
Article:
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1. Introduction

There is unanimous agreement in the management literature on the strategic role middle managers nowadays play in organisations. Indeed, their contribution has been recognised in: facilitating information exchange and supporting the distribution of knowledge-based resources throughout the organisation (Dutton, Ashford, O'Neill, Hayes, & Wierba, 1997; Floyd & Wooldridge, 1994; Nonaka, Takeuchi, & Umemoto, 1996); in leveraging key organisational decisions and outcomes thanks to their strategic influence at *vertical* (upwards, by championing alternatives to support the top managers' decisions, and downwards, by collecting and channelling the specific needs at the operating level towards the organisation's goals), *lateral* (by exchanging information from formal and informal activities with peers and their respective departments), and *external* levels (e.g., with customers and suppliers) (Ahearne, Lam, & Kraus, 2014; Bamford & Forrester, 2003; Callari, Bieder, & Kirwan, 2019a; Conway & Monks, 2011; Dutton et al., 1997; Floyd & Wooldridge, 1997; Pappas & Wooldridge, 2007); in supporting organisational change (Balogun, 2003; Conway & Monks, 2011; Huy, 2001; Kuyvenhoven & Buss, 2011; Heidrich, 2014).

Even if enhancing safety remains a key challenge in civil aviation, safety research has mainly focussed on front line operators, top managers and safety managers (for example: Callari, McDonald, Kirwan, & Cartmale, 2019b; Flin & O'Connor, 2013; Fruhen, Mearns, Flin, & Kirwan, 2014a, 2014b; Gualardo, 2008; Klockner, 2018; McDonald, Callari, Baranzini, & Mattei, 2019; Vogus & Sutcliffe, 2012; Tappura, Nenonen, & Kivistö-Rahnasto, 2017; Weick, & Roberts, 1993; Yiu, Sze, & Chan, 2018; Zuofa & Ocheing, 2017; Zwetsloot et al., 2017), and very little is known about how middle managers take safety into account in their daily operations, and the challenges they face. Schulman and colleagues (2004) in their analysis of high-reliability networks highlight the key role of what they call 'reliability professionals'. These actors, although not limited to middle managers, may be referred to as 'middle-level professionals' as they work directly in operations, and are the ones who reconcile "*the need for anticipation and careful causal analysis with the need for flexibility and improvisation in the face of turbulent inputs into complex and tightly coupled systems*" (p.24). Bhattacharya and Tang (2013) investigated the impact of senior officers' leadership on ratings' occupational health and safety (OHS) management in the shipping industry. In contrast to formal settings in which ratings showed hesitation to express their concerns and views about OHS, informal settings (such as recreation room, and/or changing/locker room) and practices (e.g. informal chats/discussion, working together, social activities) result the privileged moments in which senior officers could elicit more effective engagement from ratings in the management of shipboard OHS. Rezvani and Hudson (2016) followed and audio-recorded – over a period of one month – the daily

interactions that one middle manager from a national oil company undertook in managing safety with organisational members. The authors tracked all the activities and actions performed, and mapped the different tasks. They conclude that middle managers play a strategic role in organisations, particularly in detecting, handling, and filtering information between the different organisational layers. In 2017, Tappura et al. investigated the organisational factors hindering and promoting managers' commitment to safety in five industrial organisations in the fields of energy, industrial services and chemical processing. The list of hindering factors includes role overload, production pressure, overly formal safety procedures. Conversely, safety awareness, organisational safety procedures, support from superior, safety benchmarking and safety improvement are on among the factors promoting managers' commitment to safety. Recently, Callari et al. (2019a) published a study highlighting the practices the middle managers from the civil aviation industry rely on when embedding safety in their daily activities. We suggest that 'managing information', 'making decisions', and 'influencing others' constitute the three high-level distinctive and idiosyncratic 'competency' that middle managers refer to when it comes to contributing to safety.

This study represents a complementary work to the one published in 2019 (Callari et al., 2019a). The over-arching aim of this study was to add further knowledge on the dimensions and/or conditions that play a role in influencing the middle managers' safety-related practices, specifically within European civil aviation organisations. Although we recognise – as cited earlier – that recent studies have started focussing on the intermediate levels of management, especially outside of specific safety management functions, we argue that more research should be undertaken on the topic. Therefore, we drew from the data-set of our previous research [1] , and analysed the views, experiences and challenges of middle managers in relation to all the conditions that could play a role in either supporting or hindering their contribution to safety. These conditions may embrace external factors (i.e. outside of the organisation, such as societal factors, governmental/European

[1] The overall research was framed within the FSS programme as explained in the acknowledgements, spanning a two year period of data collection involving semi-structured interviews with middle managers from a number of organisations partner of the programme. The full data set comprised 48 middle managers from manufacturers, airports, air traffic control organisations, airlines and airports. Whilst the focus of the first study was on the safety-related practices of middle managers, this study revolved on the middle managers' surrounding conditions and dimensions that could support and/or hinder their safety-related decisions and actions. Methodologically, the first study involved the entire data set of 48 middle managers, whereas this study relied on the interview data from organisations responding to the following criteria: (1) organisations where at least four middle managers participated to gather varied views for the same organisation; (2) organisations from aviation activities (namely manufacturers and ATCs) for which we had at least three different organisations. As such, the organisations involved were 9 in the first study, and 6 in this second one. Further, the Qualitative Content Analysis method was employed in the first study to describe the emerging practices; in this study Thematic Analysis was used to both describe and explain the emerging dimensions and the relationships between them.

frameworks/policies, etc.), organisational factors (i.e. inside of the organisation, such as organisational processes and procedures, culture, etc.), but also individual factors (such as personal attitudes and managers' background experiences) guiding the way safety is intended and implemented by the middle managers.

This study was conducted within the framework of Future Sky Safety (FSS) Programme, an EU-funded transport research programme in the field of European aviation safety. The civil aviation companies involved in this study were partners of the FSS network.

2. Literature review

2.1 Organisational factors

Aviation is commonly referred to as a high-reliability activity. Critically, air traffic management was one of the field studies that led to the development of the HRO theory in the late 80s early 90s (Bourrier, 2011). Although Amalberti (2013) in his distinction between three categories of organization rather characterizes it as an ultra-safe industry, Pettersen and Schulman (2019) challenge this view and confirm civil aviation's characteristics fall under the HRO theory.

