Accident investigation : from searching direct causes to finding in-depth causes. Problem of analysis or/and of analyst ?

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Accident Investigation: from Searching Direct Causes to Finding In-Depth Causes. Problem of Analysis or / and of Analyst?

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Abstract

Current operating feedback systems in industry show some limits as, in numerous industrial companies, the numbers of events do not decrease anymore and as similar events seem to recur. Our assumption is that weaknesses come from analysis methodology used. After a description of analysis methodology history, we focus on interest of applying an ***organisational analysis of events****, familiar to scholars but not yet in industry, and we describe its main characteristics. Then we highlight roles of analysts who are not neutral in using event analysis method, assuming that these roles could be a block to progress of event analyses.*

Keywords: *Accident, Industrial Safety, Organisational Analysis, Event Root-Causes*

1. Introduction

One of the ordinary goals of high-risk industries is to operate in a safe manner. Industrial policy for fulfilling this goal involves, amongst others: safety oriented equipments design, relevant organisation (i.e. awareness of interactions needs between company Departments, of staffing quality and quantity requirement, of educational background of employees, of training, of ...), compliance with regulations, ...

This set of measures cannot prevent occurrence of every event[1] and high-risk industries have to cope with minor events. In order to learn from these events, i.e. for preventing that the same or a similar event happens again, industries set up operating feedback system (OFS) as part of their safety management process. Methodology used by every OFS generally implies several steps: (i) detection, identification of event, (ii) data collection, (iii) event analysis – causes finding –, (iv) definition of corrective measures, (v) decision-making regarding measures, (vi) implementation of corrective measures, (vii) verification and validation of corrective measures, (viii) storage of information dealing with the treatment of this specific event, (ix) diffusion of information and lessons. Considerable resources are devoted by industries for running OFS. OFS is one of the pillars of safety management process as it is seen as an essential tool in the framework of prevention.

Nevertheless, numerous experts express concerns regarding limits of OFS. It is getting harder to establish convincing corrective action plans. Indeed, in spite of substantial efforts put for running OFS, the same human errors or series of similar technical breakdowns seem to recur (Dien and Llory 2004). Once could say that, concerning safety, industries have reached a limit and are "*dancing tango on asymptote*" (Frantzen 2004), meaning that numbers of annual safety records are either slightly higher or slightly lower than the ones of the previous year, but are more or less the same since several years.

Are we subjected to be satisfied with these weaknesses of current OFS? Does prevention have to find new paths? Some specialists implicitly reject event analysis and advocate either to analyse daily routine situation in order to figure out factors of operation strengths and reliability (e.g. Rochlin et al. 1987, Laporte and Consolini, 1991) or, at the opposite side of the spectrum, to be prepared to manage crisis because accident occurrence is inevitable (e.g. Lagadec 1994).

Fundamental question is: what has to be reappraised? The whole OFS (Dechy and Dien 2007) ? Event analysis itself or analysis methodology ? Furthermore can we define analysis methodology only in terms of set of conditions to follow or to fulfil or can we extend definition up to role and features of the ones who applied the methodology? Indeed, could we consider that implementation of a methodology is "neutral" disconnected from, for instance, position in the safety management process and/or self-interests of persons in charge of carrying out the analysis, investigation.

After a brief description of analysis methodologies evolution grounded on a better understanding of what is an event, what is at stake when dealing with organisational dimensions of socio-technical systems, this paper will propose a way to improve event investigation by the use of organisational analysis approach and will (try to) show how role of analysts[2] is as important as methodology used itself.

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[1] By event we mean every type of malfunctioning with effects on either process availability or process safety: from minor and major incident to accident and disaster and also crisis.

[2] This point is developed further (section 4) but we would like to precise the importance of the analyst in the construction of identification, interpretation and analysis of the Accident. .

2. Evolutions of Understanding of What is an Event and What constitutes Safety

Event investigations intend to figure out causes of event occurrence in order to define and to implement corrective measures in order to improve safety level of the plant. As part of the safety management process, event investigation methodology is closely linked with the way safety-related concerns were taken into account. Reason (1993) described three periods regarding main focus of safety. Wilpert and Fahlbruch (1998) added a fourth one:

- *Technical period*: source of problems is technology;
- *"Human error" period*: source of problem is the person(s);
- *Socio-technical period*: source of problem is interaction between social and technical subsystems;
- *Inter-organisational relationship period*: source of problem is dysfunctional relationship between organisations.

