SMARTE BYER ER SMARTE, MEN ER DE OGSÅ SÅRBARE? HVORDAN VURDERE ROBUSTHET?

Lars Bodsberg og Knut Øien

ESRA seminar, Hvordan oppnår vi en helhetlig risikostyring i fremtidens «smarte» samfunn?, Oslo, 1. juni 2017

Innhold

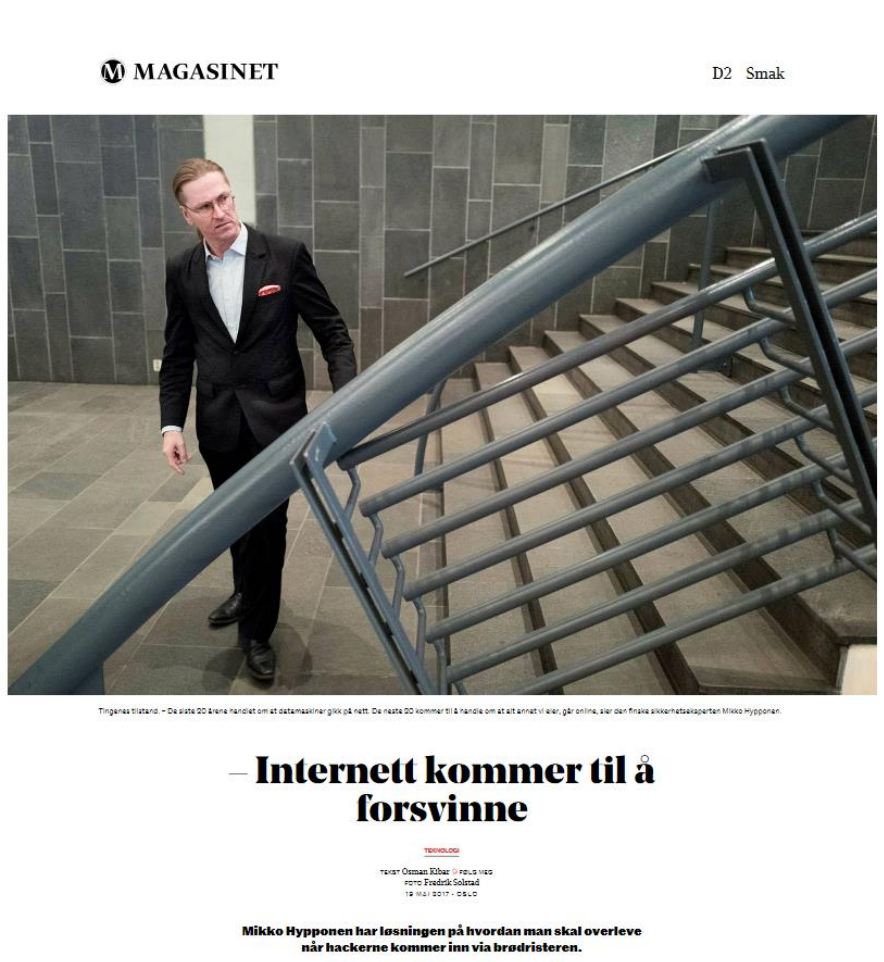
- Hva er en smart by?
- Nytt trusselbilde
- Resiliens – hvordan håndtere det uventede
- Hvordan vurdere robusthet/resiliens
  - REWI metoden
  - EU-prosjektet: SmartResilience
  - Andre EU-prosjekt

https://kth.instructure.com/courses/293

Byene leder i dag an i utviklingen mot det fornybare samfunnet – og trekker nasjonalstatene etter seg

Kommunal- og moderniseringsdepartementet:
Meld.St. 27 (2015-2016): Digital agenda for Norge

SINTEF


MAGASINET D2 Smak

Tingenes tilstand. – De siste 20 årene handlet om at datamaskiner gikk på nett. De neste 20 kommer til å handle om at alt annet vi eier, går online, sier den finske sikkerhetseksperten Mikko Hypponen.

– Internett kommer til å forsvinne

TEKNOLOGI

TEKST Osman Kibar FOLG MEG
FOTO Fredrik Solstad
19. MAI 2017 - OSLO

Mikko Hypponen har løsningen på hvordan man skal overleve når hackerne kommer inn via brødristeren.

Mikko Hypponen,
Forskningsdirektør sikkerhetsselskapet F-Secure

Ifølge DN Magasinet, 20. mai 2017:
En av verdens mest respekterte sikkerhetseksperter, kjent for sine teknologiske samtidsdiagnoser

"Når noen beskriver noe som smart, bør du alltid oppfatte dette som sårbart."

"Hver gang vi bringer funksjonalitet og intelligens inn i enhetene våre, gjør vi dem mindre sikre og tilgjengelige for nye former for risiko".

SINTEF

Hva er en gris?

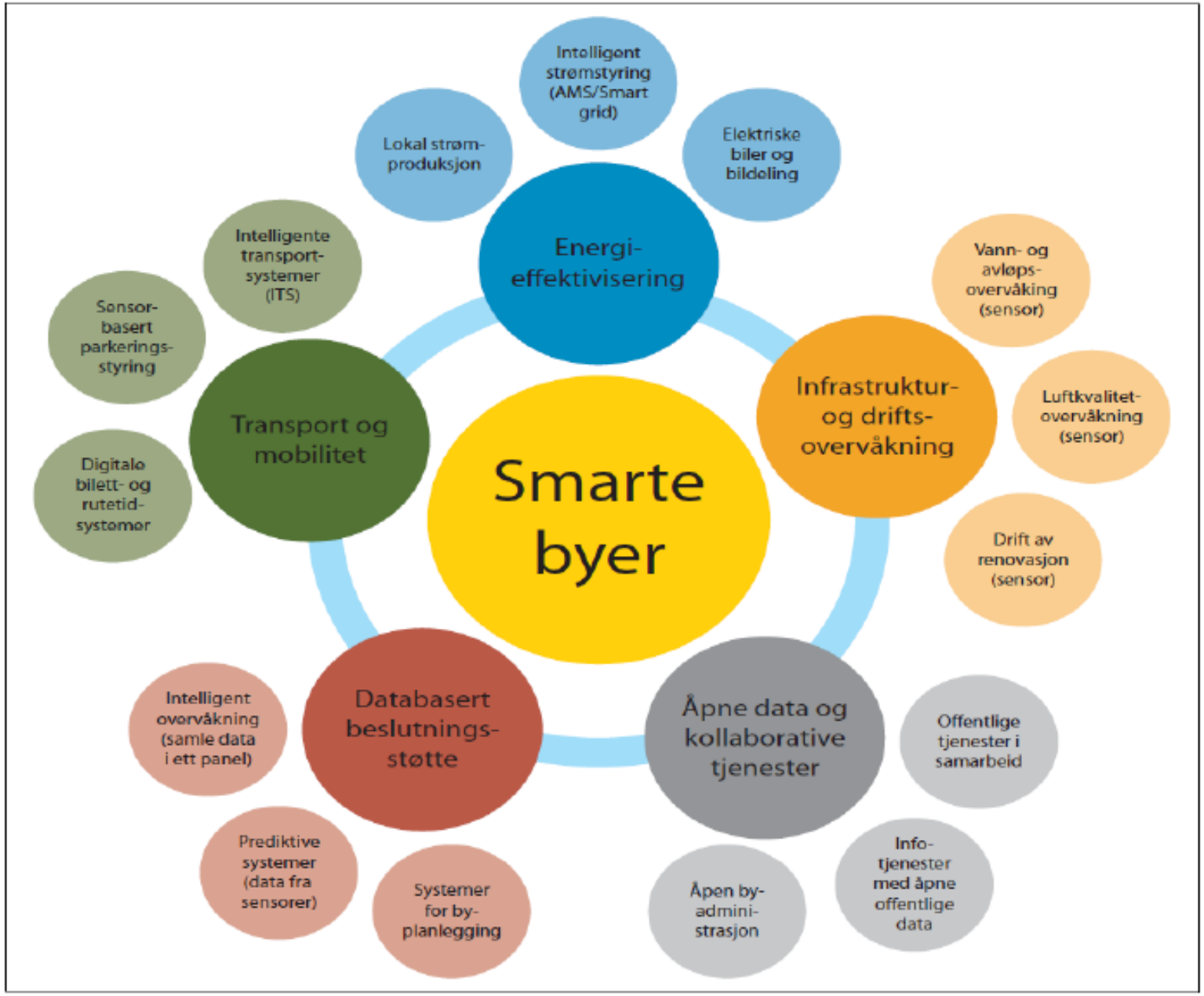
Gareth Morgan

Hva er en smart by?

"The answer is, there is no universally accepted definition of a smart city.

It means different things to different people. The conceptualisation of Smart City, therefore, varies from city to city and country to country, depending on the level of development, willingness to change and reform, resources and aspirations of the city residents."

http://smartcities.gov.in/content/innerpage/what-is-smart-city.php



«En smart by bruker digital teknologi til å gjøre byene til bedre steder å leve, bo og arbeide i.

Smartbyinitiativer har som mål å forbedre offentlige tjenester og innbyggernes livskvalitet, utnytte felles ressurser optimalt, øke byenes produktivitet, samt å redusere klima- og miljøproblemer i byene.»

