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Individual and environmental dimensions influencing the middle managers' contribution to safety: the emergence of a 'safety-related universe'

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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

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

48 This study represents a complementary work to the one published in 2019 (Callari et al., 2019a). The
49 over-arching aim of this study was to add further knowledge on the dimensions and/or conditions
50 that play a role in influencing the middle managers' safety-related practices, specifically within
51 European civil aviation organisations. Although we recognise – as cited earlier – that recent studies
52 have started focussing on the intermediate levels of management, especially outside of specific
53 safety management functions, we argue that more research should be undertaken on the topic.
54 Therefore, we drew from the data-set of our previous research¹, and analysed the views,
55 experiences and challenges of middle managers in relation to all the conditions that could play a role
56 in either supporting or hindering their contribution to safety. These conditions may embrace
57 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.

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

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

65 2. Literature review

66 2.1 Organisational factors

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

72 In line with this, according to Schulman et al. (2004), an organisation needs to possess a number of
73 characteristics to have a high-reliability performance. These characteristics may include a formal
74 specification of the core unwanted events, as well as an identification of precursor events or
75 conditions, but also clear priorities and procedures to prevent them from occurring. Beyond a
76 specific focus on the events to be precluded, they also need to foster and reward employees'
77 sensitivity and attentiveness, find ways to manage conflicting goals and strategies and buffer their
78 paradox. It also needs to establish formal roles, responsibilities and reporting lines that can change
79 when the situation demands quick responses requiring specific expertise. Finally, it also needs to
80 identify and acknowledge its key features that can degrade with time and have an external
81 environment supporting all of the above through watchfulness (e.g. regulation, oversight).

82 Interestingly, the HRO theory underlines, beyond the organisational characteristics supporting a
83 high-reliability performance, the importance of external factors. La Porte (1996) insists on the key
84 role of these external support "*for achieving the internal conditions of trustworthiness*" (p.65).
85 Indeed, whether regulators or even more so "*knowledgeable 'watchers'*"(p.65), they contribute to
86 maintain the culture of reliability, and legitimate investments/operations contributing to reliability
87 and safety in the eyes of corporate and regulatory actors.

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

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

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

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

127 2.2 Individual factors

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

130 Safety commitment is often associated in the scientific literature with effective leadership,
131 appreciation of responsibility for safety, continuous safety-related feedback and reinforcement for
132 an effective safety climate (Fruhen, Griffin, & Andrei, 2019; Fruhen et al., 2014a). The quality of
133 leadership is argued to play a significant role in sustaining and influencing the organisations’ and
134 employees’ safety performance and productivity. Different leadership approaches and styles may
135 achieve this: trait (focusing on physical, mental, and personal attributes that could be associated to
136 leadership success), behavioural (the way the leaders behave sets an example to the workforce),
137 situational (effective leadership is task-relevant and considerate of the ‘performance readiness’ of
138 the group to influence), and transactional/transformational leadership theories/models (Bass, 1990;
139 Blanchard, Zigarmi, & Zigarmi, 1985; Hersey & Blanchard, 1969; Kuhnert & Lewis, 1987; Stogdill,
140 1948; Yukl, 1989, 1994). Bass' Transactional and Transformational Leadership theory is argued to be
141 one of the most comprehensive leadership theory in organisational studies (Bass, 1990, 1997; Bass &
142 Avolio, 1994), and an effective method of leading safety towards positive safety compliance and
143 safety participation (Clarke, 2013; Tappura, Sievänen, Heikkilä, Jussila, & Nenonen, 2015). While a
144 transactional leading style is more about setting targets, monitoring performance, rewarding good
145 results, transformational leaders motivate and encourage staff to commit to safety goals through
146 his/her own example (Flin & Yule, 2004; Fruhen et al., 2019; O'Dea & Flin, 2001; Tappura, et al.,
147 2017). Further, these leaders show a certain *charisma*, through their personality and ideas for which
148 they stand, and as a consequence of this, the followers go after their leader(s) on the basis of the
149 confidence and trust they have in him/her (Bass, 1985; Conchie, Taylor, & Donald, 2012; Hoffmeister
150 et al., 2014; Podsakoff, MacKenzie, Moorman, & Fetter, 1990).

