Optimisation of Procedures for Interventions & Operations

Enhancing emergency services through refined information management, risk assessment, centralised alert systems, intelligence-led strategies, and advanced technologies is essential for improving operational efficiency, proactive decision-making, and community safety across police, fire, and ambulance services.

Optimisation of Procedures for Interventions & Operations

EENA
European Emergency Number Association

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Executive Summary

[Optimisation of Procedures for Interventions and Operations]

Enhancing police operations and interventions is crucial for improving the efficiency and effectiveness of law enforcement. While the primary focus of this document is on policing, the principles outlined are equally applicable across all emergency services, including fire and ambulance. This requires refining information flow management, risk assessment, centralised alert systems, intelligence-driven policing, and leveraging advanced technology.

Effective Information Flow Management (IFM) ensures timely and accurate decision-making by integrating diverse data sources and implementing real-time communication systems. Risk management involves anticipating identifying, assessing, and mitigating risks to minimize their impact, with strategies including hazard identification, risk assessment, and mitigation measures. Centralised alert systems, such as Automated Call Distribution (ACD) and Computer-Aided Dispatch (CAD), facilitate rapid information exchange and resource allocation.

Leveraging advanced technologies like data analytics, drones, and AI enhances decision-making and operational efficiency. Intelligence in security actions supports proactive decision-making through models like community policing and intelligence-led policing. Implementing robust technical infrastructure addresses information silos and ensures data security.

Rapid response strategies, including advanced technology and regular training, are critical for saving lives and minimizing damage. Effective coordination and communication, standardised protocols, and public engagement further enhance emergency management. Continuous improvement and staying abreast of emerging trends, such as AI and IoT, ensure that organisations are always prepared to protect and serve their communities.

This document intends to…

- Contribute to enhanced law enforcement efficiency and information flow management through procedure optimisation.

- Demonstrate the importance of centralised alert systems and advanced technologies for quick information exchange and risk assessment & mitigation.

- Highlight how intelligence-driven policing models can support decision-making and promote rapid response.

- Promote the implementation of robust infrastructure to ensure data security.

Abbreviations

ACD	Automated Call Distribution
AI	Artificial intelligence
AR	Augmented Reality
BI	Business Intelligence
CAD	Computer-Aided Dispatch
eCH	e-government standards
EENA	European Emergency Number Association
EOC	Emergency Operations Centers
GIS	Geographic Information System
GPS	Global Positioning System
IFM	Information Flow Management
IoT	Internet of Things
ML	Machine Learning
NG112	Next Generation 112
OSINT	Open Source INTelligence
PSAP	Public safety answering point
PSBN	Public Safety Broadband Networks
PTI	Police Technology and IT
RFID	Radio Frequency Identification
SARA	Scanning, Analysis, Response, Assessment
UC	Use Case
VR	Virtual Reality

Introduction

Optimising intervention and operational procedures is vital for enhancing the efficiency and effectiveness of emergency response and management. This optimisation follows a continuous improvement cycle, divided into three phases: before, during, and after an incident. The incident may involve an emergency or a non-emergency situation. The cycle is driven by the collection, processing, analysis, and dissemination of information to support decision-making at every phase. By transforming raw data into actionable intelligence, organisations can inform strategic, operational, and tactical decisions. Refining these procedures ensures timely, coordinated responses, minimises risks, and improves overall outcomes.

At a higher level of abstraction, this approach mirrors the philosophy of problem-oriented policing, which emphasises a more analytical and proactive approach to public safety. Rather than relying on a reactive, incident-driven model, the focus shifts toward identifying and addressing the root causes of issues, fostering preventative measures, and enhancing overall preparedness. In this way, emergency management can evolve beyond simply responding to incidents and towards anticipating and mitigating risks before they escalate.

This article explores key strategies and best practices for optimising police intervention and operational procedures, with insights from intelligence in emergency response, information flow management, risk management, and technological advancements.

Emergency Response: the case of Policing

Policing encompasses a wide range of definitions, each highlighting different aspects of its purpose and roles. Maurice Cusson describes it as "l'action de sécurité"[1] (action of security), while David H. Bayley and Clifford D. Shearing define it as "the activity of making society safe"[2]. Jerry Ratcliffe expands this notion, describing it as "a set of processes within society that fulfill specific social functions related to regulation and control."

Maurice Cusson defines policing as a set of measures designed to achieve three key objectives:

- Protection (objective): Safeguarding against dangers, vulnerabilities, and risks.
- Reassurance (subjective): Promoting a sense of tranquility and security within the community.
- Pacification (objective/subjective): Establishing and maintaining civil peace while mitigating conflict.

While this conceptual framework is rooted in law enforcement, these principles are widely relevant across all emergency services. Fire and rescue teams, for example, also focus on protection (fire prevention, hazard mitigation), reassurance (public safety education), and pacification (stabilising dangerous scenes or hazardous environments).

The police roles are to intervene, respond to incidents, and manage crises effectively to maintain public order and safety. Police organisations typically include specialised divisions (Figure 1):

- Intelligence divisions are responsible for gathering, analysing, and disseminating data to inform operations (Figure 2).
- Prevention units conducts patrols and community outreach to deter criminal activity and enhance public trust.
- Law enforcement uses legal authority to neutralise threats and ensure compliance with laws.
- Investigative divisions handle criminal cases and enforcement.

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[1] Cusson, M. (2010). L'Art de la sécurité. Montréal : Éditions Hurtubise.
[2] Bayley, D. H., & Shearing, C. D. (2001). The New Structure of Policing: Description, Conceptualization, and Research Agenda. U.S. Department of Justice, Office of Justice Programs, National Institute of Justice.

- Emergency response units manage critical situations, such as rescues, hostage incidents, and crowd control.

Similar structures exist in other emergency services: fire departments may include investigation units, hazardous materials teams, and community education branches; emergency medical services often feature rapid response units, triage specialists, and data-driven risk assessment teams.

It's essential to distinguish between specialised emergency units and general emergency response teams. Specialised units are trained for high-risk or niche situations (e.g., bomb threats, chemical spills, mass casualty events), while general emergency teams represent rapid-reaction capabilities mobilised for a wide range of incidents[3].

PROBLEM	MANAGEMENT	ACTIONS	RESULT
Threats	Intelligence and analysis	Prevention / Enforcement / Crisis and emergency management	Internal security
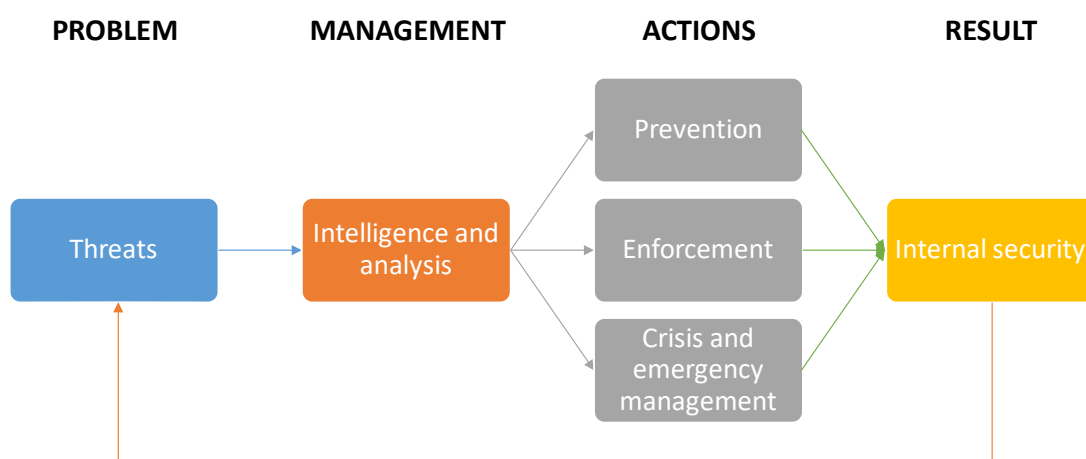
Figure 1 The relationships between the four functions of policing[4].