Kommunal- og moderniseringsdepartementet: Meld.St. 27 (2015-2016): Digital agenda for Norge

SINTEF

Kritisk infrastruktur

SECTOR		PRODUCT OR SERVICE	
I	Energy	1	Oil and gas production, refining, treatment and storage, including pipelines
		2	Electricity generation
		3	Transmission of electricity, gas and oil
		4	Distribution of electricity, gas and oil
II	Information, Communication Technologies (ICT)	5	Information systems and networks protection
		6	Instrumentation automation and control systems (SCADA etc.)
		7	Internet
		8	Provision of fixed telecommunications
		9	Provision of mobile telecommunications
		10	Radio communication and navigation (e.g. Loran, GPS and Galileo)
		11	Satellite communication
		12	Broadcasting
III	Water	13	Provision of drinking water
		14	Control of water quality
		15	Stemming and control of water quantity
IV	Food	16	Provision of food and safeguarding food safety and security

SECTOR		PRODUCT OR SERVICE	
V	Health	17	Medical and hospital care
		18	Medicines, serums, vaccines and pharmaceuticals
		19	Bio-laboratories and bio-agents
VI	Financial	20	Payment services/payment structures (private)
		21	Government financial assignment
VII	Public & Legal Order and Safety	22	Maintaining public & legal order, safety and security
		23	Administration of justice and detention
VIII	Civil Administration	24	Government functions
		25	Armed forces
		26	Civil administration services
		27	Emergency services
		28	Postal and courier services
IX	Transport	29	Road transport
		30	Rail transport
		31	Air traffic
		32	Inland waterways transport
		33	Ocean and short-sea shipping
X	Chemical and nuclear industry	34	Production and storage/processing of chemical and nuclear substance
		35	Pipelines of dangerous goods (chemical substances)
XI	Space and Research	36	Space
		37	Research

Klaver et al., 2016, based on European Commission, Green Paper on a European Programme for Critical Infrastructure Protection, COM(2005) 567 Final, Brussels November 2015

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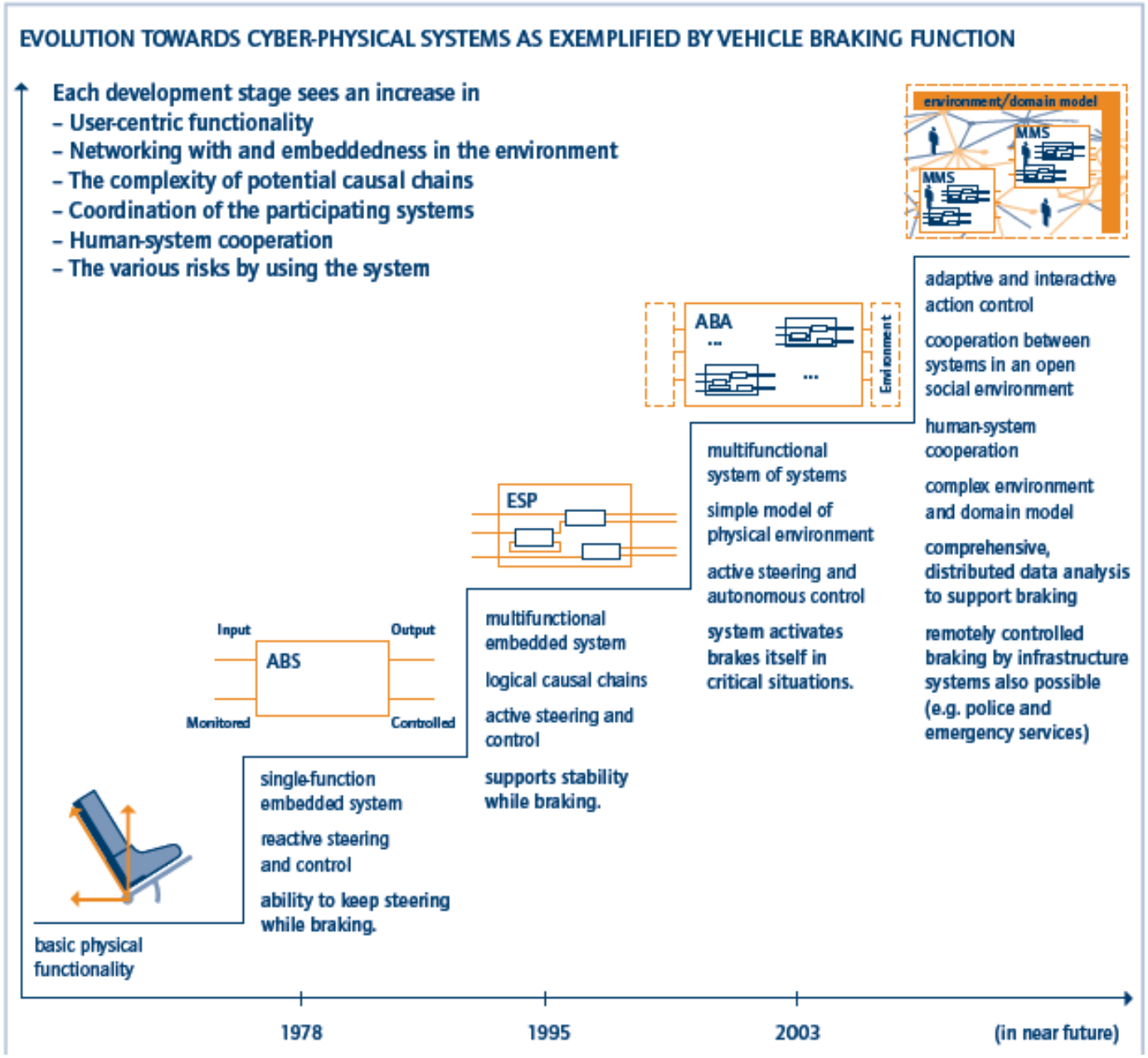
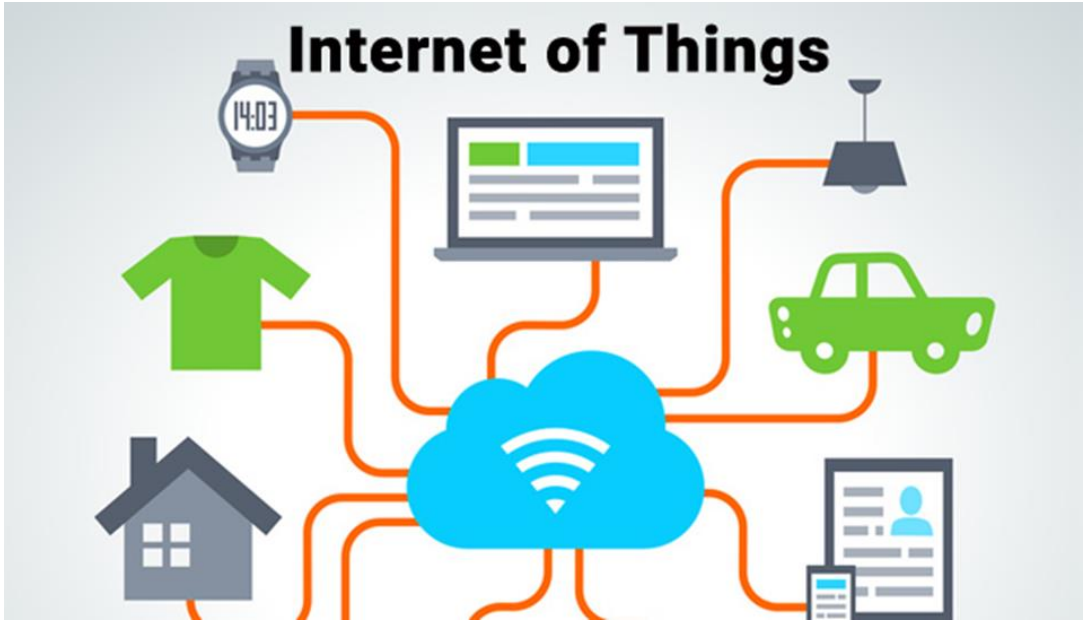


Living in a networked world, Acatech STUDY, March 2015

SINTEF



Tingenes internett

Fysiske gjenstander koblet til internett som samler inn data, bearbeider eller overvåker noe og kan kommunisere over nett

Nicolai Hjermind Hjelmager

SINTEF

Nye trusler

Du kjøper en IoT kaffemaskin og den har sikkerhetshull som lekker passordet til det trådløse nettverket

"Prisen er viktigst. Du begynner ikke å stille spørsmål som: Har den en brannmur? Har den systemer for å oppdage inntrengingsforsøk?"

"Kjensgjerning! Misliker å oppdatere enheter som fungerer."

Mikko Hypponen,
Forskningsdirektør sikkerhetsselskapet F-Secure

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WannaCry

The attack started on Friday, 12 May 2017, and within a day was reported to have infected more than 230,000 computers in over 150 countries.Parts of Britain's National Health Service (NHS), Spain's Telefónica, FedEx and Deutsche Bahn were hit, along with many other countries and companies worldwide

Wikipedia

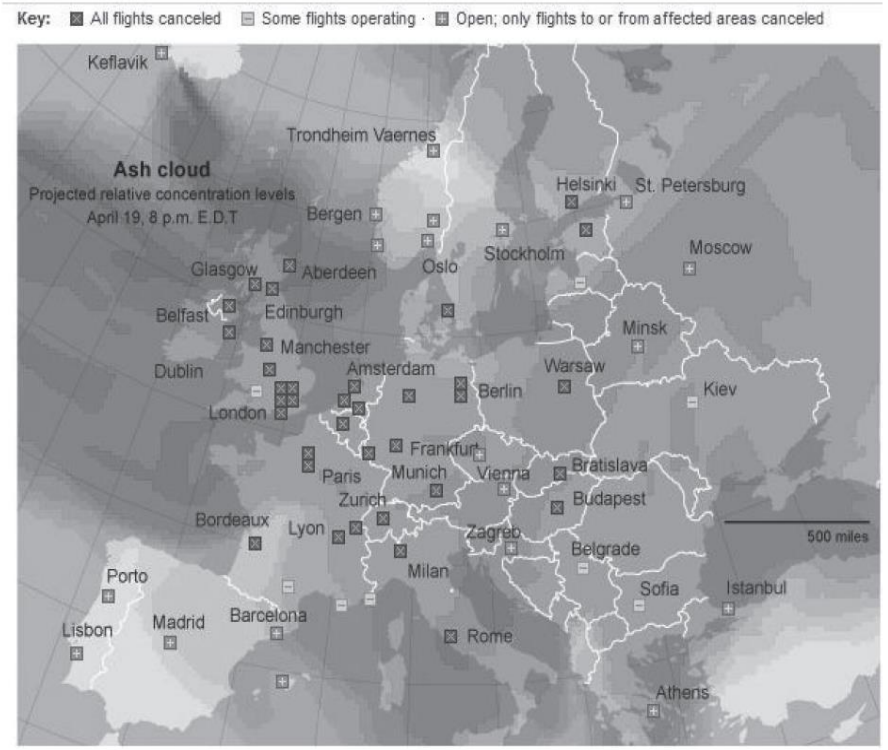
Et tilsvarende scenario med konvensjonelle våpen ville vært om USAs forsvar var blitt frastjålet noen av sine Tomahawk-raketter

