# Examples of Common Operational Picture and proposed innovation

Traditional approaches to COP development, conceived as systems for collecting and representing information, are now considered indequate for enabling the development of a common understanding of the emergency situatio. These systems seem to be oriented exclusively towards emergence management teams, neglecting the role of the community, as key (potential) responders to the emergency. Moreover, these systems ignore that, even if common collaboration tools are available, actors do not share their information and knowledge without trust. These systems neglect the differences in terms of goals and actions among the actors involved in a response to the emergency. The same information might not be relevant for every actor. Exposing all individuals to the same information in the same way might affect the team's ability to generate novel ideas and interpretations.

Moreover, existing COP systems ignore how cultural diversities, with specific reference to organizational culture, influence the way different actors perceive the topology of their own interactional network, and, consequently, their strategies to collect useful information. Empirical evidence demonstrates how some actors assume a strongly hierarchical structure of the information exchange process. That is, they will exclusively trust information flowing from the vertex through different intermediary levels. Other actors consider the multi-central structure as the most effective structure in allowing the rapid exchange of information within each level of the organizational structure and between different levels. That is, actors tend to adjust their interpretations in ways that consider the information their "network neighbors" provide. Neglecting these differences could lead to the development of ineffective COP for emergency management, because the actors will not recognize the network through which they collect the information as trustable.

Information management and sharing procedures within a responding organization and/or among different organizations might be jeopardized by the need to alter the organizational structure and roles, procedures and use of information in order to meet the demands of an exceptional event, such as an emergency situation. Moreover, the dynamic and complex nature of crisis situations does not allow for

**Examples of COP systems**

Several COP systems are currently available for supporting emergency responders. The below are just few examples of information management systems aiming at creating a broad situational awareness by combining Geographic Information System (GIS) data with changing, real-time event data through the integration of different information sources, and supporting coordinated control and communication:

Disaster Management Information System (DMIS) (https://www- secure.ifrc.org/DMISII/Pages/00_Home/login.aspx),

SAHANA (https://sahanafoundation.org/), the NC4's Emergency Operations Center (EOC) software solution E Team (E TEAM) (http://nc4.com/Pages/eteam.aspx), the Department of Homeland Security (DHS) COP system (https://cms.geoplatform.gov/node/574),

The COBRA Emergency Management Information System platform (http://cobra2020.com/products/cobra-platform/),

Rhe ArcGIS for Emergency Management solution (http://solutions.arcgis.com/emergency- management/situational-awareness-overview/),

VIEW POINTE 4QTRS (http://www.viewpointe.info/), SENTIO (http://c4ic.com/products/sentio/),

IBM Intelligent Operations Center for Emergency Management (http://www-03.ibm.com/software/products/it/ioc-emergency-management)

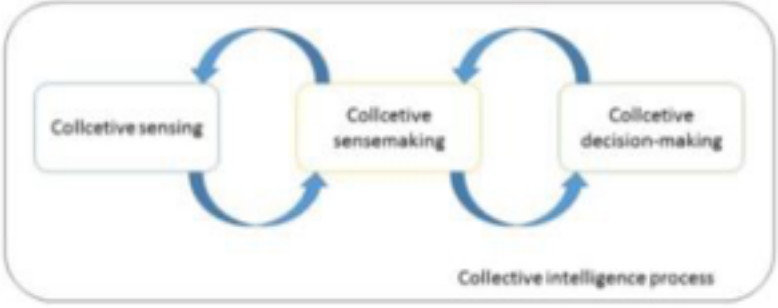
a static framework of the crisis responses. Interaction networks change dramatically during an emergency. Some actors may assume the role of informal leaders, whereas the official responders could be characterized by a low level of trust. The existing COP systems and the institutional protocols for information management in case of emergency seem to be incapable to adapt themselves to this changing interactional situation.

Although emergency management agencies put great efforts on building complex information system architectures, these evidences challenge the understanding of the COP as a technological mean aiming at reducing information incompleteness by making information better and more widely accessible. Enhancing the capability to capture information using different, even innovative, sources (e.g. Internet-of-things, smartphone, smart city cameras and stoplights, etc.) and put it in a shared system where it can easily be accessed represents a partial solution for supporting emergency management. The implementation of communication technologies has failed in many a situation because of the oversimplification of social processes.

Last but not least, current COPs have been often developed to deal with specific types of emergencies, which makes it difficult to adapt them to different types of crises, particularly when the spatial and temporal features of the latter are taken into consideration. What is urgently needed is a novel environment in which current applications and systems may be intelligently retrieved and adapted to respond to different types of scenarios, making interoperability a key condition rather than an afterthought arrangement that often does not fulfil the expectations and the real needs of people acting on the ground.

The evidences previously mentioned, the increasing awareness of the complexity of the emergency responses situations allow us to affirm that enabling the process for SSA development for coordination and decision-making requires a shift from innovating information production and management technologies towards enhancing the interaction processes among the different actors in emergency management. Interaction represents the mechanism allowing the different actors to interpret their environment, to achieve a satisfactory shared understanding of the situation, and to cope with the organizational and individual improvisation needed to deal with extreme events. Moreover, interactions allow to mitigate the conflicting interpretation of information about emergency due to differences in knowledge belief, customs and assumptions. Stressing the role of interactions in emergency management puts knowledge co-production, sharing and regeneration at the core of the SSA development and coordinated emergency management. Knowledge and interaction are strongly intertwined. Knowledge is distributed in social systems and is continuously processed and regenerated via interactions between teams and among members of the same team with different background.

COP systems for Situational Awareness should allow the different actors to create a common ground for communication and interaction, based on insights contributed




The three main phases of the collective intelligence process.

by different members of the team with different background and disciplinary perspectives. SSA should be conceived as the results of a collective intelligence process. Therefore, an effective COP should be defined as a tool capable to

enhance connection/interaction among the different responding organizations and communities so that – collectively – they act more intelligently than individuals or groups in case of emergency. The basic assumption is that the capability of a collectivity of actors to perform some tasks is a property of the group itself, not just of the individuals in it. That is, collective intelligence seems to go above and beyond what can be explained by knowing the abilities of the individual group members, and it notably depends on the way group members interacts.

An innovative COP systems for effective coordinated emergency management are conceived as a human-computer environment, designed in such a way that the collective processes characterizing intelligent systems – sensing, sense-making and decision-making – would be more or less automatically structured to be optimal for emergency management tasks. This approach looks at group sensing as a process activated through the development of a shared system that individuals in a team use to collectively encode, store and retrieve information or knowledge in different domains. Finally, this approach conceptualizes the effectiveness of collective decision-making processes as a property associated with eliciting the relevant information and combining it appropriately in order to take the right collective actions. For an SSA to be effective, two-way relationships between sensing/sensemaking/decision-making have to be supported. Sensing, through sense-making processes, provides information that feeds decision-making. Conversely, decision-making often stimulate the surprises and confusion that create occasions for sensemaking and, thus, innovation in sensing the environment.