These periods are "time-marked" periods, i.e. that vision of safety sources of problems has changed with time. This evolution can, for example, be seen on the nuclear industry.

Through the '70s safety was mainly based upon technical reliability. Human Performance (i.e. human capabilities and human weaknesses) was not taken into account. Mitigation of potential or proven process failures resulted from technical changes and/or improvements.

During the '80s, after the TMI-2 accident, concept of "human error" has emerged. A positive effect of it is, that "the operator(s)" was (were) inserted in the loop of process operations. It allowed improvements in domains of human-machine interface and operating procedures design, of training,... During this decade, "Operational Feedback" systems were set-up in order to promote lessons learned. We have to highlight that event analyses were operator-error oriented.

After the Chernobyl accident, during the '90s, concept of "Safety Culture" emerged. The safety culture of a company comprises the beliefs, behaviours, norms, and work practices of employees and management as well. Safety culture refers to what an organisation is like in terms of safety. This concept is of the first importance because it acknowledges for the first time that management activities are part of safety process – it means that managers could be seen, as the operators, accountable for occurrence of events -.Nevertheless it is, to us, less operational that it seems. Indeed, according to International Nuclear Safety Advisory Group (INSAG) a safety culture could be ensured in an enterprise (i) if role and responsibilities of everyone are clearly defined and known and (ii) if the relevant question is asked at the right person at the right time. In other words, "safety culture" can be seen as the willingness to work on behaviour through organisation (INSAG 1991).

In parallel, specially thanks to Reason (1990, 1993, 1997), concept of *organisational event* "came into the world". It widens event analysis potential scope. So, this decade is moving toward a taking account of "Organisational Factors". From a conceptual

point of view, "Organisational Factors" cover *Socio-technical* and *Inter-organisational relationship* as well.

Results of evolution we briefly described are cumulative, non exclusive – from "technical aspects" to "human factors" and then to "organisational aspects" –. No-one aspect has to be ignored in favour of another. This statement can be seen as the "*Onion skin theory*": Approaches (skins) are prioritised from the core to outside: (i) technical approach, (ii) human factors approach, (iii) organisational approach. Each approach gives results, and the whole set of results allows to have a better vision – a better understanding – of the (causes of occurrence of the) event.

3. Towards an Organisational Analysis of Event

3.1 Status of Event Investigation

Unfortunately, if concept of organisational accident is already familiar to scholars, it is more recent in industry, and so not applied[3]. Indeed, it was noticed by the Columbia Accident Investigation Board (CAIB) in its investigation concerning accident of the space shuttle *Columbia* occurred on February 1, 2003. CAIB states: "*Many accident investigations* ***do not go far enough***[4]. *They identify the technical cause of the accident, and then connect it to a variant of "operator error"* [...]. *When the determination of the causal chain is limited to the technical flaw and individual failure, typically the action taken* [...] *are also limited* [...]" (CAIB 2003). Due to flawed analysis, i.e. actual root causes of the event are not figured out, correctives measures defined and implemented do not match "requirements" of the situation and a "similar" event is ready to (re)occur[5].

The CAIB also points out a side effect of a weak analysis: "*Putting these corrections*[6] *in place leads to another mistake – the belief that the problem is solved*" (CAIB 2003) As Turner said (1997), this kind of belief about the world and its hazards are *culturally accepted* within the organisation (i.e. the company). So, organisation will live, according to Turner's expression (1997), an *incubation period*: a period during which some events occurring will remain unnoticed because they are at odds with current beliefs about existing hazards[7].

Nevertheless, some events were analysed from an organisational point of view: collision of trains in England (Cullen 2000), loss of *Columbia* space shuttle (CAIB 2003), accident in a plant manufacturing explosives (Le Coze and Lim 2003),

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[3] We do not say that investigation of event within the industry do not address at all human and organisational factors, but, rare are the investigations which really go beyond technical aspects and "human error paradigm" and very rare are the ones which refer to the organisational analysis paradigm.

[4] Emphasis added.

[5] See for instance similarity between *Challenger* Space Shuttle and *Columbia* Space Shuttle accidents ("*Echoes of Challenger*" in CAIB, 2003).