Brad Smith, Microsofts toppsjef

SINTEF

En serie vulkanutbrudd på Island i 2010 lammet flytrafikken i Europa

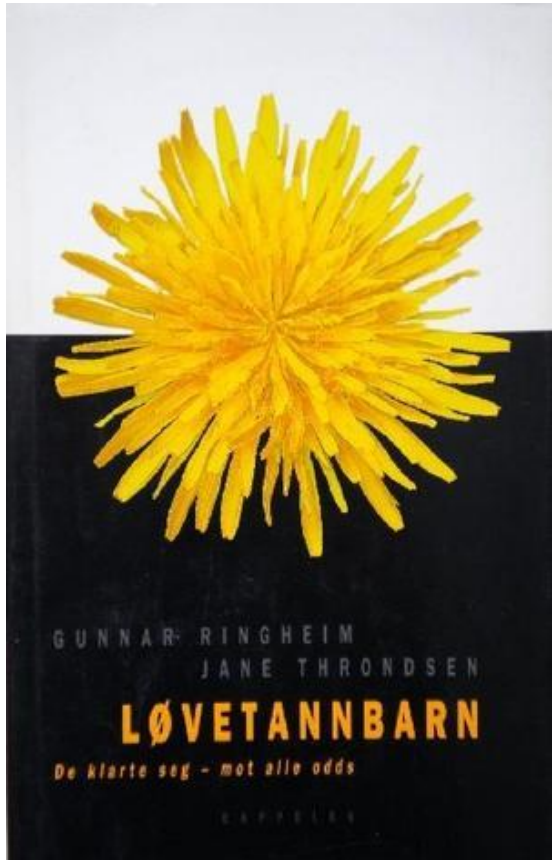
https://gfx.nrk.no/F1YR59ASX5nf0E-2eR2Yrwn-hMYl55m3FAAhhGMgR_BQ

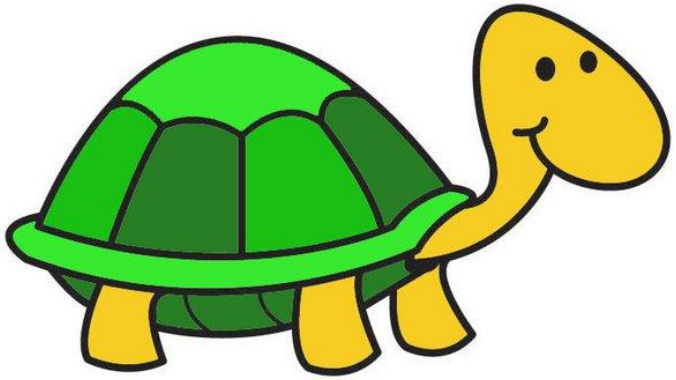


Source: Brandt, J., National Environmental Research Institute at Aarhus University, Denmark.

SINTEF

Resiliens

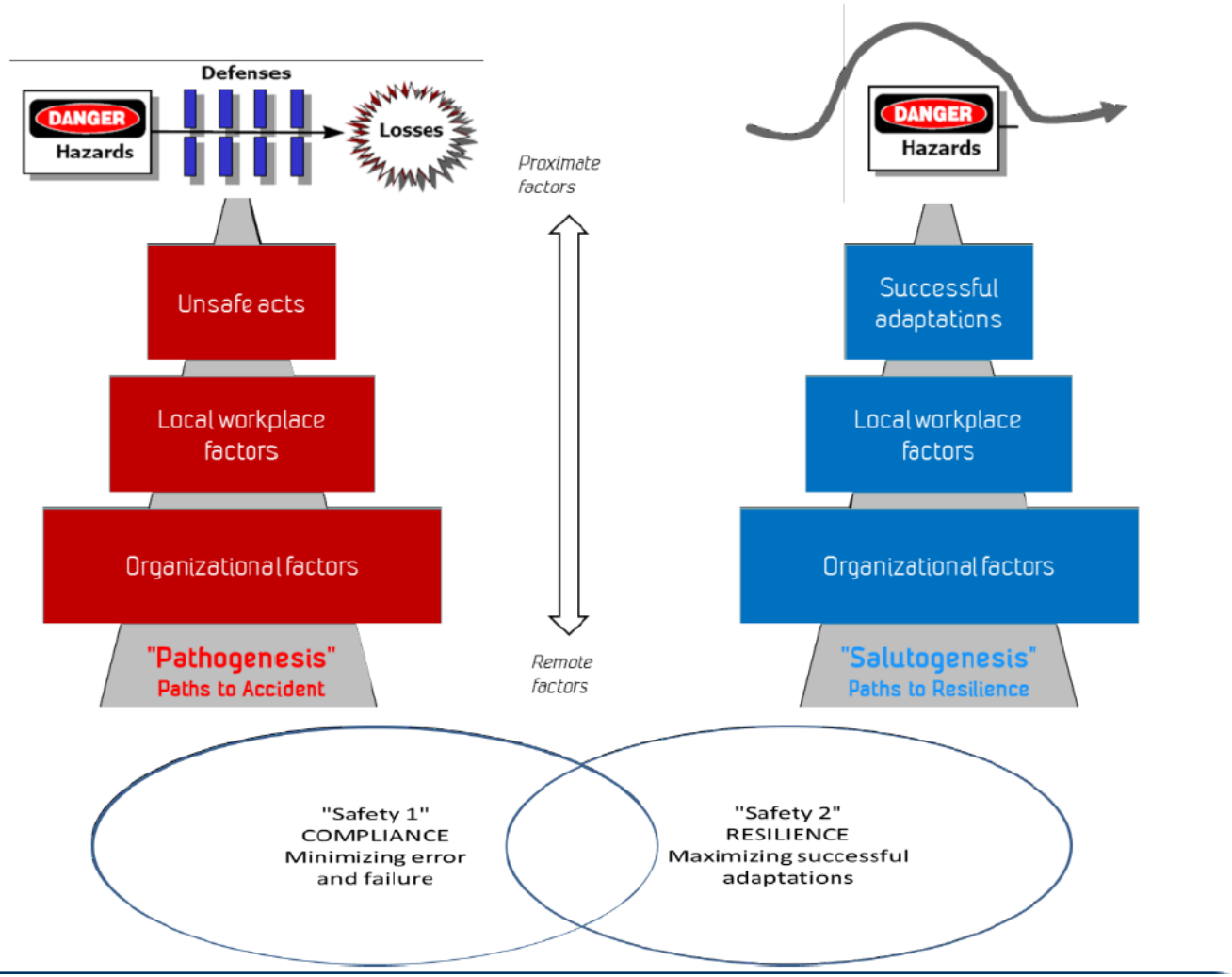

GUNNAR RINGHEIM
JANE THRONDSEN
LØVETANNBARN
De klarte seg – mot alle odds



Robust

Resilient

Combining Compliance and Resilience



T.O. Grøtan (2010)

SINTEF

Hvorfor skjer det ulykker?

- Vi etablerer og vedlikeholder barrierer,
  - planlagte tiltak for å hindre bestemte hendelsesforløp i å utvikle seg til ulykker

