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Crisis Management Between Public Relations and the Holonic Multi-Agent Approach

Levente BAKOS*

Sapientia Hungarian University of Transylvania, Cluj Napoca, Romania
Lucian Blaga University of Sibiu, Sibiu, Romania

Abstract

Crisis management represents a multidisciplinary topic in many sciences. Social sciences, state affairs, medicine, engineering and many others are interested to handle unforeseen major great impact events. The paper presents some differences and common topics of crisis management using two different approaches. The first is Public Relations (PR), as part of the communication sciences; and the second is the Holonic Multi-Agent (HMAS) Concept, which is a research topic belonging to software engineering and computational sciences. We have two different approaches, but one common goal: providing the feasible support for the crisis management team under abnormal working conditions. Dealing with the holonic approach, the paper suggests a centralized distributed crises management, a non-linear approach in which the human factor's intuition, skills and expertise are key elements.

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Keywords: Crisis Management, Public Relations, Holonic Multi-Agent Systems, risk management

1. Introduction

Crisis situations can happen everywhere, anytime, to everybody. Crises are part of each-day life, but we are set to believe that these unexpected events will not happen to us. This is valid for us as individuals, but also for the organizations, as well. If unpredictable situations occur, humans by instinct try to solve the situation and/or get out of it. In the case of organisations where hundreds and thousands of people might be involved the situation gets more

* Corresponding author. Tel.: +40-721-208-954
*E-mail address:*bakos@ms.sapientia.ro

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complicated. This might lead to uncontrollable collective behaviour. The unexpected collective behaviour of complex systems is called emergent. In the case of those systems in which beside the human operators there are highly automated technologies with computers, robots, intelligent machines and other devices to handle a crisis situation it is even more complicated. System and software engineers, human resource specialists, managers, PR practitioners and many other experts work together to be prepared for the unexpected.

We'll mean here by crisis a sudden emergency event that causes serious damages and might have major consequences to the future of the company. This restricted definition of the crisis overlooks those situations when the unexpected event has impact only at the level individuals or a small group of people, and also ignores those situations that must be handled by governmental authorities. In our case in the stake is the survival of the organization, regardless of its size and the causes of the crisis in which it might be involved. The author of this paper tries to make a contribution to the rich literature of crisis management by merging the concepts developed by Public Relations scholars and practitioners, experts of social (human) communication sciences, with the latest achievements of the multi-agent concepts designed by software engineers, experts in computer sciences. By presenting and comparing the two different approaches we can make visible the advantages and disadvantages of these two approaches. By more, we suggest a non-linear system approach, based on the holonic system concept, which provides unusual approach for both sciences, thus new theoretical perspectives arise. By merging some characteristics of these approaches, and adding a non-linear approach, we create an innovative environment in which managers can find better solutions for handling crisis situations. That is the reason why this paper is prepared for an international conference in Management and Entrepreneurship.

The paper is organized as follows. In the following first two paragraphs there are presented some key issues of the two scientific fields. These reviews are not (only) critical statements of the presented approaches, but also contain proposals and contributions of the paper for the presented topic. The last paragraph assembles the most important findings of the previous discussions and makes some recommendations.

2. Preparing for the unexpected from PR point of view

Handling a crisis situation, in a first instance, it's about communication. The success rate of getting out with minimal damages often hinges on what, to whom and how we communicate. Crisis communication, being an extremely important topic of communication sciences, it has its own literature. We acknowledge, PR practitioners must be in crisis management teams in any organisation, and a specially trained staff should do the crisis communication. The majority of communication scholars treat crisis communication as distinct PR activity in organization. Beside some reference scholars like Fearn-Bank (Fearn-Banks, 2002), or David Guth David and Charles Marsh, (Guth- Marsh, 2005), some authors try to present the overall picture of crisis management integrating crisis communication in different strategies and tactics of the organization (Coombs, 2006), (Bernstein, 2011), (Barton, 2001)

