Resilience management guidelines and Operationalization applied to Urban Transport Environment

RESOLUTE project presentation
Emanuele Bellini, emanuele.bellini@unifi.it
Paolo Nesi, paolo.nesi@unifi.it
University of Florence

ASPN

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**RESOLUTE 5 Objectives**

**Obj1** - Conducting a systematic review and assessment of the state of the art of the Resilience assessment and Management concepts, national guidelines and their implementation strategies in order to develop a conceptual framework for resilience within Urban Transport Systems.

**Obj2** - Development of European Resilience Management Guidelines (ERMG).

**Obj3** - Operationalize and validate the ERMG by implementing the RESOLUTE Collaborative Resilience Assessment and Management Support System (CRAMSS) for Urban Transport System (UTS) addressing Roads and Rails Infrastructures.

**Obj4** – Enhancing resilience through improved support to human decision making processes, particularly through increased focus on the training of final users (first responders, civil protections, infrastructure managers) and population on ERMG and RESOLUTE system.

**Obj5** – ERMG wide dissemination, acceptance and adoption at EU and Associated Countries level.
RESOLUTE Map

State of the art

New Holistic Approach (FRAM, RAG)

Advisory Stakeholder Board

Consensus Driven

ERMG Guidelines

Dissemination and exploitation

Operationalize

RESOLUTE Tools (CRAMSS, Emergency App Game based Training app)

Adaptation for UTS

Feedback/refinement

Operationalize

Deployment

Pilots (Florence, Athen)

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Learning from Past

Big Flooding of 1966

Approximately **90% of the city's population were completely unaware** of the imminent disaster that would befall them as they were sleeping during the early hours of 4 November 1966.

Killed 101 people and damaged or destroyed millions of masterpieces of art and rare books.

From the first signal (first victim was at 2.30PM of the 3 Nov.) to the big event at 5.00AM of the 4 NOV passed 15 hours!!

**NB: The results of the risk assessment for flooding were there**
People took local WRONG decision to escape from the hazard...

- Lack of community preparedness
- Lack of contextual and real time information
- Lack-wrong official early warnings (P2P communication)
- Questionable allocation of the resources (all were concentrated at downtown)
  ...

Water flow direction
“Mud Angels” - community resilience
Florence Pilots objectives

Demonstrate and validate an integrated system of mobility management which, besides forecasting, will involve a corrective strategy actuation for restoring of safety condition for system users and of effectiveness of the public transport network in case of flooding.

- Reinforcing collaboration among city actors (and city departments..)
- Clarifying responsibilities and roles (e.g. underpasses)
- Improving self resilience of citizens and exploiting who is willing to help
- Improving communications and early warnings systems
- Monitoring the status of the Urban Transport System and detecting signals of possible issues
- Improving the interdependencies understanding
- Managing the resource available (e.g. First Responders) for planning and for real time emergency management
- Obtaining a tools to support the create and continuously update the city resilience plan.
Smart City and Big Data

Huge amount of data are produced from: Open Data, Linked Data, Real Time sensors, Twitter, WiFi, etc.
(Big Data: velocity, variety, volume, veracity, …)

Data available and collected through km4cty platform
http://www.disit.org/km4city

• Traffic data flows
• Public mobility services real time positions (e.g. bus, metro)
• Open Data (close to 1K available datasets including
  • Hidrogeological risk maps)
• City free Wifi covers the 80% of the city (trakking peoole flows and movement)
• Social networks (twitters)
• IoT (real time data from environmental sensors e.g. level of the river)
• Real time Parking availability
• City services (business,
• Real time status of the city hospitals-beds availability (pronto soccorso)
• Meteo data
• Cadastre data
• ….but more data are needed.

ISSUES
Multiple data owners-producers,
Different delivery rate,
Different formats,
Different data quality,
Different licence for data reuse, etc…
Twitter Vigilance

http://www.disit.org/tv

- Citizens as sensors to
  - Assess sentiment on services, events, ...
  - Response of consumers wrt...
  - Early detection of critical conditions
  - Information channel
  - Opinion leaders
  - Communities
  - formation
Learning from PastTraffic and People Flow Assessment

http://www.disit.org/6694

- **Origin Destination Matrix**
  - Specific Sensors, vehicle Kits, mobile App, Wi-Fi Access Points, etc.

