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# How the Simplification of Work Can Degrade Safety: A Gas Company Case Study

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**Abstract.** Work is focused on a gas company that wishes to develop a better understanding of its safety culture and identify potential enhancement opportunities. The hypothesis that emerged from an exploratory phase of work suggests that the corporate restructuring initiated four years ago, which has divided the company into distinct business units, has reduced organizational reliability. This issue raises a question faced by most industrial organizations, namely the trade-off between productivity and safety. On the one hand, streamlining activities offers an opportunity to save money, particularly through economies of scale and employee specialization. On the other hand maintaining flexibility generates costs, but provides a defence against silo effects, which are detrimental to safety. This paper describes how the company was restructured and the effects on risk management. The aim is to better understand the effects of the rationalisation on organizational reliability and performance, in order to identify potential solutions that may limit any counter-productive impacts.

## 1 INTRODUCTION

This article examines why, after several years of continuous improvement, the safety performance of a company has shown no further progress in the past two years, despite significant financial and human investment. The research project is carried out in partnership with a major company in the gas sector, whose mission is to transport and distribute natural gas at medium and low pressure from the network to the end user.

Research is focused on events that degrade safety performance and the conditions under which they occur. The initial phase consisted of participant

observation (at the company's headquarters) and (on-site) non-participant observation, combined with semi-structured interviews. This phase revealed that the corporate restructuring exercise, which had begun four years earlier, had profoundly transformed the company's work. Restructuring consisted of dividing gas distribution activities into distinct entities, with the consequence that each entity covered a wider geographical area and the work of employees became more specialized.

The initial phase of research led to the hypothesis that the corporate restructuring had deteriorated organizational reliability. This article therefore examines the following question: what was the impact of corporate restructuring on organizational reliability and performance? The answer should help shed more light on a situation faced by most industrial organizations, namely the trade-off between productivity and safety.

We begin with a description of the organization in its current state and the impact of this structure on work. We then examine the issues in detail and outline the methodology, before finally presenting some initial findings.

## **2 RESEARCH QUESTION**

The question which arises from the initial phase of research is: why has this corporate restructuring had an impact on its ability to manage risks?

After quickly presenting the organizational context, we outline some of the answers provided by the safety science literature. Next, we put forward a hypothesis related to changes in the nature of risk and the work of those who have to deal with it on the ground, namely field operators. Finally, we present our methodology.

### **2.1 Organizational context**

The corporate restructuring has resulted in the division of gas distribution activities into four departments: network operations (BEX); planning (CAPA); actual field operations divided into routine maintenance (ARG) and specialized operations (MSG). In the new structure each employee is linked to a single functional group, and is expected to routinely carry out a clearly-defined set of tasks related to a particular aspect of the project.

Specifically, in terms of day-to-day activities this led to both a simplification of "real" work (employees carried out a limited range of simplified tasks more often) and increased the time spent on administration, which became necessary in order to coordinate the work of the various departments (Dujarier, 2006). If we take a definition of the organization of work as, "a

dynamic set of responses to contradictions” (Pagès et al., 1979) administration describes the need to integrate individual actions, which has become necessary at all levels, including that of field workers, on whom research focuses (along with the relationship with their direct supervisors). As far as they are concerned this is due mostly to an increase in the meta-work they must take care of, i.e. familiarising themselves with procedures and tracking activities (reporting, providing feedback, etc.).

## **2.2 Division of Activity, Risk Homeostasis and the Silo Effect**

The safety science literature provides some useful approaches to understanding the effect of the corporate restructuring on the company’s safety performance.

In normal (functional) mode, where there are no hazards to manage, the new division of responsibilities seems to undermine the resilience of the socio-technical system. There is a decrease in individual vigilance, as each worker tends to rely on his colleagues, in a way that is consistent with the principle of risk homeostasis (Wilde, 1988, see section 4.2). Moreover, it has created a silo effect within the organization. This makes it impossible to maintain an overview of ongoing projects and operations and degrades individual and collective effectiveness, making it more difficult for everyone to take the constraints of their colleagues into account in their daily work. This is an example of the negative impact the silo effect has on safety – and the limited awareness effect that it creates (Hopkins, 2006).

