# Cases on Adoption, Diffusion, and Evaluation of Global E–Governance Systems:

## Impact at the Grass Roots

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# Section 2
# Operation, Management and Innovation

Chapter 5

# The Information Management of Co–Located Emergency Response Rooms in The Netherlands

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**EXECUTIVE SUMMARY**

*This case is about the re-organization of the Dutch emergency response sector. It involves the diffusion and implementation of new communication and information technologies (ICTs), the introduction of safety regions and the establishment of co-located emergency response rooms (ERRs). The challenge for those organizations is to introduce the new technologies in such a way that they meet the demands of the people who have to work with them. The impact of the reorganization is illustrated by two embedded case studies: new ICTs in the safety-regions Hollands-Midden and Amsterdam-Amstelland. What the case shows is that the implementation of new ICTs in the Dutch safety-sector is not just a matter of technological skills, but of a mutual shaping of the ICTs and the organizations to enhance platform of e-governance, in this aspect the emergency response system serves as an important element. That is an important lesson for those responsible for the Dutch safety-regions, which are confronted with a new organizational and technological challenge: Netcentric Work.*

## ORGANIZATION BACKGROUND

This case is about emergency response organizations in the civil safety-sector in the Netherlands. The organization and information management of emergency response systems is an emerging area of interest to academics, students and practitioners (Perry, 1995; 2003). The emergency response rooms (ERRs) are interesting public sector organizational arrangements. They conduct the intake of 911-calls (in North America) or 112 (in Europe) for help and relay them to the appropriate services and disciplines; the fire brigades, the ambulance services and the police. ERRs are organizations, which highly depend on advanced information and communication technology (ICT) systems. They may comprise of time-critical decision support systems to provide real time support to the people or communities at need, and recent trend of research in this aspect leads to incorporate intricate ICT methodologies in designing, operationalizing and maintaining these systems. They not only save peoples life, or support them in various formats, but also provide a continuous source of information and knowledge during normal period of their livelihood. In essence, this form of real-time decision support system forms a core component of e-government and elevates e-governance at the grass roots (Nelson, 2004). However, this chapter is illustrating two cases on emergency response room that are being used for emergency purposes.

The case presented in this chapter is not about e-governance in the way that it presents changing communication patterns between the government and the citizens, but rather about the way ICTs are implemented and used in governmental organizations – in our case emergency response rooms – and on how they influence the way people in these organizations work and share information with each other.

Since 9/11 and hurricane Katrina academic studies on safety and security have increased dramatically. Many different aspects of these have received attention. In some studies the gap between policy makers and operators is discussed (McConnell & Drennan, 2006); others deal with the new safety environment (Walter, 2003), or the use of training in the preparation for disasters (Perry, 2004). Yet, the organizational dimension has received far less attention. Usually, preparation for disasters is done in military fashion. Hierarchy predominates in predetermined responses to crises to be. Only, increasingly, awareness is rising of the use of emergent, networked forms of organization. These should supplement but not replace the existing hierarchies (Moynihan, 2008; Newburn, 2001). Central to these networked forms of emergency response according to some are ERRs (Perry, 1995; 2003). Unfortunately, there is a relative scarcity of literature on ERRs, let alone on ERR ITs (an exception is Schooley & Horan, 2007).

Emergency response rooms are not only responsible for the first reaction at the time of an incident or crisis but also for the quality of information and communication of the relief workers and professional services. ERRs are not stand-alone entities. They are – or are supposed to be – integrated organizations that work together at times of crisis whether they are man-made (e.g. terrorist attacks), natural (e.g. flooding or hurricanes) or incidents (e.g. a plane crash).

An interesting aspect of emergency response organizations is that they are hybrid organizations. They are not hybrid in the sense that they consist of various disciplines per se (they do), but hybrid because they partly exist on a continuous basis and partly on a temporal basis. They are 'emergent' organizations, since an important part of the emergency organization only comes into being and action during a crisis. To give an example, emergency response organizations are operational on a daily basis, but when a plane crashes emergency response organizations are 'scaled-up', that is, extra organizational layers including administrative bodies are added to the basis-organization. Up-scaling also means the

involvement of representatives from other municipalities, disciplines or safety-regions. In case of up-scaling the *Regional Incident Procedures* (the Dutch abbreviation is 'GRIP') is the leading protocol. This up-scaling characteristically asks for mutual agreements between the disciplines involved about the operating procedures including mutual understanding of ICTs in-use, adequate information sharing practices facilitated by ICTs, and the responsibilities and roles of the actors involved.