In line with this, according to Schulman et al. (2004), an organisation needs to possess a number of characteristics to have a high-reliability performance. These characteristics may include a formal specification of the core unwanted events, as well as an identification of precursor events or conditions, but also clear priorities and procedures to prevent them from occurring. Beyond a specific focus on the events to be precluded, they also need to foster and reward employees' sensitivity and attentiveness, find ways to manage conflicting goals and strategies and buffer their paradox. It also needs to establish formal roles, responsibilities and reporting lines that can change when the situation demands quick responses requiring specific expertise. Finally, it also needs to identify and acknowledge its key features that can degrade with time and have an external environment supporting all of the above through watchfulness (e.g. regulation, oversight). Interestingly, the HRO theory underlines, beyond the organisational characteristics supporting a high-reliability performance, the importance of external factors. La Porte (1996) insists on the key role of these external support "*for achieving the internal conditions of trustworthiness*" (p.65). Indeed, whether regulators or even more so "*knowledgeable 'watchers'*"(p.65), they contribute to maintain the culture of reliability, and legitimate investments/operations contributing to reliability and safety in the eyes of corporate and regulatory actors.

However, the organisational and external characteristics highlighted by the HRO theory are not defined as sufficient to guarantee high-reliability, nor can one establish minimum thresholds for

each of these to ensure high-reliability performance (Schulman et al., 2004). Achieving high-reliability performance also needs a capability to adjust decisions and actions in real-time, as high-reliability professionals do (*Ibid)*. Interestingly, the HRO literature focused initially on the features that contributed to making the overall organisation's performance high-reliability performance, without entering into the details of how the various professional groups would be affected or would contribute. These attributes are described across the overall organisation, not for a specific professional profile. The notion of 'high-reliability professionals' as key actors of High-Reliability Networks (HRNs), allowing for making organisations performance high-reliability performance, appeared in a later research on HRNs (Schulman et al., 2004; Roe et al., 2008).This research was not initially targeted at any specific employees' profile or hierarchical layer. Yet, the role played by these high-reliability professionals came out as critical to ensure real-time resilience. These 'high-reliability professionals' were 'middle level professionals' ranging from controllers to department heads in the electricity provision domain, that is all the actors involved in operational activities, from first line operators to department heads, namely controllers, dispatchers, technical supervisors and department heads (Schulman et al., 2004). Roe and Schulman (2008) characterise reliability professionals by their *'special cognitive skills and flexible performance modes (that allow to) maintain reliable operations even in the face of widely varying and unpredictable conditions´*. (p.13). This research suggests that beyond organisational and external aspects, individual factors are also worth considering when trying to understand what supports middle managers' contribution to safety.

Tappura et al. (2017) focussed their research on managers and identified a number of organisational factors promoting or hindering the managers' commitment to safety. Their research involved both middle and line managers from five organisations in the domains of energy, industrial services and chemical processing. The factors promoting managers commitment to safety included: safety awareness, managers' safety attitudes, recognition of safety commitment, organisational safety procedures, support from superior staff, safety benchmarking and safety improvement. On the other hand, the hindering factors were identified in: role overload, production pressure, formal safety procedures, safety goals, employee attitudes, management attitudes. Methodologically, the authors employed interviews to collect the middle managers' perceptions on the topic, and conducted workshops to identify organisational measures supporting the managers' commitment to safety. Overall the measures identified are instantiations of the categories or organisational factors promoting managers commitment to safety. They include for example, developing "safety procedures that are consistent, clear and easy to follow", "creating uniform safety instructions and ensuring their enforcement at all organisational levels supports managers when conflicts arise »,

"developing safety attitudes among all employees" through « e.g. meetings, trainings, bulletins and safety Walks », « providing managers with information on the expectations regarding their role and safety responsibilities ».

2.2 Individual factors

Streams of research regarding the managers' attitudes and commitment towards safety have been explored in the human factors, safety and management literature.

Safety commitment is often associated in the scientific literature with effective leadership, appreciation of responsibility for safety, continuous safety-related feedback and reinforcement for an effective safety climate (Fruhen, Griffin, & Andrei, 2019; Fruhen et al., 2014a). The quality of leadership is argued to play a significant role in sustaining and influencing the organisations' and employees' safety performance and productivity. Different leadership approaches and styles may achieve this: trait (focusing on physical, mental, and personal attributes that could be associated to leadership success), behavioural (the way the leaders behave sets an example to the workforce), situational (effective leadership is task-relevant and considerate of the 'performance readiness' of the group to influence), and transactional/transformational leadership theories/models (Bass, 1990; Blanchard, Zigarmi, & Zigarmi, 1985; Hersey & Blanchard, 1969; Kuhnert & Lewis, 1987; Stogdill, 1948; Yukl, 1989, 1994). Bass' Transactional and Transformational Leadership theory is argued to be one of the most comprehensive leadership theory in organisational studies (Bass, 1990, 1997; Bass & Avolio, 1994), and an effective method of leading safety towards positive safety compliance and safety participation (Clarke, 2013; Tappura, Sievänen, Heikkilä, Jussila, & Nenonen, 2015). While a transactional leading style is more about setting targets, monitoring performance, rewarding good results, transformational leaders motivate and encourage staff to commit to safety goals through his/her own example (Flin & Yule, 2004; Fruhen et al., 2019; O'Dea & Flin, 2001; Tappura, et al., 2017). Further, these leaders show a certain *charisma*, through their personality and ideas for which they stand, and as a consequence of this, the followers go after their leader(s) on the basis of the confidence and trust they have in him/her (Bass, 1985; Conchie, Taylor, & Donald, 2012; Hoffmeister et al., 2014; Podsakoff, MacKenzie, Moorman, & Fetter, 1990).

Transformational leadership is also associated with positive safety outcomes, such as improved safety climate (Zohar, 1980; Zohar & Luria, 2005; Zohar & Tenne-Gazit, 2008). Safety climate refers to the safety-related perceptions that employees share about their work environments, and serve as a frame of reference for guiding appropriate and adaptive task behaviours (Zohar, 2002). This includes maintaining an open communication with ongoing safety-related feedback and performance goals. Critically, safe-prone organisations would support the following

dimensions/characteristics for an effective safety climate: (a) perceived management attitudes towards safety, (b) perceived effects of safe conduct on promotion, (c) perceived effects of safe conduct on social status, (d) perceived organisational status of safety officer, (e) perceived importance and effectiveness of safety training, (f) perceived risk level at work place, and (g) perceived effectiveness of enforcement versus guidance in promoting safety (Zohar, 2002, p.98). Indeed, to improve safety climate within organisations, feelings of workers' responsibility for safety and more positive appraisals of senior management commitment should be enhanced (Yule, Flin, & Murdy, 2007). Other researches have investigated the role of management's influence on organisational practices and their safety values as reflecting managers' safety commitment. Trust in management and perceived safety climate were found to mediate the relationship between an high-performance work system and safety performance measured in terms of personal-safety orientation (i.e., safety knowledge, safety motivation, safety compliance, and safety initiative) and safety incidents (i.e., injuries requiring first aid and near misses) (Zacharatos, Barling, & Iverson, 2005). The mediated role of trust in safety leadership styles was investigated by Hansez and Chmiel (2010). Their findings suggest that trust and affective bonds seem more effective than 'good reason' arguments in encouraging safety voice behaviours in employees. The perceptions of safety in organisations, and role of safety climate, motivation, and behaviour to perform safely were explored in a number of studies of Griffin and Neal (see for example: Griffin & Neal, 2000; Neal & Griffin, 2006).