At this level of development of crisis communication theory, the organizations are mostly considered as linear systems, in which changes of the inputs result proportional changes of the outputs (for example, they may incorrectly assume, the consequences of an accident are proportional to the number of victims or the value of damages). This way of preparing for the crisis situations omits, same to the most engineering and management models, the fact that crisis situations appears for that very reason that the previous linearization of the system missed a singularity or an extremely unexpected value. The safety measures, the communication protocols and many other frames used by management to rule an organization supposes that all variables fluctuates between a predictable ranges. The systems might collapse if these values go beyond the expected margins. That is why we suggest that communication experts should not assume that they can be prepared for the unexpected situations in all stages of crisis management.

Timothy Coombs, one of the reference names in crisis communication, same to the majority of the scholars, identifies three phases of crisis management: pre-crisis, crisis and post-crisis (Coombs, 2010). In the first phase there are preparations before crisis. The organization using risk and crisis management techniques tries to prevent any crisis to occur, or prepare itself if the situation still happens. The second phase is the response to ongoing crises; this is the "real" crisis management. The last phase, the post-crisis, takes place after the crisis is finished. At this stage the management evaluates how the situation was handled, it is analyzed what were the reasons of the crisis and what can be learned about this event. The scientific literature and the practice already set up specific techniques for all the three stages. In Table 1. we present some of the recommended issues during risk management.

Table 1.Crisis handling tasks

Phase	*Tasks*
Pre-crisis	Create Crisis Management Plan Select and train Crisis Management Team Conduct exercises Pre-draft some crisis messages
Crisis Response	Be quick, initial response within one hour Be accurate, check all facts Be consistent, keep spokespeople informed Make public safety the number one priority Include employees in the initial response Take care about emotions
Post-Crisis Phase	Deliver the informational promises Release updates on the recovery process Make crisis a learning experience Consult victims about the organization's role in any anniversary events or memorials.

This approach uses as a reference tool the Crisis Management Plan and the Crises Management Team. The first is a kind of checklist what should be done in a crisis, the second being a group of experts designated to handle crises. The weakness of this approach is that it tries to foreseen the unexpected events and relies on a fixed centralized team to handle all the situations. The core of crisis management team should know what to do in all cases, and some members of the crisis team may vary based on the nature of the crisis.

The PR practitioners and managers focus mostly on external crisis communication. There are researches showing the underestimation of the value of internal communication during crises. (Mazzei, Ravazzani, 2014), (Johansen et. al.2012). These researches showed that employees could be effective ambassadors of the organization, but the companies don't have internal communication policies for crisis management and there are communication gaps during these unexpected situations. The employees were not properly informed about what is going on, and could not find information about the corrective actions and to have positive action. A key figure of the crisis team is the spokesperson. He/she must have a special training to be prepared to talk to the news media during a crisis. Also there are instructed to prepare pre-draft messages that might be used during a crisis. These are templates containing statements, news releases and social media messages, too. By more, it is advised to create also dark websites. The major advantage of this preparation is that it saves time during the crisis, and legal department / the top management can pre-approve the use of the messages. During crises the first (thoughtless) statements sometimes causes as much damage as the crisis itself does. The preparation and practice leads to better and faster reactions and to more effective decisions.

The communication strategy from the PR point of view during the crisis has two dimensions: the initial response and reputation repair. The initial crisis response focuses on speed, accuracy and consistency. According to the PR literature the initial crisis response must be delivered within the first hour after a crisis started. There is also a priority in handling the different issues. First concern is public safety, than reputation and financial concerns, and finally stakeholders and impact management. Having its origin in social sciences, the PR point of view of crisis management affords significant attention to the emotions involved in crises. Because crises can generate strong emotions, they should be considered in the crisis response. Anger, sympathy, fears and other emotions shape the reactions of all stakeholders involved in the crisis. Under pressure and under strong emotions it is difficult to make decisions and to be lucid and objective. One of the reputation building reasons for an organization consists of creating a "sympathy reserve" for these hard times. Crises amplify stakeholders' emotions. If there is sympathy it is likely to have supportive stakeholders, in other case beside the difficulties created by the crisis, the organization might face negative actions from its stakeholders.