”Bow-tie” ulykkes- og barrieremodell

= *Barrieresystem* som skal utføre en *Barrierefunksjon*

Årsaksforhold

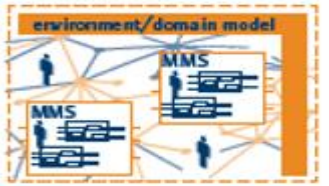
Hendelsesforløp

Gasslekkasje

Konsekvensutvikling

Påvirkende forhold

Påvirkende forhold



adaptive and interactive action control

cooperation between systems in an open social environment

human-system cooperation

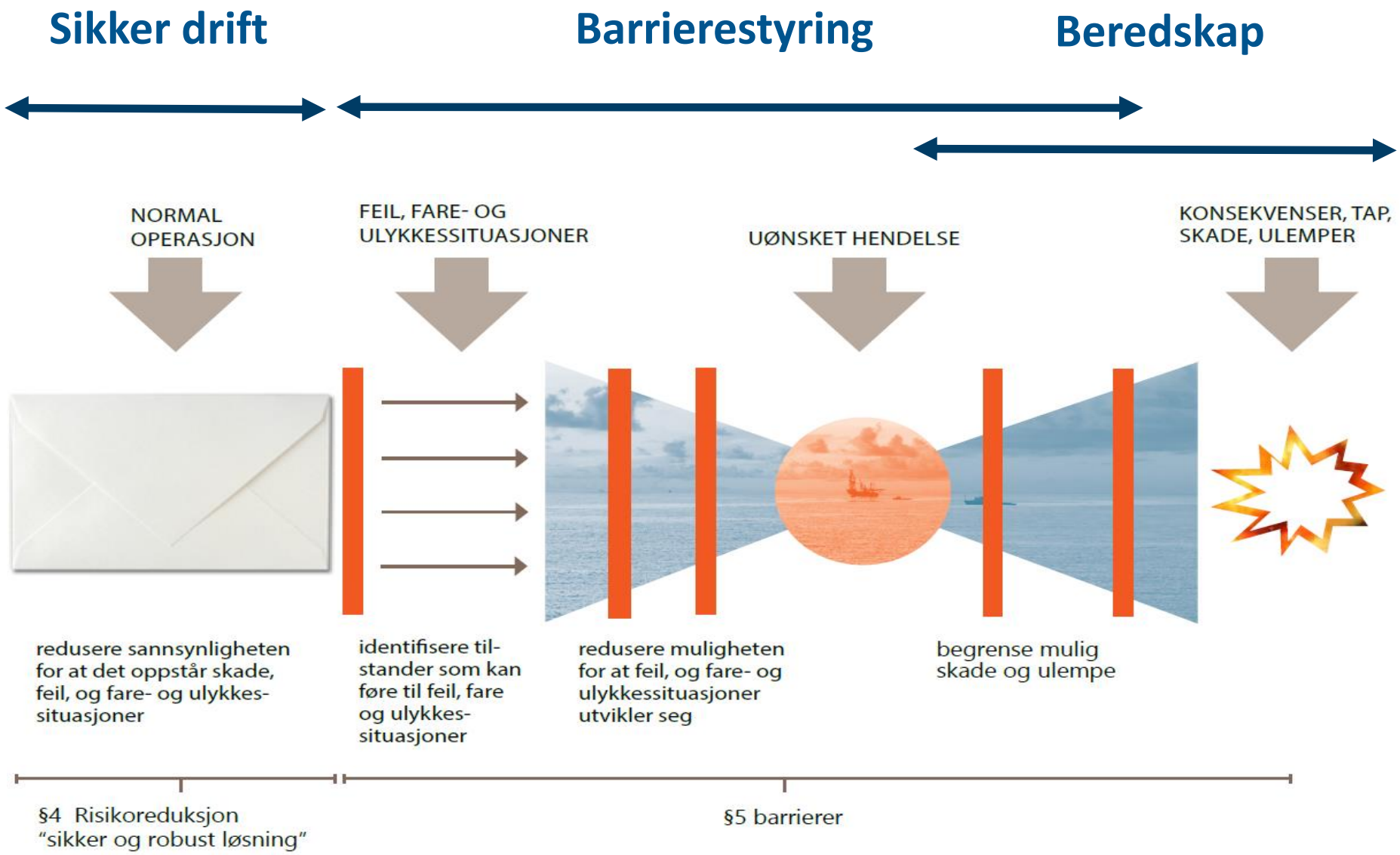
complex environment and domain model

comprehensive, distributed data analysis to support braking

remotely controlled braking by infrastructure systems also possible (e.g. police and emergency services)

SfS Samarbeid for Sikkerhet

SINTEF



Barrierenotat 2017, Petroleumstilsynet

Hvorfor skjer det ikke flere ulykker?

- Vi etablerer og vedlikeholder barrierer,
  - planlagte tiltak for å hindre bestemte hendelsesforløp i å utvikle seg til ulykker

- Vi har evne til å improvisere når det oppstår en situasjon ingen har forutsett
  - vi finner en løsning og implementerer den mer eller mindre umiddelbart

Robuste organisasjoner

- Tradisjonell ulykkesteori er vinklet mot de «sykdomsskapende faktorene», dvs. forhold som gjør at en organisasjon er utsatt for ulykker.

- Utvikling av robuste organisasjoner innebærer at vi må studere og kultivere de «helseskapende» faktorene

Eksempel «helseskapende» faktorer

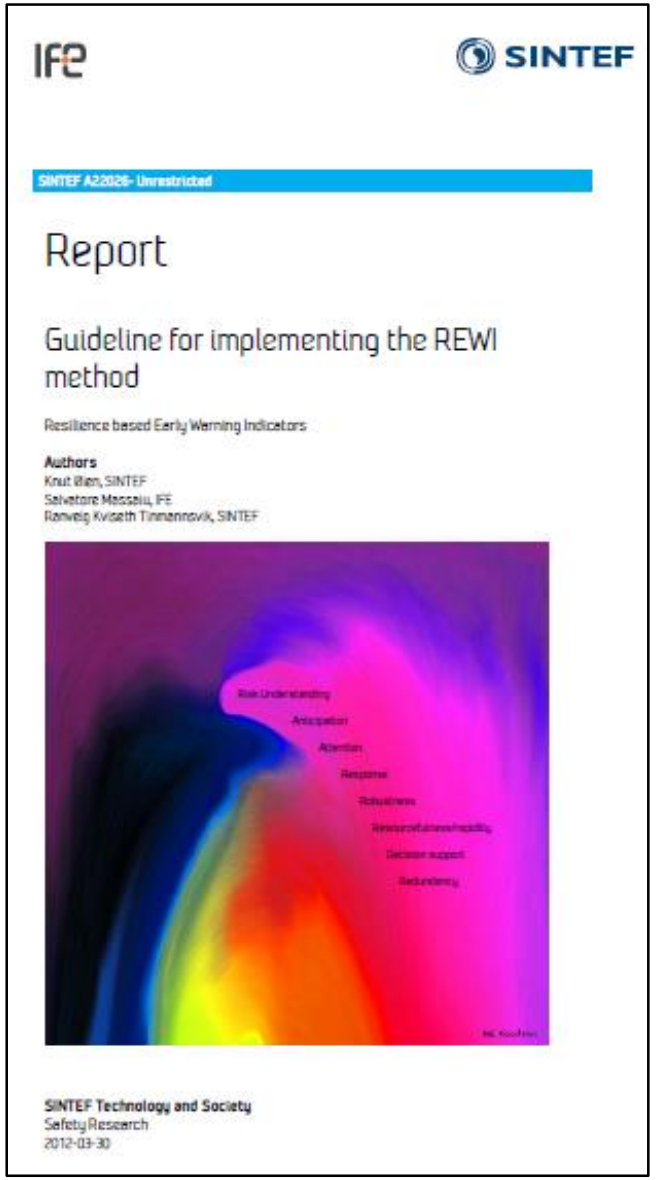
- Organisasjonen totalt sett har en bred risikoforståelse.
- Ansatte kjenner de tekniske systemene til bunns – fra de abstrakte fysiske prinsippene og ned til lunene og nykkene til hver enkelt duppeditt.
- Ansatte forstår operasjonene, ikke minst hvordan jobben de selv er ansvarlig for, virker inn på andres arbeidsoppgaver.
- Ansatte kjenner arbeidsprosedyrene så godt at de forstår hva som er konsekvensene av å avvike fra prosedyren.
- Ansatte har nok innsikt til å takle uforutsette situasjoner og til å kunne improvisere sikkert og effektivt i krisesituasjoner.
  - Ikke nok at kunnskapen sitter i hodene på enkeltpersoner. Organisasjonen må evne å dele kunnskap på tvers av faggrenser og organisatoriske grenser.

Resiliens – en alternativ tilnærming

Tradisjonell tilnærming	Resiliens tilnærming
Feil og svikt ses på som unormalt	Feil ses på som en normal variasjon i ulike måter å gjennomføre en arbeidsoppgave på
Ulykker kan forklares gjennom enkle årsakskjeder	Ulykker kan forklares gjennom uforutsette samspilleffekter
Barrierer mot kjente, planlagte hendelsesforløp	Forberede organisasjonen til å takle uforutsette situasjoner
Fokus på hva som kan gå galt – risikoanalyser	Fokus på hva som skaper sikkerhet

The Resilience based Early Warning Indicators (REWI) method

- A method for establishing safety indicators based on resilience thinking
- The concept of resilience is made operational through a set of Contributing Success Factors (CSU)