Managers' attitude towards safety may have a positive impact on the safety culture of the whole organisation. Safety-related attitudes relate to the beliefs and views in the context of safety (Fruhen, et al., 2014a, 2014b; Neal & Griffin, 2006; Rundmo & Hale, 2003; Zhang, Chen, Fu, Yan, & Kim, 2016). They have been studies as predictors of different types of behaviours (using either self-report scales or response-time measures), particularly in relation to compliance with safety procedures (Bohner & Dickel, 2010; Neal & Griffin, 2004).

3. Methodology

In a two-year period (2016-2017), we engaged in an extensive field research activity that involved middle managers from six different organisations of the European civil aviation industry. A qualitative research strategy was employed, and in-depth interviews undertaken (Ritchie, Lewis, Nicholls, & Ormston, 2014). The entire research activity (i.e., decision-making points recorded alongside the research design, data storage, data coding and analysis) was managed using the computer-assisted qualitative data analysis software NVivo (v.11 Plus for Windows, ©QSR International) (Bazeley, 2007), and a study NVivo project was created. This helped the qualification

and quantification of the study outcomes. Further, it supported the achievement of the study reliability and validity. Both authors of this study shared the same NVivo project and validated all phases of the research (particularly during the codification and analysis activity), to enhance the trustworthiness of the study results (Bazeley & Jackson, 2013; Nowell, Norris, White, & Moules, 2017).

3.1 Study participants

Overall, 43 middle managers were involved in this study. The recruitment process was launched in the organisations partners of FSS and was on a purposeful and volunteering sampling basis (i.e. information about the study objective was disseminated via email with contact details where submit the interest for taking part). The organisations considered in this study included three aircraft manufacturers and three air traffic control organisations (see Table 1), ranging from a few hundred to several tens of thousands of employees.

Table 1: Study participants

	Manufacturers	**ATC**	
Wave 1	14	14	
Wave2	6	9	
Total	**20**	**23**	**43**

The middle managers' selection was based on the following search criteria: managers "*in the middle line of the organisation, having managers reporting to them and also requiring to report to managers at a more senior level, and holding budget responsibility*". In line with the volunteering sample, the interviewed middle managers belonged to a variety of functions, such as engineering, R&D, operations, system design. As anticipated, no safety managers were included in our sample.

3.2 Data collection

Over a two-year period, two waves of data collection were undertaken. Initially, the study phenomenon was investigated in an exploratory way, free from any pre-constituted models and theories, capturing the middle managers' experiences and perceived role in contributing to safety within their organisations, and unstructured interviews were preferred. Two high-level topics of investigation were included in the interview guideline – i.e. (1) the middle manager's current role, tasks and the actual activities they carry out daily that may relate to safety, and (2) what supports or conversely challenges them in these activities. This phase supported the emergence and organisation of recurring themes (see Figure 1) and guided the design of the interview guideline for

the second wave of data collection. In the second phase the involved middle managers were enquired about their overall practice in 'managing information', 'making decisions', 'influence others' and the contributing/hindering factors that affect their activity and actions in relation to safety.

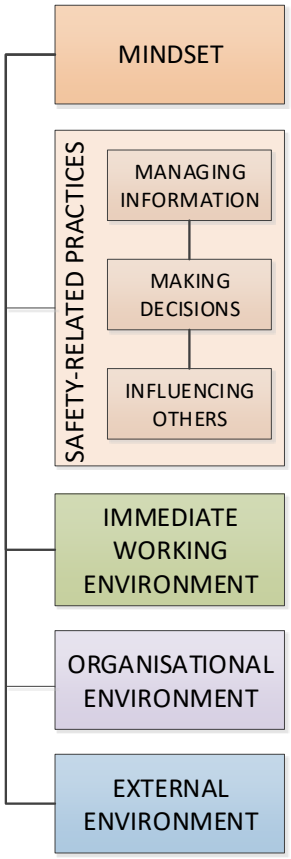

Figure 1: Codes/themes guiding the design of the interview guideline

All interviews were conducted in person. Informed consent was signed prior to each interview. As audio recording was not permitted, the researchers took notes, transcribed the information collected, and waited for the interviewee's validation before proceeding with the analysis. The average interview length was one hour.

3.3 Data analysis

A codebook was designed and tested until it was evaluated stable (for a detailed description of this phase see: Callari, et al., 2019a) (Boyatzis, 1998; Schreier, 2012). All 43 interviews were coded using the proposed codebook. A thematic analysis was performed (Boyatzis, 1998; Brawn & Clarke, 2006), and descriptive and explanatory analyses were undertaken using NVivo. The descriptive analysis supported the in-depth comprehension of each code/theme of the codebook (i.e. Mindset, Safety-related Practices, Immediate Working Environment, Organisational Environment, and External Environment). The outcome of this analysis is presented in Section 4.1.

Following this, a subsequent explanatory analysis was performed through the identification of existing relationships between the codes/themes of the codebook, and as such able to infer the mechanisms/factors that affect the middle managers' practice in taking safety into account. In the NVivo project a 'Matrix Coding Query' was run to cross-tabulate the co-occurrences identified between the codes of the codebook - namely. between the Mindset, Immediate Working Environment, Organisational Environment, and External Environment, (i.e. the middle managers' individual and environmental dimensions) on the one side, and the middle managers' Safety-related Practices, on the other (Figure 2). This was done to explore which middle managers' individual or environmental characteristics were mostly associated with middle managers' safety-related practices, and hence more likely to suggest a possible relationship between them.

	A : SAFETY-RELATED ...
1 : EXTERNAL ENVIRONMENT	100
2 : IMMEDIATE WORKING ENVIRONMENT	215
3 : MINDSET	129
4 : ORGANISATIONAL ENVIRONMENT	217

Figure 2: 'Matrix Coding Query' results in the NVivo Project

After this stage, each co-occurrence was analysed in-depth, and a 'Relationship Node' was created in the NVivo project to formalise the association between two codes/themes (individual or environmental and safety-related practices). Initially, the type of association that was created had a 'neutral' direction – i.e. 'External Environment' 'IS ASSOCIATED WITH' Safety-related Practices. Then, the content of the 'Relationships Node' was carefully analysed and formalised with a specification of the 'Type' of association (chosen between a list edited by the authors which included: 'SUPPORT(S)' (i.e. 'to strengthen, help something to continue'); 'HINDER(S)' (i.e. 'to obstruct, get in the way'; 'INFLUENCE(S)' (i.e. 'to have an effect on', whether positive or negative) and the 'direction' of this association. As a decision rule, existing relationships were kept as part of the analysis when we had at least one quote/coded strings from two middle managers representatives of two different organisations. By so doing, we tried to reduce possible biases due to organisational specificities. The outcome of this analysis is presented in Sections 4.2 and 4.3.

