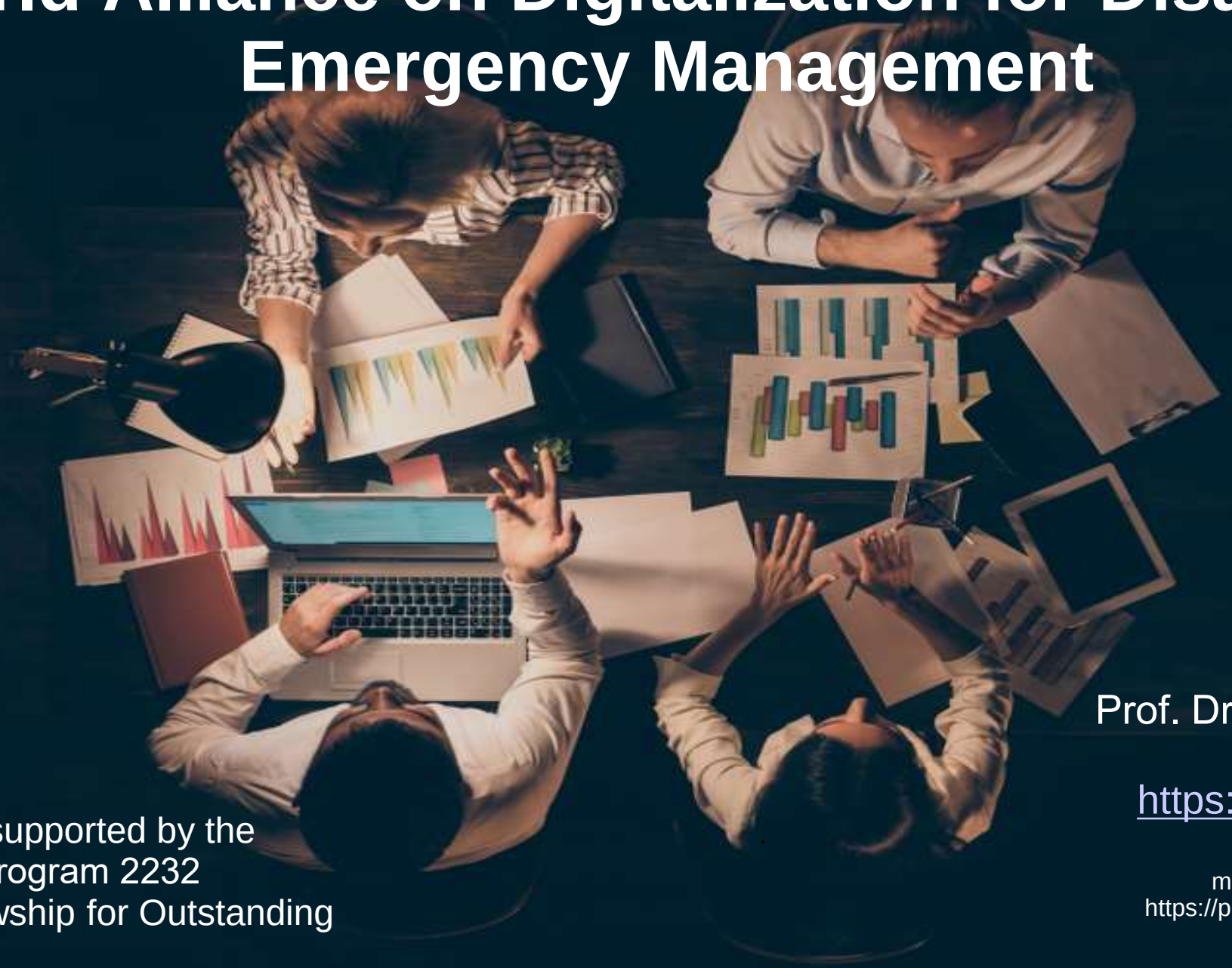
World Alliance on Digitalization for Disaster & Emergency Management



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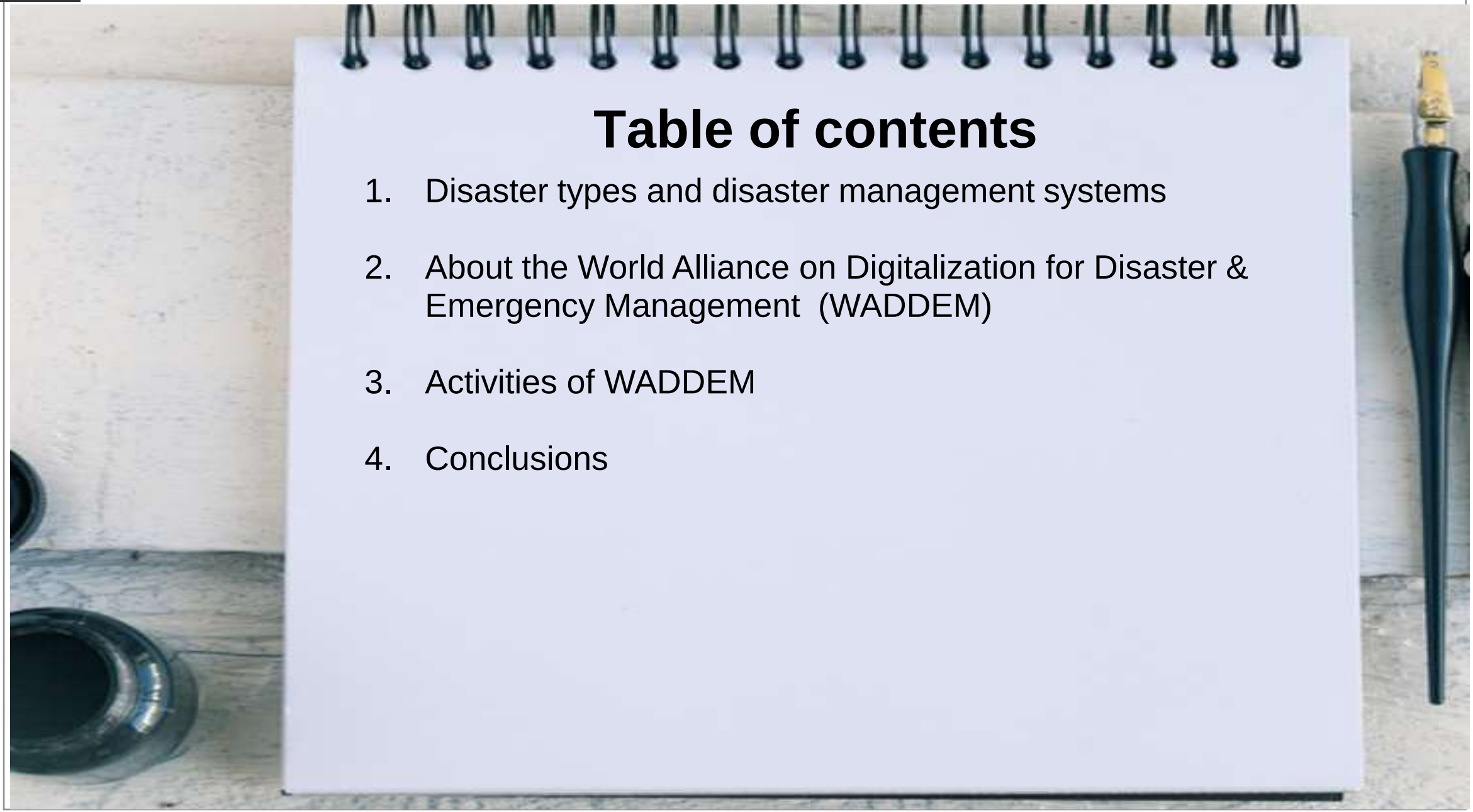