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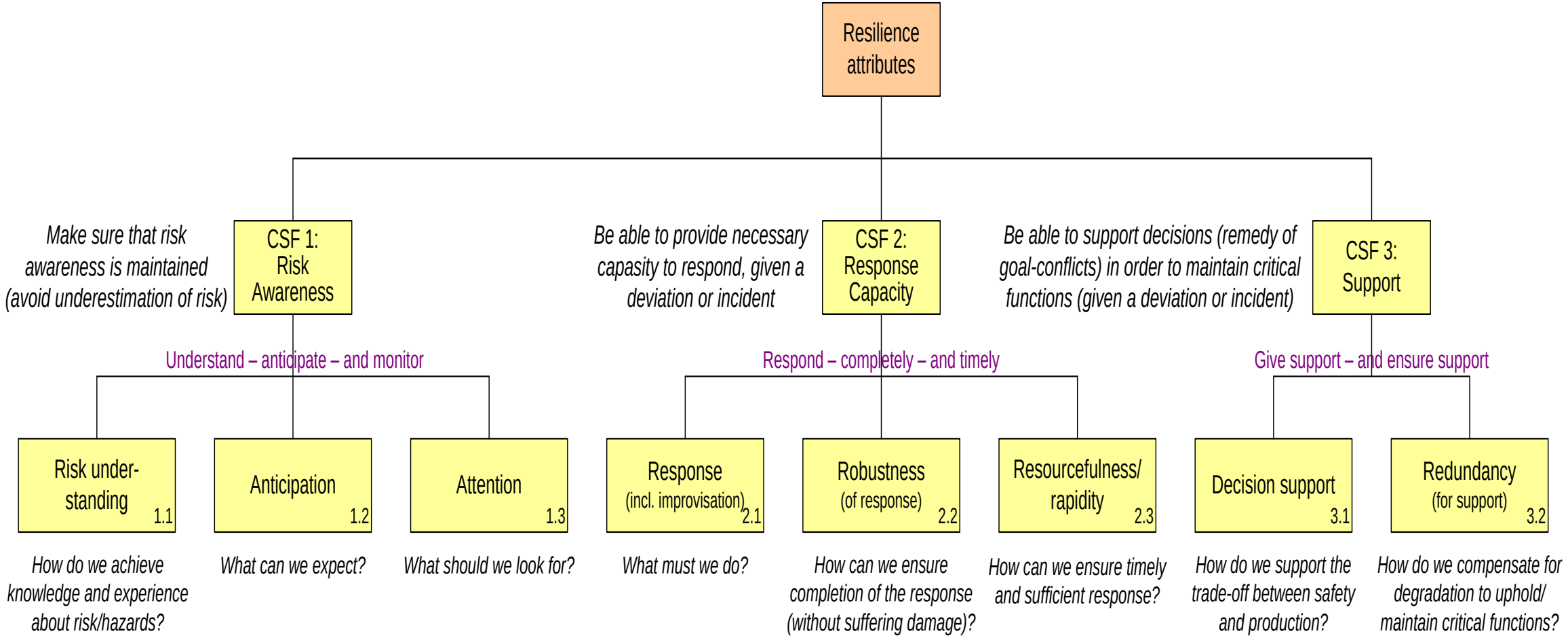
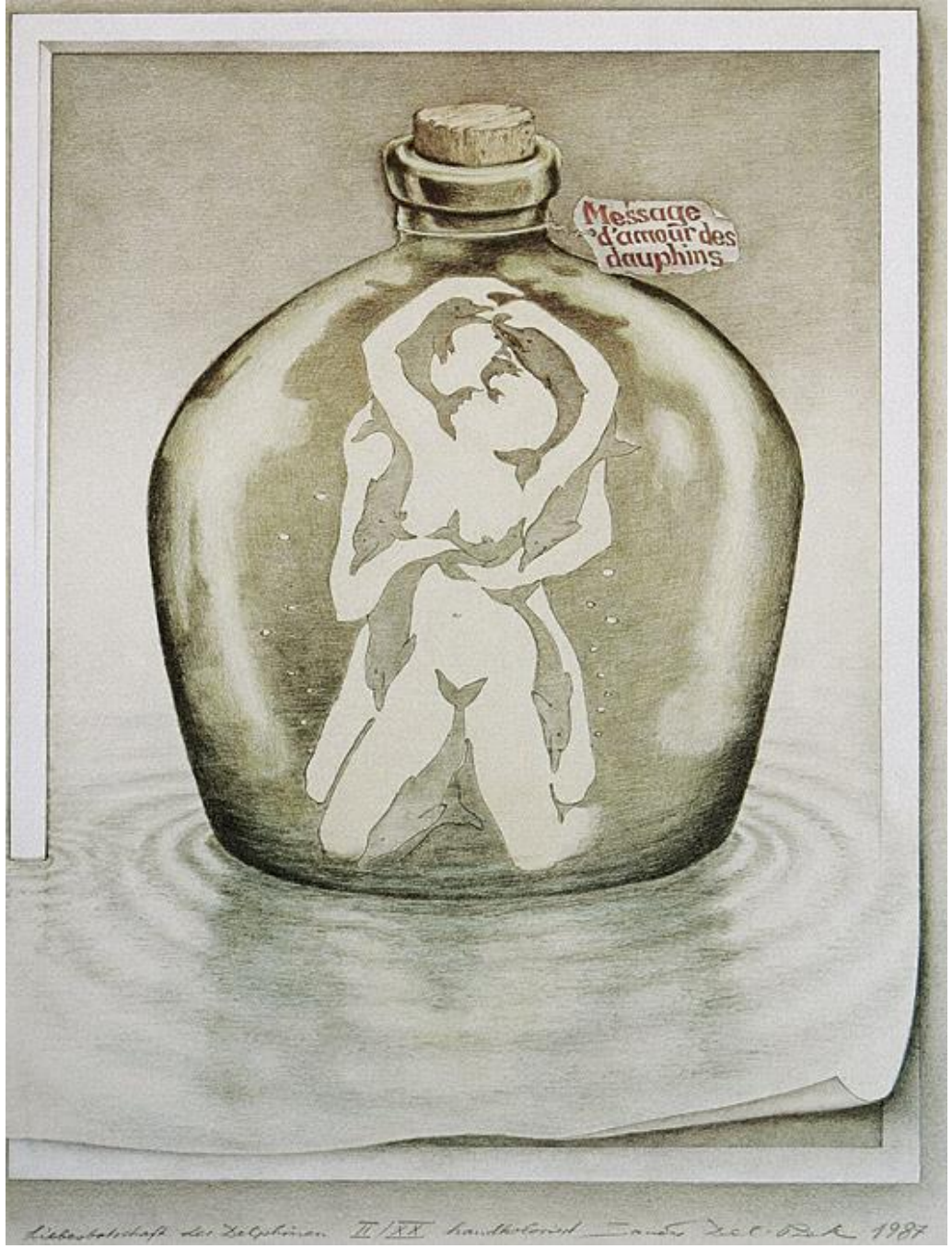
Contributing Success Factors





The Illusions of Love

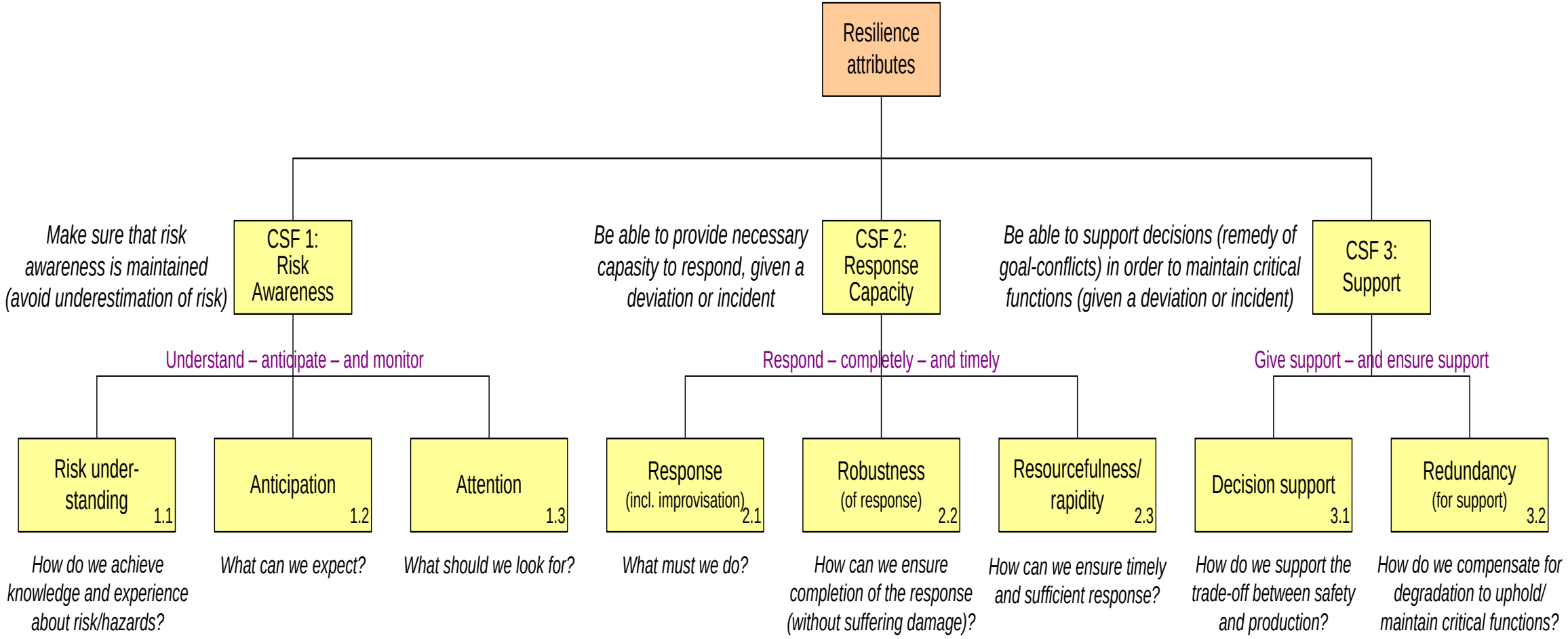
The way we see things depends on our frame of mind.

Adult viewers see two nude lovers embracing.

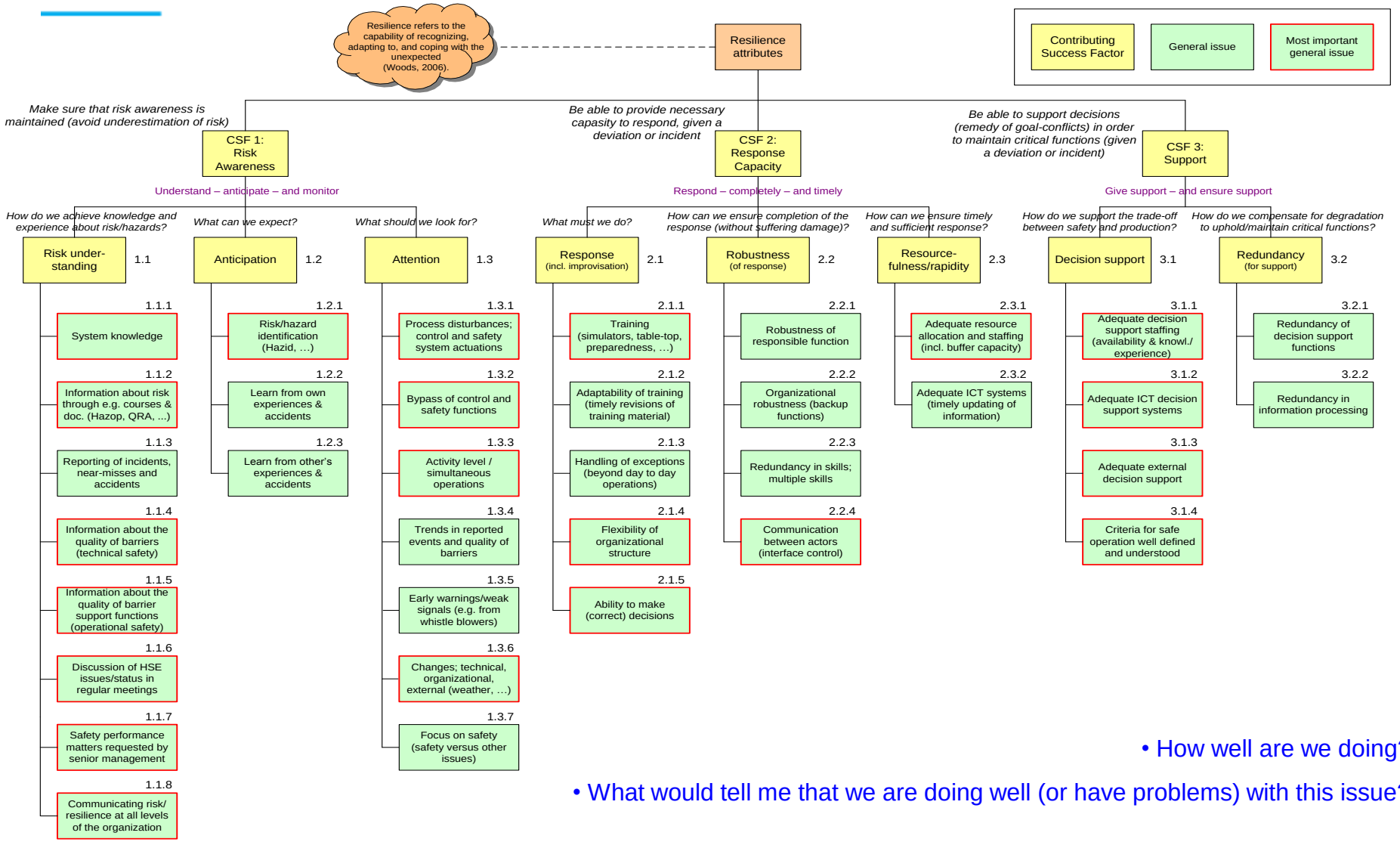
But when young children look at this image, they see only dolphins.