In the scope of an emergency response, first responders hold a strategic position for timely intervention in addressing public safety threats. Their capacity to act quickly and effectively is critical in disrupting potential harm and preserving life.

To fully execute their mission, emergency professionals must not only react to events but also anticipate them, take decisive action, and prevent incidents from escalating into disasters. This proactive stance integrates intelligence gathering, prevention, suppression, and crisis management into coordinated, evidence-based action on the front lines.

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[3] True Crime Weekly. (2023, September 29). Breaking down the different units within law enforcement. True Crime Weekly.

[4] Cusson, M., Dupont, B., & Lemieux, F. (2008). Traité de sécurité intérieure. Presses polytechniques et universitaires romandes.

Figure 2 Transforming raw data into actionable intelligence.

These functions – intelligence, prevention, enforcement, and crisis management – have become critical activities for first responders. Their objective is clear: address risks before they evolve into major threats, and uphold public safety through swift, informed, and collaborative action
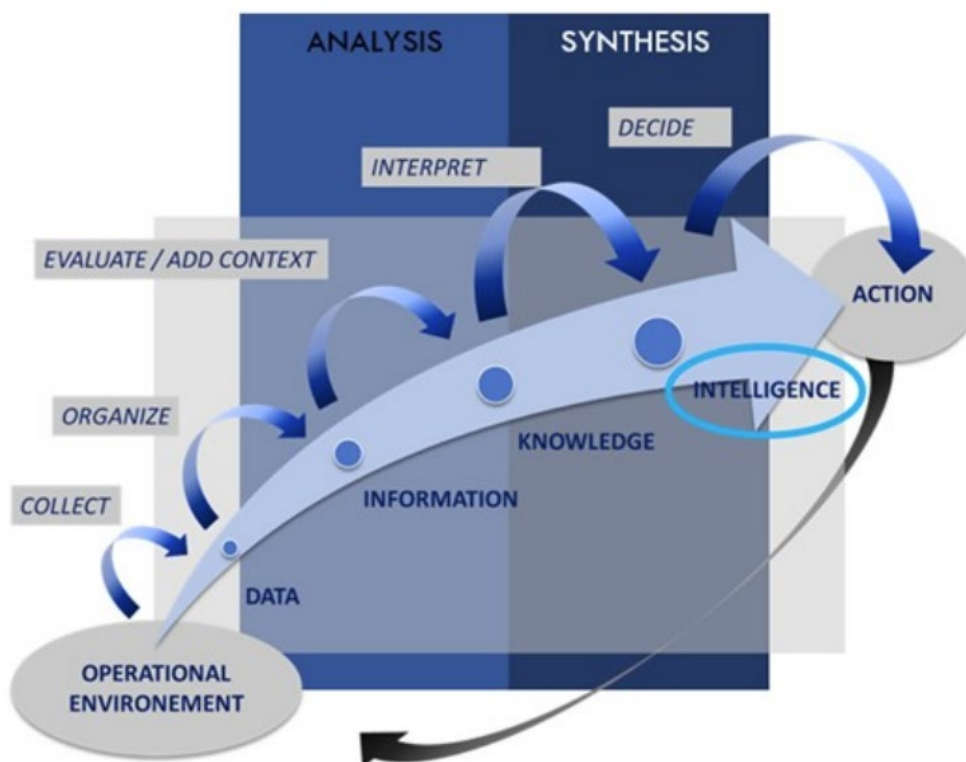
Risk Management

Effective event management relies on a risk management approach[5]. The definition of risk varies according to its application domains and various disciplines[6]. Generally, risk is defined as the product of the probability of occurrence of an event and the extent of the damage or impact expected (Figure 3).

Risk management is essential for optimising operational procedures. By identifying, assessing, and mitigating risks, organisations can minimise their impact and enhance the safety of responders and the public. Analysing historical data, conducting hazard assessments, and using predictive models help identify potential risks. Understanding these risks allows for the development of targeted mitigation strategies.

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[5] ISO. (2021). Security and resilience — Vocabulary (ISO 22300:2021). Winterthur: SNV Association Suisse de Normalisation.
[6] Renn, O. (1998). Three decades of risk research: accomplishments and new challenges. Journal of risk research, 1, 49-71.

Hazard identification involves analysing past incidents, assessing current vulnerabilities, and predicting future risks. This process helps organisations anticipate potential hazards and prepare accordingly. By understanding the specific risks they face, organisations can develop more effective response plans and allocate resources more efficiently.

Evaluating the likelihood and impact of identified hazards prioritises risks based on their severity. This assessment informs the allocation of resources and the development of response plans. Risk assessment involves determining the probability of occurrence and the potential consequences of each hazard. By prioritising risks, organisations can focus their efforts on the most critical threats.
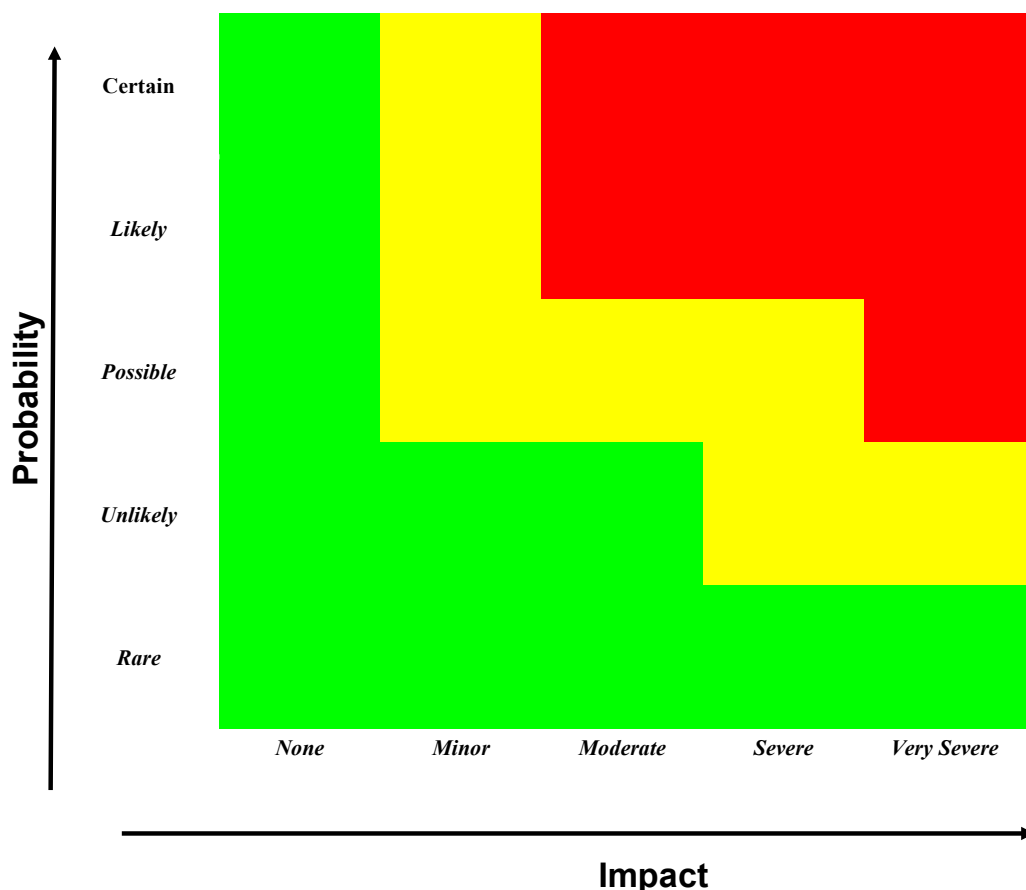
Figure 3 An example of risk assessment matrix

