

A framework to assist with the improvement of emergency planning of floods - FIM FRAME

D. Lumbroso^{1,2}, K. Stone³, A. Tagg¹ and F. Vinet⁴

¹ HR Wallingford, Howbery Park, Wallingford, Oxfordshire OX10 8BA, UK

² Institut Français des Sciences et Technologies des Transports, de l'Aménagement et des Réseaux, Centre de Nantes, BP 4129, 44341 Bouguenais, France

³ Deltares, Rotterdamseweg 185, Delft, The Netherlands

⁴ Gestion des Sociétés, des Territoires et des Risques (GESTER), University of Montpellier III, Montpellier, France

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Abstract

This paper details research carried out in England and Wales, France and the Netherlands to produce a framework to assist in improving emergency plans for floods. The research comprised an assessment of the effectiveness of current flood emergency plans, an evaluation of the use of tools available to flood risk managers to inform these plans and the development of a framework with which emergency plans can be developed or improved. The framework developed under the ERA-NET CRUE project, Flood Incident Management a Framework for Improvement (FIM FRAME), was tested via a number of workshops and case studies carried out over an 18 month period. The framework was applied to flood emergency plans for the city of Sheffield in the UK, the city of Dordrecht in the Netherlands and two towns in the Rhone Basin in France. The resulting framework is relatively simple to apply without specific training, can be applied independently anywhere and by any flood emergency management team and is generic in that it can be adapted by the user for their specific purpose. It is recommended that the framework developed as part of this work is used internationally to assist with the development and improvement of emergency plans for disasters worldwide.

Introduction

Recently, the emergency management of floods in Europe has placed increasing importance on developing enhanced preparedness capacities. In this regard, the concept of emergency management has shifted from a primary focus on responding to the flood and its impacts to one of increased attention to communities becoming more resilient to the impacts of floods. The capacity to respond effectively remains important, however emergency responders and planners are looking more intently at the earlier stages of emergency planning and how plans for floods can be improved.

An emergency plan may be defined as a “*coordinated set of protocols for managing an adverse event, whether expected or untoward in the future*” [1]. Recent decades have seen significant increases in the number, scope and complexity of incidents and disasters. The process of constructing a written emergency plan is of great benefit to organisations that have to respond to an emergency [2]. It is now generally agreed that for places that are significantly at risk of hazards authorities should be required to produce emergency

plans [1]. Grunfest and Handmer [3] also note that emergency planning is the best way to significantly reduce the loss of life from floods.

The research was carried out in the following stages:

1. An assessment of the effectiveness of flood emergency plans using developed metrics
2. A review of the functionality and use of currently available tools that can be used to inform plans
3. The development of a framework to assist with the improvement of emergency plans for floods
4. Improving the developed framework after implementing it on a number of case studies with emergency responders, emergency planners and other stakeholders

An assessment of flood emergency plans

As part of the research 22 metrics were developed to assess and compare emergency plans for floods in the three countries. The metrics covered six broad areas: Objectives, assumptions and target audience, Organization and responsibility, Communication, Flood hazard, Flood risk to receptors (e.g. people, buildings, critical infrastructure), Evacuation. The metrics provided a basis to allow an assessment and comparison of the plans. An online survey was carried out aimed at emergency planners to assess their requirements. Many emergency planners stated that a well defined description of the roles, responsibilities and communication is essential for a plan to be effective. These aspects tend to be well covered in the plans in the three countries. However, other more technical aspects such as accessibility of roads during floods, evacuation, and the depiction of flood hazard and impacts of floods on critical infrastructure could be considerably improved [4].

A review of the functionality and use of currently available tools

A review of the current available tools (e.g. guidelines, checklists, software) to assist flood risk managers provide information that can aid the production of flood emergency plans was carried out. An online survey of flood risk managers was also carried out in the three countries. From the survey it became apparent that many flood risk managers were not aware of the tools that are available to assist them in providing information to emergency plans for floods. The three main obstacles to tools not being used appeared to be:

- Lack of awareness of the methods that are available
- Availability of data
- Lack of communication between flood risk managers and the stakeholders such as emergency services and local authorities responsible for writing the plans

Development of the framework

The framework, developed as part of the ERA-NET CRUE project, Flood Incident Management a Framework for Improvement (FIM FRAME), was tested via a number of workshops and case studies carried out in the three countries over an 18 month period. This framework was designed to be:

- Simple, so that it can be applied by anyone without specific training

- Transportable, i.e. it can be applied independently anywhere and by any flood emergency management team
- Generic, so that it can be adapted by the user for their specific purpose

The framework was structured in three steps:

1. Appraise – Screening of an existing plan, undertaken by applying the metrics to ‘flag up’ possible general issues
2. Tackle – This step consists in going through the plan, by analysing the current structure of the plan (or a particular aspect of the plan) to identify possible specific issues and actions to address the issue
3. Implement - Identify possible ways forward to put into practice the identified actions and update the plan

These steps are shown in Figure 1.