In dysfunctional, hazard management mode, these negative effects are compounded by the need for a rapid response to contain risk (Knegtering and Pasma, 2009). Various factors slow down the company’s ability to respond. These include: decentralization of decision-making and ability to take action; identification of the most appropriate interlocutor; different working practices / vocabulary in different departments (which slows down mutual understanding); need to arbitrate between the priorities and constraints of departments; etc. In other words, the proliferation of sub-systems within the organization acts as a brake on action (Crozier and Friedberg, 1977).

## **2.3 The Managerialisation of Field Workers for Risk Management**

What’s more, as risks have become both pervasive and chronically unpredictable (see e.g. Beck, 2001; Mignard and Terssac, 2011), they cannot be fully anticipated during preparatory work. Therefore, when unforeseen risks arise once work has begun, it is the field operators who are actually there who have to deal with the situation. In this perspective, risk management means identifying emerging risks, analysing the underlying causes and making the appropriate decision. Effective risk management is

therefore based on the worker's capacity to go beyond their formal role of operator and on their ability to pay proactive attention to their environment, carry out a context analysis and make sensible decisions. However, such roles and skills are traditionally expected of managers (Mintzberg, 1973), not field operators. It also means that the operators must base their actions on a clear understanding of the cause of the problem and that they are able to articulate why they chose to take such action. On a practical level, it emerged from semi-structured interviews that this was the main characteristic of a "good gasman", while at a theoretical level it refers to the exercise of practical reason as described by Paul Ricœur (Ricœur, 1986).

Our first hypothesis was that corporate restructuring had had an impact on organizational resilience, which led to an examination of risk management at the organizational level. Subsequent research led to a second hypothesis, which is that effective risk management must rely on the managerialisation of field operators. However, the current practice of confining field operators to a strictly operational role, which has been reinforced by the corporate restricting, prevents this managerialisation and therefore degrades organizational reliability.

## **2.4 Methodology**

Research was mainly based on observational techniques that combined non-participant observation in the maintenance department (within operational teams) and participant observation at the company's headquarters.

Observational techniques were chosen as they avoid the filter of discursive constructions and make it possible to capture simultaneously the technical and cognitive practices of agents (Arborio, 1999; Thiétard, 2007). The method involved making direct observations of the way in which projects were "framed" at briefings (i.e. the information volunteered by the supervisor); how workers prepared for work; what happened when they arrived on-site; their behaviour throughout the duration of the operation; what provoked discussions with colleagues (operators usually work in pairs) and potentially supervisors, and the nature of these discussions; etc.

The aim is ultimately to apply a ricœurien approach based on the concept of practical reason (ibid.), which is founded on ideas of "motivation", "rationale", "attitudes" and "practical reasoning". The value of taking this approach lies in the ability it provides to analyse the actions of field operators in their own terms, i.e. in the context of their own configuration and dynamic (and not only in their relation to procedures and external constraints, as is frequently the case), while retaining the ability to link these actions to the (notably organizational) context, in which they originate.

Participant observation is ongoing. A particularly useful exercise was participation in post-incident analyses, a procedure that had been established by the company four years earlier (Desmorat et al., 2013).

### **3 INITIAL RESULTS**

The analysis of the following incidents focuses on the impact of corporate restructuring on risk management. The first one describes the impact of the new organization on on-site project management, while the second case shows the impact of company structure on incident management.

#### **3.1 The Overlooked Bypass**

During operations to replace a length of pipe, failure to install a bypass led to the gas supply to hundreds of customers being cut off.

This oversight was the result of a failure to prepare. While preparing the project, an employee in the engineering department had handwritten “bypass?” on the plans. A bypass is necessary when the network has an “antenna” topology, i.e. the rest of the network is only supplied from one side, unlike a “mesh” topology where the rest of the network is supplied from both sides. In this case, the bypass maintains the mains gas supply to both sides of the section where the work is done.

The employee in the operations department who was responsible for the case did not see the hand-written note, assumed that the network was a mesh configuration (the most common situation), consequently did not run a check with mapping tools and did not therefore recommend the use of a bypass. The employee in the maintenance department who was in charge of site preparation did not therefore provide the equipment necessary for the work to be carried out.