Implementing prevention measures, preparedness activities, and response actions reduces the likelihood and impact of risks. Regular training, public awareness campaigns, and safety regulations are critical components of these strategies. Mitigation strategies involve developing plans to prevent, prepare for, respond to, and recover from emergencies. By taking a proactive approach to risk management, organisations can enhance their resilience and reduce the impact of emergencies.

An effective risk management process involves a comprehensive and integrated approach[7]. This includes:

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[7] Rogers, P. (2011). Development of Resilient Australia: Enhancing the PPRR approach with anticipation, assessment and registration of risks. Australian Journal of Emergency Management.

- Prevention and Mitigation: Identifying and anticipating potential threats and reducing their impact on the community. This involves measures such as safety regulations, infrastructure improvements, and public awareness campaigns.
- Preparation: Ensuring readiness to respond effectively to emergencies. This includes regular training for responders, developing detailed response plans, and conducting drills and simulations.
- Response: Rapid and efficient response to minimise disruptions and protect the population. This involves deploying resources, coordinating with various agencies, and implementing response plans.
- Recovery: Restoring normalcy and learning from the event to improve future responses. This includes analysing the effectiveness of the response, identifying lessons learned, and updating plans and procedures accordingly.

There is a relationship between the physical impact and the human consequences of a disaster. A minor physical event can lead to a major event in terms of casualties and losses if circumstances combine unfavorably[8]. For example, a fire that destroys a small structure may be considered less severe than the explosion of a chemical warehouse. The explosion that occurred on August 4, 2020, in the port of Beirut, Lebanon, illustrates this point well. It resulted in serious injuries, deaths, damage within a 1.8 km radius, and extensive pollution[9].

Effective risk management requires robust coordination and communication among all stakeholders. This includes sharing information, collaborating on response efforts, and ensuring that all parties are aware of their roles and responsibilities. A centralised platform for emergency management can facilitate this process by providing a coordinating response.

Risk management is an ongoing process that requires continuous improvement. By regularly reviewing and updating risk assessments, response plans, and mitigation strategies, organisations can adapt to changing threats and enhance their overall resilience. This iterative process ensures that risk management practices remain effective and responsive to new challenges.

Emergency Management

Emergencies represent serious disruptions to the normal course of events, often causing confusion, loss of control, and an imbalance in social dynamics. People affected by emergencies may panic, act unpredictably, or become dangerous, while others may face immediate threats requiring rescue. Rapid response is integral to the concept of emergency management, as swift action is necessary to save lives, prevent further harm, and restore order.

Emergency management and public order maintenance involve measures to:

- Rescue individuals in danger.
- Reestablish order and peace.

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[8] Alexander, D. (2002). Principles of emergency planning and management. Oxford University Press, USA.
[9] Valsamos, G., Larcher, M., & Casadei, F. (2021). Beirut explosion 2020: A case study for a large-scale urban blast simulation. Safety Science, 137, 105190. https://doi.org/10.1016/j.ssci.2021.105190

- Secure assets.
- Restore social controls disrupted during emergencies.

Emergencies that disrupt public order can be categorised into five main types:

- **Altercations and Fights:** Conflicts can escalate rapidly when emotions such as fear, anger, or frustration intensify, often culminating in physical violence. These situations may arise from personal disputes, misunderstandings, or heightened tensions during public events. Altercations can escalate into larger confrontations, posing risks to bystanders and law enforcement alike. Weapons may be involved, increasing the severity of the threat. Timely intervention is crucial to de-escalate tensions, prevent harm, and restore order. Without prompt action, these situations can lead to significant injuries, property damage, and even broader public unrest.
- **Crowds and Gatherings:** While most assemblies, such as celebrations or protests, are peaceful, they carry inherent risks of becoming chaotic. The high energy and excitement within crowds can lead to dangerous behaviors, including vandalism, pickpocketing, and sexual harassment. Opportunistic criminals may exploit the situation to commit theft, drug-related offenses, or even violent acts. Additionally, crowds may become targets for terrorism, posing significant threats to public safety. The risk of spreading misinformation or inciting panic can exacerbate the situation, leading to further disorder and potential harm.
- **Incivilities:** Incivilities in public spaces, such as vandalism, graffiti, littering, and other forms of neglect or antisocial behavior, create an environment of fear and insecurity. Examples include broken windows, public drinking, verbal harassment, and loitering. These signs of disorder may erode social cohesion, discourage community engagement, and make public spaces feel unsafe. Incivilities also act as a magnet for further illegal activity, such as drug dealing or property crimes, contributing to a cycle of urban decay. Addressing these issues promptly is essential to restore public confidence, reduce fear, and maintain the integrity of shared spaces.
- **Individuals in Distress:** Vulnerable individuals who require immediate assistance, including injured persons, lost children, the elderly, or those experiencing medical emergencies often requires police intervention. Examples include individuals injured in accidents, victims of crimes, or people suffering from mental health crises. Timely intervention by first responders is vital to prevent further harm, ensure the safety of individuals, and provide reassurance to the community. Failure to assist individuals in distress can lead to escalating risks, including increased injuries, fatalities, or public distrust in authorities. Providing professional and empathetic care in these situations strengthens public confidence and ensures that help reaches those in need promptly.
- **Natural or Technical Disasters:** Events such as earthquakes, floods, hurricanes, fires, and technical failures (e.g., power outages, industrial accidents, or infrastructure collapses) pose significant threats to lives, property, and public safety. Natural and technical disasters often result in mass casualties, displacement, and widespread disruption of essential services. During these crises, responders must prioritise rescue operations, evacuation, and the protection of vulnerable populations. Secondary risks, such as fires, hazardous material spills, or looting, may arise, complicating response efforts. Quick coordination between emergency services, law enforcement, and the community is essential to mitigate damage, save lives, and restore normalcy in affected areas.

Emergency services professionals play a vital role in managing crises and restoring social order through four primary methods:

- Pacification: First responders act as peacekeepers, de-escalating conflicts, intervening in fights, and mediating disputes to calm tensions.
- Reinstating Social Controls: During crises, people may feel that rules no longer apply. The visible presence and action of emergency services help reestablish a sense of order and accountability.
- Rescue Operations: Emergency teams, available 24/7, provide urgent medical aid, evacuate endangered individuals, conduct search and rescue missions, and offer immediate assistance.
- Reassurance: The presence of coordinated emergency response efforts, whether law enforcement, fire services, or medical personnel, prevents panic and restores confidence among the population.

