperability and continuity of operations of responders;
- Legal issues connected with the previous elements.

**Programme outreach.** Connecting the programme with the society is twofold. On one side, a CIP-r programme should have a strategy and address proper resource to engage the regional community and the education system. On the other side, a Public Information/Risk Communication plan is needed, covering the following elements:

- communication resources (at least a dedicated website) for emergency management related public information;
- a process to ensure timely information is provided to the public under different emergency scenarios, with particular reference to the users of specific vital services and with specific information needs (e.g. passengers on regional transport systems, drivers, home patients with electrical medical devices);
- allocation of information and communication responsibilities among public and private organisations within the PPP;
- ways of leveraging and involving press and other media as a channel to communicate critical information;
- ways of using internet and social media to educate and empower the public throughout the emergency management process – preparedness, response and recovery.

**Programme financing.** Financial resources required to sustain the programme activities and action plan are generally granted by local government and agencies. Adopting specific fund raising strategies to finance specific projects or actions within the programme also demonstrated to be a viable alternative; it generally requires having the PPP and the programme already in place and well recognised by the local community and society.

The involvement of the PPP, or some of its members, in local or international research projects addressing CIP-R issues, is another potential source of additional resources and knowledge needed to develop the programme. Fostering such a kind of practice is highly advisable.

### 8.3.2.CIP-R Programme Implementation

The successful implementation of a well-designed Regional CIP-R Programme encompasses few relevant elements.



**Action Plan.** It must be clearly defined in terms of actions and workplan, feasible and endorsed by all the stakeholders involved in the PPPs. Private organisations should be involved only on few and well-focused relevant for their specific business or responsibility. Running in parallel task forces on specific subjects and with different compositions and degree of involvement of businesses is a good practice, as in Lombardy or Montreal cases. Some sort of coordination mechanism (e.g. a steering committee or an assembly) is then needed to assure the coherent implementation of the programme and the harmonisation of activities carried out on different tables.

The action plan should cover a time horizon of two-three years, followed by a full revision cycle. Mid term planning is needed by both private and public stakeholders; the former don't want to embark on long term commitments without clear and sensible returns, the latter need to accommodate for political cycles. This is why it is also important to establish expected intermediate (yearly) achievements, and avoid long planning and preparation phases with no sensible results. Concurrently, the action plan should be set following a win-win logic (§6.3) that convinces all stakeholders of real and quantifiable benefits.

**Sector-specific needs and actions.** Specific CI sectors or regional vital services generally face specific challenges and have specific needs that are not necessarily covered by the core actions of the plan. It is important that also minor or specific actions that respond to sector-specific needs, are considered part of the programme and tracked by the action plan. This is particularly useful in the view of:

- the opportunity of leveraging on synergies and critical mass,
- solving possible interferences in the implementation of the action plan or assuring the adherence to path-dependences between some actions, if any;
- demonstrating the commitment of all the PPP in endorsing and supporting also sector or company specific needs.

**Exercises and Training.** Exercises and Training sessions are recognised as some of the most effective preparedness actions for Emergency Management. From CIP-R perspective it is important not only to involve CI operators in Civil protection exercises, but also to plan periodical table top or full scale exercises focused on CI disruptions and related interdependencies.

Specific training programmes addressing CIP-R issues are also part of a successful implementation strategy for building a shared resilience culture a lower down inter-organisational barriers.

In the next section, some good practices at international level are reported as an opportunity to leverage on existing knowledge and expertise when designing and implementing a new CIP-R programme.



**Measure and communicate results.** Measuring results through a simple but effective set of KPI it is crucial not only for promoting the programme within the PPP, and thus justify its existence and required resources. It is also important for sustaining programme outreach, for building and maintaining the largest possible consensus in the public around the usefulness and validity of the programme.

#### 8.4. CIP-R Programme development strategies

A long lasting CIP-R Programme is expect to pass through different phases in its life cycle. Its evolution is strongly influenced by the origin and goal set at the beginning of the Regional CIP-R Programme life. Sometimes the goal may change due to changes in political priorities (e.g. security and protection issues vs safety and resilience issues) or dramatic evolutions in the most relevant threats a certain region is exposed to (e.g. due to Climate Change).

Another evolutionary dimension is the increase in size of the PPP, thanks to new members, or of the geographical extension of the programme.