In the post-crisis phase, the PR point of view stresses out the importance to keep the promises made during the crisis. Each crisis must be a learning experience, which strengthens the organization. Also there is a care for the victims that can continue years after the crisis. The organization must consult victims or their families about the organization's role in any anniversary events or memorials.

One of the main weaknesses of this approach consists of its concern mostly on external communication and the centralized hierarchic management of the situations. Mostly, the techniques developed by PR scholars and practitioners are for "known unknowns". The focus is on effective communication with the stakeholders and how public appearances and public speaking might be done.

Crisis communication it is (not only) about "selling" to the stakeholders, that we can manage the crisis situation, but also about *to solve it*. Thus, communication is not the goal as itself, but it is tremendously important to have good decisions handling the crisis. Crisis communication is not (only) reputation management, nor just an image-preserving project, it is a tool for managers to handle the crisis and to make the best possible decisions under abnormal conditions.

3. Preparing for the unexpected from MAS point of view

The study of the emergent behaviour of the complex systems can be done through so-called agent-based modelling methods. Among these concepts the Multi-Agent Systems (MAS) represents one of the most used research topics. The MASs are computerized systems with interacting components, called agents. The *agents* are autonomous entities, able to function without a supervisor. The MASs methods try to model an organization which is able to handle crises situations by a distributed, non- hierarchical approach. Among the multiple MAS concepts we chose the holonic system concept, being one of the most developed in industrial context. Holonic Multi-Agent Systems (HMAS), are already performing well in large-scale applications. The concept shows adaptability, robustness against disturbances and it is just ready to be used in more generalized context.

In HMAS the agents are called "holons". The holons are artificial entities, mostly software agents, but they can have a processing component, too. Human operators are considered holons, as well. The holonic concept is based on Arthur Koestler's *holon* (Koestler, 1967). Based on some observations on social and biological systems, Koestler proposes entities that are "wholes" and "parts" at the same time (*holos* in Greek means whole, *-on* is a suffix, meaning particle, like in prot*on*). A holon is something that is whole and part of a greater whole, at the same time. The holons forms a loosed coupled structure, called *holarchy* (a notion also coined by Koestler; here the suffix -*archy* means a rule or a government). The original holonic concept developed by Koestler was based on Herbert Simon's famous watchmaker parable (Simon, 1981), in which Simon shows that those systems which contains intermediate stable forms are more adaptive to disturbances. In this parable that watchmaker Hora prospered because he decided to use subassemblies (intermediate stable forms). This way every time when he was disturbed (let's assume, by a costumer) he has to restart to rebuild just last subassembly. The other watchmaker, Tempus, became poor because he had to restart the watch he was working on, each time he was disturbed. Koestler states, that the complex systems can evolve more rapidly if they have stable intermediate forms. This translated to our topic means: in the case of a crisis situation the chances for evolution (survival) of the organization are higher if it is composed by stable autonomous entities. Being constrained by the length of this paper, we will not present the evolution of holonic concept from Koestler to the latest achievements. A nice survey can be found in (Christensen, 1994), (Babiceanu, Chen, 2006), and more recently in **(**Valckenaers - Van Brussel,2015)

The holonic systems perform better in practical applications comparatively to the most of other multi-agent concepts. Fig. 1. shows the middle position of holonic systems between traditional organizations and the multi-agent concept.