Emergencies within policing, as one example, demand a structured and effective response to address the challenges posed by crises and ensure public safety. By fulfilling their core functions - intelligence, prevention, repression, and crisis and emergency management - police forces contribute to the stability and security of society, protecting lives, assets, and social harmony during times of disruption.

Information Flow Management

In order to optimise these functions, PSAPs should rely on continuous information flow that enhance the first responders operations. Information Flow Management (IFM) is critical for effective incident response and public safety. It involves collecting, processing, and distributing information to ensure timely and accurate data-drive decision-making. Key objectives include optimising information flow (Figure 4), ensuring data accuracy, protecting sensitive information, and providing feedback.

In emergency scenarios, such as those managed by services like 112, 117, and 118[10], the ability to quickly and accurately handle information can mean the difference between life and death.
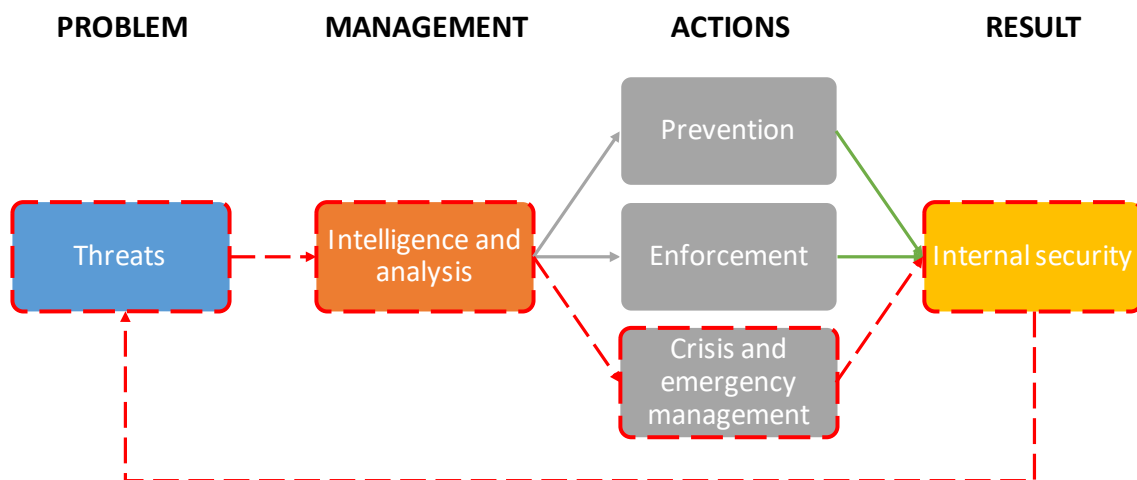

Figure 4 Optimisation path in dashed red line.

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[10] Switzerland emergency numbers: 117 for police, 118 for fire fighter

In the emergency call handling chain, the Public Safety Answering Points (PSAPs) play a pivotal role. Their responsibilities typically include[11]:

1. Reception of the call
2. Data collection:
   • Reception of the caller location data
   • Collection of detailed data about the emergency situation
   • Call history data (if there were previous calls about the same incident)
3. Classification of the call
4. Dispatch and initial operation management:
   • Dispatch appropriate intervention resources
   • Lead the initial phases of the operation

This structured process ensures that critical information flows seamlessly to support rapid decision-making and action. From a chain-of-command perspective within police operations management, the emergency call-handling process aligns closely with a structured decision-making chain, which is essential for managing police operations and responding to emergencies effectively[12].
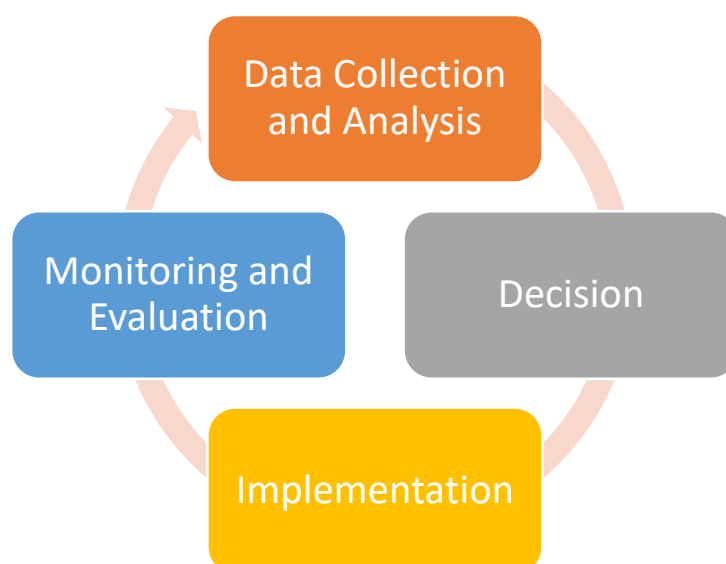
Figure 5 Operational decision-making chain.

The operational decision-making chain involves the following steps:

1. Data Collection and Analysis: Information is gathered from sources such as incident reports, surveillance systems, and community feedback. For example, data on crime hotspots or recent incidents is analysed to identify patterns and trends, leveraging tools like crime mapping and predictive analytics.
2. Decision: Decisions are made on the analysis, such as dispatching resources or initiating specific operations.
3. Implementation: Actions include assigning tasks, coordinating with agencies, or launching interventions.

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[11] European Emergency Number Association. (2020). Emergency call handling service chain description. Brussels: EENA.

[12] Aepli, P., Ribaux, O., & Summerfield, E. (2011). Decision Making in Policing: Operations and Management. EPFL Press.

4. Monitoring and Evaluation: Results are monitored and assessed to ensure effectiveness and guide future actions. For example, strategies that succeed in reducing crime in one area can be applied elsewhere.

At each stage, information highlights problems, assesses risks and opportunities, supports decisions, and provides data for evaluating results. Ensuring coherence in this decision-making cycle requires adherence to a systemic approach, aligning ends, ways, and means.
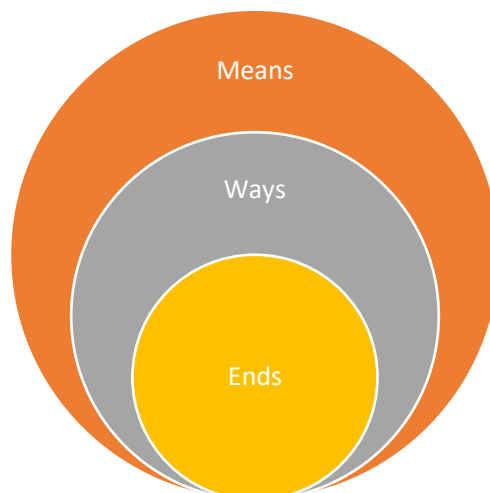

Figure 6 Coherent approach between means, ways and ends.

