

An Exploratory Study of Crises in Product Development - DTU Orbit (08/11/2017)

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In April 2010, the Deepwater Horizon oil rig exploded in the Gulf of Mexico. The explosion killed 11 workers. In order to stop the oil outflow, the workers attempted to activate the blowout preventer, which failed. As a consequence, more than 779 million litres of oil streamed into the Gulf of Mexico during the following 4 months, causing the biggest oil spill in history. Besides the enormous environmental destruction and the death of 11 men, the Deepwater Horizon crisis accrued a high image loss for the oilrig operator. The direct cost of the crisis summed up to 35.6 billion € [The Economist 2015]. Crises, as described above, happen in every sector, including product development. They are independent of the size of the enterprise. Prominent examples are the A-Class "moose test" crisis [Andrews 1997], [Töpfer 1999], the Boeing Dreamliner battery crisis [Mouawad 2014], reception problems of Apple's iPhone 4 [Ionescu 2010], [Helft 2010], or most recent the Volkswagen "emission cheating" crisis [Russel et al. 2015]. The characteristics of these crises differ. In particular, their causes and effects differ clearly. The causes can be internal, e.g. personal negligence or construction faults, or external, e.g. legal changes or natural disasters. The effects are as diverse as the causes. They range from safety, environmental disasters, to economic meltdowns, threatening a company's success, which could lead to bankruptcy. However, these situations also have similarities. With a crisis, the workload of the involved people and their stress levels increase. Identifying these similarities for a characterisation of crises in product development is the main goal of the presented research work. Our first research question is: 1. How can crises in product development be characterised? Literature on crises in economic science is the most relevant literature for the characterisation of crises in product development, e. g. [Mitroff et al. 1987], [Lalonde 2007], [Regester and Larkin 2008], [Korand Sikdar 2014]. These works focus on organizational crises. Literature on crises in product development is lacking, which leads to the absence of crisis-specific design support [Münzberg et al. 2015]. We conducted an explorative interview study to address the first research question. In this study 15 experienced design engineers were interviewed about their experiences with crises. We documented their understanding about crises and their chosen approaches to overcome crises. This expert knowledge supports the development of a crisis-specific design support. Thus, our second research question is: 2. What are success factors for effective crisis solving in product development? Various detailed approaches for the development of technical systems exist, such as Engineering Design (Konstruktionslehre) from Pahl/Beitz [French and Council 1985], [Pugh 1991], [VDI 1993], [Roozenburg and Eekels 1995], [Ehrlenspiel and Meerkamm 2013], [Pahl and Beitz 2013]. Applying systematic design approaches increases the project success, diminishes the time of product development projects [Hales and Gooch 2004], [Graner 2013], and may help to reduce the likelihood of a crisis occurring. But the approaches lack guidance on how to effectively address crises. In this paper, we identify success factors for effective crisis management from the interview results, by reflecting them against product development success factors [Gericke et al. 2013]. We propose these as a design support tool for crises, which is suitable for industrial practice. By answering the two questions, this paper contributes to theory by identifying "context factors", which characterise features of crises, and by providing a product-development-specific definition of crises. Furthermore, we present examples of crises from industrial practice. These situations illustrate the varied nature of crises. To support industrial application, we present success factors for efficient crisis management. These factors are starting points for the development of a crisis-specific design support. The following Section 2 briefly introduces existing crisis definitions and the foundations for the description of the "context factors" to characterise crises. Section 3 describes the research design of the interview study. In Section 4, crises are characterised and example situations are presented. Section 5 focuses on success factors. Section 6 closes with a discussion and conclusion, examining the answers to the research questions and developing a novel definition of crises in product development.

General information

State: Published

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Pages: 533-542

Publication date: 2016

Host publication information

Title of host publication: 14th International Design Conference - Design 2016

Publisher: Design Society

BFI conference series: International Design Conference (5020076)

Main Research Area: Technical/natural sciences

Conference: 14th International Design Conference, Dubrovnik, Croatia, 16/05/2016 - 16/05/2016

Crisis, interview study, Example situations, Context factors, Success factors

Publication: Research - peer-review > Article in proceedings - Annual report year: 2016