[6] i.e. fixing the technical problem and replacement or retraining of the individual responsible.

[7] Using a medical metaphor, we can say that if diagnosis (analysis) is weak (only deals with direct causes), associated treatment (corrective measures) will only treat symptom(s), not the disease. For instance, patient's temperature will go down and virus is still **potentially** active. Furthermore as symptom is deleted, sick person (doctors and physicians as well) will think he/she is in good shape, while a virus is waiting to act again.

destruction of part of an alternator in a nuclear power plant (Dien and Hofseth 2005), explosion in a refinery (US CSB 2007).

What is currently at stake, is to define organisational analysis features in a way it could be disseminated in industry culture.

3.2 Challenging the Event Chain Analysis Methodology

Currently, event analysis are mainly based upon an Event Chain approach. Event Chain Analysis methodology aims at directly "connecting" every single event to its cause(s). It means "in the other direction" that every action leads to direct consequence(s) and yet studies of accidents have shown that effects of some decisions (here seen as actions) are visible several years after they are made, and the way between decisions and consequence(s) is not direct (see for instance Vaughan 1997).

Studies of accidents have also shown that factors causing an event are often interlinked, overlap each other. They can be present at the same time with effects of mutual strengthening or reduction (Dien and Llory 2002).

Some scholars, as Perrow (1984), argue that roots of an accident are embedded in the system itself and that ways taken for coming to, reaching occurrence of event are so complex, that it is almost impossible to describe them by a "set of arrows joining (single event) boxes".

3.3 Main Assumption

Any event is **generated** by direct or immediate causes (technical failure(s) and/or "human error(s)") **nevertheless** its occurrence and/or its developing is considered to be **induced**, **facilitated** or **accelerated** by underlying organisational conditions (complex factors) (Dien 2006).

3.4 To Understand or To Explain?

Goal of an organisational analysis is not necessarily to explain an event from an expert point of view resulting in list of (more or less numerous) direct causes leading to consequences (with, at the end the fatal consequence). This approach brings some potential improvements in terms of, for instance, human machine interface, training, communication procedures (!!), ... Nevertheless, it leaves into shadow context of the event (i.e. a set a various phenomena as organisation, regulation, general and specific to the event decision-making processes, company beliefs and culture, ...). Very often "explaining approach" is operator oriented and takes poorly into account managers actions (for instance "decision-making") and its role in occurrence of event – indeed, management actions have, generally, no **direct** effects, impacts concerning occurrence –. In contrast, organisational approach tries to understand events in/by taking account of context and to highlight its relevant features (i.e. history, every actor, entity potentially involved, ... It allows to propose corrective measures with broader effects. These measures are usually less "technical", and could be related to cultural aspects and it could take times before their effects are felt.

Purpose of organisational analysis is to understand how organisation is working: it leads to (try to) understand weaknesses and vulnerabilities of/coming from daily, routine, day-to-day, ..., functioning.

3.5 Event organisational Analysis Main Features

According to Reason (1997), a system producing an event is made of three levels:

- The person (having carried out the unsafe acts, the errors);
- The workplace (local error-provoking conditions);
- The organisation (organisational factors inducing the event).

Development of event is "bottom-up", i.e. direction causality is from organisational factors to person. In the event analysis, direction is opposite. "Gate" – starting point – of analysis is direct and immediate causes of bad outcome (event). Then, step by step, analysis considers, as far as possible, how and when defences failed.

In addition to results obtained by scholars in the field of organisational studies, real event organisational analyses carried out allow us to define the three main axis of an innovative approach, helping to go from direct causes to root organisational causes (Dien and Llory 2006):

- Historical dimension;
- Organisational network;
- "Vertical relationships" in the organisation.

We have to note that, if these dimensions are introduced in a independent way, they are interacting and an analysis has to deal with them in parallel.

a) Historical dimension

As Llory states (1998): "*accident does not start with triggering of final accidental sequence; therefore, analysis require to go back in time,* [...]" in order to put in prominent place deterioration phenomena. Analysis has to "go upstream" in the History of the organisations involved for highlighting significant malfunctioning aspects: what was not appreciated in real time has to "make sense" when risk was confirmed (i.e. when event has happened). Vaughan reminds (2005): "*The O-ring erosion that caused the loss of* Challenger *and the foam debris problem that took* Columbia *out of the sky both had a long history.*" Early warning signs have to be looked for and detected long before time event occurrence.