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Section 1.
Disaster types and disaster management systems

Disasters

natural,

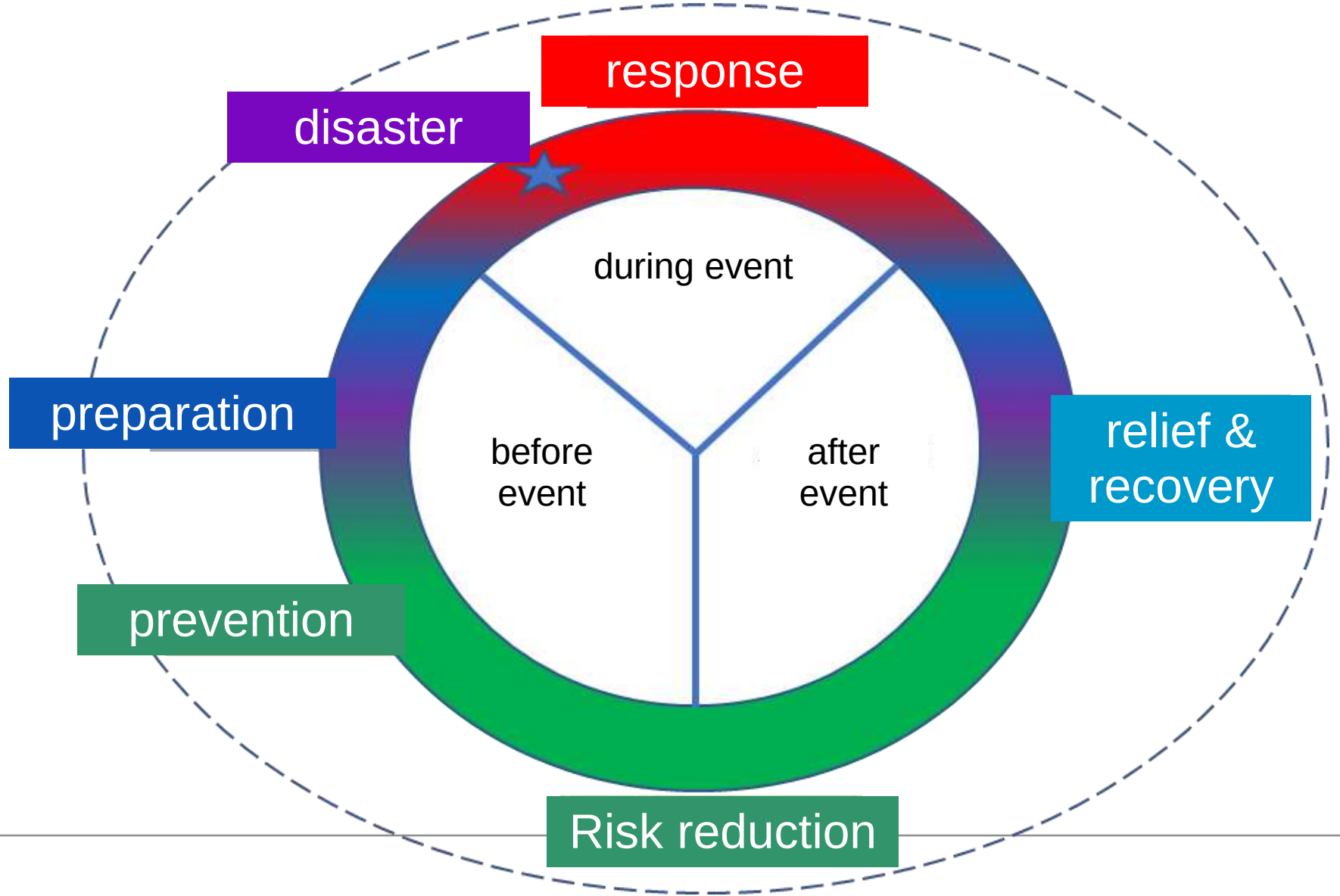
technological,

or human

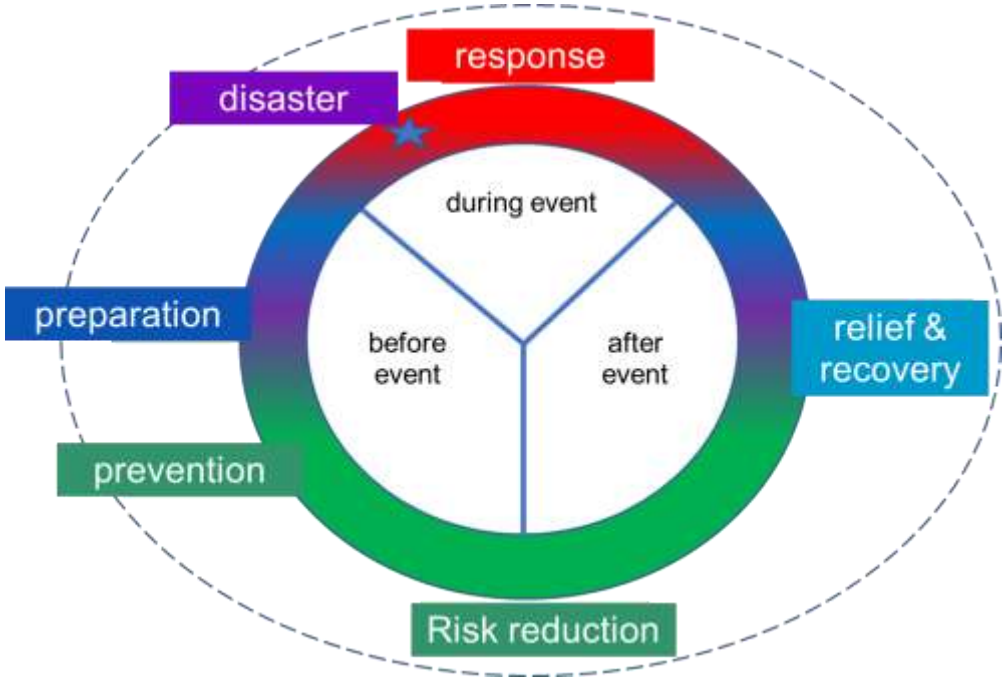
The phases of disaster management

Control room

Disaster management lifecycle



Management procedures and kinds of disasters



In general, actions to be taken depend largely on the disaster kind.

In the literature, most risk reduction techniques focus on the ‘before event phase’. Response operations are also called rescue or intervention operations.

Disaster response: state-of-the-art