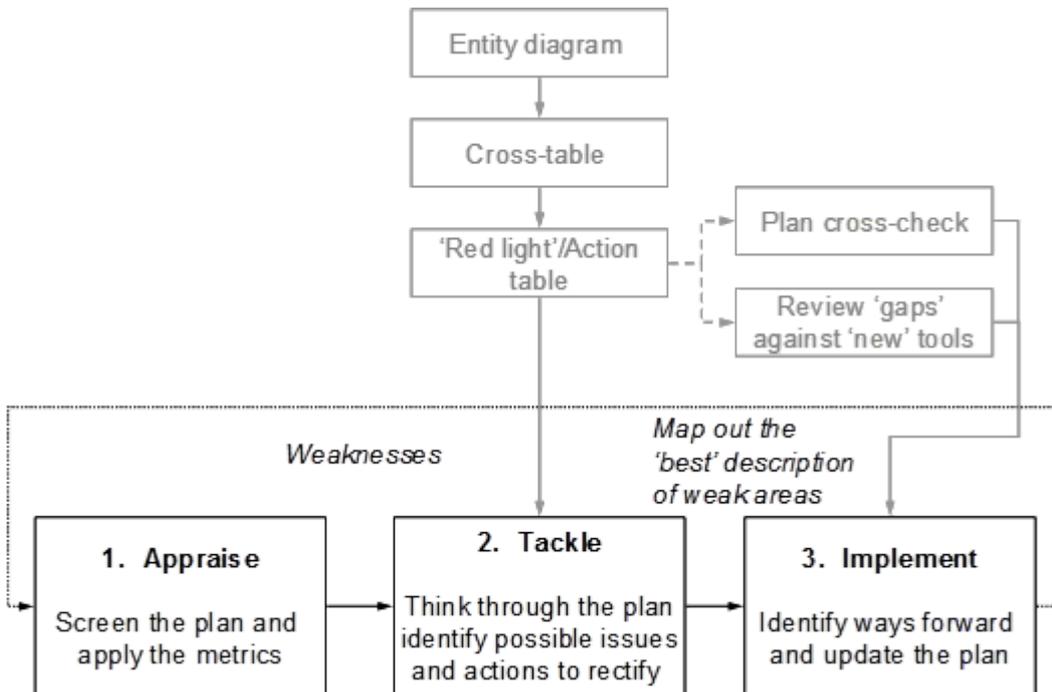


Figure 1: Diagram of the framework

These steps do not need to be applied sequentially and the framework can be used starting at any point. For example, if no plan is in place the framework can be applied starting from Step 2. If some issues have already been identified e.g. as a result of a post-emergency appraisal or exercise, then the starting point could be Step 3. The framework can also be applied as a loop, re-appraising the plan after its last update. Stage 2 ('Tackle') is based on our interpretation of how the 'Business Elements Method' could be applied for emergency planning. The Business Elements Method is a tried and tested guide for analysing any process (or event); in this case the flood emergency plan [5]. This method consists in examining the process in terms of five elements:

1. Processes
2. Roles and responsibilities
3. Data and information

4. Tools

5. Audit

Considering these elements helps to produce a clearer picture of the process, and gain an understanding of the interdependencies within the different parts that constitute the process. The three stages of the framework are discussed below.

1. Appraise - Apply the metrics and flag up general issues or weaknesses

The appraisal of the emergency plan comprises assessing the plan against the 22 developed metrics. This appraisal provides an initial understanding of how the plan is likely to perform and its main weaknesses.

2. Tackle - Structuring\“de-structuring” the process and identifying specific issues

This step can be performed for the whole plan or to particular aspects e.g. parts of the plan that obtained a low metric score in Step 1. This step “de-structures” specific processes (or plan components) into “entities”. Each of these entities is analysed both individually and in combination with the other items they are linked to. This analysis is based on the application of the five principles of the Business Element Method (BEM) that have been adapted to comprise the three following steps:

- (i) Describe the process
- (ii) Process\Responsibilities\Tools\Information
- (iii) Identify and tackle the issues

An entity diagram is used to describe the process of interest (e.g. the identification of vulnerable people). The entities are essentially the elements of the process, with each entity corresponding to a specific action, feature or sub-process.

For each of the items identified in the entity diagram the following needs to be identified:

- Who are the people responsible for\have a role into the process?
- What are the tools or technology used or needed to enable the process?
- What is the information needed to carry out the process?