## SETTING THE STAGE

As becomes clear in the introduction of this chapter, emergency response organizations are not isolated organizations but interconnected with other organizations and actors who operate in the context of safety and security. In the Netherlands some major incidents have given rise to an intensive and political discussion about the way emergency response organizations and especially the ERRs, function. Incidents like the El Al Boeing 747 plane crash in Amsterdam in 1992, the explosion of a firework factory in the city of Enschede in 2000, the fire in a pub in Volendam in 2001, the fire in 2005 in a building close to Schiphol Amsterdam that housed asylum-seekers and, finally, the crash of a Turkish Airline Boeing close to Schiphol Amsterdam in 2009, have not only caused national traumas but have also lead to a discussion about the quality of the information sharing practices of the ERRs.

The question that was made explicit by investigators in evaluation reports was whether the ERRs were sufficiently equipped for their task. The main problem was not the quality of information sharing practices within one discipline (e.g. communication between members of the police-force), but the mismatches between the various disciplines (e.g. the communication between members of the police, the ambulances, and the fire-brigade). To be short, and as an example: in the case of the

explosion in Enschede the emergency response rooms were not able to transfer the information about the development of the fire to the ambulance services (Commissie Onderzoek Vuurwerkramp 2001). The incidents caused three direct reactions in the Dutch emergency response sector.

Firstly, in order to cope with communication problems, the Dutch government already in 1995 decided to implement a single national communications network for the police, the fire brigades and the ambulances, which was called C2000 (communication 2000). C2000 was part of the comprehensive approach to safety and supports the communication between the reliefworkers in the field and the ERR's operators. Next to C2000 the ERRs were equipped with the emergency room software GMS. GMS is the Dutch abbreviation for Integrated Emergency Room Systems (see for details on C2000 and GMSGMSGMS: Groenewegen and Wagenaar, 2006). It is linked to the public emergency telephone number 112, to the communication system C2000, to radio and telephone systems, and to a Geographic Information System (GIS). The latter is an important database for the operators in this respect. It is software in which entities are spatially indexed and which is used for all kinds of policing (see: Snellen 2000).

GMS facilitates the actions of the ERR operators in the following way. After an emergency-call the operators use GMS to electronically follow and develop the story of an incident. The GMS software enables the operator to make time-lines, to store information from the relief workers in the field, to make a visual image of the incident on GIS and to follow the police cars, ambulances, and fire engines that are operational. GMS is also used as a device to store the data – and in a way it is also a surveillance system. Since it is an integrated system, GMS can also be used as a tool that enables information sharing practices. It is a crucial device for the ERR to function properly.

In the second place, the Dutch government decided to re-organize the civil safety-sector in the Netherlands by implementing 25 different

safety-regions that together cover the whole country - most of them are operational since 2007. The safety-regions vary in scale and have their own characteristics but have the same responsibilities. Each and every safety-region must: integrate the administrations of the different disciplines, organize itself around a regional bureau that is responsible for emergency-response and the communication with the majors of the cities that are part of the safety-region, develop a risk-analysis of its region, and facilitate an emergency response room.

Finally, as part of the reorganization and the implementation of the safety-regions, the Dutch government decided to house the three disciplines' ERR-personnel at one site. Such a new ERR, which is a crucial part of the safety-region, is known as a 'co-location' or a 'co-located' ERR. The idea behind the co-location is that communication and information-sharing between the three disciplines will become easier. Working in a co-location enables the operators of the three disciplines to get to know each other, and each other's practices, procedures and ICT systems in-use.

## CASE DESCRIPTION

This section will present two sub-cases: the integrated co-location of the emergency response room of the safety region HollandsMidden and the virtual co-location Amsterdam-Amstelland. The sub-case HollandsMidden makes clear that the implementation of new ICTs and the merger of the three disciplines was a heavy managerial burden for the responsible actors of the room. However, the three different disciplines have been able to mutually develop the ICTs in such a way that multi-disciplinary routines could be developed. The second sub-case is about the safety-region Amsterdam-Amstelland, which is the only safety-region in the Netherlands in which the three disciplines still are located in separate locations spread over the city. The three

emergency response rooms each have their own emergency room systems and are – at the time of writing this case - only virtually co-located by means of webcams.