Ground-based Data sources

Drones

Sensors

Security cameras

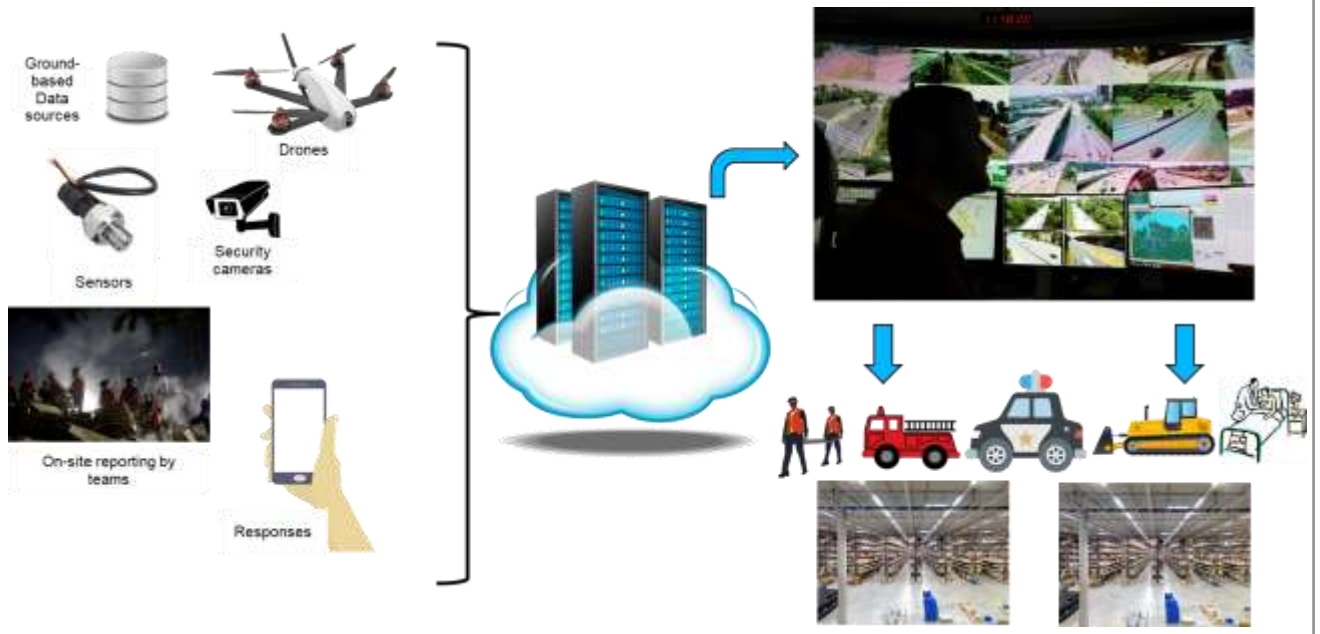
Responses

On-site reporting by teams

Software Technologies are adopted in situation awareness & deduction, data gathering and storage, visualization, logistics, communication, etc.

What's missing with today's disaster management systems?

- Lack of end-to-end traceability and process support for command and control.
- Weak or absence of automated demand generation and optimal allocation of resources.
- Lack of key performance indicators.
- Lack of mechanisms to optimize the aid operations on-line.
- Lack of digital ecosystem platforms.