We have to note that one chapter of the CAIB report (2003) is named: "*History as A Cause*". Few years before, Presidential Commission on the Space Shuttle *Challenger* Accident (1986) has entitled one chapter of its report: "*An Accident Rooted in History*". So taking account of past is important to understand the event. Goal is to go back in time for comprehending and analysing relevant processes and trends which led to the event. Numerous industrial events show that weakness of operational feedback could be incriminated for their occurrence – i.e. that previous relevant event(s) was/were not taken into account or poorly treated after their occurrence –.

Analysts have to pay a specific attention at incidents, faults, malfunctioning occurred prior to the event.

Analysis of the "historical dimension" is parallel to detailed examination of parameters, of variables of context which allow understanding of events.

Analysis of the "historical dimension" has to avoid a "retrospective error". Fine knowledge of event scenario – i.e. sequences of actions and decisions which led to it – allows to assess actual mid and long term effects of each action and decision. Analysts have to keep in mind that this evaluation is easier to make after the event than in real time. In other words, analysts have to avoid a blame approach.

b) Organisational network

Within an organisation, entities[8] communicate: they exchange data, they make common decisions – or at least they discuss for making a decision –, they collaborate, ... So it is of the first importance to "draw" *organisational network*" between entities concerned in the event. This network is not the formal organisation chart of entities. It is a tool for showing numerous and complex interactions involved for occurrence of event. It is a guideline for carrying out the analysis; it is built all along analysis itself.

Organisational network is hardly defined once and for all for a given organisation. It is draft according to the analysis goals. Parts of organisation can be ignored because they were not involved in the event.

Organisational network allows visualising complexity of functional relationships between entities, and sometimes, it highlights absence of relationships which had to be present.

c) "Vertical relationships" in the organisation

This dimension is a part of organisational network on which a specific focus is needed. It covers *top-down* and *bottom-up* communications. It is essential to isolate it since it makes easier understanding of interactions between various management levels, experts and "field operators". We have to remind an obviousness often forgotten during event analysis: organisation is a hierarchical system.

The main interests of this dimension are: modes of relationships, of communication, of information flows and modes of **co-operation** between hierarchical layers. Real events show that deterioration of these modes are cause of their occurrence.

At least, thanks to this dimension, causes of an event cannot be focussed **only** on field operators.

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[8] "Entity" means a part of organisation more or less important in terms of size, staffing. It could be a small amount of people or even an isolated person (for instance a whistle blower).

3.6 Some Other Concepts of Organisational Analysis

Organisational and structural features are of importance to understand the nature of Accident Analysis. However, we could also take other dimensions into account. Social sciences provide interesting findings to understand people's action in risky situations. Special attention has to be paid during investigations/analyses to the two following issues. They are not the only ones but seem of particular importance.

a) Weak signals

Notion of "weak signals" arose from Vaughan's work (1996). She defined a weak signal as "*information informal and/or ambiguous, so that threat to the flight safety*[9] *was not clear*". In other words, we can say that a weak signal is either a technical or a human phenomenon which is not the/one direct cause of an event but which is meaningful regarding potential weakness, fragility of the socio-technical system in domain of safety.

b) Whistle blowers

Sometimes "whistle blowers" make the effort of writing to signal a malfunction and express their concern for safety. These written exchanges occur among some operational staff-members, or their management, who sound the alarm about persistent malfunctions, the treatment of which falls to others, and they often underline the accident-generating consequences of these situations. These persons take their responsibility and also take risks through personal involvement, especially regarding their careers. Their objective is to reach the decision making centres in order to remedy the situation they are concerned with (Llory 1998).

3.7 Some Principles for Applying Organisational Analysis

a) Field Analysis

Even if an organisational analysis could be carried out from documentation (having high quality), usually it is implemented through a field analysis with contacts with every actor (operators, managers, ...) and with every entity (company where event occurred, safety authority "in charge", ...). In order to collect "true" information analysts have to have an empathic attitude toward people met during analysis[10], and to insure an understanding approach.

b) Background Knowledge

"We only find what we are looking for" !!

An organisational analysis cannot do without a set of background knowledge related to methodologies, main findings of organisational approach. Indeed, as some root

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[9] She spoke about the Space Shuttle *Challenger* accident.