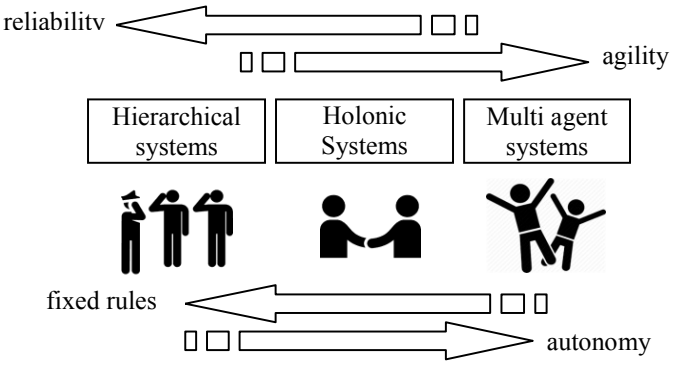

Fig. 1. Holonic system features related to the traditional organisations and the multi agent concept

The reason for this better performance is due to the existence in the model of the fixed rules among holons. In the

majority of other multi-agent systems, the agents are totally autonomous and independent entities. These properties offer them high adaptability in changing environments, but sometimes also results an unpredictable behaviour. The holarchy defines the basic rules for cooperation of the holons and thereby limits their autonomy. (Christensen, 1994). This way this concept tries to combine the predictable behaviour of the classical systems with the agility of the multi-agent systems. Thus, the holonic systems are more likely to emerge and survive in dynamic environments, but at the same time they are more reliable than other artificial complex adaptive systems.

The holons can find solutions for their problems themselves, being able to negotiate and they are fault tolerant. The autonomy gives the holon the capacity to cope with changes, uncertainty, and disturbances in its environment. Thus, the main characteristic of a holonic system is its flexibility and adaptability in changing environments. This ability allows them to handle the unpredictable situations. That is why the way in which these systems perform can have applicability in crisis management in any (non-holonic) organization.

We have to admit, the majority of the holonic literature is techno- centered. Engineers automated what was easy to automate, leaving the responsibility of complex things to human operators, such are the abnormal conditions. (Boy,2013) In these techno-centered approaches usually it is overestimated the ability of the human operator. It is supposed they make all the time the perfect decisions, they respond in suitable times, they make no mistakes. They are some kind of "magic humans" (Trentesaux and Millot ,2016)

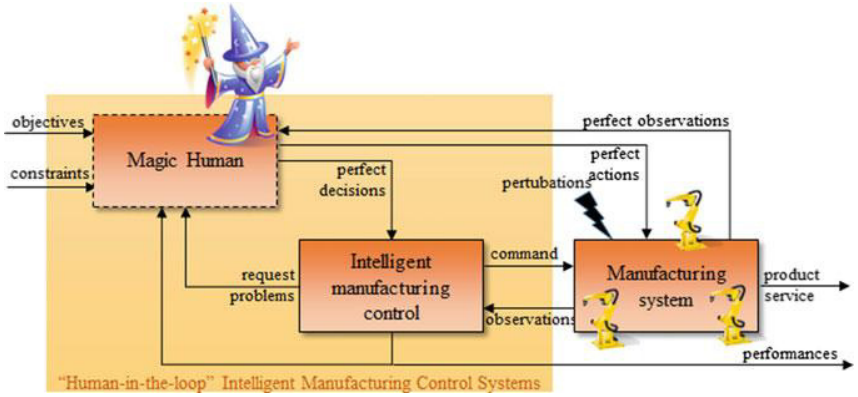

Fig. 2 Techno-centered design (Trentesaux, 2016)

Recently, in the holonic/multi agent literature there are some signs about a paradigm change. For example, Guy Boy speaks about human-system integration (Boy, 2013), Trentesaux and Millot about a human-centered approach of intelligent manufacturing (Trentesaux-Millot, 2016). Pacaux-Lemoine et. al. in a very recent paper (Pacaux-Lemoine, 2017) presents a human-centered design framework with some ideas to limit the "magic human effect". Among other ideas, there is a proposal related to mutual observation among human-machine in order to investigate the limited reliability of both counterparts.