With regard to the technological components and the synopsis of its structure, the reader must understand that the specific characteristics of the ICT in-use can differ from ERR to ERR. That means that, in the cases below, the technology in-use will not be described in detail, but generalized and described. In general, any GMS in-use in a Dutch ERR must be seen a decision support system is used as a communication tool, for data storage and - via the archive - enables the evaluation of first responders. Next to C2000 and GIS, the IT can be attached to MobiPol and Enterprise Resource Systems. MobiPol is an application in a police-car with which the officer can communicate with the ERR-operators. It also enables the individual police-officer to get access to the GMS-content while being in the field.

An important element of GMS is data-storage. The content of the archive can be – on an abstract level, provide the ERR manager of information regarding the response time and the adequacy/ quality of the communication between the responder and the citizen. The archive – in which the data of previous incidents is collected - is also used for a periodical, external review of the ERRs quality.

## Sub-Case HollandsMidden: A Co-Location with Integrated ICTs

The implementation of the co-location of HollandsMidden, which is in full operation since 2007, was not a process without problems (see for details of this sub-case: Wagenaar et.al, 2009). First of all the management of the three existing emergency response rooms had to find ways to (re)organize the rooms and to find a well-equipped room that was big enough to house the three disciplines. The details of this process are outside the scope of this chapter. What is impor-

tant to know is that eventually the co-location was realized: the new emergency response room was housed under the roof of the fire brigade but under the administrative responsibility of the police in Leiden, which is the main city in the safety-region HollandsMidden. Interesting is the way in which the ICTs – and most important the GMS – was used as a basis for integration. The integration of the ERRs of the fire brigade, the ambulance services and the police took place in different phases.

Firstly, the three disciplines were brought together under the same roof but without really integrating the different operating procedures and information sharing practices of the disciplines. Although the management of the co-located ERR felt the urgency of more multi-disciplinary work, the implementation of the new GMS was a heavy burden that took too much of the time of the management. Multi-disciplinary work in the first stage of the co-location thus was an illusion. Yet, in the second stage, the operators of the different disciplines within the ERR stared to understand each others' routines and work-procedures and – as a result - they actually started to collect information that was needed by the other disciplines without direct intervention of the management. Yet, there still were no multi-disciplinary procedures, and there were many misunderstandings of each others' work. For example in the case of a fire, the fire brigade is interested in the extent, development and putting out the fire itself, the emergency medical team is focused on saving possible victims, and the police wants to apprehend witnesses or perpetrators. These different routines made multidisciplinary communication difficult. Instead of using the GMS that was implemented to facilitate multi-disciplinary information sharing practices, for a long time the operators relied on the telephone to get into contact with the other disciplines. Part of the problem was the inadequate translation of the different work routines into GMS.

In the final stage of the co-location, however, the ERR's personnel started to develop interdisci-

plinary operating procedures. The ERR's operators came to appreciate and understand each other's work. At the same time they were able to translate this appreciation into new practices – also based on multi-disciplinary training – and adaptations of GMS. That means that the operators were able to change parts of GMS' information scripts so that certain information that is relevant for the other disciplines can be shared and other information can stay within one discipline. For example if the citizens' privacy is at stake, the operators of the ambulance services do not transfer that information from their GMS to that of the police. The new GMS is also extended by a so-called scratchpad on which on discipline can transfer the most crucial information about an incident to another discipline. However, the co-location enables them to orally exchange that information to the other discipline. We found that most of the crucial information was exchanged on an informal way: by walking to each others' desks the operators are able to quickly share information with the other disciplines.

What this sub-case illustrates is that the way the ERR of HollandsMidden functions nowadays is a result of a mutual shaping of ICT (GMS) and the organization (the co-location). Yet, the ERR still lacks embedded multi-disciplinary work routines and information sharing practices. And, as Stinchcomb and Ordaz have shown, the integration of different disciplines within one location is problematic from an organizational (cultural) point of view (Stinchcomb & Ordaz, 2007). Too often the disciplines have to be focused on their own work, have different work routines, and sometimes the law doesn't even allow them to exchange information. Also the formal terms of employment (e.g. the salary, pensions, etc.) are still subject for discussions within the ERR. The operators of the different disciplines now work closely together but are paid different. It is the local employees councils of the ERR in HollandsMidden that tries to find a solution for this problem. That means that whereas the benefit of

fully integrated ERRs is not questioned, how the ICTs can facilitate multi-disciplinary work still is the question.