Accordingly, the temporal evolution of the CIP-R programme, managed through its design-implementation cycles, can be driven, time by time, by different priorities or by a different mix of perspectives. Here we highlight two main development strategies, identified as the basic ones:

- **Emergency Management-driven development strategy** emphasises the operational integration of the CIP-R Programme with the management of real events. It is preferable when the PPP is led by public authorities, with security roles, or by responders; in these cases the goal of the CIP-Programme is generally more focused on EM improvement (e.g. Kennemerland Safety Region, LABEOC, PNWER).
- **Resilience-driven development strategy** emphasises the supportive role of the PPP and its Regional CIP-R Programme. The programme is developed to build protection and resilience capabilities into the regional system, that are exploited by different organisations (e.g. EM, Civil Protection agencies, or Police forces) through decision making and operational processes that are largely out of the scope of the programme (e.g. Lombardy Region, Scotland). This is typical when the PPP is led by private stakeholders (Montreal Metropolitan Community).



## 9. Practices

Good practices (GPs) are generally defined as ‘*Commercial or professional procedures that are accepted or prescribed as being correct or most effective*’<sup>7</sup>. It is any collection of specific methods that when applied solve an existing problem, produce expected results and bring benefits. Within the context of these guidelines, the concept applies to available knowledge to addressing:

- Establishment and management of regional PPPs for Critical Infrastructure Protection and Resilience;
- The implementation of a CIP-R programme in an efficient and effective way, thus assuring the achievement of its main objectives and goal.

The rationale is to disseminate and promote a set of practices that have been effective in addressing key issues in regional CIP-R initiatives and, as such, can be deemed as a reference or source of expertise to set-up and develop regional CIP-R programmes.

The collection of Good Practices (GPs) that is reported in the following sections focuses on *Activities, Procedures, Tools, and Technologies*. The full description of the methodology that has been applied to identify and select these GPs, as well as the detailed description of the practices are reported in Deliverable 2.2 of the MIRACLE project [7]. In Table 5 and Table 6 we only report a brief classification and description of the same GPs, with the primary aim of connecting them to the core elements of the MIRACLE Framework for the development of Regional CIP-R programmes (Figure 3).

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<sup>7</sup> Dictionary, O. E. Oxford dictionary of English. Online version, 2012.



TOOLS and TECHNOLOGIES	WHO	WHY	WHAT	LINK TO MIRACLE FRAMEWORK
<b>DOMINO tool</b>	Centre risque & performance (CRP) of École Polytechnique de Montréal	Barriers to information sharing at the point of interdependency identification and analysis	A modelling, mapping, decision and planning assistance tool using a flexible cartography approach which preserves the confidentiality of information. Used for managing interdependencies and analysing domino effects.	CIP-R Programme Design – System Analysis [8.3.1]
<b>Virtual Business Emergency Operations Center (V-BEOC)</b>	NIMSAT Institute, Louisiana (USA)	To incorporate and leverage on nation's best practices in information sharing, lessons learned from research in PPPs, and from experience	A free, web-based information sharing platform that facilitates collaboration between public, private and non-profit organizations. Capable of supporting existing processes and existing incident management systems	Management model – Emergency Management [8.2]
<b>Northwest Warning, Alert and Response Network (NWWARN)</b>	Pacific Northwest Economic Region (PNWER)	To encourage cross-sector information sharing	An alert, warning and information sharing platform exploiting experts for particular infrastructure systems. Enables near real-time two-way exchange of critical information and suspicion activity reporting to authorities	CIP-R Programme Design – Programme Outreach [8.3.1] CIP-R Programme Implementation [8.3.2]
<b>Computer Based Alarm System Øresundsbron (COMBAS Ø)</b>	Øresundsbron (Denmark-Sweden)	Need for a stable, effective and rapid alarm system for those involved in emergency preparedness and response	A computer-based alarm system for the Øresund Fixed Link. Information on an accident is efficiently passed to the emergency services. Provides immediate access to action plans, cross-border information sharing and collaboration.	CIP-R Programme Design – Organisational set-up [8.3.1] CIP-R Programme Implementation [8.3.2]
<b>SUSI (Sistema Unico di Scambio delle informazioni)</b>	Lombardy Region, Italy	To support communication between the operators and Civil Protection Authorities	A multimedia platform to share data about disasters or options for prevention and monitoring the events before disaster happens. Interoperable and secure communication channel for timely communication between all involved organizations.	CIP-R Programme Design – Organisational set-up [8.3.1] CIP-R Programme Implementation [8.3.2]
<b>NATO Architectural Framework (NAF)</b>	Developed by NATO. Used in Lombardy Region, Italy.	Standard for presenting operational models of the socio-technical systems. Analysis tool to develop new capabilities, structure organizations and to optimize processes	An Enterprise Architecture framework defines how to organize the structure and views associated with a complex, socio-technical system that comprises interdependent resources of people, information, and technology that must interact with each other and their environment in a common mission. Used as analysis tool to develop new capabilities, structure organizations and to optimize processes.	CIP-R Programme Design – System Analysis [8.3.1] CIP-R Programme Design – Organisational set-up [8.3.1]

