Holonic crisis management case study using problem tree analysis

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Abstract: - The paper presents the preliminary results of an ongoing research at an international automotive company. The novelty of the approach consists of the variety of crises that might be handled at the organization's level. The proposed procedures are complementary measures for those cases when the most common solutions such is the risk management plans, the contingency plans, crisis communication plans and all other crisis management scenarios fail. The procedure encourages non-linear thinking, where the members of the crisis management team use their intuition and creativity to solve unforeseen events.

Key-Words: crisis management and communication, holons, problem tree analysis

1 Introduction

In common language crisis is synonym with the notion of disaster, emergency, incident, event or issue. The rich literature of crisis management makes several differences among these notions. We will avoid using the notion of disaster instead of crisis, because disasters cause great damage or serious loss, while a crisis might have positive outcome. At the same time, we'll avoid using as synonym the *issue*, *incident* and *emergency* terms*;* all of the three notions terms refer to a less complex situation, but which can escalate into a crisis.

The majority of communication scholars treat crisis communication as a Public Relations activity in organization. Some authors try to present the overall picture of crisis management integrating crisis communication in different strategies and tactics of the organization [1], [2]. In our approach, crisis communication is not (only) reputation management or about "selling" something to the stakeholders, but also a way *to solve it*. Thus, communication is not the goal as itself, but it is tremendously important to have good decisions in handling the crisis. In our approach crisis, refers to a crisis close to Pearson's and Clair's definition [3], where organizational crises are low-probability, high-impact events that threaten the viability of an organization. Also we agree with Ian Mitroff, one of the most cited scholars and practitioners in crisis management, who defined crisis as: an event that affects or has the potential to affect the whole of an organization. [4]. Thus, we define the (organizational) crisis as a sequence of sudden and unexpected events which threatens important goals (or even the further existence) of the organization. Apart from natural crises (disasters) that are inherently unpredictable (act of God), most of the crises that we face are created by man. Man-made crises are "normal events triggered by the complexity of the system itself and by faulty decisions as well as by the interrelationship between technological systems and the humans who attempt to manage them" [5].

In spite of the above mentioned complexity and importance for the organization, we mustn't see crises as a danger. A crisis in many situations represents also an opportunity; if the crisis management works well, the outcome might lead to an improved market position and better image. Crisis Management, here, means both direct management of the response to an incident, and the management of the medium and long-term consequences. At the same time, in short term, we try to manage the preservation of the life, the environment and property and to assure the business continuity and the long term recovery, by minimisation of financial and reputational losses. The goal is to restore normality (or the best that can be achieved) as soon as possible.

In the practice, crises are usually handled by a Crisis Management Team (CMT). In this carefully designed team each member has a well-defined defined job. The members are key executives, heads of the most important divisions and some key role players, like, Public Relations practitioner, legal counsellor, financial adviser and facility manager. We must emphasize that usually, from communication point of view, during the crises there is a focus mostly on external crisis communication, and there is an underestimation of the value of internal communication. [6], [7]. These two previously made assumptions, -the existence of a centralized CMT and the focus on external communication-, led us to start a research on industrial companies where in spite of the carefully designed CMT and well-prepared crisis communication plan (developed by PR professionals) there were complains about the slow reaction time during crises.

We choose as theoretical background the holonic multi-agent system (HMAS) concept in order to develop a practical framework for crisis management at the studied company. The holonic system modelling is based on the concept of the ”holon”, coined by Arthur Koestler in the middle of the past century [9]. It describes an entity which is *a whole* (“holos” in Greek) and a *part* (“-on”, particle in Greek, like in prot*on*) at the same time. The holons can be artificial entities consisting of humans, robots, (numerically controlled) machines, computers, software agents and a mix of them. 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 [10], in which Simon shows that that system which contains intermediate stable forms are more adaptive to disturbances. Decades after Simon and Koestler, the holonic concept became extremely interesting for the manufacturing process planners, software engineers and IT experts in charge for system modelling. Today, the holonic system model beside other similar concepts, like organic-computing ([11]), learning factory, weak-links concept and many others, tries to handle the increasing complexity of the today’s society. The holonic structures tries to find balance between the stability of the rigid hierarchy of traditional organizations and the adaptability of the structures recently developed by computer sciences, formed by total autonomous entities (Figure 1).