SINTEF

Contributing Success Factors



General Issues - overview



- How well are we doing?
- What would tell me that we are doing well (or have problems) with this issue?

General Issues - examples

No.	CSF level 2	General issue
1.1	Risk understanding	
1.1.1		System knowledge
1.1.2		Information about risk through e.g. courses & documents
1.1.3		Reporting of incidents, near-misses and accidents
1.1.4		Information about the quality of barriers (technical safety)
1.1.5		Information about the quality of barrier support functions (oper. safety)
1.1.6		Discussion of HSE issues/status in regular meetings
1.1.7		Safety performance matters requested by senior management
1.1.8		Communicating risk/resilience at all levels of the organization
1.2	Anticipation	
1.2.1		Risk/hazard identification
1.2.2		Learn from own experiences & accidents
1.2.3		Learn from other's experiences & accidents
1.3	Attention	
1.3.1		Process disturbances; control and safety system actuations
1.3.2		Bypass of control and safety functions
1.3.3		Activity level/simultaneous operations
1.3.4		Trends in reported events and quality of barriers
1.3.5		Early warnings/weak signals (e.g. from whistle blowers)
1.3.6		Changes; technical, organizational, external (weather, …)
1.3.7		Focus on safety (safety versus other issues)

SMART RESILIENCE INDICATORS FOR SMART CRITICAL INFRASTRUCTURES

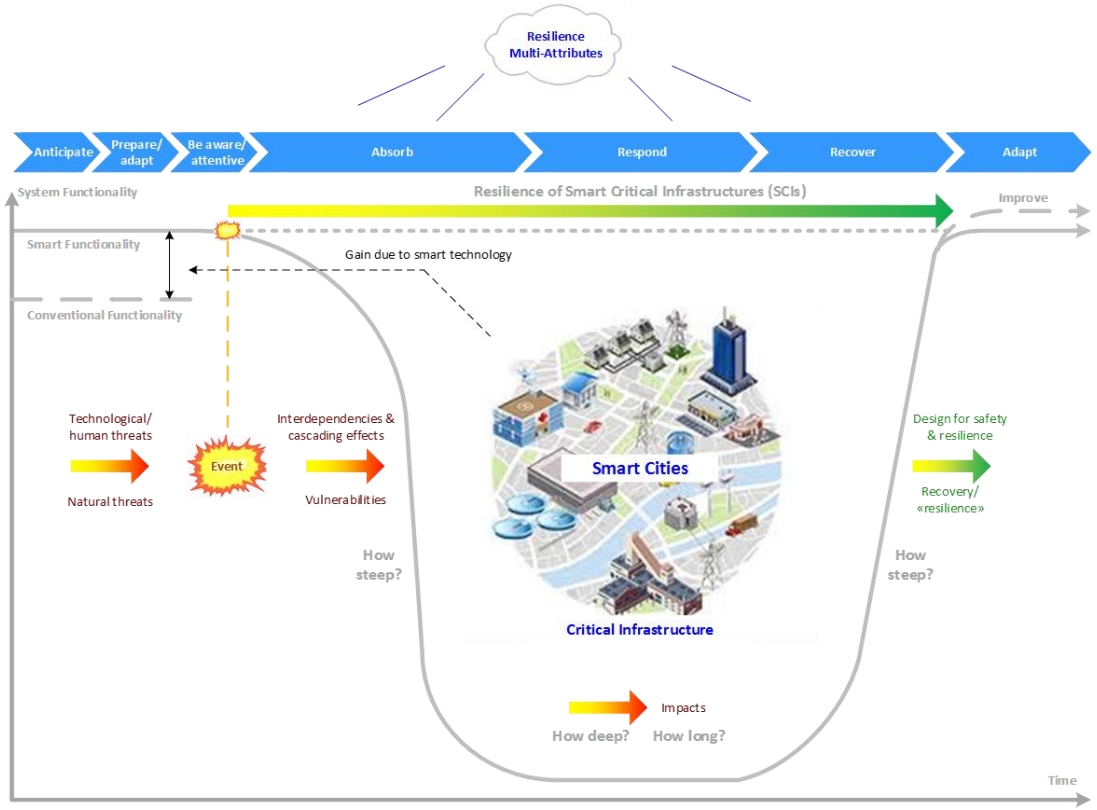
- Call: H2020-DRS-2015, DRS-14-2015
- Call name: Disaster-resilience: safeguarding and securing society, including adapting to climate change
- Topic: Critical Infrastructure Protection topic 3: Critical Infrastructure resilience indicator – analysis and development of methods for assessing resilience
- Budget: 4.9 mill EUR
- Duration: 3 years (May 2016 – April 2019)
- Coordinator: A. Jovanovic, EU-VRi *
- No. of partners: 20

* EU-VRi – European Virtual Institute for Integrated Risk Management

Consortium

No	Short Name	Participant organization name (beneficiary)	Type	Country
Coordination				
1	EU-VRi	European Virtual Institute for Integrated Risk Management	RES/SME	Germany
End users: Industry and public bodies				
2	IBM	IBM Israel Science & Technology Ltd.	IND	Israel
3	SwissRe	Swiss Reinsurance Company Ltd	IND	Switzerland
4	CoL	City of London Corporation	PUBL/IND	UK
5	SWH	Stadtwerke Heidelberg GmbH	PUBL/IND	Germany
6	CCC	Cork City Council	PUBL	Ireland
7	HNP	Hungarian National Police	PUBL	Hungary
8	NIS	Petroleum Industry of Serbia	IND	Serbia
Service to industry & research organization				
9	VTT	Technical Research Centre of Finland Ltd.	RES	Finland
10	SINTEF	Stiftelsen SINTEF	RES	Norway
11	IVL	Swedish Environmental Research Institute	RES	Sweden
12	R-Tech	Steinbeis Advanced Risk Technologies GmbH	RES/SME	Germany
13	FhG	Fraunhofer Gesellschaft e.V.	RES	Germany
14	ED	European Dynamics SA	RES/SME	Greece
15	AIA	Applied Intelligence Analytics	RES/SME	Ireland
16	BZN	Bay Zoltan Nonprofit Ltd. for Applied Research	RES	Hungary
Academia				
17	MUW	Medical University of Vienna	HE	Austria
18	SRH	Heidelberg University of Applied Sciences	HE	Germany
19	BUW	University of Wuppertal	HE	Germany
20	USTUTT	University of Stuttgart	HE	Germany