4. Results

4.1 Understanding the middle managers' safety-related practices and their surrounding dimensions

This section reports on the results of the descriptive analysis performed on the study codebook. Table 2 presents the total number (i.e. quantification) of coded text associated/coded within each code/theme of the codebook to support the comprehension of the related dimension.

Table 2: Codes and related references of unit of analysis and coding unit

Code/theme of the codebook	# Unit of analysis (interviews)	# Coding unit (coded text)
Mindset	39	432
Safety-related Practices	42	968
Immediate Working Environment	40	583
Organisational Environment	38	524
External Environment	37	261

Safety-related Practices [2]

The safety-related practices that the middle managers identify as central in relation to their role in the management of safety seem to point to three high-level categories: (1) managing information, (2) making decisions, and (3) influencing others.

'Managing Information' relates to all safety-related inputs that the middle managers receive, have access to, look for, or would like to receive/have access to in practice. This can be drawn from formal (e.g. participation in meetings and workshops where safety is discussed) and informal sources (e.g. personal networks and/or listening to peers and/or staff and/or field operators). Notably, informal channels appear to play a critical role in the middle managers' screening of information.

Further, both quantitative (statistics, figures, etc. from databases) and qualitative (e.g. hazard analysis, expert judgement, etc.) types of information are employed by the middle managers, who also seem to agree that there is not a preferred choice between the two, as one completes the other.

The middle managers' peculiar central position and role in the organisational hierarchy (i.e. constituting the middle line, providing the link between the strategic apex and the operating core) seem to create the right information-based and viewpoint-based environment to make decisions.

[2] This section summarises the findings (i.e. the middle managers' safety-related practices categorised as (1) managing information, (2) making decisions, and (3) influencing others) presented in a greater detail in Callari, et al. 2019a.

These decisions can be taken individually or counting on the available organisational resources depending on the time available or complexity of the stakes.

Finally, middle managers play a crucial role in promoting upward (with top-managers), downward (with staff) and lateral (with peers) influence throughout the organisation when safety is involved. In addition, the frequent contacts with outside-of-the-organisation stakeholders (e.g. clients, subcontractors, etc.) seem to suggest additional 'external influence' in relation to safety.

Although analysed individually, all three activities (managing information, making decisions and influencing others), or safety-related practices, constitute the distinctive and idiosyncratic competency that middle manager rely on to get the job done when it comes to contributing to safety. A detailed description and examples of the safety-related practices of middle managers in the safety aviation industry are provided in a previous study developed by the authors (Callari et al., 2019).

Mindset

This section reports what middle managers consider relates to the way they perceive and value safety as a broad concept. These beliefs may be drawn from the middle managers' personal approach to safety and to a manager's role, their individual experiences (e.g. memorable experience of real-life situations where safety translated into something concrete), and/or the educational and professional backgrounds.

All interviewed managers showed a strong sensitivity to safety. They argued that in their role of middle managers – the ones who deliver and support key organisational safety outcomes – safety becomes an indissoluble aspect of their professional identity that guides their actions and shapes their practices.

> *"I have been in aviation for so long, it goes into the blood, it becomes a reflex."*
>
> *"Safety becomes second nature, you think about safety all the time."*

The interviewed middle managers shared a strong commitment to safety. In their words, safety shall make a difference when it is fully embedded in the company's business – not considered as an overlay- even if it requires some independence from other stakes (e.g. production, budget, etc.). Further, they suggest safety is complex and dynamic, it relies on everyone - not just the safety department. They commented that 'safety of operations' should be inbred in every team member, and that safety related issues should always be addressed and not avoided or dismissed to another team. Further, they think that 'safety of operations' translates in the way business is done. It

involves taking safety as a starting point to access every business' capacity, efficacy and efficiency. This includes going beyond one's scope of responsibility to address safety. If safety is improved, then there is a direct link/impact on the overall performance.

> *"Safety is not another department's job. Safety has to be part of what we do, not 'the big thing on top of daily business'."*

> *"From my point of view, safety assessments are similar to audits: they might be perceived as additional obligations, a waste of time, but if you look at the positive side of them, they help you in identifying what you can do better, more efficiently, and this is beneficial for the system."*

The educational and professional backgrounds provide the middle managers with the experience needed to frame and address safety in their daily work. Some middle managers agree that their past experiences (either in the same or in a different organization, and/or same or different role) have given a consistent scaffolding to deal with safety-related events. A certain proximity to operations at a certain point in their career, witnessing a safety related event or its consequences, or emblematic mediatized accidents appear as triggers or amplifiers of middle managers' sensitivity to safety. Further, the roles of top managers (as model, sometimes also with a negative connotation), peers and/or colleagues in shaping their understanding and reflexivity of their safety-related practice becomes part of the middle manager's background experience.

Immediate Working Environment

The middle manager's immediate working environment refers to the specific middle manager's unit/department environment in which they operate, with its peculiar practices and culture[3]. To support this, the middle managers provided examples taken from their daily activity, and the way they coordinate their teams. Safety-related issues are discussed in formal meetings, but they are also discussed informally by middle managers with peers and/or staff. Safety is discussed as a cross-cutting topic; it is an embedded element in the agenda, not a specific topic for discussion. Current challenges to pursue safety in operations include: time availability within the teams, budget, the competency available within the unit/department, the existence of a trusting and 'Just Culture', and the support from the unit's management to create and develop these conditions.

> *"Safety issues are tackled systematically as part of the debriefing after each project. Safety is rarely the main topic of a dedicated meeting; it is usually one element among others."*

> *"People within the teams address the topics in depth. They don't want to be put in check by reviewers. We have several independent "justices of the*

[3] The middle manager's immediate working environment was distinguished from the organisational environment to account for the variability of practices within big organisations between different units/departments.

peace"; "If my staff discovers something, they will tell me. I've put in place an action follow-up activity (there's one guy responsible for that) for the recommendations agreed in the agreement meeting."