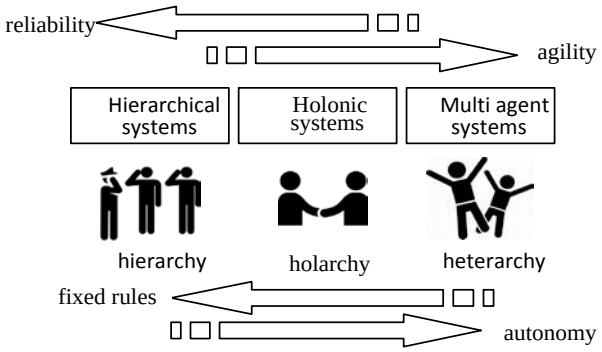

Figure 1. Holarchic structure position among hierarchy and heterarchy

The basic idea translated from the general holonic theory to our topic is the assumption that there are increased chances to handle crises if we create stable autonomous entities inside the organization.

Being constrained by the length of this paper, we will not present the evolution of holonic concept from Koestler to the latest achievements. A broad survey can be found in [11], [12], and more recently in [13]

2 Problem tree analysis for efficient crisis communication

During the preliminary research phase the management of the studied company pointed out the long reaction time when unpredictable events occur. It’s difficult to define what is an “enough short” or “relatively long” reaction time to an event that might appear once in a year, or even once in a decade. Even so, being a company from automotive industry, a full stop for 4 hours can cause an average direct damage of 300.000€. We mean by direct damage the costs of the late delivery (penalties), extra costs for overtime and extra delivery costs. The other loses can’t be even roughly evaluated. The cost of bad reputation, the cost of a breach or the costs involved to repair the damages caused by the crisis (for example the investments to replace some machines or the destroyed supplies or products) depends on the gravity of the crisis. It is out of the scope of our research to estimate these costs. Our objective is to reduce with several minutes the reaction time -regardless of the crisis’s cause, and to solve most of the cases within 8 hours after they appear. In present, the average reaction time is approx. 4 hours, and each minute of out of order costs approx. 1500€. A 25% improvement of the reaction time can save at least 75.000€-100.000€ for the company.

In order to have a detailed image what kind of crises the company already had and what might they face in the future, we made a detailed field research and plot cause-effect diagram. The cause-effect diagram

presented in Figure 2 is a result of several interviews, discussions with the CEOs, head of departments and professionals involved in handling the crises. Totally we had interviews with 8 persons, and discussions with other 10 professionals. We had over 20 meetings, and more than 40hours of evaluation and survey. The Figure 2 shows the most important causes and the consequences of the analysed topic.

In the figure 2. we can see that the most important causes are:

- external causes
- management related causes
- human resources related causes
- technology related causes

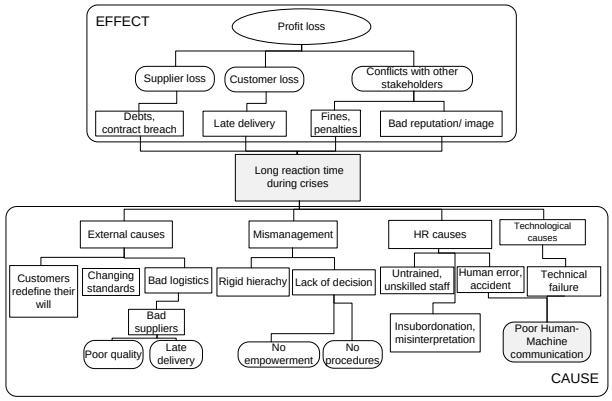

Figure 2. Cause- effect diagram

The above mentioned causes sometimes were detected simultaneously. Our objective is not to eliminate these causes, but to handle the situation better if a crisis situation arises. The crises caused by the external causes are widely discussed inside de organization and there are several solutions for those situations. For example, there are special clauses in each contract for the case when a customer intends to modify the initial order. These situations are handled by their CRM (customer relationship management) department. Also, their highly developed quality assurance system can handle, under normal circumstances, all issues related to bad logistics. The logistic department using a specially designed software can track in real time all orders and supplies. The warning signals are set to let the human operators to find an alternative if something goes off track. During our preliminary research the managers were aware for the crises that might appear because of bad management decisions. Being a multinational company this might be a less probable cause, but the rigid hierarchy, in some cases can be a barrier for quick solutions, or can be itself the cause of the crisis. Middle-level managers felt the lack of empowerment to handle them certain situations. In the same manner, they show their fear that in the case of certain situations there are few procedures to handle unexpected situations. It's obvious, that's quite impossible to create procedures to all issues that might appear, but still, we put this fear regarding the lack of procedures as a possible cause in the figure 2.