SMART RESILIENCE



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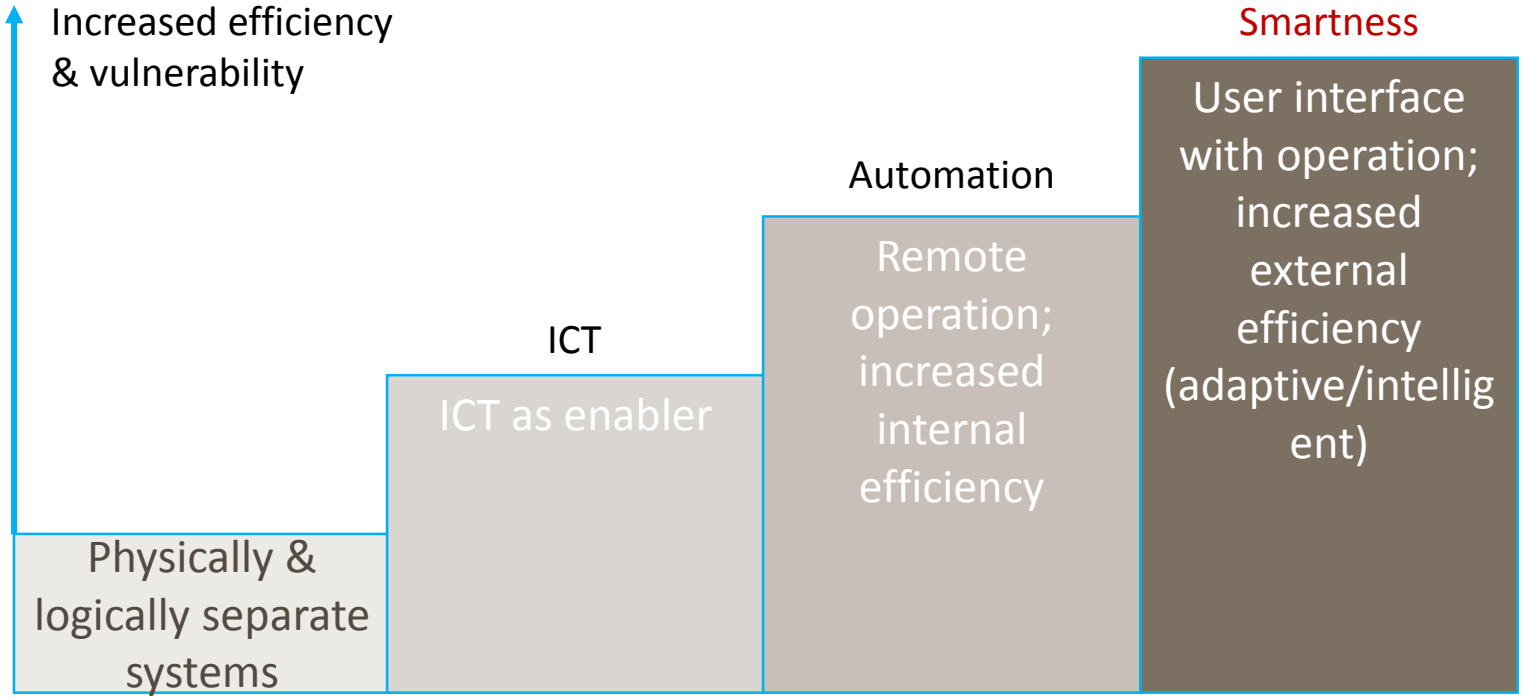
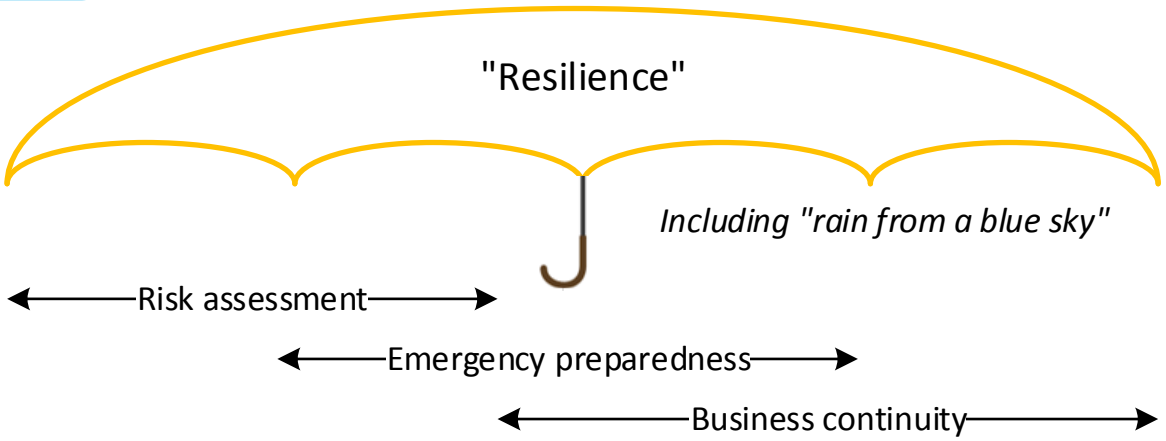
What is "Smart" related to Critical Infrastructures?

As a result of advances in information technology and the necessity of improved efficiency, however, these infrastructures have become increasingly automated and interlinked. [PPD-63]

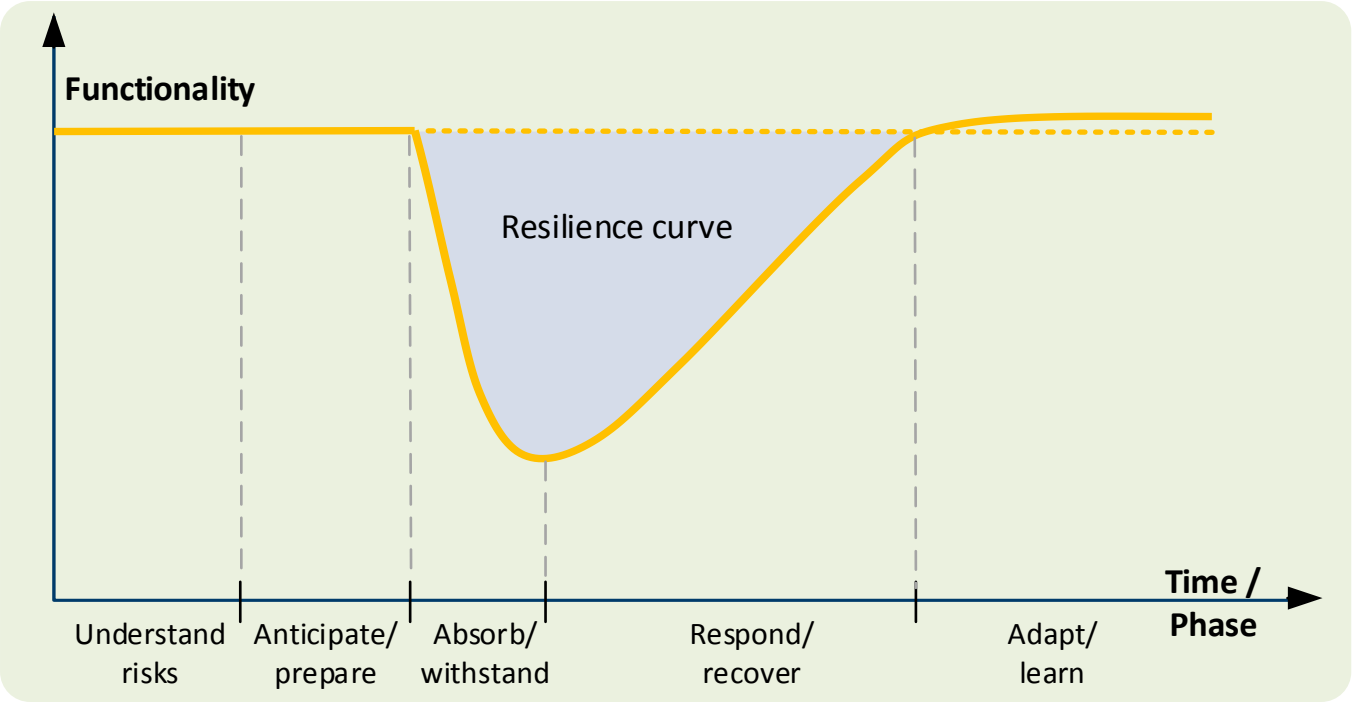


SINTEF

Resilience



"Umbrella" term

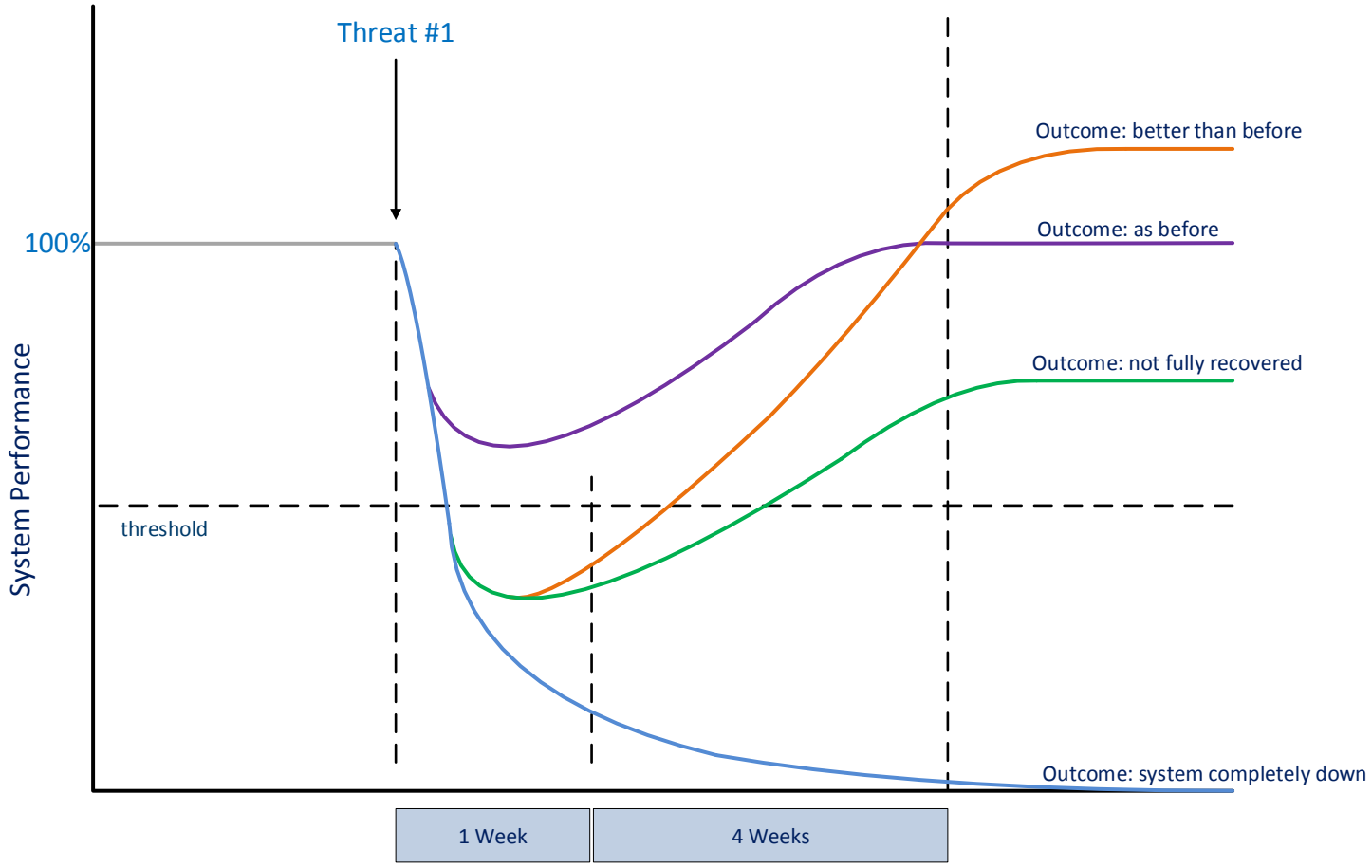


Cover all the various aspects (ISSUES) and the various stages (PHASES) of crisis management (RESILIENCE CYCLE)

K. Øien (2017)

How extreme are the extreme events?