Keeping the focus on safety, the interviewed middle managers shared how the activities are implemented and the role played by the organisation (immediately surrounding them). Overall, they all agree that they receive support from the management whenever it's safety-related, before any budget or other priority issues. The management may challenge the middle manager to check the safety boundaries, but in the end they will always support. Overall, the interviewed managers showed a commitment to the Just Culture approach. Within the teams, to ensure there is no self-censoring to report safety issues, statements and assumptions written in the report are challenged. Overall, a trust climate is promoted, in which they push the staff not to hide anything safety related, maintaining very open communication channels.

"People from my team inform me if there is a problem but there is no difference between safety and other aspects. It is a matter of developing a trust climate. I proceed in a similar way for all aspects."

"I encourage reporting within the team, even with small stuff & low level. I'd rather know what's going on. I do not interfere with the low level stuff to give them local empowerment, but on major investigations I'm heavily involved."

Organisational Environment

The Organisational Environment covers the overall organisation's structure, processes, procedures, and culture, beyond the middle manager's unit/department, as they may play a role in influencing/affecting the middle managers' actions.

"In particular, I notice unnecessary complexity in the management of safety improvement proposals (emerging from safety investigations), where I have to handle actions that are not under my responsibility and which could be better managed at central level. Sometimes this decentralisation may impair the achievement of all the proposed safety goals"

Specifically, it includes the resources (qualitatively and quantitatively) made available to the middle managers by the organisation (human, technical, financial, time, information, processes/procedures, best practices/lessons learned…) or the framework/environment defined by the organization that influences the way the middle managers take safety into account in their daily activities. Various types of pressures – budget cuts, staff turn-over, and bureaucracy were mentioned, even though middle managers agreed these pressures are less strong when safety is at stake.

Additionally, they shared the opinion that people in supporting functions (HR, Finance…) might not have the same concern when safety is involved. They don't seem to consider safety to be a part of their business. Strong safety culture in most organizations involved especially at operational or close

to operations functions and for people having this kind of background. More doubts for other so-called "business" or "supporting" functions.

> *"Top issues in my organisation: management of staff and resources, and sometimes HR department is disconnected with the operations."*

> *"Air safety is present in the culture. The closest to the aircraft, the more present the subject (safety). It is present as well in Engineering (aircraft design), but is it in Finance?"*

External Environment

The external environment includes all the aspects, such as the regulatory environment and relationship with regulator, clients, supplier, etc., that may affect middle managers' decisions, work and actions in relation to safety. According to the middle managers' views, a number of issues are perceived as potential challenges: external pressure (e.g. time, financial, etc.) from customers, new market needs, new technologies, use of subcontractors to perform specific activities, and the relationship with the authority – i.e. EASA as a partner. On the other hand, they highlighted the support they receive from these same external stakeholders.

> *"The certification barrier is still there. Of course we need to do our job well, but it is healthy. EASA regrets to rely more and more on processes than on experts, but all in all, they do their job well. It is a good barrier."*

> *"The customer was nervous but we kept the aircraft for the evening to change the tyres. In that case, the pressure comes from the customer itself."*

4.2 The interplay between middle managers' individual / environmental dimensions and their safety-related practices

This section reports on the results of the explanatory analysis performed on the study codebook, and specifically, what helped, or conversely hindered, the middle managers' contribution to safety. Figure 3 presents the identified (type of) relationship emerging from the data between two codes/themes.

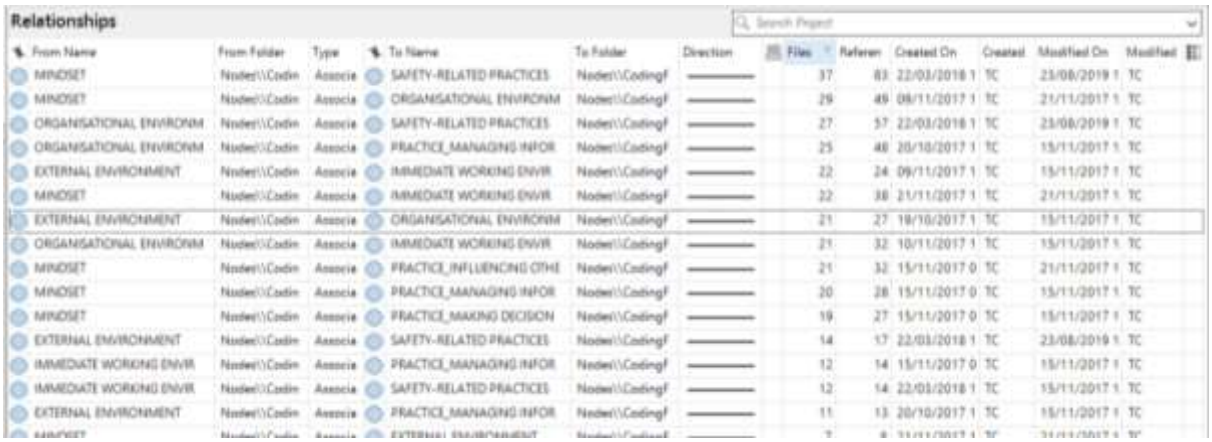

Figure 3: 'Relationship Nodes' in the NVivo Project.

The 'Mindset-Safety-related Practices' interrelation

Beyond shaping their sensitivity to safety, middle managers background and experience as well as their understanding of their management role are influencing their practices in several respects. Regarding their ways of making decisions, it not only influences the importance they give to safety, but also the process they rely on to make decisions.

For example, managers having had a certain proximity with operations or having had an inspiring experience through a senior's behaviour or reaction in the past (e.g. having experienced a manager standing up for safety and pushing to think further, beyond theory, compliance and at longer-term, or having had a manager always considering the safety impact of whatever decision or action) has a lasting influence on middle managers' sensitivity to safety. These experiences increase the reflexivity of middle managers' practice when it comes to safety and lead them to be conservative in case of doubt, whether directly or through supporting and encouraging their team to take a conservative approach when safety is at stake. To some extent, they act as a permanent safety consciousness guiding their decisions.

> *"These experiences contribute to ring a bell in such case and help me step back and respect the time it needs to find solutions."*

> *"If the situation involves releasing an aircraft into service, it draws my attention to safety, it puts me into "safety mode". We need to make sure of what we are doing."*

> *"I had to validate decisions from my certification & safety people that stopped things on the program to make sure documents were updated or other things were done. This induced additional work or pressure on Programs. But I always told them 'I support you'."*

Regarding the decision-making process, acknowledging the uncertainty when it comes to safety - namely that safety is rarely black or white, and that one cannot anticipate all the implications of a decision-, leads middle managers, when time permits, to confront differing viewpoints, involve several profiles and rely on multiple sources of information to make decisions. Even if the decision ultimately has to be made by one person only, middle managers had rather go through a collective approach to come up with the best trade-off considering as many aspects and inputs as possible.