At a broader level, a generalised police decision-making model encompasses five steps and two crosscutting activities, offering a structured framework for decision-making under pressure[13]:

- Five steps:
  - o Understanding the problem;
  - o Evaluating the situation;
  - o Making a decision;
  - o Planning for implementation of the decision;
  - o Executing orders.
- Two crosscutting activities
  - o Time planning;
  - o Urgent measures.

The importance of information in emergency management can be categorised into three distinct levels of decision: strategic, operational, and tactical.

- At the strategic level, information is used to develop long-term plans and policies for emergency preparedness and response. This involves analysing trends, assessing risks, and identifying emerging threats. Strategic information helps in resource allocation, planning large-scale emergency operations, and setting priorities for future actions. It ensures that decision-makers have a comprehensive understanding of the broader context and can make informed policy decisions to enhance overall emergency readiness.
- At the operational level, information supports the coordination and management of ongoing emergency response activities. This includes monitoring the progress of emergency operations, adjusting plans based on new information, and ensuring

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[13] ISP. (2017). Conduite des engagements de Police - Réglement. Neuchâtel: Institue Suisse de Police.

that all parts of the response organisation are working towards common goals. Operational information flow ensures that there is a seamless exchange of information between different units and that emergency operations are conducted efficiently and effectively.

- At the tactical level, information is used to make immediate decisions and actions in response to specific emergency incidents or threats. This includes real-time data on the location and status of resources, situational reports, and intelligence on immediate threats. Effective information flow ensures that responders have the most current and accurate information to make quick, informed decisions during emergencies.

Integrating diverse data sources, such as Geographic Information Systems (GIS), internal databases, and external records, enhances situational awareness. This comprehensive view supports informed decision-making and timely interventions. Overcoming data silos, ensuring data quality, and protecting sensitive information are crucial for comprehensive information flow management. By integrating these data sources, organisations can create a more holistic view of the situation, allowing for better coordination and response.

Implementing real-time communication systems ensures that information is rapidly shared among responders. Information can take various forms, such as verbal descriptions, real-time photos, videos, or data gathered from open-source intelligence (OSINT). Technologies like digital radios, mobile apps, and satellite phones facilitate seamless communication, even in challenging conditions. Real-time communication enhances coordination and ensures that critical information is not delayed. This immediate exchange of information is vital for making quick decisions and deploying resources effectively.

Establishing feedback loops allows for continuous improvement of information flow processes by incorporating various mechanisms such as the SARA[14] model (Scanning, Analysis, Response, and Assessment), operational monitoring[15], and the integrated approach[16]. Regularly reviewing and updating procedures based on feedback ensures they remain effective and responsive to changing needs.

- SARA Model: This model involves systematically identifying issues (Scanning), analysing their root causes (Analysis), implementing solutions (Response), and evaluating the outcomes (Assessment). This structured approach ensures that feedback is continuously integrated into the process, allowing for iterative improvements.
- Operational Monitoring: This mechanism involves the daily acquisition of data through various means, such as crime scene interventions or proactive operations. The integration function combines new data with previously known information, potentially altering its structure and understanding. This process includes autonomous detection, constantly searching for signs of new problems. The analysis verifies known issues, tests hypotheses, and identifies causes to produce actionable insights. Actions are then chosen and implemented, with their effects systematically measured to ensure relevance and effectiveness.
- Integrated Approach: Combining the SARA model and operational monitoring, this approach creates a comprehensive and iterative process that addresses the needs of emergency services. It involves four main steps: data acquisition, information

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[14] Eck, J. E., & Spelman, W. (1987). Problem-solving: Problem-oriented policing in Newport News. Police Executive Research Forum.

[15] Ribaux, O. (2023). De la police scientifique à la traçologie: le renseignement par la trace. EPFL Press.

[16] Saad, T. (2024). Le renseignement dans la réponse d'urgence et immédiate du 112, 117 et 118. Université de Lausanne.

integration, intelligence exploitation, and intelligence valorisation. This model includes a continuous memory component that records all information from each phase and level, making it available at all times. This continuous availability of information helps combat "linkage blindness" and ensures that improvements are preserved and utilised in future emergencies.

By integrating these feedback mechanisms, organisations can pinpoint areas for improvement and implement changes to enhance overall efficiency. This iterative process of evaluation and adjustment, guided by structured approaches like the SARA model, operational monitoring, and the integrated approach, is crucial for ensuring the sustained effectiveness of information flow management.

Information plays a central role across all phases of the decision-making process. It helps operators, first responders and field units become aware of emerging problems, supports interventions and preventive measures when needed, and enhances the quality of responses. Additionally, it aids in management monitoring and preparing for future incidents. The levels of decision-making occur across varying timeframes, ensuring adaptability and alignment with both immediate and long-term objectives.
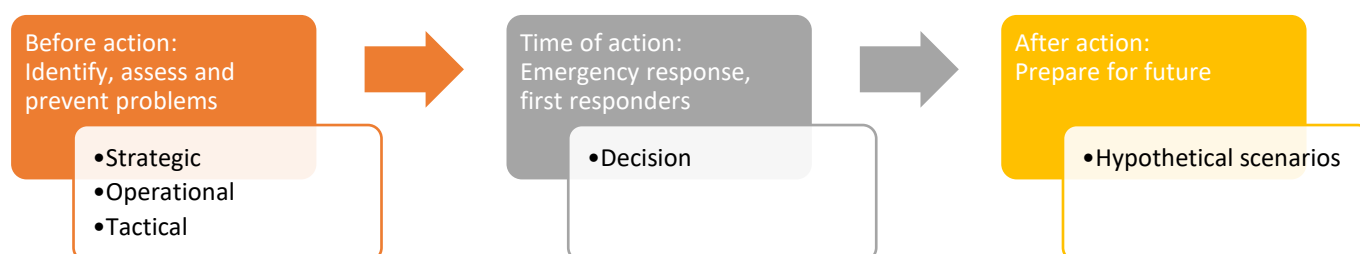
Before action: Identify, assess and prevent problems	→	Time of action: Emergency response, first responders	→	After action: Prepare for future
• Strategic • Operational • Tactical		• Decision		• Hypothetical scenarios

Figure 7 Levels and time frame.

One notable example that illustrates the importance of data-driven decision-making in public safety is the 1995 study by Sherman and Weisburd on the general deterrent effects of police patrols in crime "hot spots"[17]. This randomised, controlled trial demonstrated that focusing police patrols on areas with high concentrations of crime could significantly reduce criminal activity and disorder. The study underscores the value of identifying and responding to patterns of incidents in specific locations.

By utilising the incident localisation capabilities of PSAPs, hot spots of emergency activity can be identified, analysed, and used to optimise resource allocation. For instance, identifying areas with recurring emergencies or criminal activity enables decision-makers to strategically deploy resources, ensuring a more effective response. This process aligns closely with IFM objectives by providing actionable insights that enhance decision-making at strategic, operational, and tactical levels. This process aligns closely with IFM objectives by providing actionable insights that enhance decision-making at strategic, operational, and tactical levels. Today, the availability of vast amounts of data and advancements in technology will significantly transformed how interventions can be optimised.