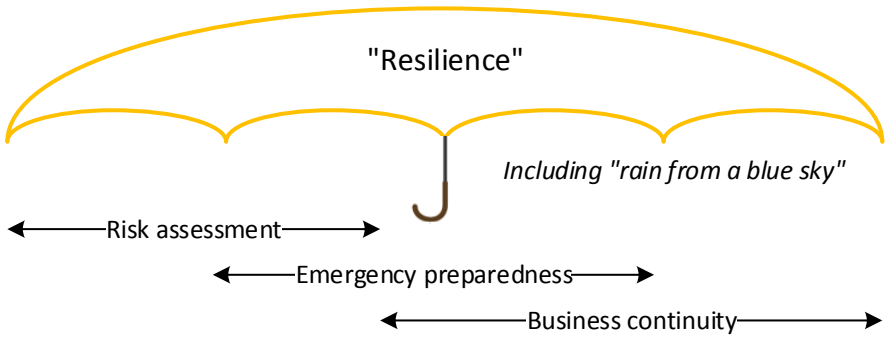
Will smart critical structures be able to "survive"?

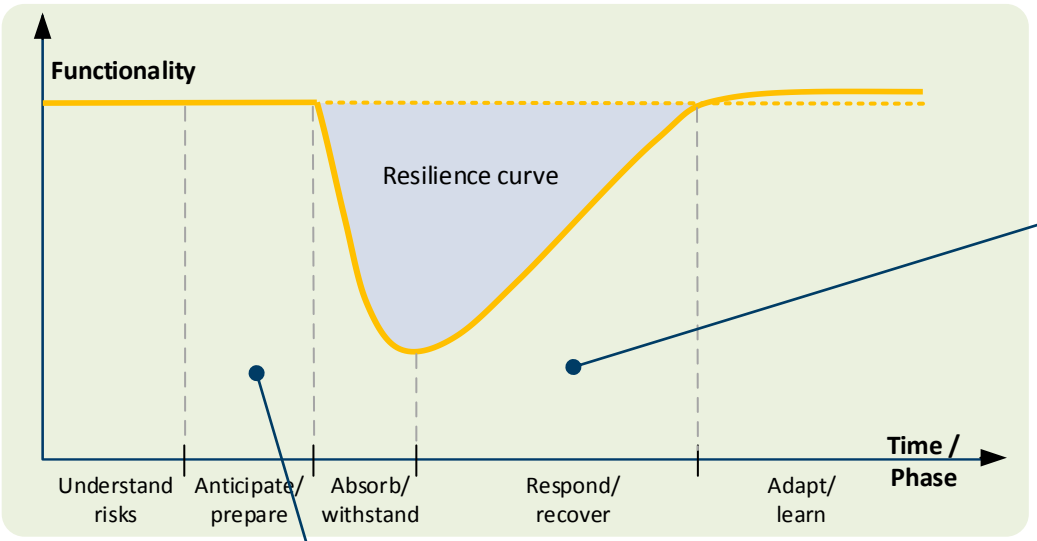


If they survive, do we include thresholds/acceptance criteria/…?

Acatech, Recil-Tech, 2016

What are Resilience Indicators?





Resilience indicators are HOW we measure the aspects/issues (WHAT) that are important for each phase of the resilience cycle

Including existing indicators from, e.g.

- Risk assessment
- Emergency preparedness
- Business continuity

ISSUE: Organizational robustness (back-up functions)

- IND1: % of time with back-up
- IND2: Degree of equal training for back-up functions

ISSUE: Expecting the unexpected (look into the horizon)

- IND: Amount of resources dedicated for this (e.g. Risk Monitors)

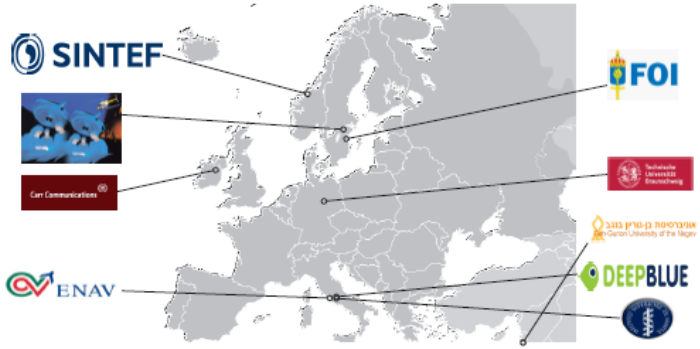
Example Issue and Indicators

ID	Type	Name of Issue/ Indicator	Description	Critical Infrastructure									Phase					
				All	Financial	Energy Supply	Health Care	Transportation	Industrial Production	Water Supply	ICT	Other SCIs	All	Understand risks	Anticipate/prepare	Absorb/withstand	Respond/recover	Adapt/learn
	Issue	Training (simulators, table-top, preparedness, …)	Training on how to deal with potential scenarios is essential in order to know what to do, not only with respect to identical or similar scenarios as trained on, but also with respect to response to other (unexpected) scenarios. This includes the use of simulators, table-top exercises, emergency preparedness drills, etc.	x											x			
	Indicator	Average no. of exercises completed by operating personnel each month	-	x											x			
	Indicator	No. of hours simulator training in total for operating personnel each month	-	x											x			
	Indicator	No. of emergency preparedness exercises last three months	-	x											x			

DARWIN – Expect the unexpected and know how to respond

Improve the ability of stakeholders to anticipate, monitor, respond, adapt, learn and evolve, to operate efficiently in the face of crises.

Duration (June 2015-May 2018) Deliverables: www.h2020darwin.eu

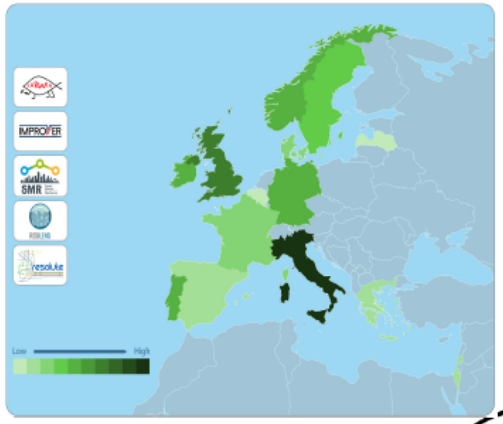


Partners

- 9 organizations
- 6 European countries

DARWIN Community of Practitioners (DCoP - 2016)

- 50 members
- 8 EU and other countries
- DRS- Projects



DRS-7 – DARWIN, SMR, RESOLUTE, IMPROVER, RESILIENS (2016)

- 53 organizations
- 13 European countries

http://www.sintef.no/en/projects/darwin/

DARWIN
ADAPT TO SURVIVE

SINTEF

Project number: 653289
Project duration: June 2015 – May 2018
Project Coordinator: Ivonne Herrera, SINTEF
Website: www.h2020darwin.eu

HORIZON 2020: Secure Societies
TOPIC DRS-7-2014
Crisis and disaster resilience – operationalising resilience concepts
RESEARCH AND INNOVATION ACTION

D1.3 – Public

DARWIN Expecting the unexpected and know how to respond

ADAPT TO SURVIVE

Practitioner and academic requirements for resilience management guidelines

VERSION	DATE
Version 0.7	24-May-2016

ABSTRACT

The DARWIN project aims to develop state of the art resilience guidelines and innovative training modules for crisis management. The guidelines, which will evolve to accommodate the changing nature of crises, are developed for those with responsibility of protecting the population or critical infrastructure/services from policy to practice.

This deliverable describes the requirements on the DARWIN Resilience Management Guidelines (DRMG) to be developed within this project. It contains requirements derived from: a) an extensive literature survey on resilience concepts, practitioner practices, definitions, needs, and issues, from which criteria were generated and concepts condensed and agreed-upon; b) a workshop where practitioner organisation experts discussed the content and practice of developing and evaluating current guidelines; c) a literature search on guidelines for writing and implementing guidelines; d) an ongoing project-wide scoping discussion; and e) the Description of Action (DoA). The requirements specification encompasses 124 requirements for consideration during the development and evaluation of the DRMG. Of these, 92 requirements have been posed on the product, i.e. the DRMG; 26 requirements have been posed on the process of developing the DRMG; and 6 requirements have been posed on the process of evaluating the DRMG. This document is thereby intended as the single source of requirements, and the baseline, for the DARWIN Resilience Management Guidelines (DRMG), stemming from both academics and practitioners.

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RESEARCH AND INNOVATION ACTION

D2.1 – Public

DARWIN Expecting the unexpected and know how to respond

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Generic Resilience Management Guidelines

VERSION	DATE
Version 1.0	31-01-2017

ABSTRACT

The DARWIN project aims to develop state of the art resilience guidelines and innovative training modules for crisis management. The guidelines, which will evolve to accommodate the changing nature of crises, are developed for those with responsibility for protecting the population or critical infrastructure/services from policy to practice.

This deliverable presents the initial version of the generic DARWIN Resilience Management Guidelines (DRMG), which aim at supporting organisations in developing and enhancing their resilience in the context of crisis management. The document describes the evolving process that was adopted to define the nature of the guidelines and create an initial version, based on the development requirements and content received from WP1. The guidelines are developed around the Concept Cards (CC), which represent sets of interventions proposed in order to develop and enhance specific resilience management capabilities captured in the conceptual requirements. The CCs are organised in themes (higher level capabilities) and related to each other as well as to basic functions of crisis management. This organisation of the guidelines allows for multiple ways of accessing their content, and anticipates the variety of needs and interests of the intended users. In addition to the guidelines themselves, the document describes a knowledge management platform, the DARWIN Wiki, built in parallel in order to facilitate the development, management and future use of the guidelines.

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Teknologi for et bedre samfunn