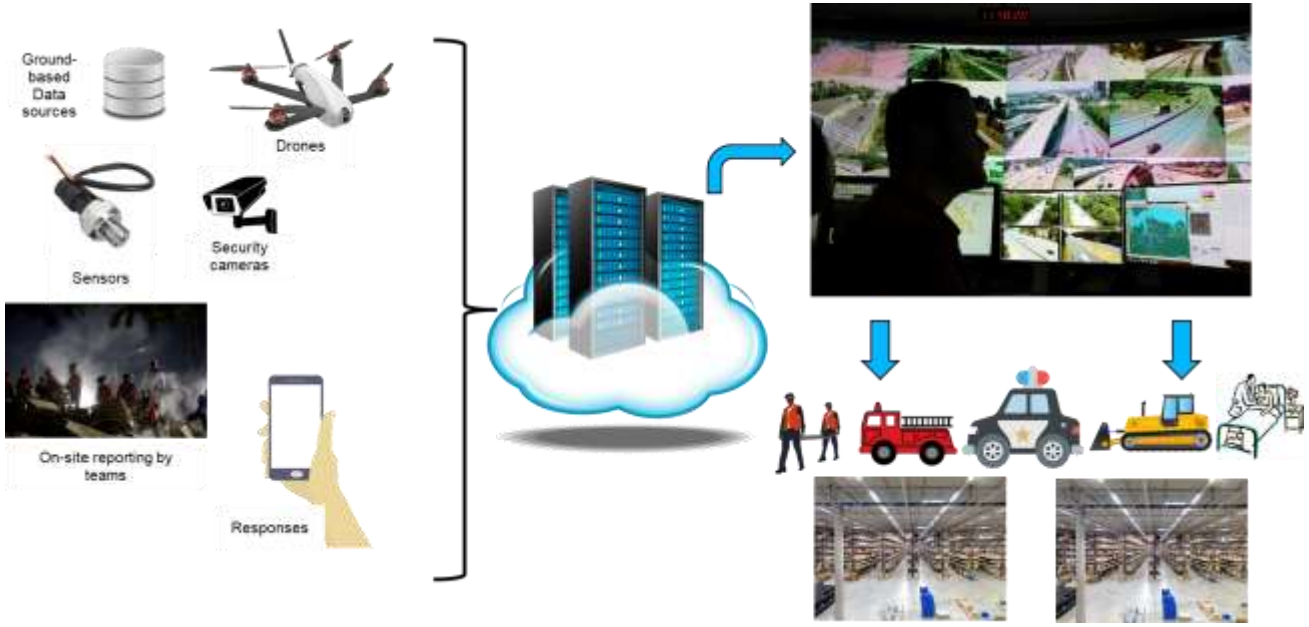


WADDEM's claim

"We missed only two strategic goals: Supply and demand."

CartoonStock.com

WADDEM claims that disaster management is a resource management problem and digitalization is needed to its fullest extent!



Section 2.
About the
World Alliance on Digitalization for Disaster & Emergency Management (WADDEM)

The alliance

WADDEM will cover disasters caused by all types of hazards including

natural,

technological,

and human.

The objectives as defined by WADDEM are identified by extensive field study and problem analysis


Dijital Afet Yönetim Sistem Gereksinmeleri Üzerine Anket

Prof. Dr. Ir. Mehmet Akgül

Sürüm 1.1
(01-09-2022)

65 general requirements identified by questionnaire on the following viewpoints:

1. Disaster management
2. System architecture
3. Software design
4. Quality


Dijital Afet Yönetim Sistem Gereksinmelerinin Önceliklendirilmesi

Prof. Dr. Ir. Mehmet Akgül

Sürüm 1.1
(01-09-2022)

Prioritization: Identify the requirements that can be deferred!


Birinci derecede acil dijital Afet Yönetim Sistem Gereksinmelerinin Teknolojik Sentezi

Prof. Dr. Ir. Mehmet Akgül

Sürüm 1.1
(01-09-2022)

Synthesis: Identify the technologies and skills necessary

The alliance distinguishes itself in the following ways:

a) Process automation for command control

b) Digital ecosystem platform

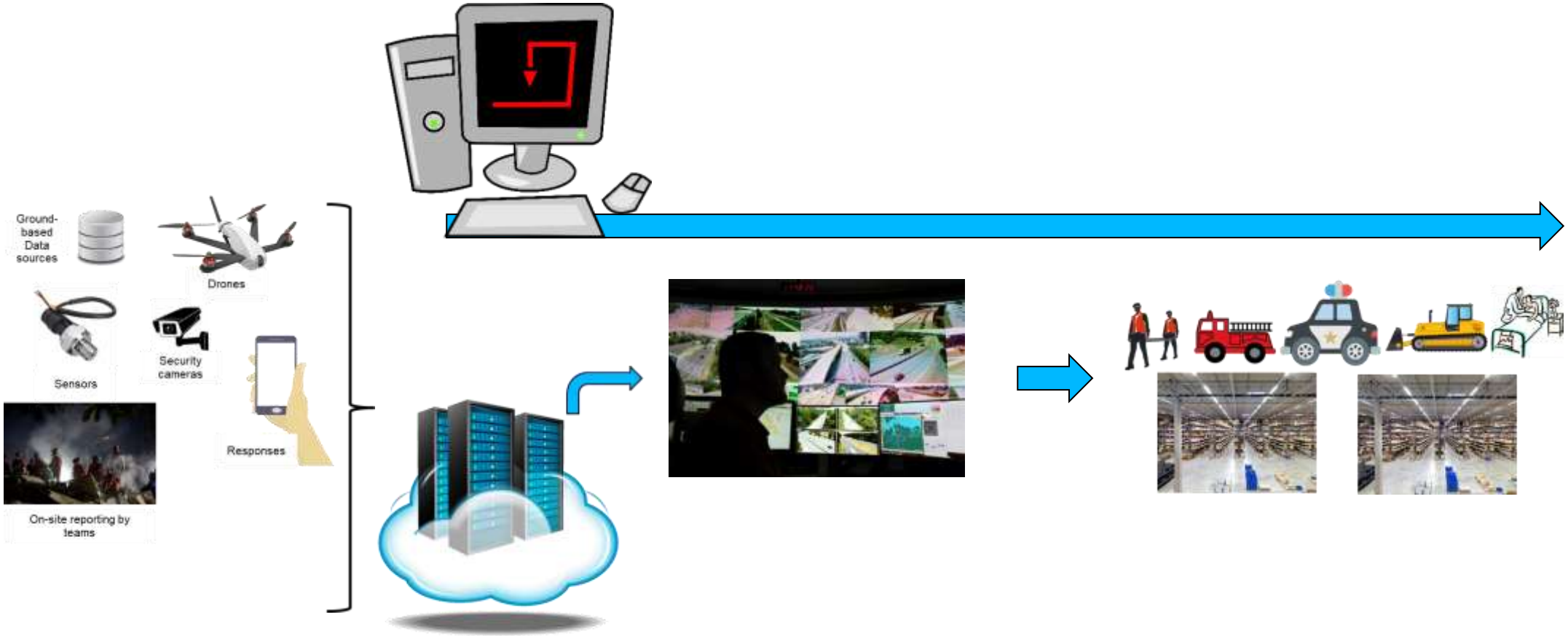
c) The ADOPTS principle

d) The role of social capital

e) Disaster and emergency resilient economies and industries

A new paradigm in disaster & emergency management

a) Process automation for command and control



The alliance focuses on novel techniques in automating disaster and emergency management processes and traceability for command and control in the broadest sense, for each disaster instance, for each victim, for each rescue operation, for each resource used, etc.