(continue)

Table 5. Summary description of MIRACLE Good Practices - Tools and Technologies



TOOLS and TECHNOLOGIES	WHO	WHY	WHAT	LINK TO MIRACLE FRAMEWORK
<b>CEPP Situational Awareness Tool (SATool)</b>	Colorado Emergency Preparedness Partnership (CEPP)	Smooth lines of communication between and across the public, private and non-profit sectors. To strengthen the region's collective EM capacities	An exclusive, secure, online Situation Center, designed to connect the different organizations responding to an event together. It is a centralised portal to respond to and communicate during critical events and share day to day information.	Management model – Emergency Management [8.2] CIP-R Programme Design – Programme Outreach [8.3.1]
<b>Dutch National Crisis Management System (LCMS)</b>	Institute For Physical Safety, The Netherlands	Need for all responders within 'safety regions' to form PPP for CIP-R and be able to collaborate very closely. Connection of safety regions	A distributed information system highly focused on geographical information and linked data. Contains modules for Communication, Coordination and Logistics; efficient exchange and disclosure of information; Drafting a GIS view – Operational Picture, CM and Reporting. Flexible platform that scales to meet circumstances, accessible via a web service.	Management model – Emergency Management [8.2] CIP-R Programme Design – Organisational set-up [8.3.1]
<b>Emergency Elements: Ontology for Interoperability (EMERGEL)</b>	The European DISASTER Consortium	To achieve a detailed Common Operational Picture shared between organisations with different systems, between regions, or even countries	A technology (and supporting tools) that provides interoperability between EM Systems. Allows exchange of information between EMS facilitating semantic interoperability via translation and mediation	Management model – Emergency Management [8.2]
<b>GIS Mapping for CI Assets</b>	Police Scotland, Scottish Government, Scottish Water, Scottish Roads Works	A need for a visual awareness tool to spatially identify CI assets in Scotland, to allow a better understanding of physical and logical interdependencies and locational vulnerabilities.	A GIS Mapping product which could be used to map all CI and other appropriate sites, including network and interdependency relationships. Identification of infrastructure interdependencies, support tool for planning and exercising. Platform for data and information collation.	CIP-R Programme Design – System Analysis [8.3.1]
<b>Traffic Scotland Information Service</b>	Transport Scotland	To provide key partners, responders and the public with up to date traffic and travel information	An accurate, timely, consistent and tailored to the needs of users Information Service. Covers desktop and mobile web sites, internet radio services, mobile web applications and smartphone apps, social media.	CIP-R Programme Design – Programme Outreach [8.3.1] CIP-R Programme Implementation [8.3.2]
<b>Performance &amp; Risk-based Integrated Security Methodology (PRISM)</b>	Harnser Risk Group	Approach to raise concerns amongst stakeholders about how organisations make strategic and operational decisions that affect their exposure to security risk and its impact on their supply chains.	An empirically based, modular risk management tool. Four phases 'Strategy & Planning', 'Risk Assessment', 'Design' and 'Implementation & Review'. Guidance notes and templates for user in each phase – raises awareness and understanding.	CIP-R Programme Design – System Analysis [8.3.1]