[10] Collecting "true" information does not mean to take what it is said as "holly words". Analysts have to understand speeches according to the context, the role of the speaker(s), ... Information collected have to be cross-examined as well.

causes could be "hidden" in the past or by the situation, analysis is based upon assumptions to be confirmed or denied.

Background knowledge are a general framework for (field) analysis and are useful as well for making a synthesis and for drawing conclusions.

Knowledge of day-to-day operations is also part of background knowledge required for an organisational analysis.

c) A "Thick" Description of An Event

First output of an organizational analysis is a "story" as detailed as possible which is, as said Geertz (1998), a dense description, a thick description of the situation having led to the event. For synthesis, story is expurgated in order to highlight on the one hand main technical and organizational processes "responsible" and, on the other hand specific organisational factors involved in the situation.

4. Analysts and Organisational Analysis

4.1 Historical and Sectorial Developments of Organisational Analysis

The understanding and explicit formalisation of the human and organisational dimensions of events and safety came with public reports upon some major accident investigations and work of scholars. It implies that the different industrial sectors (and in particular their analysts and the available methodologies) are at different stages of knowledge and practice of these new paradigms. Very recently, it seems that the CAIB report and posture constitutes a turning point on the organisational paradigm. This investigation has integrated some of the latest developments proposed by scholars, has used them explicitly and has criticised the approach in other investigations (too much focused on technical factors or human error oriented). This investigation is producing a 'trickle down effect' (Vaughan 1996) on other sectors such as in the process industries with US CSB investigation (2007) of Texas City accident and CCPS[11] learning lessons process on the Columbia case (2005). We can see here, the important role of independent safety boards and independent ad-hoc commissions in the development of this paradigm. Some analysts in those sectors and safety boards are now more familiar with those concepts.

4.2 Position of Analysts Within the Organisation and Epistemological Barrier

It was shown by J. Rasmussen (1997) that several "layers" are involved in hazardous processes –Work, Staff, Management, Company, Authority, Government. We assume that causes of an accident could stem from flaws in several layers. Event analysts usually belong to one layer. Their problem is to be able to detect and to take account of the whole set of event causes. For instance, CAIB (2003) showed that "American political system" (i.e. the White House and the House of Representatives) played a role in loss of *Columbia* space shuttle in cutting down the NASA budget. This budget decreasing, with no parallel changes in the goals of NASA led to staff downsizing,

[11] Center for Chemical Process Safety at http://www.aiche.org/CCPS/index.aspx

time schedule pressure, ... which weakened the "space shuttle system". Some root causes of an event could be outside of the company "affected" by it. Could an analyst or a team of analysts members of a company, be able to detect such root causes or are they beyond their reach?

In addition "culture of efficiency" will lead analysts to emphasise on controllable and manageable causes for which corrective measures are within the organisation boundaries analysts could reach. According to A. Hopkins (2003), analysts can be driven by "stop rules" in their investigation. Study of several event analyses reveal that often analysts implicitly halt searching causes to causes they handle, i.e. to causes for which they can propose corrective measures in order to prevent them. That means, for instance, if analysts belong to "management layer", they could "put aside" causes implicating "company layer" because decisions concerning corrective measures have to be made at the corporate level. That is a reason why, very often, analyses do not go far enough.

So, position of analysts within the organisation influences their vision of situation and therefore their analysis. It seems that, in order to take an event in its broad scope, analysts have to be in position enabling them to catch the "big picture" of the event and to catch the comprehensive – organisational – situation prior to it.

Furthermore, position of the analysts towards the event, gives them implicit or explicit goals for the analysis. In other words, depending on position of analysts, results of analysis could be tremendously unlike each other. Thus, Hopkins (2003) shows, in analysing investigations carried out after an explosion in a gas plant in Australia, that results, and therefore definition of causes, were different according to the company owning the plant and according to the courts. In performing his own investigation of this event, Hopkins figured out a third set of results, of root causes having led to the accident.

In addition and at the basis also, Llory (1999) talked about an epistemological barrier for some actors, in particular with engineers, to think about organisational dimensions of accidents. The behaviourist model is still in mind to conceive the human factors despite the fact that they can refer to organisational, communication problem to explain some of the situations they face. And at the other end of the socio-technical system, the justice also uses this underlying worldview.