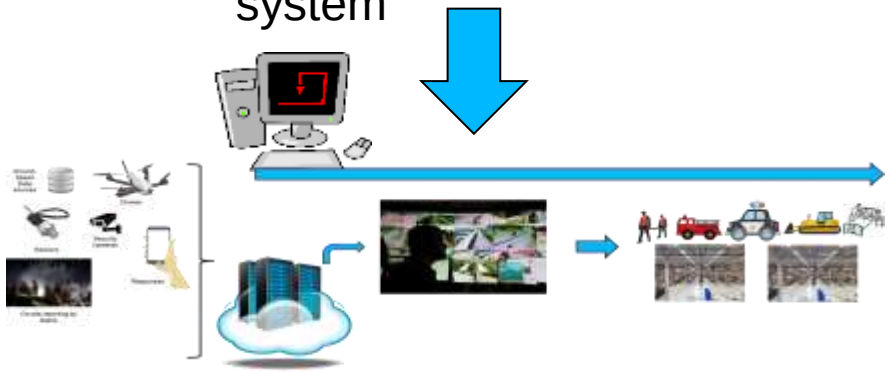
b) Digital ecosystem platform

Companies developing applications

App. store

WADDEM Platform owner

Users of the disaster and emergency management system



The alliance undertakes a ‘digital ecosystem engineering approach’. Instead of targeting disaster-specific applications, research and development activities are first carried out in the specification and implementation of a digital ecosystem platform, where the disaster specific automation processes can be installed on the platform when needed.

c) The ADOPTS principle

1. **A**wareness
2. **D**emand generation
3. **O**ptimization of allocation of resources to demands
4. **P**erformance of the processes
5. **T**racking utilization of the allocated resources.
6. **S**imulation of disaster situations to define, learn and optimize the processes.

C1. Awareness and situation detection (an example)

Example:

Unique Identifier	Kind	Intensity	Building Class	Number of Persons
9	Collapse	Medium High	Electricity, Gas, Water Networks	27
2	Fire	Low	Residence	2
3	Fire	Medium	Residence	5
4	Fire	Medium	Residence	3
5	Fire	High	Residence	4
6	Collapse	Low	Bridge	42
7	Fire	Medium Low	Residence	4
8	Fire	Low	Residence	4
10	Fire	High	Finance Center	14
11	Collapse	Low	Residence	4
12	Landslide	Low	Residence	4
1	Fire	Medium	Residence	2

4 objectives:

- Detect the damage with highest precision.
- Detect the locations of human beings (& living creatures) with highest precision.
- Accomplish the goals with the lowest possible costs.
- Accomplish the goals in the least possible time.

C2. Demand generation (an example)

Unique Identifier	Kind	Intensity	Building Class	Number of Persons
9	Collapse	Medium High	Electricity, Gas, Water Networks	27
2	Fire	Low	Residence	2
3	Fire	Medium	Residence	5
4	Fire	Medium	Residence	3
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10	Fire	High	Finance Center	14
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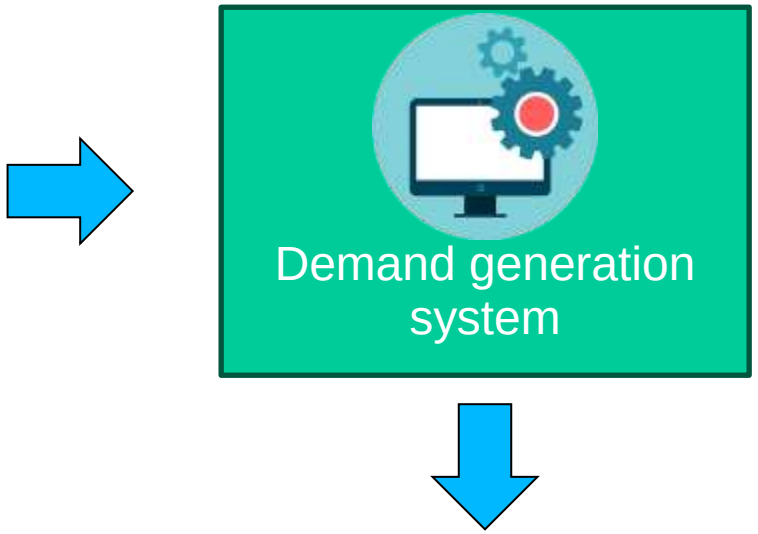
12	Landslide	Low	Residence	4
1	Fire	Medium	Residence	2

Examples of emergency instances detected by the Awareness phase



Demand lists are automatically inferred for the necessary resources so that aid operations can be executed efficiently and effectively.

