Using the BORM Methods in the Protection of Historical Artifacts against Floods

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Abstract. This paper deals with the use of Business Objects Relation Modelling (BORM) methods in crisis management. Restoring the damage caused by natural disasters is not only expensive but in the case of cultural values, losses are incalculable. An example of this was the damage caused by the flooding of the National Library in Prague in 2002.
For this reason, it is crucial to have an accurate roadmap that is feasible and understandable to those who have not been involved in its development. The paper demonstrates the use of BORM methods as a successful solution to an individual crisis.
The flood plan of the Czech Republic is based on a sketch diagram created with individual consultations. This diagram demonstrates the Business processes, i.e., scenarios of BORM methods. The plan highlights steps to be taken in the implementation of BORM methods in future crisis management.

Keywords: BORM; crisis management; business process modeling; floods.

1 Introduction

The most destructive natural disasters in the Czech Republic were the floods of July 1997 in Moravia and Silesia, which took 52 lives and caused damage over CZK 63 billion (Czech Crowns). Similarly, the flood in Bohemia in August 2002, took 19 lives and damage exceeded CZK 70 billion (Ministry of the Environment 2004). The flooding in eastern Bohemia in July 1998 (6 victims, the loss was about CZK 2 billion) was lesser in scope. The occurrence of destructive floods following a long period of relative calm raises the question as to what extent these floods are the results of natural climatic variability or the consequence of anthropogenic conditioned global warming that could result in future increase in frequency and intensity of floods (Houghton et al. 2001, Beniston 2002, Milly et al. 2002, Christensen and Christensen 2003). To implement protective measures that would tend to minimize human and material losses, it is necessary to have a good plan, which can be logical not only by experts but for everyone (Brásdil, Dobrovolny, Kakos and Kotyza 2006).

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The legal code 254/2001 Coll., On Waters, as amended by Act No. 20/2004 Coll., (Hereinafter referred to as the Act on Waters), comprehensively regulates the area of water management, including protection before floods in the period before the declaration of a crisis state and after its cancellation. The Act also provides a general hierarchy of water authorities (the Ministry of Finance) agriculture - regions - municipalities with extended powers), which play an essential role in the process of identifying flood areas, also the line over which it is managed flood protection in times of threat, under the self-government obligation (i.e., flood authorities). The staffing of both related areas is intertwined mainly at the level of smaller towns and municipalities, where the so-called mixed model of state administration and self-government in the area of water management (Čamrová and Jílková 2006).

The effective management of water wealth as a public good is carried out by designated watercourse managers (Povodí, Lesy ČR, Agricultural Water Management).

Modeling Business processes for crisis management support was already realized by the BPMN model and the Statechart diagram (Kushnareva, Rychkova, and Le Grand, 2015).

2 Motivation

Floods cause irreparable damage to cultural heritage. The cost to Czech cultural heritage by floods was estimated at CZK 3.6 billion for the 2002 floods and CZK 0.5 billion for the 2013 floods. Worse than the financial damage itself. In some cases, the loss has been irreversible - for example, the destruction to the National Library for about CZK 20 million in the 2002 floods. Other losses occurred in some parts of the premises even subsequently - e.g., sinking of floors in non-basement parts, damage to distribution systems, etc. (Výstava Národní knihovny připomíná ničivé povodně roku 2002, 2002)

During the flood, over 800,000 copies of books were damaged (140,000 were eventually dried and rescued). To prevent such irreparable damage, the project "Methodology of Protection and Rescue of Cultural Heritage against Flood" was launched (Nedvědová 2014 and 2015). The project objectives were as follows:

- Vulnerability analysis of cultural heritage.
- Creation of methodology of protection of cultural heritage and areas with cultural-historical values against floods.
- Creation of risk preparedness plans for crisis.
- Guidelines for flood protection system planning in historical sites
- Assessment of the role of historical waterworks in the flood protection system.

The output of the project was recommendations in text form, and so in connection with the project we formalized these processes using the BORM method.

3 BORM

BORM stands for Business Objects Relation Modelling. It is a complex method for building process-intensive business conceptual models. It is focused on overcoming the gap between business engineering and software engineering (Knott 2000). The technique has been developed since 1993. It originated as a VAPPIENS project funded by the British Council. The development was supported by Deloitte consulting company since 1996, where it started to be used for big consulting projects. Although it is an old method, there is no standard, and there are many advantages like elementary notation that is easily understandable by non-technical users, object-oriented approach, effective concepts for business engineering — reports, concepts and diagram transformations, supports MDA, and strong formal background (communicating finite-state machines).

In the field of theoretical informatics, the finite-state machines (FSM) theory is a study of abstract automatons and the problems they can save. An automaton is a mathematical model for an entity that responds to its external environments, receives data, and produces other data. Automata can be constructed in a way that the output from one of them becomes an input for another. Finite-state machine activity is determined not only by receiving data but also by the internal status of a given machine. The output is created as a combination of input and internal status.

BORM uses an original diagram for business process modeling and subsequent simulation. It conveys together information from three separate UML diagrams: state, communication, and sequence. The BORM group has found that business stakeholders clearly understood it. Main principles of the BORM process diagram are (Knott 2000):

1. Each subject participating in a process is displayed in its states and transitions.
2. This diagram expresses all the possible process interactions between process members. The business process itself consists of a sequence of communications and data flows among participating subjects.