- **Assess people and traffic flows to**
  - improve services
  - predict critical conditions on Crit. Infra.
  - take real time decisions and sending messages in push to population
  - Increase city resilience
  - optimize traffic flow
  - take decision of routing
City Services mapped

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Km4City: Open Smart-city Ontology

- The data model provided have been mapped into the ontology, it covers different aspects:
  - Administration
  - Street-Guide
  - Points of interest
  - Citations from strings
  - Local public transport
  - Sensors
  - Temporal aspects
  - Metadata on the data
  - Statistics
RESOLUTE Theoretical approach: FRAM

A system resilience side in the ability to understand and monitor resources and the capacities that they provide towards coping with both expected and unexpected amplitudes of performance variability

Efficiency-thoroughness trade-offs (ETTO model)

FRAM Functional Resonance Analysis Method
- Understand system interdependencies
- Monitor sources of variability
- Investigate system architecture and events

I = Input: That which engages function operation and is used to produce the function output
P = Preconditions: System conditions that must be met before function can be carried out
T = Time: This is simultaneously a resource and a constraint
C = Controls: That which supervises or adjust function performance
O = Output: That which is produced by the function and becomes the input for other functions
R = Resources: That which is needed and/or consumed by the function to process the input
Data Driven Approach

- Prevent
- Proact
- React

Strategic: Long Term
Tactical: Medium Term
Operational: Short Term

Connecting real (Big) Data to the model

Decision Support System for: Decision Makers and CI managers

- Data driven Resilience Assessment
- Prediction-simulation
- Real time emergency management (tradeoff costs-time to recovery)
- Data Driven training

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RESOLUTE Architecture

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RESOLUTE Solution

- **CRAMSS framework** is based on an open, service oriented, multi-layer architecture and will embrace both a vertical (top-down and bottom-up) and a horizontal (across sectors and stakeholders) approach and that incorporates, at a minimum – and subject to final architecture, open standards data ingestion services; a data substrate containing both reference and dynamic data (the DATA layer);

- **internal APIs** for the application of analytics tools, modelling and simulation services (the Application Framework), RESOLUTE applications (the Application layer), and so on;

- **full public API** that allows the integration with existing external systems (the Integration Framework), in order to promote and effect the exploitation of RESOLUTE services by third parties.
Game-based training has been associated with greater cognitive effort - an important condition for skill learning and improvements in

- skill execution,
- problem solving and
- decision-making

following game-based training than training involving repetitious technical instruction.

In RESOLUTE we design and develop a game based meta-application for Training in order to train different user categories and to improve the community self-resilience.
Emergency mobile app

New position acquired:
Building: Santa Marta
Floor: 2
Department: Ingegneria
Room: 496
OK

QRcode Reader

Reach emergency
Reach building

Position
Collecting Areas
Indoor collecting areas
raccoltaDiProva
Distance: 46 m
punto di raccolta 2
Floor: 0
CORTILE
Floor: 0

Outdoor collecting areas
Area 1
Distance: 4668 m
Parcheggio
Distance: 4740 m

Mobile Emergency Pro

Position
Building: S.Marta
Department: DEMO
Floor: 2
Room: 502
Street: via S.Marta
Street Number: 28
Date: 14-02-2013 17:03

Update position
Update your position

Indoor map
Your position inside building

Outdoor map
Your GPS position

Reach Area

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Paolo Nevi, Emanuele Bellini, UNIFI
ASPEN Risk and Resilience
ASPEN, CO

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Some notes:

• Is National Library of Florence adapted now? No..
  historical books are in the same places, no specific protections or recovery plan

• Are the citizen more prepared or aware now? No..
  they are only more worried each time the level of the river rises up a bit.

• Is there a clear communication protocol among public depts. involved in managing
  resilience in the city as civil protection, mobility dept, ICT dept, etc.?
  Thanks to RESOLUTE they just start to think about of sharing information
Thanks for the resilient attention