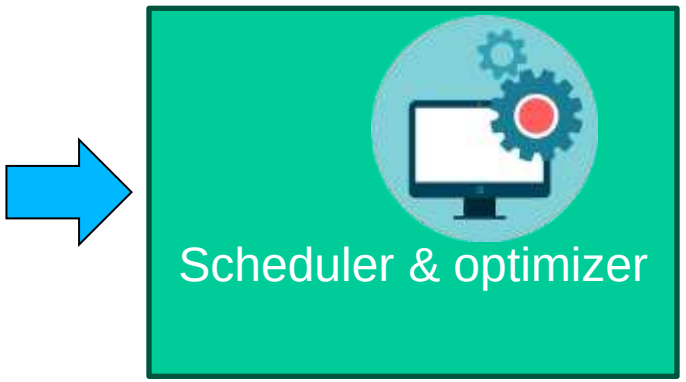
Unique Identifier	Firefighters	MedicalTeam	Repair Team	Rescue Team	Security Forces
9	1	2	4	3	3
10	5	5	1	1	2
5	5	5	1	1	2
11	1	1	1	1	1
1	3	3	1	1	1

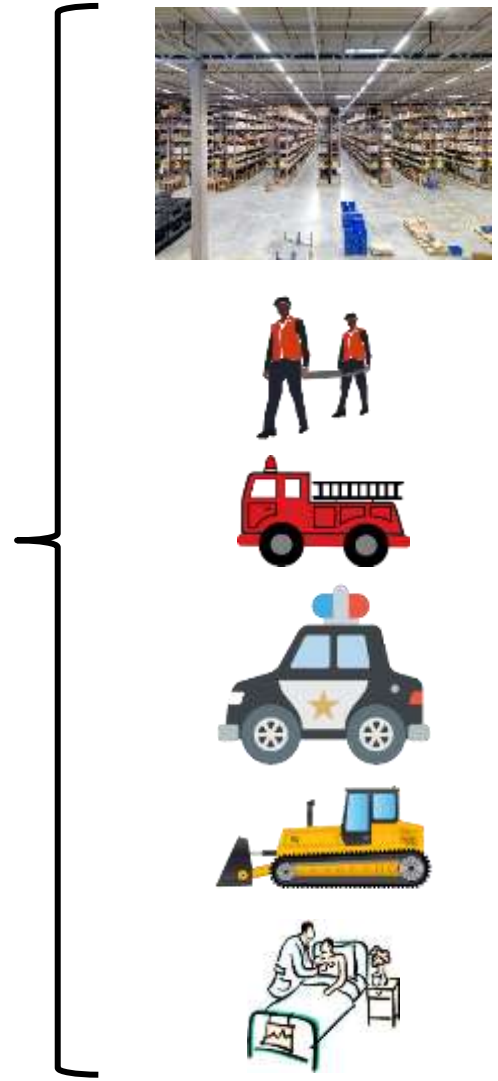
Examples of demands requesting certain resources

C3. Optimization (an example)

Unique Identifier	Firefighters	MedicalTeam	Repair Team	Rescue Team	Security Forces
9	1	2	4	3	3
10	5	5	1	1	2
5	5	5	1	1	2
11	1	1	1	1	1
1	3	3	1	1	1

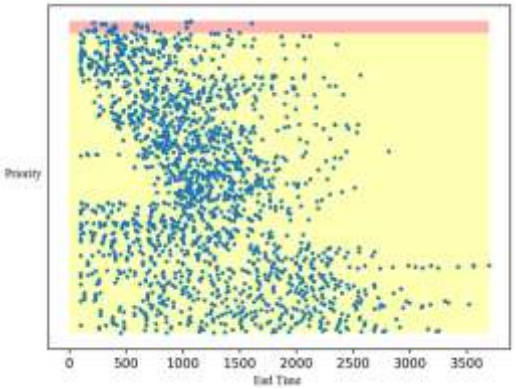
Examples of demands requesting certain resources





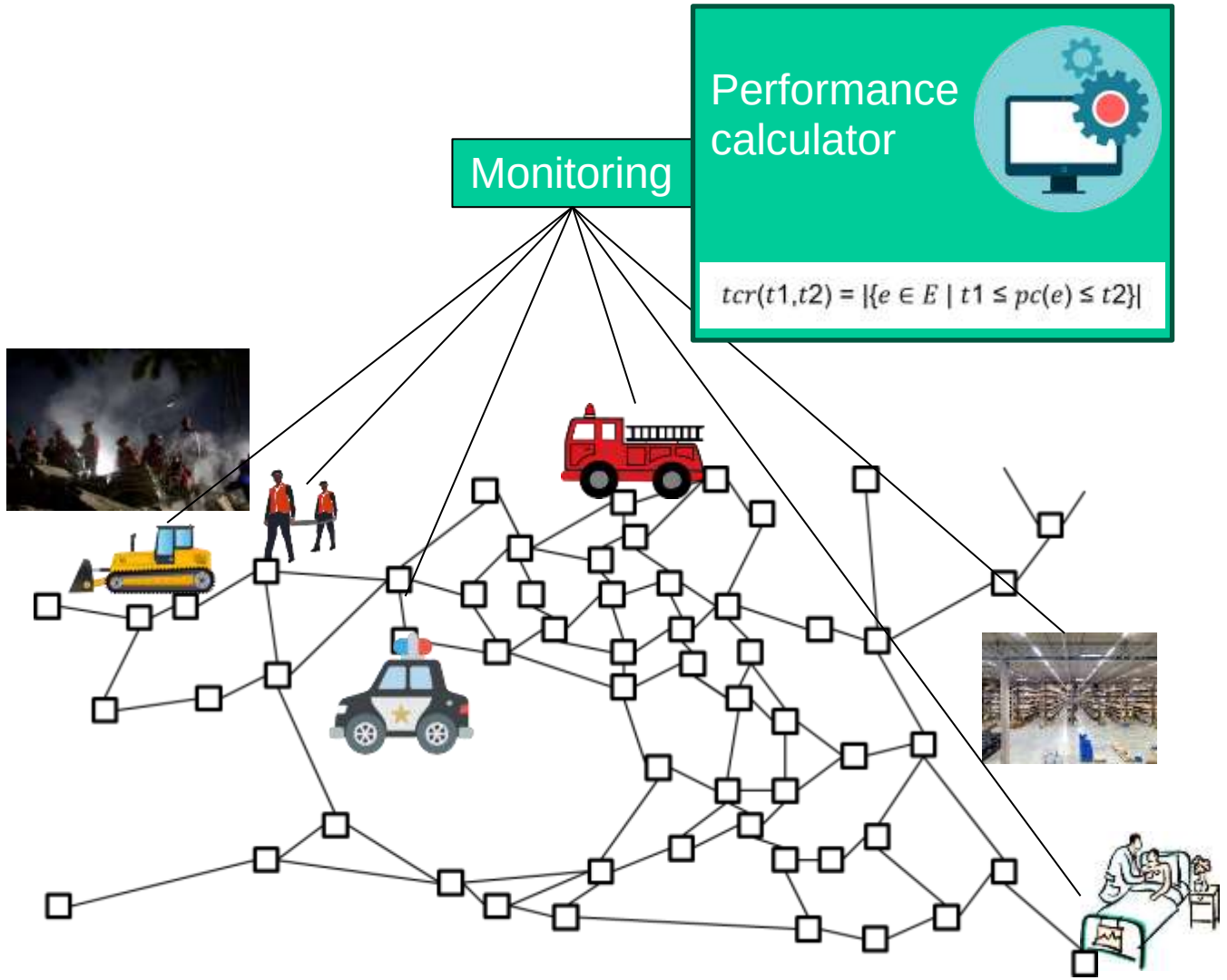
The available resources are optimally assigned to the inferred demands on time. In case of insufficient resources, prioritization, trade-off and/or dynamic selection techniques are applied.