Officially, BORM process diagrams are graphical representations of interconnected Mealy- type automata, where each automaton represents some participating entity of the entire business process. Visual simulation of a business process is based on the market-graph Petri net. Hence, we can model states, transitions, and operations of all entities involved in a given business process in a compelling but still relatively intelligible and straightforward graphics for domain experts who typically are not educated in detailed computed science (Pergl 2011). BORM process diagrams can be easily automatically transformed into BPMN diagrams (Tůma 2015) or HTML textual instructions (Pícka 2015).

Today, the method is being further developed in different directions (Merunkova 2017, Merunka 2018) - one of the possibilities of using BORM in a case of floods, that the Czech Republic had problems in the past time.

4 Results

We think that to proceed according to processes, and it must be in clear form. And if processes want to be used as a basis for software development, it is good to have

them in formalized structure. Both conditions are met by the BORM method, and we have perfect experience with it.

During creating process diagrams, we proceeded based on the project documentation; key participants were identified. Based on documentation (e.g., Floods Management Plans of the Czech Republic (Ministry of the Environment 2019) or EU floods directive (European Commission 2007)) and consultations with interested project members have created sketch diagrams. For these participants, at least one chart has been created showing the activity from his perspective. This diagram is used both to capture the activities (on fig. 1 symbolized by oval elements) and to find candidates for the BORM members (rectangular elements), too.

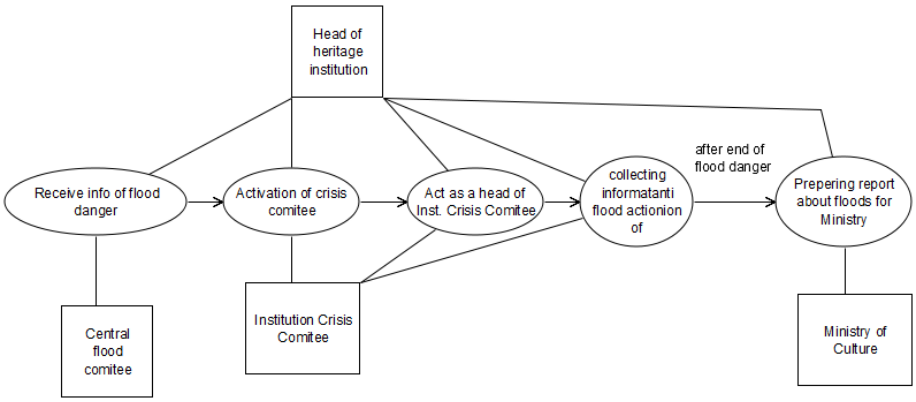

Fig. 1. Sketch diagram - Flood management from the Head of Heritage institution view.

According to these diagrams were found (business) processes, i.e., scenarios in the BORM method.

Afterward, process diagrams have been created for the most critical scenarios that describe in detail what is happening in each scenario.

Figure 2 shows an example of a created process for the entire flood management. The diagram contains seven members. In each participant, there is a mealy automaton that controls its activity. These machines communicate with each other and thus coordinate their activities.

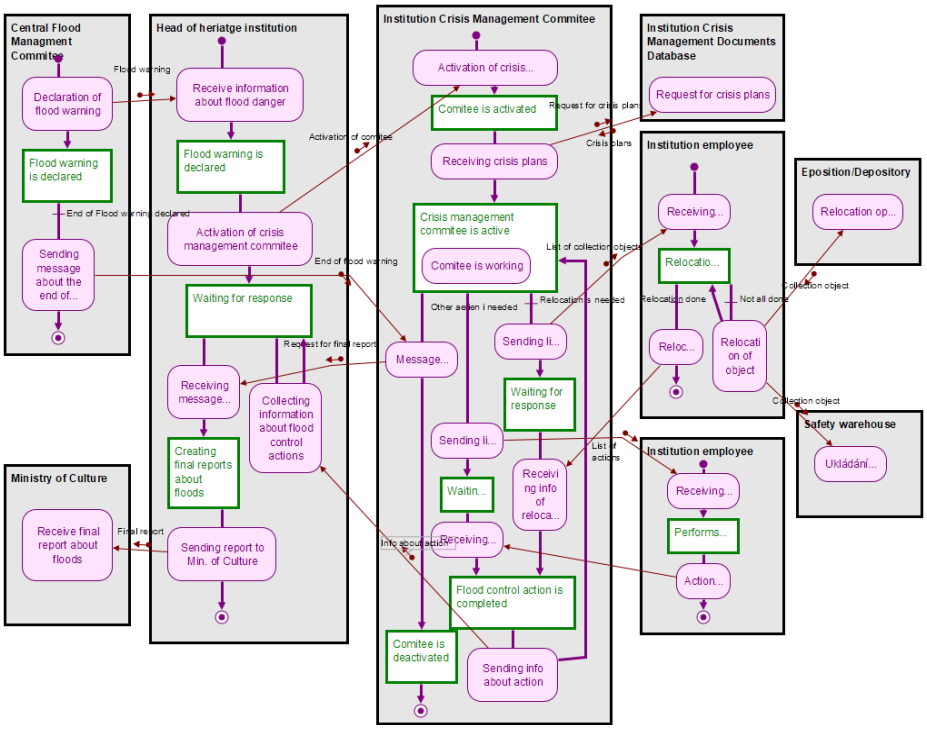

Fig. 2. BORM process diagram - Flood management.

Finally, the process diagrams were verified in comparison with the help of discussions with interested people, simulation, and facts.

Based on Mealy-type automata, BORM process diagrams can be easily transformed into a workflow system, and software can be created to assist in coordinating individual crisis management steps.

5 Conclusion

BORM methods show us the ideal solution for future crisis. BORM diagrams are not only understandable to experts and are therefore suitable for use in these situations where experts are not always available, and acute steps must be taken quickly.

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