## Sub-Case Amsterdam-Amstelland: A Virtual Co-Location with Loosely Coupled ICTs

The region Amsterdam-Amstelland is the only region in the Netherlands that still houses its ERRs in three different rooms. Amsterdam-Amstelland is a relatively small safety-region in which the city of Amsterdam is the main agglomeration (see for details of this sub-case: Boersma et.al, 2009). Interesting about this sub-case is that the three disciplines of this region are still housed in their own ERR at different locations in Amsterdam. And, in addition, the ICTs in-use are not (yet) electronically connected. The ERRs of the police and the fire-brigade each work with their own version of the Dutch standard GMS systems, but these differ slightly from each other. The ERR of the ambulance services does not work with GMS but with a system called 'MIOS', which it has developed itself. In the daily practice of the emergency response organization this means that the information is not shared via an integrated emergency response room system.

Because the emergency response systems are not interlinked with each other, most information is still exchanged through telephone. This makes it difficult for the operators of the various disciplines to come to a shared understanding of what exactly is going on during an incident. It can even happen that not all ERRs are aware an incident is taking place. Especially during the up-scaling GRIP-procedures of the emergency response rooms the exchange of information between emergency response rooms is insufficiently guaranteed. In the daily practice of the emergency response organization the information (as laid down in the systems) is usually not digitally shared real-time among the different ERRs, which can lead to simple miscommunications (for example about the exact

location of an incident). Not coupling the systems is thus a huge disadvantage. Clearer agreements on communication between emergency response rooms are definitely required. Enabling operators to look into other emergency response rooms' information systems could prevent a few of the most elementary mistakes.

The question in this sub-case is whether a co-location with an integrated GMS can help the disciplines to communicate (better) with each other. The sub-case of HollandsMidden has taught that the implementation of a co-located ERR is complicated and the outcome of a mutual shaping of the ICTs in-use (especially GMS) and the organization. This mutual shaping is a situational matter and the failure and success depends highly on local circumstances and choices. A complicated factor is that the three Amsterdam ERRs operate in a very demanding area because of the population density, and therefore the operators work under constant pressure. A co-located ERR in the Amsterdam situation could also create a too large and too turbulent environment. Yet clearer agreements on communication between ERRs are definitely required.

## CURRENT CHALLENGES FACING THE ORGANIZATION

As the two sub-cases show, in the process of ICT implementation both the organizational and the technological structures and systems are (re) interpreted and (re)defined. The selection of possible practices is a process that takes place in the context of daily routines and therefore, depends on situational circumstances. Only when an ICT is studied 'in use' can one understand the way an ICT, like in this case a GMS or a GIS, affects the organization and vice versa. That means that whenever new systems are introduced, subgroups of users decide the manner in which the system fits their purposes and work processes (Orlikowski, 2000). ICT in-use puts emphasis on the idea that

actors, through working with it, reconfigure the information system where possible due to their needs. This can be seen as a mutual shaping (MacKenzie & Wajcman, 2002) of the technology and the organization of the ERR, which is an on ongoing process.

Many actors are involved in the mutual shaping of the ERRs and the ICTs in-use. It is important for the work of these people in the ERRs to create a culture of trust. The disciplines have to find a common ground for operating and communicating with each other. In order to facilitate information-sharing practices of a high quality, emergency response organizations are equipped with ICT tools of all kind. The challenge for the different disciplines is to find shared ICT routines. GMS, through standardization, was supposed to facilitate the communication between the different ERRs and the disciplines. Yet, thus far the ICTs in-use, like GMS, still has to prove that they can meet that goal. As long as the routines are not standardized and the ERR operators do not create multidisciplinary routines, this will continue to pose a constraint. Therefore the Dutch government, in cooperation with the civil safety-sector, is looking for new ways to cope with this problem.

The latest development in information management that tries to give a solution to the multidisciplinary information sharing problems is Netcentric Work (Von Lubitz et al., 2008; Houghton et al., 2008; Van Lier, 2009). Netcentric Work is an organizational principle based on the innovation of interactive internet-tools. These interactive tools – the so-called *web 2.0* technologies like Wiki's, Youtube and Blogs – enable the netcentric worker (in and outside the emergency response room) to collect real-time information about a certain incident from the professionals in the field and to add information about the operation in the systems. This information is supposed to be shared without the restraints of formal organization. The main idea behind Netcentric Work is netcentric warfare – a concept from the military that is suppose to enable the troops to create a

'common operational picture' at the time of an incident or action.