Scattered plot of the end-time of the scheduled resources for the emergency instances



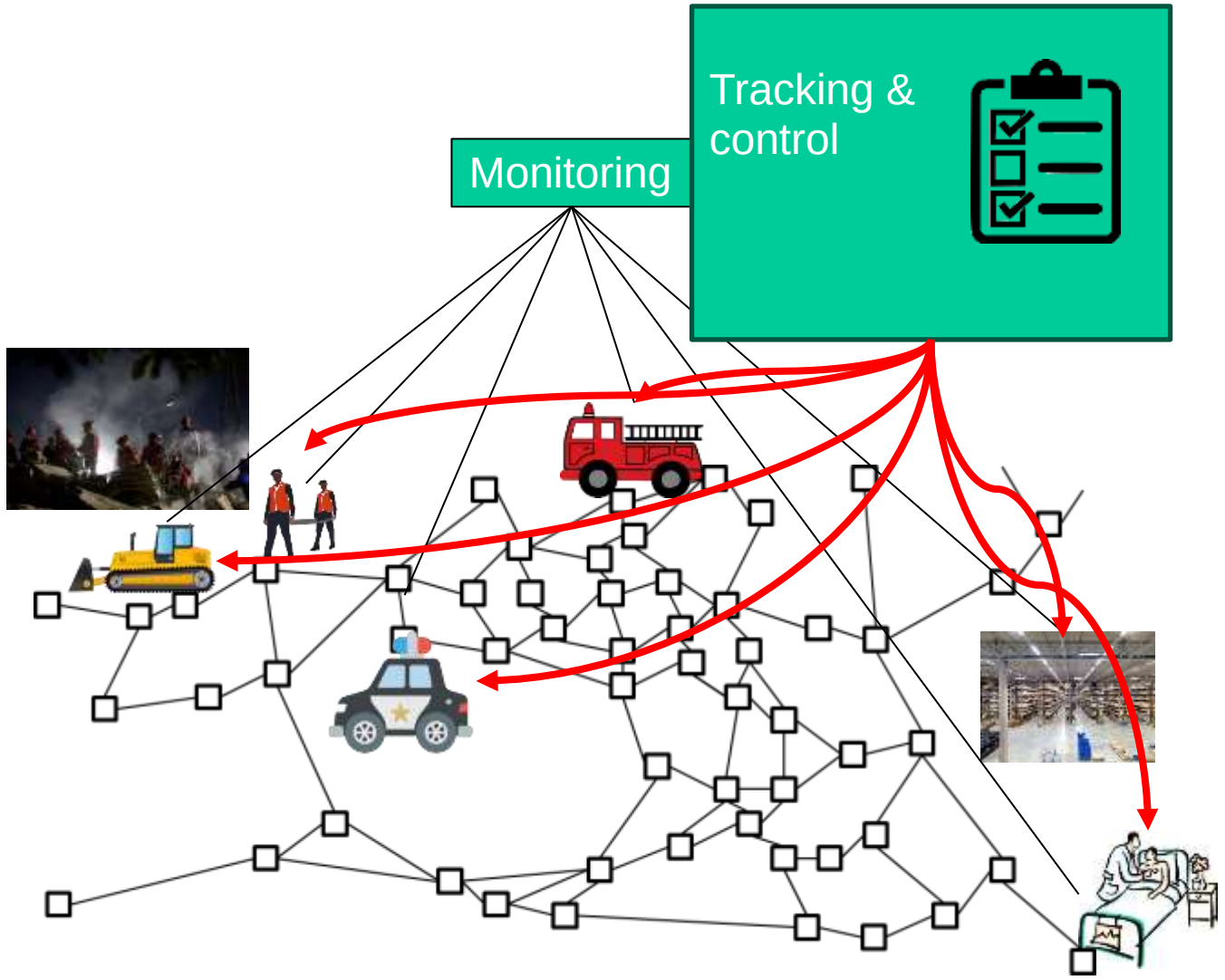
C4. Performance

The performance indicators of operations are defined formally so that the desired objectives can be specified and measured. Accordingly, ongoing operations can be monitored online and in case of deviations from the desired performance values, corrective actions can be executed.



C5. Tracking and control

This phase includes both monitoring, evaluation and controlling actions of the ongoing activities as well as coordination among the aid operations.