> *"It is key to confront several viewpoints and validate together with these other people. We need to have a multi-culture, multi-viewpoints approach".*

The way the middle managers perceive their role as managers also influences their practices in relation to safety. Two aspects came out in particular as influencing the middle managers' safety-related practices: acting as a 'middle-man' and giving meaning and broadening people's horizons. The first

one leads middle managers to value informal channels and talk directly to people both to influence them, but also to look for information, especially directly from field operators/their staff. The second one leads middle managers to explain decisions and give the bigger picture to understand not only the safety stakes, but also the other stakeholders' objectives, problems, and constraints, thus identify the important questions to influence others on safety-related matters.

> *"Requests for collaboration are at personal levels with "sorts of gentlemen's agreements" and availability among people".*

> *"My role is to avoid adding noise to the system i.e. to cool my teams by explaining why there can be contradictory opinions, by giving meaning to the decisions"*

The 'Immediate Working Environment-Safety-related Practices' interrelation

The immediate working environment dimension was mentioned by middle managers as generally facilitating, sometimes even encouraging, their safety contribution. The characteristics presented hereafter as supporting middle managers are to be considered with some caution though, for they were mentioned and qualified as such with respect to a broader context.

Backing up conservative decisions of their staff when safety is at stake and symmetrically, knowing that their decisions will be backed up by their own manager influences both the decisions made by middle managers, and their staff's practices and attitudes in relation to safety. All will have a tendency to stay on the safe side. The middle manager may be challenged (e.g. by his/her own manager) regarding the decision, like s/he may challenge his/her own staff to make sure it makes sense and is not for comfort. If there are real safety implications, the middle manager will be supported, and will likewise support his/her staff.

> *"We never encountered obstacles when we said we do this, it is safety-related. I never had a boss who would said 'No, we don't do it on safety' "*

The middle manager's immediate working environment may also support the middle manager's practice in influencing others, making their voice heard with respect to safety, even if they are not the ones making the decision ultimately. One of the key supporting aspects is an immediate working environment encouraging and making it easy to have direct exchanges and discussions with others and developing personal relationships. One of the enablers highlighted by middle managers is the geographical proximity, ideally co-location for it helps developing credibility and trust, thus providing a basis for influencing others. Formal meetings are also a way for discussing with others, however they don't appear to be as powerful as informal channels when it comes to influencing others. In addition, a working environment facilitating open communication channels and encouraging reporting supports the middle manager's influencing others practice.

> *"I give the information I have during our Monday meetings and then I go and see the people involved."*

> *"We have a speak-up culture i.e. everybody has the feeling that s/he can speak of any topic (HR, safety…) with you and s/he'll get feedback. We are very much collocated (excepted for a small part in another country). Anyone can come and see me easily or send an email. (…) We go through the teams from time to time. Some people won't come to you. It's important to get a personal relation."*

The immediate working environment may also support middle managers in their management of safety-relevant information. Indeed, an immediate working environment, where safety is part of a meeting's discussions helps managing information, as it allows receiving and disseminating information needed to make safety wise decisions/work. Likewise, an environment facilitating easy access/open relationships with others (e.g. staff, peers, top-managers) supports middle managers in getting information that is relevant to safety, even if it requires an effort to discriminate between facts and perceptions.

> *"We are data rich but not necessarily information rich. There is currently no individual reporting of fatigue but we know from informal discussions & anecdotal feedback there is fatigue. So you have to go to people and talk to them and listen to them. We're not overly busy but getting out that information is difficult (and cutting out the rubbish is difficult as well). Is what we are being told true or perceived to be true?"*

The 'Organisational Environment-Safety-related Practices' interrelation

Several aspects of the organisational environment were shared by middle managers as influencing their safety-related practices, thus ultimately their contribution to safety.

Proximity either geographical or through regular opportunities to work and exchange with the people who have the information, have to be influenced, can be involved in decisions turns out to be a key aspect facilitating (or hindering if absent) middle managers' contribution to safety. This proximity may partly rely on formal organisational arrangements, such as colocation or processes/procedures bringing people together on a frequent enough basis that may as well facilitate informal open exchanges. By fostering exchanges, through people working together, sharing their information, views and knowledge, developing trust, proximity ultimately promotes the three main activities through which middle managers contribute to safety, namely, managing information, influencing others and making decisions. Its absence conversely is perceived as hindering middle managers' safety-related activities.

> *"What helps a lot is the daily work between the different people: project manager, technical deputy of the chief engineer and safety representative."*

"There is also an informal one. Since at our level we know each other in the various departments, we can share doubts but eventually, the ones in charge of the topic (e.g. programs) make the decision".

"The lack of proximity to some people is a challenge. People are in different sites. The local Chief engineer is here but the more central ones are not, so we don't see them often. It takes time for him to understand us and for us to understand him. It takes time to develop credibility."

Time pressure, induced by bureaucracy and the increase in information availability and accessibility, prevents middle managers from taking sufficient time to process all the information (amount and pace) they are getting, understanding all the aspects and impacts and properly informing the decision or developing the right arguments to influence others on aspects related to safety. What may counteract this pressure though is the middle manager mindset (his/her view of what needs to be protected most between safety and other demands).

"The increase in information and speed to get the information is a challenge. Discriminating between important and non-important information becomes a real challenge."

"We are overwhelmed with HR & financial tasks to the detriment of time spent to understand things."

The organisational culture and the importance of safety overall in the organisation is another big area making a different on middle managers' practices to influence others on safety-related matters. A good safety culture, widely shared across the organisation, will support middle managers' contribution to safety. Conversely, when safety culture is not so good or not shared across the organisation, it hinders middle managers' contribution to safety. It is the case for example when some middle or top-managers in the organisation are focused on other 'core business' indicators (e.g. costs, productivity) or not wanting to hear bad news. Indeed, it creates conditions detrimental to raising or defending possible safety concerns at all levels or making conservative decisions by fear of not being supported.

"I very often have to make that kind of decision with impact on cost and time. Sometimes, there is a very high business impact. Organisationally, we are very well supported."

"In the operational environment, I try influencing peers for them to adopt this style of management. It might be more problematic for others because they may have a tendency to be driven by delivery, milestones, costs, etc. So, their focus is different from mine."

"Organisational decisions are always more on product and business. It is very difficult to trade off safety and business. You always need evidence and knowledge supporting the leverage of safety argument against operational arguments"

The 'External Environment-Safety-related Practices' interrelation

Although depending on their role within their organisations, middle managers did not all have similar interactions with the outside world, some external factors came out as influencing their contribution to safety.