In human- centered approach we know that in crisis situations human agents can play many characters. They can be anything between the devil and the hero; sometimes they are problem and sometimes solution. They can cause the crisis and they can solve it. The crisis's outcome may depend on what degree are they intuitive, how experienced they are, and if they are there or they are absent. People make mistakes, people forget, they are influenced by emotions, over and under-react. Sometimes they are action heroes, and sometimes victims or powerless witnesses. Beside these characteristics, we must mention separately, two relevant and specific characteristics of human agents, often ignored in crisis management practice and literature. First, they can be opportunists. They are the only holon type, which may profit perceiving an unexpected situation. Even in the most severe crises the humans can search for their own benefits (in any sense) and improve the current situation. The second specific feature is their accountability. We can speak about legal and social accountability. This feature can play a key role how the human agents behave in crisis situation. If the system is properly designed this can lead to awareness, self-control, and synthetic mind. If humans are aware about their responsibilities, and the consequences of their acts, their motivation to solve a crisis situation increases.

The holonic concept is a good example, how the human-machine communication must be designed. In crisis situations there is a special relationship between the automated machines and humans. In human-machine communication the crisis may have multiple reasons. Beside the failures, errors and missbehaviours of the two communicating parties (which are relatively more easy to predict), there are several reasons related to the failure of the communication paths and those which incriminate the changes in the communication environment. In order the handle these unexpected situations several rules must be set. The first rule in human-machine communication is the freedom of the human operator to decide when to rely on the automated system, and when to switch it off. The automated part of the holonic system must allow to be controlled by the humans whenever desired. In the highly automated systems, in the case of techno-centered design, there are special safety protocols against human intervention, too. The system interprets human intervention as an external disturbance, and disturbance-handling algorithms may start. This feature contains several risks for the safety of the system, if the human factor can get out of control. In a human centered approach such situations are limited, because other priorities are in the focal point of the human-system cooperation. The lesson learnt from the holonic approach is, that holons in the case of crises, must have a special know-how to control the situation without information exchange with other holons. Nevertheless, the holonic concept encourages the communication among holons whenever and wherever they consider so. The emergency cases are not exceptions to this rule. By cooperation, sharing and communication the human holons can get the necessary information to make the best decisions.

The latest achievements of holonic concept states, that the down-flowing information can be sometimes disregarded and/or if there is a suspicion of unauthorized request the system offers sanitized information (Valckenaers - Van Brussel,2015). In such crisis situations if the centralized coordination and control is not disregarded, it can harm the overall system. Crisis situations can be scarcely handled by individuals. The success rate is considerably higher if there is a team spirit, mutual understanding and cooperation. The lonely hero is mostly a movie character, for successful crisis management usually teamwork is needed. Thus, a centralized distributed crises management is recommended, a non-linear approach in which the human factor's intuition, skills and expertise are key elements.

4. Differences and common themes of PR and the holonic approach

Each of these two previously mentioned scientific fields, Public Relations (PR) and Software Engineering, has the ambition to submit feasible solutions to managers in handling crisis situations, but their approach is different. Both scientific fields approached the communication theory from social sciences and the multi-agent theory from computer sciences focuses in communication issues in crisis situations. Both approaches, in our opinion, have certain advantages and weaknesses, too. In Table 2 we summarize some main characteristics of these approaches:

Table 2.Comparison of the two approaches presented in the paper

	PR approach	Holonic Approach
Strengths	human-centered approach takes in consideration emotions careful preparation for anticipated crises trainings, drills, skill development sympathy building before crises first priority public safety	ready for "unknown unknowns" focus on problem solving properly designed communication protocols non-linear approach (intuitive) creativity, team spirit in handling the unexpected distributed crisis handling first priority: technological safety
Weaknesses	focus mostly on external communication centralised crisis handling focus mostly on reputation and image linear approach (rule based) ready for mostly "known unknowns" fixed individual tasks in a team	focus mostly on internal communication Still mostly techno-centered approach ignores reputation and image management ignores emotions