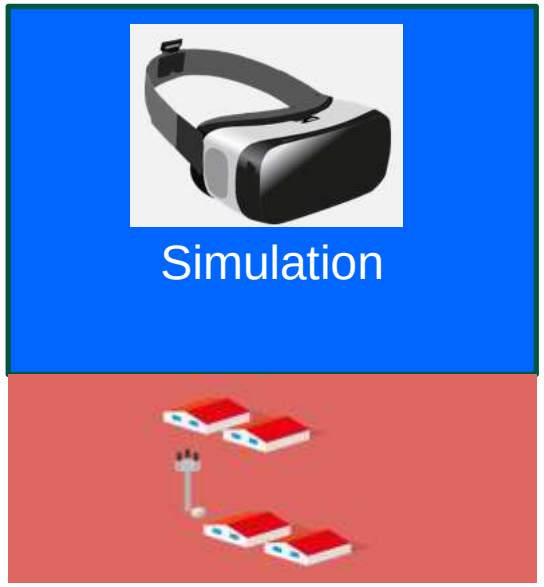


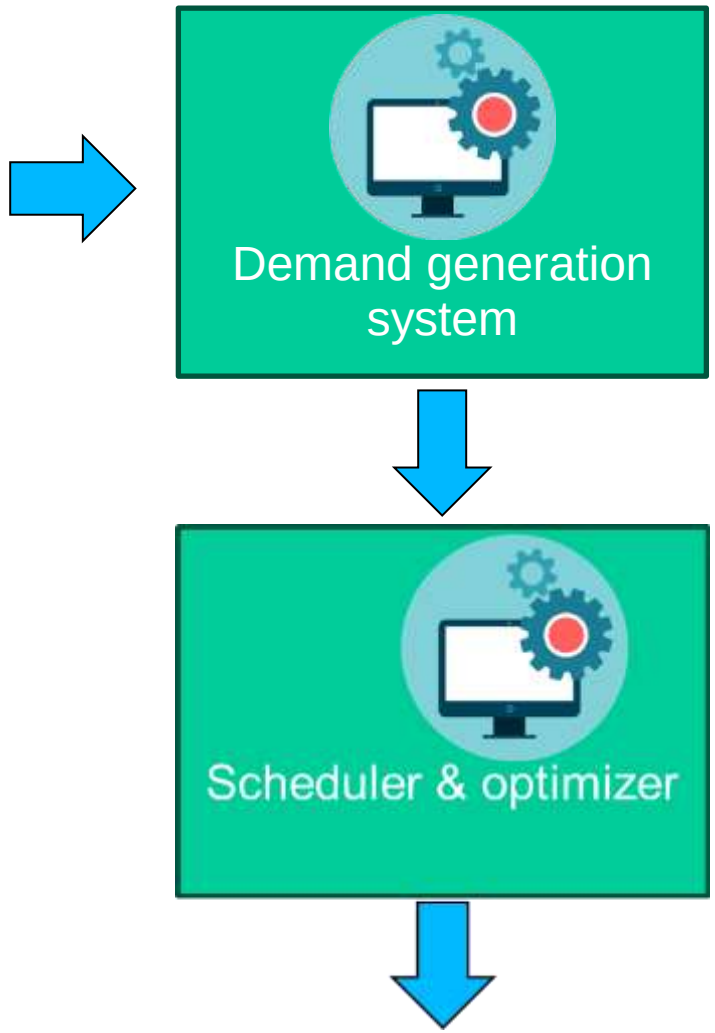
C6. Simulation

- To determine the effect of a large set of prospective disaster scenarios,
- determine the effectiveness and efficiency of the disaster and emergency ecosystem platform,
- evaluate the necessary quantity of resources and to optimize the locations of logistics centers,

simulation environments and techniques must be researched, designed and implemented.

Even in times when no disasters are experienced, triggered by the simulated disaster scenarios, the ecosystem platform must be continuously operational so that it can be optimized using online machine learning techniques.





D. Social capital

The role of social capital in disaster preparedness and intervention: Social capital can be defined as the value of the relationships between people who work or live together and the knowledge and skills that they have and share. The research activities on this topic investigate the role of social capital in disaster preparedness and intervention from three perspectives: a) the role of richer social capital in disaster preparedness and intervention; b) coordinate the responsibilities and authorities of governmental and social capital roles in meaningful disaster management scenarios; and c) the methodological policies to increase wealth in social capital from the perspective of disaster management.

E. Economics for disaster prevention and preparedness

Economics for disaster prevention and preparedness: These research activities have three important goals: With the use of digitalization techniques, creating economical and industrial infrastructure which can a) withstand major disasters and emergency conditions; b) reorganize and optimize the capabilities in creating new resources and products in minimizing the negative effects; and c) guiding policymakers and practitioners to make smart investments that can strengthen disaster resilience.

Section 3.
Activities of WADDEM

What we do: Problem analysis, research & cooperation (i)

1. Starting from the human-centered disaster scenarios, formulate the areas where the current disaster and emergency management systems fall short of the needs.
2. Elaborate on the digital solution domains and define the areas of technological research in harmony with psychological, sociological, economical, and industrial considerations.
3. Coordinate with the governmental agencies and work out strategies in bringing the importance of digitalization of disaster and emergency management issues high on the political agenda. Carry out lobbying activities in creating national and international granting programs.
4. Initiate, support, and collaborate within research and education activities. To this aim, create opportunities for mutual visits and joint research activities among the members of the alliance.

What we do: dissemination (ii)

5. Organize workshops, conferences, special issues in journals. Publish and disseminate the generated knowledge as manifesto, standards, and ecosystem infrastructures and research contributions in the relevant public media.

6. Define professional certification criteria based on offered training plans and accredit evaluation bodies in various roles e.g., aid personnel, decision makers, managers, technologists, and entrepreneurs.

What we do: standardization (iii)

7. Support national and international standardization activities. For example:
   - Disaster & emergency data: Data that can be used in improving situation awareness and data fusion must be conveniently possible.
   - Simulation: The required disaster management cases and scenarios within spatial dimensions can be reused, extended and shared.
   - Systems of systems infrastructure: Cooperation among distributed computing nodes can be facilitated for the common goal.
   - Digital ecosystem and application stores: Applications developed by different parties can utilize the disaster and emergency management platform effectively.
   - Models of disasters and emergencies, GIS elements, events, digital twins, demands and resources: Independently developed models can be easily reused.
   - Performance models: Independently developed systems can be optimized for the common performance goals
   - Models for tracking and coordination: Independently developed and managed aid operations can be tracked and accordingly integrated.

Conclusions

- WADDEM will cover disasters caused by all types of hazards including natural, technological, and human.
- WADDEM provides a conceptual paradigm shift in disaster and emergency management by Process automation, Digital ecosystem platform, The ADOPTS principle, and Research activities on the Role of social capital in disaster preparedness and intervention and Economics for disaster prevention and preparedness.
- WADDEM is complementary to current research activities on disaster risk reduction and management.
- Disaster and emergency management systems are long-living systems which require continuous investment, research and development activities.

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