Regulatory authorities through their requirements or recommendations may influence middle managers' practices in ways that are not always intuitive. Sometimes the targets or requirements set by Authorities are considered not beneficial to safety, or as being uneconomic. These cases can lead to significant discussion effort and/or middle managers choosing to comply with overly prescriptive requirements. However, the most safety-oriented practices are the ones of middle managers who are more driven by what makes their activity safe than by mere compliance (as a result of their mindset). Indeed, they then go beyond regulatory requirements if they consider it is needed.

> *"I sometimes regret that some engineers consider the Authorities as a referee: "We will ask the Authorities"".*

> *"The Authorities have an influence. In one case, they were more stringent than we would have liked in the interpretation of the requirements. It was easier to comply & deliver the aircraft to the waiting customers than argue they were overly prescriptive."*

> *"We discussed with them [the Authorities] for we thought their proposal was uneconomic and bringing no benefit. We engaged into a lengthy discussion process to explain our solution."*

4.3 The interplays among the individual and environmental dimensions

Beyond the interplay between the middle managers' individual and environmental dimensions, and their safety-related practices, , the immediate working environment, organisational environment, and external environment dimensions appear to be as well intertwined with one another, forming a complex whole. The main interrelations identified are developed hereafter. The middle manager's mindset significantly influences the immediate working environment in creating safety-prone conditions. For example, a middle manager with a safety-oriented mindset encourages his/her team to resolve safety issues before any other priority issues, pushes them to adopt a reflexive attitude, including making sense of what they do, challenging the impact of what they do. S/he also creates conditions (trust, openness, listening attitude) that encourages the team to speak up, or that make his/her staff confident in the fact that they will be supported when making, for example, a conservative decision for safety-related reasons.

> *"My responsibility is to remind my teams that understanding everything that is safety-related is key."*

The middle manager's mindset also acts as a moderator of the organizational environment or of the external environment. Indeed, a safety-oriented mindset may [lead] middle managers to stand up for safety and counterbalance any pressure coming from organizational or external factors (e.g. top management and/or regulatory/clients requirements) that could jeopardise safety.

> *"The airline was keen to dispatch the aircraft because it was a small leak and they wanted to go back to their home base to fix it. On the first call, I decided that I wouldn't let them go. It was a fire of unknown origin and a fuel leak of unknown size."*

The immediate working environment and the organisational environment are also intertwined in several respects, even more so in large organization where they can easily be distinguished (as developed later in the Discussion). For example, if the staff feels supported by their middle managers, they may feel pushed to take safety precautions that may have significant impacts at the overall organizational level.

> *"My team insisted to make tests with erroneous information provided by the system. It induced some delay to the project, but it proved that the erroneous information had an unwanted impact. I was pleased that we insisted since it led to modifications."*

At the overall organisational level, Human Resources (HR) policies, especially regarding competence and career management, can either be an enabler or an obstacle to having a favourable immediate working environment to positively contribute to safety. What makes a big difference is especially the turn-over policy, the possibility to let people stay for a long enough period of time to become experts in certain domains, face sufficient challenges on the job and in the area to be able to stand back and properly consider safety.

> *"What helps also is the competence management. In my department, we try and have people that are mature in certification and safety."*

> *"Sometimes it is not so easy with the HR when we want to do it. They [the HR] have good reasons but there is too big a distinction between the talents and the rest of the employees. The ones who bring experience and do a good job are not so easy to reward."*

In large organisation, where the activity tends to be formalised by an increasing number of processes, several middle managers observed that people tend to rush to processes and think less by themselves, pay less attention to understanding the reasons why the processes involve such steps.

> *"This [the frameworks, processes, procedures] may have diluted reflection and reduced the sense of responsibility a bit too much. (…) People tend to rush to processes and think less by themselves. "Why did you write this? Because it's written in the template." But without understanding why it is so."*

The interplay between the external environment and the immediate working environment is sometimes unexpected. Setting targets and monitoring what organisations do by Authorities, may, in

some cases, turn out to have a negative influence on the middle manager's immediate working environment. Indeed, it may lead to too much reliance on the Authority as a front-line actor to ensure safety ("tell us if what we've done is fine") as opposed to considering the Authority as a redundancy or an ultimate independent safety net ("just checking because we already convinced ourselves that it is fine").

5. Discussion

This study aimed to shed light on the middle managers' contributions to safety in the European civil aviation industry, and more specifically to provide an overview of the conditions able to support, or conversely hinder, their doing so.

Some concrete actions were suggested by middle managers to make their environment more supportive to their contribution to safety in several respects. Reviewing KPIs to avoid their being sometimes in contradiction with necessary precaution, or strong safety messages coming from the top were advanced as ways forward to create the conditions to allow and encourage everyone at all levels to make a conservative decision when safety is at stake. Co-location or regular occasions to meet and work together (including time from informal exchanges) with a variety of people were cited to create the conditions to facilitate open communication channels, direct exchanges and personal relationships between employees from different functions and different hierarchical levels when just culture is a reality. Limiting the volume of resources dedicated to administrative activities and more generally limiting the organizational pressure that can be induced not only by bureaucracy but also by pressure on cost, delay and resources thus by current performance indicators and the way they are used was another area that was suggested by middle managers as a practical way to creating the conditions for them to have sufficient time to gather and process relevant information, understand the possible safety stakes and develop adequate arguments to inform decisions. Furthermore, reviewing the organisational processes (e.g. the multiplication of very detailed ones), individual appraisal practices, empowerment was advanced as a way to create the conditions for people to think by themselves, challenge themselves, make sense of what they do rather than rely on others to review what they do.

Although these insights can be considered as a basis for further investigation, their value needs to be qualified since they make sense in a global context, that of the managers who expressed these views, and need to be adapted to the specific context of each organisation.

The data-driven approach adopted, relying on a thorough and robust analysis of interview material, led to the identification of recurring dimensions (internal and external to the organisation) that

interplay with middle managers' safety-related practices to either support or hinder their contribution to safety. These dimensions and the various aspects they involve are interrelated not only with the middle managers' safety-related practices directly, but also with one another. As such, they create a sort of 'safety-related universe' (Figure 4) in relation to which the middle managers' contribution to safety emerges.

Figure 4: The middle managers' safety-related universe

Thus, understanding middle managers' contribution to safety and how to support it, requires embracing at least these three dimensions, conversely to most studies that focus on either individual or organisational aspects.