4.3 Analysts as Political Actors

An event analysis can be sum-up as series of decision-making (what is important, what to look for, what to take account of, ...). Now, decision makers in any organisation "*are not perfectly rational individuals. They are collections of normal human being, constrained by common cognitive and organizational limits on rationality* (Sagan 1994)".

Effects of organisation/company culture, self interests of analysts, ... can have an impact on results of event investigation: " *organizational blind spots can hid failures*

modes. Organizations often have ***taboo subjects which cannot be discussed***[12]*, because to do so hurts the morale and self-image of the organization* (Sagan 1994)".

Llory (1999) referring to Crozier (1995) analysing French failures of top decision making *"Obstacles are not only epistemological and cultural, they are grounded on an organisational and hierarchical system that bans the accountability of executive elites*[13] ".

Does it lead to promote investigation carried out by "external" experts – in the sense not belonging to organisation/company affected by the event –? It is not either the "pure" solution. Indeed external experts have also their limits to rationality. For instance, Sagan (1994) refers to a study made by Hawkins showing that safety "*inspectors tend to report problems only when they believe there is a good chance that* ***they*** *can win a case against the violators, rather than focusing on the actual effects on the hazards.*"

This goes back to the independence as a political factor facilitating the tackling and explicit formalisation of those political factors (organisational, hierarchical, managerial, power, responsibility). However, there is no perfect situation as addressed by Bourdeaux and Gilbert (1999): the external (a priori more independent) person will have less difficulties to ask questions not asked by the insiders, and an insider could have the advantage of understanding the power relationships. A way of improving the whole situation is to protect the analyst, to institute the beneficial role of Cassandra's in high risk industries (Dien and Pierlot 2006) and look for analyst with will not be complacent under contractual or hierarchical pressure.

4.4 Analysts and Organisational Data

Such organisational analysis requires specific methodological approaches, specific data and resources, to conduct interviews, to analyse collected data, that are far from the resource allocation currently observed for incident analysis within industrial organisation. This is a reason among others why, those analyses have often yet been performed by scholars, researchers and independent safety boards or commissions.

Furthermore, the access to the needed data is not that obvious. As a first comment, Llory (1996) pointed out in his book titled *"Industrial accidents: the Cost of Silence - –Operators Deprived of Speech and Untraceable Managers"*. Most often, the accidents are not described from the point of view of actors and the work of managers and experts is not described in those analyses. The technical factors of accidents are politically more neutral.

Following an accident, an a posteriori assessment of the real work of actors should be performed but is hard to conduct. First, this assessment is perceived as suspicious according to the risk with the use of those information to allocate blame, to find a scapegoat and to assess individual performance of actors in human resources perspective (de Gaulejac 2005). Indeed, it implies to address real work versus formal

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[12] Emphasis added.
[13] of the country

work which is a well known subject (Bourrier 1999). But in normative perspective in this context, a secrecy culture is establishing (Llory 1999, Dejours 2003). In addition, this access to real work assumes to have access to tacit skills and as stated by Dejours (2003) *"professional intelligence, in rule, is in advance on its knowledge and symbolisation"*. Specific methodological approaches to collect data have to be practised, such as clinical approaches defined in social science. They are also facing power dimension due to the strategic knowledge of the real work (Crozier and Friedberg 1977) and individual or group *"defensive ideologies"* (Llory 1999, Dejours 2003) that can be observed in particular after accidents, when actors are fearing allocation of blame or a responsibility towards the justice litigation.

4.5 Selection and Training of Analysts

Selection and training of analysts is an issue that will have to be strengthened in the next years as we have not seen yet many actions regarding this dimension. Organisational analyst competence can be seen at the intersection of two competencies, the first one in accident investigation (and by extension in learning from experience) and the second one in human and organisational approaches of safety.

In human and organisational dimensions of safety, different sectors since the eighties have selected human factors specialist (ergonomics, psychology) following the impact of "human error" discovery ... Very few industrial organisation have integrated more organisational dimensions expert (sociology political science, ...) when thinking about safety management

In investigation and learning from experience, despite this field of safety has been implemented for several years, in France we know only one school on learning from experience and none on investigation. With the independent accident investigation boards, some developments are observed such with NTSB[14] academy. However the training proposed are still more focused on technical dimension of investigations with forensics techniques for example.