Regarding to the Human Resource Management and Production Management related crisis causes, we got only few data. These were related to the possible accidents, human errors, technical failures which can lead to a crisis. The lack of data can be explained either by the high accuracy and detailed procedures that characterize the company, either by the precaution to reveal the weaknesses of their labour force and technology. In spite of this fact the major fear of the management are related to those crises in which the communication lines collapse among departments and the management; including the connection to the international headquarters. The company IT system follows the latest standards in information security systems, all kind of backups are deployed if something unusual happens. In their risk analysis documents, we have found -as the top rated, but a less probable risk- the category of the risks related to their IT network.

The analysis made together with the CEOs led to the opinion that the most challenging crisis cause to be studied is that related to the poor human-machine communication. Analysing the recent history of the company, it can be seen that all major disturbances were caused either by bad human communication, either by bad human communication coupled with other multiple causes depicted on the figure 2. That is the reason why, among all of these categories of causes we'd like to target the poor man-machine communication cause.

The upper part of the figure 2 presents the effects caused by the long reaction time when a crisis arises. Engineers and economists usually are afraid about the costs involved to recover from a certain crisis situation; indeed, the costs might have an important weight on the short-term profit of the company. On the other hand, in a long term perspective, a crisis situation can have a totally different outcome. Let us depict two hypothetical scenarios. In the first one, we present a typical example, when the mismanagement of a crisis leads to more damage than the crisis itself. Let's suppose that the purchase department realises that they just overlooked some deadlines in purchasing some extremely important raw materials. In the developing crisis, they decide to accept some below-average materials in order to fulfil some deadlines to the customers. This way there are almost no extra costs in handling this situation (the poor quality means usually less costs), so the company in short

term realizes profit after this crisis. Unfortunately the figures look totally different in long term. The poor quality of the raw materials had a direct influence on the quality of the final product, so there are several complaints about that. The increased after-sale services costs, the gained bad reputation might lead to a long-term profit loss, or even bankruptcy. The second, an opposite scenario, shows that a short term loss caused by a crisis can be an opportunity for the long term profitability. Let's assume a situation when due to a human error there is a fire in a warehouse. The cost involved might be half of their turnover. It's obvious in this case their profit for current year is for sure lost. But, let's assume, the event got the attention of the media, and it was broadcasted how the company had a quick, honest communication with all stakeholders, including the families of the workers, authorities and investors. This way the company succeed to transmit to the audience their visible efforts to fulfil all contracts they have and their care of the families affected by the events. Under these circumstances, it is possible to gain credibility to the public and finally get even better financial figures that they had before the crisis.

3 Holonic based crisis management

Our proposals, as a complementary measure to the existing risk management measures and crisis management plans, has as starting point the fact that it is impossible to create a plan for all potential hazards. Instead of creating more and more complex and comprehensive crisis management plans the focus should be on creating plans based on response instead on focusing on different types of hazards. We'd like to handle those situations which has unforeseeable causes and can't be handled before it happens. Of course, there are a lot of things to do before a crisis happens, and we do suggest a crisis preparation, but not in the common sense. From theoretical point of view the suggested working procedure is presented in Figure 3. The Crisis Management Team Holarchy (CMH) represents the core holarchy of our model. The functioning mode and the communication protocol associated to this holarchy are presented in [14]. The crisis handling scenarios are functional even if some of the holons are not present. There are procedures where the presence of human holons is not necessarily required or their presence is not required to be in the same location. Thus, in the case of an emergency the first measures can be taken in very short time. For example, the organization's website, its social media accounts and other communication interfaces can react in milliseconds, and start to work in one of the previously designed safe modes. The CMH as a whole remains functional if some constituent holons are not operating, or if they are sending doubtful data. The main difference to the classical organizations consists of the loosely coupled relations among the autonomous holons. The holons can decide if they want to be part in a holarchy, and they can leave whenever they want. These decisions are made according to their—carefully designed—own goals. In a limited time frame the CMH has full authority to overrule any prior decision of any authority, to reschedule all resources and to assign tasks, define interconnections and reroute crews