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[17] Sherman, L. W., & Weisburd, D. (1995). General deterrent effects of police patrol in crime "hot spots": A randomised, controlled trial. Justice Quarterly, 12(4), 625–648. https://doi.org/10.1080/07418829500096221

Transition from an Incident to Major Events

The shift from routine operations to managing major events demands a systematic escalation of emergency response capabilities and adaptability. As events intensify, key metrics provide essential tools for assessing situational awareness. These metrics include the scale and nature of the event, the frequency and severity of incidents, disruptions to social and community functions, and the availability of critical resources. Together, these metrics offer a comprehensive understanding of the evolving dynamics, enabling emergency management teams to make informed decisions.

An important aspect of this transition is recognising and responding to the break from normalcy, which may manifest in various forms - organisational, structural, or operational[18]. Understanding these disruptions is essential for anticipating challenges and implementing measures to ensure continuity.

Organisational breaks arise when personnel resources are stretched beyond capacity. Major events often create sudden surges in demand for human resources at command centers and in the field. This overload can lead to inefficiencies, task mismanagement, and failures in delivering essential services. Recognising this strain early enables leaders to activate contingency plans, such as reallocating personnel or requesting mutual aid.

Structural breaks occur when vital infrastructure is damaged or rendered inoperable. For example, a flood that makes roads impassable not only disrupts transportation but also impedes the delivery of emergency services. These disruptions highlight the importance of proactive infrastructure assessments and contingency planning to mitigate the impact on response efforts.

Operational breaks reflect failures in the systems that support daily functionality. An example is the malfunction of critical operations management software, which can paralyse coordination efforts and delay response times. Identifying and addressing these breaks promptly is key to maintaining operational continuity during emergencies.

Detecting these breaks relies on recognising specific triggers, such as disruptions to critical infrastructure, resource shortages, or contingency plan failures. These triggers prompt corrective measures to restore stability and ensure operational continuity.

During the transition to managing major events, PSAPs play an integral role in maintaining effective coordination and optimising emergency response. These centers act as the nerve center of emergency communication, facilitating the swift exchange of information among responders, decision-makers, and stakeholders.

PSAPs ensure that emergency calls are efficiently processed and appropriate services dispatched[19]. By centralising information, they provide a unified platform that enhances situational awareness and streamlines coordination efforts. This centralisation is critical for aligning actions across multiple agencies and ensuring that resources are deployed effectively. Additionally, the PSAP plays a crucial role during the initial response phase,

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[18] Stroud, C., Hick, J. L., & Hanfling, D. (2013). Crisis standards of care: a toolkit for indicators and triggers.
[19] European Emergency Number Association. (2020). Emergency call handling service chain description. Brussels: EENA.

acting as the first point of contact and ensuring that rapid and accurate information is relayed to first responders to guide their immediate actions.

To further strengthen the transition from incident to major event management, integrating advanced technologies within PSAPs is essential. Key systems[20], including Geographic Information Systems (GIS), Computer-Aided Dispatch (CAD), Public Safety Broadband Networks (PSBNs), Risk Assessment Platforms, social media monitoring, NG112, etc., significantly enhance situational awareness and resource allocation.

Leveraging Technology

Technology plays an important role in optimising intervention and operational procedures. By leveraging advanced technologies, organisations can significantly enhance their capabilities and improve outcomes.

IFM is essential for ensuring that various systems and data sources can communicate and share information seamlessly. Effective management of information flow enhances situational awareness and coordination among emergency responders. By producing intelligence information from multiple sources, including OSINT (Open Source Intelligence) and other important databases, organisations can create a comprehensive view of the situation, enabling more accurate and timely responses.

- GIS technology provides vital spatial data, which is crucial for understanding the geographic scope of an emergency. By mapping affected areas, planning evacuation routes, and identifying resource deployment locations, GIS enables emergency managers to make informed decisions. Data sources such as satellite imagery, topographic maps, and real-time sensor feeds offer a visual representation of the situation, empowering teams at all levels to assess risks and prioritise actions effectively.
- Complementing GIS, CAD systems ensure efficient resource management by tracking the real-time location and availability of responders. These systems facilitate the rapid dispatch of the closest and most suitable resources to an incident. By centralising resource data, CAD systems help optimise response times, improve coordination across teams, and ensure that emergency services are deployed where they are needed most.
- Emergency Operations Centers (EOCs) serve as the central command and control facilities responsible for carrying out the principles of emergency preparedness and management. They ensure the continuity of operations during an emergency and coordinate the response efforts of various agencies.
- Early Warning Systems utilise historical data, weather patterns, and geological surveys to predict potential disasters. Early warning systems provide advance notice of impending emergencies, allowing for timely preparation and response.
- Public Safety Broadband Networks (PSBNs), such as those developed under the BroadWay Project in Europe, provide secure, high-speed wireless communication specifically for emergency responders. These networks ensure that first responders have prioritised access to critical information and can communicate effectively during emergencies.

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[20] Mavs Open Press. (2024). Current and emerging trends in the management of international disasters. Arlington, TX: Mavs Open Press.

- Data Integration and Interoperability ensures that various systems and data sources can communicate and share information seamlessly. Interoperability between CAD, GIS, EOCs, OSINT and other systems enhances situational awareness and coordination.
- Advanced data analytics, based on intelligence and information flow management, enable the rapid and accurate processing of large volumes of data, supporting real-time decision-making and optimising resource allocation. This involves using algorithms and statistical models to analyse data and generate insights. By identifying patterns, distribution, and trends, data analytics help organisations make informed decisions and optimise their response strategies.
- Drones and robotic systems provide valuable support in hazardous environments. They can assess damage, deliver supplies, and conduct search and rescue operations, enhancing overall efficiency[21]. These tools offer a safe and efficient way to perform tasks that may be dangerous for human responders, thereby reducing the risk to responders and improving the effectiveness of operations.
- Tracking technology plays a necessary role in locating responders and coordinating their movements during emergencies. Different approaches are implemented to track responders. These include mobile applications, tracking devices, integrated systems within emergency vehicles, and other advanced tracking solutions. Mobile applications can be installed on responders' smartphones, allowing command centers to track their positions and movements. Tracking devices, which can be worn or carried by responders, offer another layer of location accuracy and reliability. Additionally, GPS systems integrated into emergency vehicles ensure that the location of all assets is continuously monitored. Other methods, such as cellular tracking, Wi-Fi tracking, and RFID, can also be used to enhance tracking capabilities. This real-time tracking capability helps in optimising resource allocation, reducing response times, and enhancing the overall safety and efficiency of emergency operations.
- 5G and advanced communication networks provide high-speed, low-latency communication, which is vital for real-time data transmission and coordination among emergency response teams[22]. Enhanced coverage ensures reliable connectivity even in remote or disaster-stricken areas.
- Augmented Reality (AR) and Virtual Reality (VR) technologies create immersive training environments for first responders and provide real-time information overlays in the field, helping them navigate complex environments and perform tasks more efficiently.
- AI (Artificial intelligence) and machine learning algorithms can provide valuable support in both legal and procedural decision-making, as well as ensuring alignment with established intervention processes. By analysing legal frameworks and regulatory requirements, AI helps ensure that all actions taken during an emergency comply with relevant laws and standards. This capability is essential for maintaining legal integrity and avoiding potential liabilities. Furthermore, AI can recommend best practices and procedural adjustments based on historical data, evolving legal guidelines, and the specific dynamics of intervention processes. This dual capability enhances the overall effectiveness, compliance, and consistency of emergency response operations, ensuring that they align with both legal expectations and operational protocols.