The common themes of crisis management of both fields are mostly related to the importance of the quick reaction time and the careful preparation for the unexpected. Both approaches agree on, that the positive way out from unexpected situations is not granted by the presence of human operators. It takes special skills that come together with experience, maturity and exercise. A certain situation can end as a success, or a total failure, just

depending on the previous experiences of the human operator. For example, it takes years of driving experience to handle at high speed the explosion of the front wheel of a car. The experienced drivers, even if they did not have such previous situations, have gained certain skills and self-confidence from previous surprises. These skills create the chance to handle well the unexpected and more difficult situations.

Both the social science approach and the traditional engineering approach in practice tries to handle risks as linear problem, omitting the fact that crisis situations appears for that very reason that the previous linearization of the system missed a singularity or an extremely unexpected value. The safety measures, the communication protocols, the computer algorithms and many other frames used by management to rule an organization mustn't suppose that all variables fluctuates between a predictable range. The systems might collapse if these values go beyond the expected margins. As difference, the holonic concept shows us the rigid centralized approach is not the best way to handle crisis situations. In crises the human operators (holons) should give up standardisation, might not rely on automation and the information received from other agents, especially if there are chances that information is sanitized. In this case even the interferences with a higher authority can be cancelled.

The major differences between Public Relations (PR) and the Holonic approach of crisis consists of the scientific background of the two sciences. Public Relations has a human centred approach of the crisis and has as a first priority the reputation management of the organization. It focuses mostly on external communication leaving the most decisions in the hand of the top management. This centralized approach assumes approvals for any move of the crisis handling team and fixed tasks for each crew member. On contrary, the holonic approach relies on computers and software solutions on handling the crises. Here, the focus is on eliminating the (technical/ technological) causes of the crisis using well-developed internal communicational techniques and algorithms. It is a more intuitive approach, but still ignores reputation management and the emotions of the people involved is underestimated.

5. Conclusions and future work

During the paper we presented two scientific approaches for the same problem of crises management. Analysing the weaknesses and strengths of each, we propose a centralised crisis management approach on which the crises handling entities focus on their role, rather than to perform certain tasks. The goal orientation of the constituent elements increases their autonomy and adaptability to the previously unmet situation.

Automation, computers and stable communication relations among entities increases complacency, especially if the system performs well for a long period. In crisis situations a new approach based on intuition, synthetic mind, self-control and last, but not the least, cooperation and efficient communication is required. In order to deal with the unexpected we must have a non-linear approach, in which humans and their expertise and experience are key assets. The non-linear approach here means to give up predefined handling algorithms based of the previous best practice if the situation completely new. It is pointless to assume that something that in some previous and different conditions worked will work once again. The holonic concept shows us that goal and role definition is better way of handling crises, than rigid mechanisms based on previous experience. On the other hand, we propose more focus on reputation management and external communication during crises as the PR theory and practice show. A pure techno-centred approach may ignore the ambitions, emotions of the humans involved in crises and also might under-treat the impact of a crises situation on reputation. Stakeholders involved in crises (for example NGO reactions) may cause more damages than the crises itself. For example, the failure of a technological equipment causes less damages than the bad reputation caused by the negative advertisement made by an NGO related to the unsafe technologies revealed.

As future work we propose the development of crises handling communication model which highlights the directions that are configured in the previous paragraphs. A multidisciplinary approach is envisaged which combines the stakeholder and reputation approach of social sciences and the flexibility, non-linearity and robustness of the holonic concept. It is planned to integrate the achievements in machine- machine communication recently developed by the computer sciences, into the inter-human and human-machine interactions during crises. The experiences of software engineering in the case so called life critical systems, (for example aviation, public safety, medicine, power-plant management, space exploration) will be also included in the proposed model in order to be used in common organizations in the case of unpredictable situations.,

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