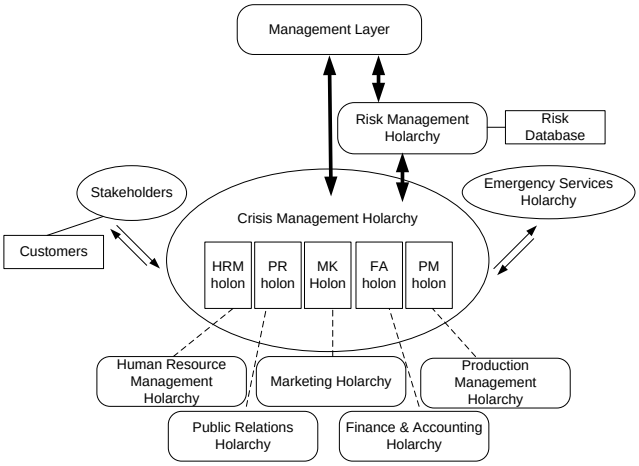

Figure 3 The theoretical frame of the suggested structure

At this stage of the research we can present some partial results, namely we succeed to create the necessary framework for the distributed authority that replaces the existing delegated authority. The developed CMH holarchy it is an example on nonlinear thinking. This is a new approach for the studied company; it's a situation when intuition, concentrating on internal factors for comprehension and communication become strengths of the organization. When the classical linear way of handling the issues, -based on rules, rationality and logic- fails, it's time for creativity. In order to have a predictive income, drills (similar to the fire drills) and trainings are required. At this stage of the research to create the framework to the necessary trainings and drills is the most challenging task. For example, the engineers must understand that they might be part a crisis which is not the result of a technical failure, in the same manner, like economists should be ready to handle and solve, let's say an IT failure.

Our theoretical model, same to many other similar models, considers the human factor as a perfect resource. In reality, the applicability of these models, hinges on the *maturity* of the human

operator. By maturity we understand several characteristics such: intelligence, cleverness, clear mind, willingness, self-confidence, experience, training, critical thinking, risk taking,,readiness
Maturity has (almost) nothing in common with the age. Of course, the odds to have experienced, self-confident, well-trained workers increase with their age. But, intelligence, willingness, critical thinking, risk taking and other important characteristics of any human resource are not depending on age. The maturity level human resources can be considered a characteristic of any organization. This characterizes the organization only in short-term and can be upgraded by motivation, training and drills.

4 Conclusion

The paper presented the preliminary results of an ongoing research at an international automotive company. Being part of a larger network, it can't change its working procedures to a holonic one, but they are open-minded to some new approaches. The complicated processes, the rigorous standards they must face and dependency from the parent company makes impossible to introduce the holonic concept at the production level. However, there are odds to create at this company, as an experiment, a real industrial frame for holonic based crisis management. The novelty of the approach consists of the variety of crises that might be handled at the organization's level. Till now, the holonic approaches mostly are applied for disturbances only at the shop floor level.
The proposed procedures are complementary measures for those cases when the most common solutions such is the risk management plans, the contingency plans, crisis communication plans and all other crisis management scenarios fail.
The ongoing research showed some limitations, yet to explore, even for the broad holonic concept. We put in discussion the efficiency of the concept in the case of human resources with low level of maturity. Same to other similar concepts like holacracy, multi-agent systems, organic computing, learning factory and many others, the holonic theory ignores those situations when the human resources are not able to perform the new tasks or they are just ignorant. Obviously, the latest system management concepts are not targeted to perform among the less intelligent workers, - we knew from the technical sciences that there are no idiot-proof solutions -, but still, the maturity of the human resources must be an important issue and constraint, both for practitioners and researchers, in their future work.

Managing crises effectively depend on the speed of response. It is proved that the traditional hierarchical structures fail in many situations, in the ever changing environment there is a need for a new approach. The concept based on distributed authority seems to represent the future of the modern crisis management. The holonic based model and the test case presented in this paper may contribute to the development of further practical applications, and can be starting point for other theoretical developments.

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