By leveraging these technologies, IFM can go beyond basic optimisation, providing a foundation for predictive and preventative approaches that significantly enhance the

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[21] European Emergency Number Association. (2019). Integrating Search & Rescue drones in airspace.
[22] European Emergency Number Association. (2019). 5G in emergency services.

effectiveness and efficiency of emergency response operations. This transformation aligns with the need for modern PSAPs to function as intelligent, data-driven hubs capable of anticipating and addressing public safety challenges in real time.

Implementation and Technical Integration

Deploying robust and redundant infrastructure is essential for maintaining high service availability during emergencies. To achieve this, solutions must be interoperable and capable of enforcing efficient information flow management. This includes addressing information silos, ensuring data security, and leveraging modern tools and technologies to streamline operations.

In the context of emergency management, there has been a paradigm shift from a "Default To Know" approach—where access to information is unrestricted and often overwhelming—to a "Need To Know" model, which restricts access to only those who require specific information. While this enhances security, it can sometimes hinder effective coordination in dynamic scenarios. To address this, organisations are increasingly adopting a "Need To Share"[23] philosophy. This approach emphasises the timely and secure dissemination of critical information to all relevant stakeholders, ensuring that decision-makers and responders have the data they need to act effectively.

Information silos are one of the main obstacles to achieving a "Need To Share" approach. Silos can significantly hinder communication and decision-making, delaying critical actions during emergencies. By interfacing systems and promoting data sharing, organisations can break down these barriers and enable a seamless flow of information across departments and agencies. A centralised and interoperable framework ensures that all relevant stakeholders can access crucial data when needed, enhancing coordination and improving the overall effectiveness of emergency responses.

However, sharing information must not come at the expense of security. Protecting sensitive data is paramount, particularly in high-stakes environments. Implementing strong security measures, such as encryption, access controls, and adherence to privacy regulations, ensures that information is shared responsibly. By restricting access to authorised personnel and maintaining rigorous security protocols, organisations can prevent data breaches and misuse while still fostering an environment of collaboration.

By moving from "Default To Know" through "Need To Know", and ultimately embracing a "Need To Share" philosophy, emergency management organisations can balance security with collaboration. This evolution fosters a resilient framework for managing emergencies, enabling timely interventions, efficient resource allocation, and improved coordination among responders.

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[23] U.S. House of Representatives, Committee on Government Reform. (2004). Moving from "need to know" to "need to share": A review of the 9/11 Commission's recommendations: Hearing before the Committee on Government Reform, House of Representatives, One Hundred Eighth Congress, Second Session, August 3, 2004. U.S. Government Printing Office.

Modern tools and technologies are pivotal in supporting the "Need To Share" model within emergency management. Platforms such as Business Intelligence (BI) tools, database servers, and integration services facilitate scalable and flexible information management. These technologies enable organisations to efficiently collect, process, and disseminate data while maintaining its integrity and quality. For instance, BI platforms can deliver real-time analytics to guide decision-making, while integration services ensure smooth communication between different systems and stakeholders. This technological synergy not only enhances decision-making but also equips stakeholders at all levels with the necessary information to improve the speed and accuracy of responses. By providing real-time insights, emergency managers can allocate resources more effectively and respond to incidents more swiftly. It is crucial that BI and integration services meet the requirements of each stakeholder level, ensuring that everyone - from frontline responders to strategic decision-makers - has access to appropriate data. While implementing these technologies can be challenging due to issues like data integration and system compatibility, adopting standardised protocols and investing in training can help overcome these obstacles. Looking ahead, the integration of Artificial Intelligence (AI)[24] and Machine Learning (ML) with BI tools is expected to further enhance predictive analytics, enabling even more proactive and informed decision-making in emergency management.

Rapid Response and Coordination in Emergencies

Rapid response is critical for saving lives and minimising damage during emergencies. Advanced technologies, such as location tracking, real-time data analytics, and dispatch systems, enable quicker and more efficient allocation of resources. These tools ensure that the nearest and most suitable units are dispatched, improving response times and overall effectiveness. Additionally, preserving evidence during interventions is vital for protecting crucial information, which can be used for investigations and legal purposes after the emergency has been managed.

Regular training and preparedness exercises are essential for ensuring that responders are ready for a variety of scenarios. Simulations and drills help responders practice coordination and decision-making under pressure. Joint training exercises involving multiple agencies foster collaboration and enhance the familiarity of procedures across organisations. Continuous education ensures responders stay up-to-date with the latest techniques and technologies, maintaining their readiness for evolving threats.

Educating the public on recognising emergencies and providing initial assistance can significantly enhance response efforts. Public awareness campaigns and training programs empower individuals to take immediate action, helping mitigate situations until professional responders arrive. Clear and accurate communication with the public during emergencies builds trust, prevents panic, and ensures community members know how to protect themselves.

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[24] Haseley, A. (2023, November 16). Leveraging AI in emergency management and crisis response. Deloitte Center for Government Insights.

Successful emergency management relies on standardised protocols, technology integration, and effective communication among agencies and stakeholders. Standardised protocols ensure clarity in roles and procedures, reducing confusion during crises. Advanced communication tools like digital radios, mobile apps, and satellite phones enable responders to stay connected even under challenging conditions, facilitating swift and accurate information sharing.

Lessons from the Field

Case studies of successful emergency management operations highlight the importance of coordination, technology, and community involvement. Learning from past experiences, such as the 2010 Haiti earthquake response and the 2011 Tōhoku earthquake and tsunami, improves response capabilities and informs best practices. These case studies demonstrate the practical benefits of effective information flow management, risk management, centralised alert systems, data integration, intelligence in security actions, and the integration of technology.

The 2010 Haiti earthquake response highlighted the importance of coordination and collaboration among international organisations, governments, and NGOs. By working together, these entities were able to provide aid and support to those affected by the disaster. This case study demonstrates the importance of effective communication and coordination in managing large-scale emergencies.

The 2011 Tōhoku earthquake and tsunami in Japan demonstrated the importance of preparedness and resilience in emergency management. Japan's stringent building codes and early warning systems helped mitigate the impact of the earthquake. The rapid response by the Japanese government and emergency services also played a crucial role in managing the disaster. This case study highlights the importance of preparedness and rapid response in minimising the impact of emergencies.

The response to Hurricane Harvey in 2017 highlighted the importance of community resilience and the use of technology in emergency management. Local communities demonstrated remarkable resilience and solidarity, organising rescue operations and providing support to those affected by the hurricane. The use of social media and mobile apps also played a crucial role in disseminating information and coordinating rescue efforts. This case study illustrates the importance of community involvement and technology in enhancing emergency response capabilities.

Use Case: Switzerland standard for data exchange between PSAPs

In Switzerland, emergency management relies on a federal structure where each canton is responsible for organising and providing emergency services within its territory[25]. Despite the fact that emergency numbers, such as 112, 117, 118, and 144, are provided at the national level, each canton remains responsible for delivering emergency services within its jurisdiction. This specificity leads to a diversity of systems used by emergency call centers. Although these centers are equipped with the necessary tools for their missions, differences in products, suppliers, and configurations make coordination between cantons complex. An incident that spans multiple jurisdictions requires this coordination to ensure an effective response.