Regarding organisational aspects, middle managers confirm that they play an important role on their contribution to safety. However, their views on this interplay with their safety-related practices leads to distinguish between the middle manager's immediate working environment and the overall environment of the middle manager's organisation itself because the culture, resources and practices may vary from one group/department/division to another in large organisations as the ones represented in this study. For example, as mentioned earlier, the proximity of people (thus of a whole unit/department) to operations increases their sensitivity to safety and the safety impact of their decisions and actions. The results overall show some convergence with the existing literature on organisational factors that are favourable to safety (Schulman et al., 2004; Tappura et al., 2017). Our research allowed for providing concrete illustrations of some of these organisational factors directly derived from middle managers' actual experience and practices as both acting as managers in the middle layer, but also as a staff member being managed by higher level managers. It is the case for example of supporting and backing-up staff when safety is at stake (that was both practiced by interviewees as managers and actually mentioned as supportive when coming from their

688 management above). In line with Schulman et al. (2004) our results confirmed and illustrated the value
689 of buffering contradictions between different organisational strategies by making sense of them.

690 Middle managers also pointed out some organisational conditions influencing their contribution to
691 safety that were already identified in the HRO theory or by Tappura et al. (2017). In particular, having
692 a supportive management when safety is involved has a positive influence, whereas the increase in
693 bureaucratic tasks reduces the time available for understanding things, which hinders middle
694 managers contribution to safety especially since the amount and pace of information is increasing.
695 The flexibility of decision-making processes depending on what the situation requires (a key feature
696 of HROs), was not worded as such by our interviewees. Yet, the examples provided by middle
697 managers illustrate different decision-making processes depending on the urgency of the decision.
698 For quick decisions in relation to real-time operations, they tend to decide on their own with the
699 assurance to be supported by their superiors, when being conservative safety-wise. For non-urgent
700 decisions, the organisational processes in place, involve or support rather collective work.

701 By entering within middle managers actual daily activities and anecdotes, our research emphasised a
702 number of other organizational factors affecting middle managers' contribution to safety.
703 Organisational arrangements facilitating 'proximity', either geographical or through regular
704 opportunities to work and exchange with others (peers, staff, managers) whether formally or
705 informally were identified by middle managers as greatly supporting their safety-related practices.
706 Sharing information, views, knowledge, doubts, developing trust, some of the key safety-related
707 aspects mentioned by middle managers are indeed fostered by 'proximity'. Likewise, HR policies
708 especially regarding competence management was highlighted by middle managers as influencing
709 their immediate working environment and therefore, their capability to contribute to safety. Staying
710 long enough in a job turns out to be necessary to develop the experience necessary to stand back and
711 consider safety.

712 Finally, middle managers also identified the role of external actors, especially authorities, as
713 influencing their practices in relation to safety as well as their immediate working environment
714 although not always in a positive manner, thereby qualifying La Porte's argument on 'knowledgeable
715 watchers' as a way to maintain the culture of reliability (La Porte, 1996). Although providing a general
716 useful framework and an external watchfulness, some drifts were pointed out as possibly negatively
717 influencing practices (e.g. relying on the Authority as a referee).

718 Although middle managers didn't spontaneously relate it to organisational factors, it was overall
719 shared that being familiar with operations, one way or another, significantly supported middle

managers' safety mindset, and as such contributes to the middle managers' safety-related practices. This aspect could also be seen from an organizational angle through career path management.

More generally, other individual aspects were advanced by middle managers as influencing their contribution to safety that we combined under the individual dimension that we labelled mindset. Attitudes and commitment towards safety were part of them. All the interview data related to these aspects were analysed qualitatively, collecting the educational and professional background and experiences, and how these shaped the middle managers' career path. Although we are aware of the limitations of this approach, and the challenge to grasp 'real attitudes', this gave us the opportunity to understand the extent to which the past experiences (both positive and negative) helped the middle manager forge specific strategies and practices, particularly in managing information, making decisions, and influencing others. The results show that beyond a direct influence on middle managers' practices such as having a tendency to stay on the safe side when in doubt, middle managers' mindset also acts as moderator of other influences. As illustrated earlier, a safety mindset may lead a middle manager to resist pressure from either internal stakeholders or external ones such as clients. It will rather lead to influencing these stakeholders to come to the same conservative decision when safety is at stake.

This result emphasises the need for adopting a systemic view combining individual, organisational, external aspects and their interrelations when it comes to understanding middle managers' contribution to safety and what may promote or hinder it. Although the analysis of the relationships and influences between the various dimensions was originally aiming at identifying the interrelations between individual, immediate working environment, organizational and external factors on the one hand and middle managers' safety-related practices on the other hand, what came out was also a number of interrelations between these dimensions. For example, in big organisations, our results suggest that the influence of the organisational environment is not only on middle managers' practices directly, but also indirectly through their immediate working environment (through HR policies for example). Similarly, the interplay between existing regulation and oversight mechanisms and middle managers' staff tendency to over-rely to Authorities as referee (i.e. between the external environment and the immediate working environment) was highlighted.

Eventually, the interplay between the various aspects account for the dynamics and complexity that middle managers were putting forward in their anecdotes and experience. Middle managers suggest that their safety-related practices emerge not only from a set of individual, organisational and external factors, but also from their interrelations with one another. Critically, characterising the influence of a given aspect as always positive or negative on middle managers' contribution to safety becomes

challenging. Indeed, the example of the Authority addressed earlier provides a good illustration. In line with La Porte (1996), the existence of knowledgeable 'watchers', as Authorities are in the European civil aviation, is characterized as one of the conditions for an organization to sustain a high-reliability performance. Yet, in some cases, it may lead middle managers' staff to over-rely on them, thereby disabling the safety net they are supposed to represent. Identifying this phenomenon and influencing his/her staff to think for themselves safety wise results from the middle manager's mindset in terms of both his/her sensitivity to safety and understanding on his/her role as a manager.

6. Conclusion

Although this research suggests a systemic view on middle managers' safety-related practices, further investigation would be needed to reach beyond the limitations of our approach. A first avenue for future work would be to complete this work with other perspectives than that of middle managers themselves. Further interviews and field observations involving their staff and top-management would help confirm, complete, and expand the reach of the results.

Moreover, the current findings show no example of negative interrelation between middle managers mindset and their practices or between their immediate working environment and their practices. Interestingly, middle managers' views on the organisational environment and external environment was more critical with a number of factual examples of hindering aspects. This result may derive from a possible bias related to the interviewees' sample consisting of volunteer middle managers, thus already having a special interest in safety. As such, they may have described mainly the supportive aspects of mindset. Similarly, the possibility of a psychological bias behind the mutual support between middle managers' practices and their immediate working environment would be worth exploring, since they may consider that this environment is partly under their sphere of control and/or influence. Interviewing a wider set of middle managers would help determining whether the views described here are representative or possibly too optimistic. Anyhow, considering middle managers safety-related practices as emergent properties of a complex socio-technical system seems a promising avenue to better understand and ultimately better support them.

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