On-site work was carried out by a service company. Once the supply to the segment had been cut, they did not check the gas pressure on each side (a required procedure involving the installation of balloons that check gas pressure). They did not even have the necessary equipment, having assumed in the absence of any indication to the contrary that the network must be a mesh. Complaints about a cut in gas supplies began to arrive shortly after the gas had been turned off (any gas remaining in the pipeline is rapidly used when the part of the network no longer being supplied is cut off), which led to the realization that an error had occurred.

#### **3.2 The Mismanaged Leak**

In this case it is the dysfunctional way in which the leak was managed (and not the leak itself) that is the subject of the incident.

The context was the removal of a network connection, which had caused a gas leak. In order to stop the leak, the operations manager (a member of the operations department) wanted to cut the gas supply. Normal procedure dictates that this involves closing the network valves that are specifically dedicated to this purpose. The manager asked the maintenance operator to close the three valves feeding the affected segment of the network, one of which proved to be stuck. The manager then asked the employee to operate a fourth valve that actually increased the gas pressure rather than cutting the supply. Contrary to what was indicated on the mapping, the valve was not open, but in the closed position. The operator was not familiar with the particular valve and therefore did not notice during the operation that they had increased the gas supply.

The manager then asked the operator to “flatten” the pipeline (mechanically stopping the gas flow) and found that the gas continued to flow: the network configuration, marked as an antenna on the map, was actually a mesh topology. Gas continued to arrive from the other side of the pipeline, which had not been flattened. The manager then asked for a cut to be made through the other side of the damaged connection and the leak was stopped.

Finally it should be noted that the post-incident analysis indicates that aggravating factors included a “misunderstanding by the manager of feedback from field operators” and the fact that the manager had only recently undertaken their duties.

### **3.3 Lesson Learned**

Both cases demonstrate that it was not one single event (a lack of gas-pressure balloons, a stuck valve, etc.) but a series of events that led to the incident. It seems clear that in these situations, not only did barriers not play a defensive role (Reason, 1990) but they also made it more difficult to manage the incident.

In the bypass incident, the separation of the engineering department and the operations department and the fact that employees did not know each other led to a reliance on a written note rather than checking in person. The operations department relied on the fact that the file had been prepared by the engineering department, and decided that it was therefore not necessary to check the network configuration. Similarly, the operator carrying out the work decided that pressure testing was not necessary; the fact that there was no bypass and the lack of any specific indicators about the network configuration was considered sufficient information.

In the mismanaged leak incident, the recent appointment of the manager to his post and his difficulty in understanding feedback from the field operator seem to be correlated, and this correlation can be seen as a factor that contributes to the risk of an incident. Classical communication theory argues that successful communication depends on the correspondence between the message sent by the transmitter and that received by the receiver. The quality of the match depends on the quality of the channel through which the message flows and the ability of stakeholders to use the same codes to encode/decode the message and ultimately, to understand the same thing. As signs (in this case, mostly words) are essentially polysemic, they must be interpreted (Ricœur, 1986). If the interpretation is to be correct, (i.e. the selected meaning is the one which the transmitter wanted to convey) there must be a common reference point, which can only be established on the basis of shared experience. Moreover, the finding that interpersonal relationships are necessary for successful workplace communication is confirmed by ergonomics research (Karsenty and Le Quellec, 2009).

It can therefore be argued that the lack of interpersonal relationships, whether the result of a recent appointment or simply a lack of contact (brought about by the corporate restructuring) makes it impossible to establish the common references necessary for successful communication. As such, it constitutes degraded conditions for risk management.

#### **4 CONCLUSION AND OUTLOOK**

Both incidents make it possible to identify two principal adverse effects of corporate restructuring. The first concerns *the impossibility of establishing a common reference point, as there are few or no shared experiences* at the functional level (the silo effect) and the human level (geographic separation). This then triggers the *organizational risk homeostasis* phenomenon, which encourages employees to rely on checks carried out by their colleagues (i.e. other barriers found in the defence system).

The identification of these effects can help to suggest actions to counteract the negative effects of corporate restructuring and restore – or even enhance – organizational resilience. The ultimate goal is to create conditions that lead to the emergence of a shared framework and “organizational intelligence”, which at the same time maintains the risk management benefits offered by the technical specialization of employees and the implementation of defence systems, hence helping optimize the trade-off between the separation of activities/employee specialization and the maintenance of flexibility.

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