To address these challenges, the Conference of Commanders of Cantonal Police Forces of Switzerland (CCPCS) launched Police Technology and IT (PTI) in 2021, as an organisation for harmonisation. This strategic project aims to improve coordination and interoperability between cantons through harmonised IT solutions, while enhancing the efficiency and cost-effectiveness of services.

Within this framework, the "PSAP Connect" project, led by PTI since 2023, aims to create a standard and a solution for the electronic exchange of data between these PASPs. The goal is to leverage potential synergies and improve the efficiency and effectiveness of their collaboration. By facilitating the transfer of intervention data, position, and status between organisations, this project represents a significant step towards more integrated and efficient emergency management in Switzerland between different actors.

The standard under study is based on two key aspects (Figure 8):

- Resource and unit sharing Between PSAPs:
  - Position: Sharing the geographical location of resources.
  - Status: Exchanging the operational status of resources.
- Incident sharing:
  - Transfer (UC30): Enabling the transfer of incident data between PSAPs.
  - Visualisation of resources related to a common incident (UC41, UC42): Allowing PSAPs to view resources associated with the same incident.
  - Exchange of intervention data during a common incident (UC51, UC52): Facilitating the sharing of intervention-related information in real time.
- Not within the scope of the protocol:
  - UC53: Sending intervention data to a third-party intervention resource.
  - UC54: Utilising an external intervention resource.

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[25] Ordonnance fédérale du 6 octobre 1997 sur les ressources d'adressage dans le domaine des télécommunications (ORAT), RS 784.104, art. 28
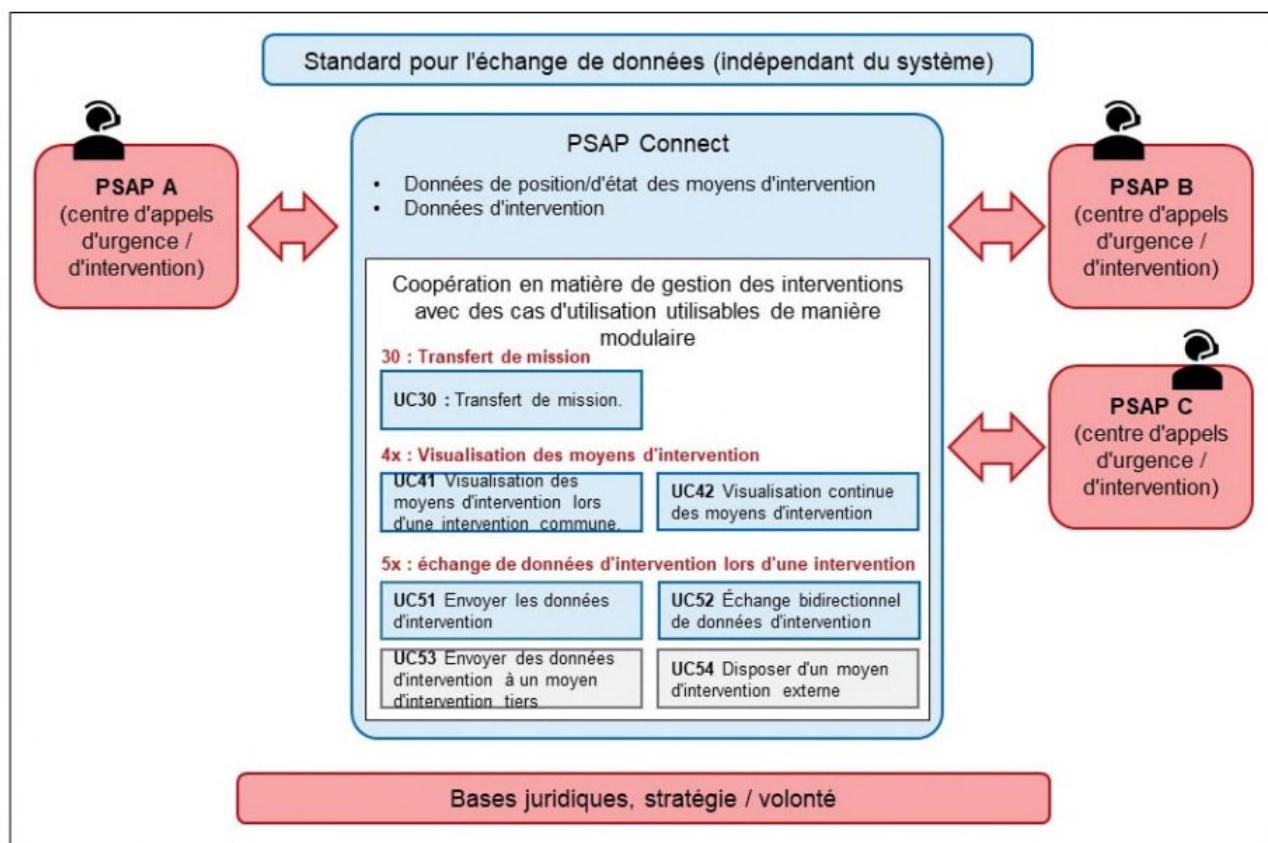
Figure 8 Information exchange use cases for the PSAP-Connect protocol.

The next step will be to establish a Swiss standard for data exchange between PSAPs in 2025, based the Swiss eCH-0051[26] standard for police data exchange. Following this, a central sharing platform for CAD incident data and visualisation of intervention resources will be acquired by the end of 2026. The current plan calls for the sharing platform to be set up in 2027, after which the pilot organisations will implement their interfaces. Subsequently, other participating organisations will be progressively connected throughout Switzerland.

Future Trends in Emergency Management

Emerging trends, such as AI, IoT, and advanced communication systems, are set to transform emergency management. Leveraging these innovations will enhance capabilities and improve outcomes. Predictive analytics, drones, and blockchain technology are among the innovations that promise to revolutionise the field. By staying abreast of these trends and continuously improving their procedures, organisations can ensure that they are always prepared to protect and serve their communities.

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[26] eCH-0051 – Basic data catalogue for the police and justice sectors / 3.0.0 /

AI and machine learning are being used to analyse data, predict emergencies, and optimise response strategies. These technologies can identify patterns and trends that may not be apparent to human analysts, providing valuable insights for decision-making. By leveraging AI and machine learning, organisations can improve their ability to anticipate and respond to emergencies.

The Internet of Things (IoT) involves the use of sensors and smart infrastructure to provide real-time data on environmental conditions, infrastructure status, and resource availability. This information enhances situational awareness and supports decision-making. By integrating IoT devices into their emergency management systems, organisations can improve their ability to monitor and respond to emergencies.

Blockchain technology is being explored for its potential to improve transparency and accountability in emergency management. It can be used to track the distribution of aid, manage supply chains, and ensure that resources reach those in need. By leveraging blockchain technology, organisations can enhance the efficiency and effectiveness of their emergency response efforts.

Conclusion

Optimising procedures for interventions and operations is essential for effective emergency management. By focusing on information flow management, risk management, centralised alert systems, data integration, intelligence in security actions, and leveraging technology, organisations can enhance their preparedness and response capabilities. Continuous improvement and the integration of advanced technologies will further strengthen these procedures, ensuring that responders are always ready to protect and serve their communities. By staying abreast of emerging trends and learning from past experiences, organisations can continuously improve their emergency management practices and ensure that they are always prepared to handle a wide range of emergencies.