ACTIVITIES and PROCESSES	WHO	WHY	WHAT	LINK TO MIRACLE FRAMEWORK
<b>Big Business – Small Business</b>	NIMSAT Institute, Louisiana (USA)	Effort to help small businesses, often lacking the resources and knowledge, to be better prepared for all-hazards disasters	Voluntary based Private-Private partnership that promotes proactive (whole community) EM approach.	Characteristics of the PPP [5.2] Management model – Emergency Management [8.2]
<b>Blue Cascades Exercise series</b>	Pacific Northwest Economic Region (PNWER), USA/Canada	To explore infrastructure interdependencies, at the same time building relationships and trust – supporting NWWARN use.	A model for bringing together public and private sector stakeholders to discuss cascading impacts across the region.	Management model – Emergency Management [8.2] CIP-R Programme Design – System Analysis [8.3.1]
<b>Major Incident Control Committee (MICC)</b>	14 ‘top tier’ industrial site operators within the Grangemouth industrial complex area, Scotland	To oversee vitally important matters such as Public Warning, Training and Exercising, mutual aid and assistance between companies and the provision of technical advice.	Through regular joint planning, training and exercising, the MICC ensures that integrated public and private sector contingency plans are in place to cover all important issues regarding EM.	Management model – Emergency Management [8.2] CIP-R Programme Implementation [8.3.2]
<b>Operation Estrela</b>	Developed by Police Scotland. Received funding from Scottish Government. The CPNI assisted in development of the concept	In response to a number of high profile cases involving insider attack. To flag up potential vulnerabilities within an organisation, to exercise and test resilience to an insider attack	An exercise programme examines the recruiting, pre-employment screening, identity verification, personnel/role based risk assessment. It also assesses the potential impact of an ‘insider attack’ and the relevant consequence management. Business continuity processes are tested to assess their adequacy	Management model – Emergency Management [8.2] CIP-R Programme Implementation [8.3.2]
<b>‘CATEX’ Regional Exercises</b>	All Hazards Consortium (USA)	As a part of an integrated planning effort - FEMA Regional Catastrophic Planning Grant Program (RCPGP) To coordinate the efforts of multiple states, federal agencies and private sector owners/operators into the planning process for major events.	Multi-year exercise program that annually engages public and private sector participants in a multi-state tabletop and/or limited functional exercise using a scenario(s) in order to focus on several important areas critical to responding and recovering from catastrophic events and establish a framework for discussion and further promote integrated planning efforts and partnerships.	Management model – Emergency Management [8.2] CIP-R Programme Implementation [8.3.2]

(continue)

Table 6: Summary description of MIRACLE Good Practices - Activities and Processes



ACTIVITIES and PROCESSES	WHO	WHY	WHAT	LINK TO MIRACLE FRAMEWORK
<b>Multi-State Fleet Response Initiative</b>	Multi-State Fleet Response Working Group (USA - NJ and Pennsylvania)	The speed up movement of large convoys of resources across multiple State and/or national boundaries to support response and recovery following disasters.	Expediting the movement of private sector resources on a multi-state level in support of response efforts and mutual assistance for rapid CI restoration.	CIP-R Programme Implementation [8.3.2]
<b>Thematic Task Forces (TTF)</b>	Lombardy Region, Italy	To develop collaborative procedures for coping with specific accident scenarios, mapping of the information flows and communication channels among actors	TTF are result of partnership between the Lombardy Region, transport and energy CI operators in the region, Civil Protection and first responders. Involving operators according to their own interests and concerns.	Characteristics of the PPP [5.2] CIP-R Programme Implementation [8.3.2]
<b>Focus on Flows</b>	The Resilient Regions Association (Sweden)	The flows which are vital for society are interdependent and taken care of by different actors, both public and private. There is no actor in the system who can singlehandedly ensure that the city's flows function.	Cooperation and the development of functional cities with a focus on the flows of goods, services, money, people, energy and information. Seminars, conferences, breakfast meetings, members' training courses, workshops and study visits	CIP-R Programme Implementation [8.3.2] CIP-R Programme Development Strategy [8.4]
<b>Partnership Alignment for Enhanced Security</b>	The Netherlands Safety Regions	Transfer of responsibilities for the preparation of plans and responses to crises and disasters to the safety regional level of government	Partnerships for alignment of security management and process include coverage of CIR, as follows: <ul style="list-style-type: none"> <li>▪ Security Regions Act (defines the partnerships)</li> <li>▪ Regional Risk Profile</li> <li>▪ Regional Crisis Management Policy</li> <li>▪ Regional Crisis Plan</li> <li>▪ Specific CIP-R Crisis Plans</li> </ul>	Regional CIP-R Regulatory Framework [5.1] CIP-R Programme Development Strategy [8.4]



## 10. Final remarks

The present Guidelines is meant to be a dynamic “living document”. Thanks to the activities that will be carried out in the context of CIRINT.NET Association, it will be revised and further augmented to accommodate increased understanding (e.g. of vulnerabilities and associated infrastructure interdependencies phenomena), new and enhanced good practices, lessons learned from real events, and ongoing regional Programmes’ experiences worldwide.

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