Important to consider is that Netcentric Work is based upon Geographic Information Systems (GIS), containing one map per discipline involved. Because the users of Netcentric Work can consult each others' GIS, it is expected that Netcentric Work can provide the operators with a view of the others disciplines' worlds, and help them to make sense of the work routines and information sharing patterns of the others. Although so far there is no formal decision about the implementation of Netcentric Work at the level of the safety-regions in the Netherlands, it is most likely that the emergency response sector will hook up with this international trend. When they actually do so, they will have used a new information system (instead of GMS) to solve the problem of organizational fragmentation and differences in sense making between disciplines. The challenge for those involved in the implementation and adaptation of Netcentric Work is to nurture the mutual shaping of the technology that comes with Netcentric Work and the organizations (in the Netherlands these are especially the 25 safety-regions) in which the new concept must be embedded. That implies also that one cannot solve organizational problems by simply implementing new technologies. As the cases have shown, these technologies are used in different and sometimes unintended ways. And maybe more important, these technologies only have a meaning when they are in-use. The idea that there is a one-for-all IT solution, therefore, is rather naïve.

## SOLUTIONS AND RECOMMENDATIONS

The lack of really integrated systems in the ERRs certainly is a problem when it comes to smooth communication among the disciplines. Yet, as this chapter has tried to illustrate, it is not so much the ICTs per se, as it is the institutional and orga-

nizational arrangements that are the bottlenecks when it comes to the emergency response room in-action. That means that if future technicians and managers of governmental organizations such as emergency response rooms start thinking of the implementation of new technologies they should include organizational issues into account.

Authors would like to say that, although the emergency response rooms in the Netherlands do function well as stand-alone organizations, the ERRs as a whole in Amsterdam-Amstelland and, less so, in HollandsMidden, are still facing problems to fulfill their most important task: to coordinate the communication between the safety services at the time of a major incident. This contribution has made it clear that although the Dutch government invested a lot in the civil safety-sector, the communication between the emergency rooms of the three disciplines is not yet optimally organized. Shared information systems such as GMS and the planned implementation of Netcentric Work – as presented in this chapter - might prevent situations of misunderstanding and miscommunication, but must be mutually shaped with the organization in which they will be in-use. In the end, it are the users (the professionals of the ERRS) who have to work with the new ICTs – therefore their wishes should be taken seriously during the various stages of ICT-implementation. That is especially true when it comes to the implementation of netcentric work as a new promising technologies and way of work.

ERRs and their information systems might seem far removed from E-governance; especially if the latter is conceived as G2C relations. Yet, when one realizes that ERRs redirect citizen calls to emergency services, after having processed them, then their E-governance character becomes much more manifest. Interesting is how these relations are evolving under the influence of new tools like Twitter and Youtube. Nowadays, because news – and footage! - of disasters hits the afore-mentioned social media as fast as it reaches the ERRs emergency services are confronted with new questions. One of those is whether one should use information citizens have gathered. The other is how to respond to citizen concerns in a situation where the public information position has so drastically improved.

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## KEY TERMS AND DEFINITIONS

**Emergency Response Room (ERR):** Public sector organizational arrangement that conducts the intake of 911-calls (in North America) or 112 (in Europe) for help and relays them to the appropriate services and the disciplines involved in emergency work: the fire brigades, the ambulance services and the police and other professional workers like those of the Waterboards.

**Co-Location:** An ERR in which the disciplines are physically housed in one building [niet 'room'] in order to stimulate multi-disciplinary work routines and information-sharing practices among the operators of the different disciplines.

**GMS:** Standardized Emergency Response Room System facilitates the work of the operators in the ERR by offering an electronic platform to import and store the (communication) data used by the relief workers at the time of an incident.

**GIS:** Geographical Information System is software through which entities are spatially indexed on maps (e.g. Google Earth) and which, in safety and security sectors, is used for all kinds of policing.

**Netcentric Work:** An organizational principle based on the innovation of interactive internet-tools. These *web 2.0* technologies like Wiki's, Youtube and Blogs – enable the netcentric worker to collect real-time information about a certain incident from all kinds of sources to create a 'common operational picture'.

**Mutual Shaping:** The mutual shaping of technology and organization is the idea that the development of a certain technology never occurs in isolation but always in interaction with its environment (in this chapter the mutual shaping of the GMS and the ERR).