Once these have been identified the links (if any) between them should be established. Whilst identifying these links, different issues can arise, for example: it is not quite straightforward to find the link, some logical links do not exist in practice, some information is not provided by any source (e.g. tool or person); information is provided but not fed back to anyone. Once an issue arises, it should be reported in a “Warning\Audit” table, together with the element(s) to which the issue is connected and the related link. For each of the identified ‘Warnings’, the user can analyse how to address it by:

- Audit i.e. where to insert auditing measures to avoid possible issues
- Action, defining a specific action that is needed to tackle the issue

3. Implement - taking actions forward

This step can start from the issues and relative actions identified in Stage 2. It can also start from specific issues identified elsewhere, e.g. directly through the appraisal of the metrics or by other means e.g. a post-event assessment. This step includes:

- Plan cross-check, to identify specific parts of the plans that cover (or should cover) the issue
- Review of the 'gaps' against specific tools that can be used to cover them
- Update the section of the plans, identifying detailed measures that should be taken to rewrite or to modify the plan so that the specific issue is covered

This step translates the actions identified in the Warning/Action table into specific implementation in the plans, including identifying the programme and resources that are needed for it.

Application of the framework

The framework has been applied in three countries as described below. Each of the three case studies is affected by different types of floods (e.g. fluvial floods, flash floods, coastal floods, surface water flooding and dam breaks).

England and Wales

In England and Wales the developed framework was applied to the Multi-Agency Flood Plan (MAFP) for the city of Sheffield in Yorkshire that has a population of approximately 547,000. There are a number of dams that surround Sheffield and in 1864 the Dale Dyke Dam failed resulting in the deaths of some 270 people. A workshop was held with emergency planners and responders from Yorkshire. The framework concentrated on two metrics the risk to vulnerable people and media communication. Feedback obtained from the first workshop indicated that the framework was relatively easy to understand, but that the framework could be improved in terms of the way that it is presented. The stakeholders indicated that the framework is useful when preparing a business case is required to further develop emergency plans. The responders found that the framework allowed them to explore and identify the 'gaps' in information concept. Responders also found that the framework could be used to provide evidence to senior managers that resources may be needed in specific areas. Following the first workshop in Sheffield a second workshop was held to further refine the framework with a limited number of stakeholders using the same MAFP. The framework was reviewed to make it more "user friendly" and applicable.

France

In France, the framework was applied to two Plans Communaux de Sauvegarde (PCS) i.e. local emergency plans in the Rhone River Valley. The two municipalities had been chosen for their different levels of knowledge and involvement in emergency management. After the assessment of the flood emergency plans the level of knowledge was found to be very different among the local communities. The Piolenc PCS scored 1.4 i.e. "room for improvement". Many problems and shortcomings had been identified in the PCS hard copy. The stakeholders agreed with the scoring of the plan even the low scores of some metrics could be explained by the local context. The entity diagram was appreciated. The workshop was the opportunity for stakeholders to discuss and share their own vision of crisis management. It was found that the communication between the professional crisis managers (e.g. firemen services) and local policy makers was not as good as it could be and comprehension was enhanced through using the framework. The second workshop was held in the municipality of Tarascon. The final comments on the framework were positive. Work is ongoing in Tarascon to improve the PCS to draw "action maps" to help emergency managers to better handle a large flood in Tarascon.

The Netherlands

The city of Dordrecht has a population of 118,000 and is located in the delta of the Rivers Rhine and Meuse. The city is surrounded by channels and is effectively located on an island. The possibility of flooding results from large river flows in combined with high sea levels. The limited number of escape route means should flooding occur probability of casualties would be high. There are two emergency plans relevant for the city of Dordrecht. These are the regional plan for flooding, developed for the region and the emergency 'high water levels' plan. Both plans were scored using the developed metrics. The plans scored 1.6 and 1.4 respectively. For both plans there was room for improvement for the 'evacuation routes' and 'shelters, safe havens' metrics. A workshop session was held addressing the aspects 'evacuation from the island' and 'evacuation of the areas unprotected by flood defences using the framework. The workshop was attended by people from the Safety Region, Dordrecht, the province of South Holland, the Water Board and the police. The session provided an opportunity to assess the applicability of the framework in a Dutch context and to introduce the framework to Dutch emergency planners. The aspect of the framework that was most appreciated by the Dutch stakeholders was the systematic step-by-step tackling of the selected topic. The framework served as a method to identify the shortcomings within the emergency plan.

Conclusion

The framework was developed independently with key emergency planners in advance of the three case studies. This allowed the framework to be piloted independently and then improved using the results of its application in three countries in places subject to different types of floods. The framework has been developed with a high degree of stakeholder consultation. The framework was successfully applied in all three countries that have taken part in the research. The framework provides a means of improving and developing plans and involving all the relevant stakeholders in this process. It allows the stakeholders responsible for writing emergency plans to identify gaps in them and implement improvements. It also aids practitioners with the development of plans. In the future the application of the framework does not have to be limited only to floods, metrics could be developed for other emergencies (e.g. earthquakes, volcanoes, nuclear accidents) and the same framework applied to both develop and improve plans.

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