4.6 Transferring tools and methods on organisational analysis ?

One of the issue that is underlying here is the gap between some knowledge of scholars, researchers, and experts in the field of organisational analysis and the industrial practices of incident analysis. An operational transfer of those concepts is lacking (Bourrier 2004). Some perspectives of developing framework, approaches, tools adapted to an industrial context with insights coming from lessons learned in organisational analysis have been proposed (Bourrier 2004, Le Coze and Dechy 2006).

4.7 Accident Analysis: A Social Product and Analyst Sense Making

As earlier mentioned, social sciences provide interesting findings to understand people's action in risky situations. This theoretical approach is worthwhile in terms of

[14] National Transportation Safety Board (USA).

accident prevention, based on a posture of doubt, critical analysis of knowledge acquired and tools implanted. We consider Macrae's study (2007) as an interesting way to explore and operate this notion. He argued that "*in modern, complex and hazardous organizations such as airlines, risks are rarely self-evident. They must be actively identified and interpreted, often in a context rich with weak or equivocal signs of potential problems*". Risk managers and experts have to try to piece together signs in order to give sense to them. The capacity of analysts or safety managers to detect, interpret and take these early signs of potential problems lies in a posture of doubt; of learning from their own ignorance. In addition to the necessary a posteriori reconstruction of those processes, we believe that this approach could be of interest for investigation a posteriori. Indeed, an issue to address is how this doubt prone behaviour (gained during daily operations and a priori analyses) could influence analysts during an event investigation?

4.8 Analyst' Judgement and Memory of Analysis of Organisations

One of the issue in organisational analysis (prior to the event or after) is the judgement that arises after the thick description and analysis when dealing with findings. A posteriori, it is necessary to avoid both the restropective bias as the historian and to avoid the '*retrospective illusion of fatality*' (Llory, 1996, Llory et al. 2007). A priori, the issue is to be able to judge complex factors, pathogenic factors and latent conditions and detect an incubation period.

In both situations, a judgement as a conclusion of analysis is pronounced by the analyst. The judgement of complex factors (with feedback loops, non linearity, counter-intuitive effects,...) is not trivial, even after the event, and relies on underlying assumption of models of safety), on a modelling of the accident (thick description provided by organisational analysis) and on accident cases to support judgement. Indeed, the medical metaphor was used by Llory (1996) to explain the need for reference cases to judge potential pathogenic conditions or behaviours of dynamic socio-technical systems. Furthermore, to study organisational pathogenic patterns, Llory (1996), referring to S. Freund metaphor regarding dreams and unconscious, has recalled that accident investigations are the '*royal road*' (versus "normal" situations analyses) for understanding organisations.

5. Conclusions

It appears that use of organisational analysis for event investigation could break current limits of OFS and improve safety since potential causes of incidents or accidents are looked for in a wider scope than the one of analysis methodology generally used in industry.

One of the issue, for the methodological dimension, would be to work on closer bridges between scholars and industries. In spite of many in depth studies on these issues, many scholars still regret that accident analysis are too technical and not deep enough. We could say that some efforts are still to make in the capacity of scholars to translate and transfer the intellectual and practical tools to the industries. This work requires taking industrial constraints into account – production, people's background, market conditions, ... If scholars and researchers tend to be closer to industries

concerns, bridges should be built in a more concrete and stronger way. It will imply also serious selection and training of analyst on those approaches.

Nevertheless, analysts either could not be able – i.e. to be in a "wrong" position within organisation – to address the whole scope or do not have self interest to extend scope of investigation. They could also face difficulties to have access to relevant organisational data and to make sense of it.

Furthermore, **practical** corrective measures have to be derived from investigation and they have to be implemented. However, some corrective measures are out of sphere of competence and responsibilities of persons in charge of drafting corrective measures, and of persons in charge of decision-making regarding their implementation. So, main improvements concerning effects of event investigations have to be sought with future studies of position and role of analysts and of decision-makers of implementation of corrective measures.

One promising, but expensive in terms of resource and time, is to promote a "check and balance" approach for investigation, meaning a collective building of results deriving from several parallel organisational analyses. Results of each analysis could be compared and discussed in order to define one set of shared results allowing to gain a "global vision" of the event. This approach could be worth for major accidents.

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