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

157 dimensions/characteristics for an effective safety climate: (a) perceived management attitudes
158 towards safety, (b) perceived effects of safe conduct on promotion, (c) perceived effects of safe
159 conduct on social status, (d) perceived organisational status of safety officer, (e) perceived
160 importance and effectiveness of safety training, (f) perceived risk level at work place, and (g)
161 perceived effectiveness of enforcement versus guidance in promoting safety (Zohar, 2002, p.98).
162 Indeed, to improve safety climate within organisations, feelings of workers' responsibility for safety
163 and more positive appraisals of senior management commitment should be enhanced (Yule, Flin, &
164 Murdy, 2007). Other researches have investigated the role of management's influence on
165 organisational practices and their safety values as reflecting managers' safety commitment. Trust in
166 management and perceived safety climate were found to mediate the relationship between an high-
167 performance work system and safety performance measured in terms of personal-safety orientation
168 (i.e., safety knowledge, safety motivation, safety compliance, and safety initiative) and safety
169 incidents (i.e., injuries requiring first aid and near misses) (Zacharatos, Barling, & Iverson, 2005). The
170 mediated role of trust in safety leadership styles was investigated by Hansez and Chmiel (2010).
171 Their findings suggest that trust and affective bonds seem more effective than 'good reason'
172 arguments in encouraging safety voice behaviours in employees. The perceptions of safety in
173 organisations, and role of safety climate, motivation, and behaviour to perform safely were explored
174 in a number of studies of Griffin and Neal (see for example: Griffin & Neal, 2000; Neal & Griffin,
175 2006).

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

182 3. Methodology

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

190 and quantification of the study outcomes. Further, it supported the achievement of the study
191 reliability and validity. Both authors of this study shared the same NVivo project and validated all
192 phases of the research (particularly during the codification and analysis activity), to enhance the
193 trustworthiness of the study results (Bazeley & Jackson, 2013; Nowell, Norris, White, & Moules,
194 2017).

195 3.1 Study participants

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

202 **Table 1: Study participants**

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

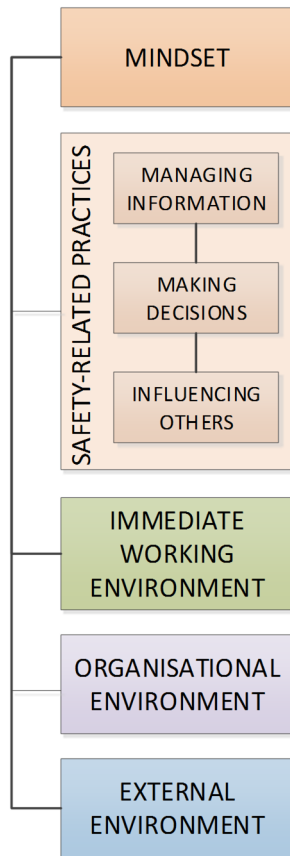
203

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

209 3.2 Data collection

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

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



222
223 **Figure 1: Codes/themes guiding the design of the interview guideline**

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

228 3.3 Data analysis

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

236 Following this, a subsequent explanatory analysis was performed through the identification of
 237 existing relationships between the codes/themes of the codebook, and as such able to infer the
 238 mechanisms/factors that affect the middle managers' practice in taking safety into account. In the
 239 NVivo project a 'Matrix Coding Query' was run to cross-tabulate the co-occurrences identified
 240 between the codes of the codebook - namely. between the Mindset, Immediate Working
 241 Environment, Organisational Environment, and External Environment, (i.e. the middle managers'
 242 individual and environmental dimensions) on the one side, and the middle managers' Safety-related
 243 Practices, on the other (Figure 2). This was done to explore which middle managers' individual or
 244 environmental characteristics were mostly associated with middle managers' safety-related
 245 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

246

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

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

260 4. Results

261 4.1 Understanding the middle managers’ safety-related practices and their
262 surrounding dimensions

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

266 **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

267 **Safety-related Practices**²

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

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

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

280 The middle managers’ peculiar central position and role in the organisational hierarchy (i.e.
281 constituting the middle line, providing the link between the strategic apex and the operating core)
282 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.

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

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

289 Although analysed individually, all three activities (managing information, making decisions and
290 influencing others), or safety-related practices, constitute the distinctive and idiosyncratic
291 competency that middle manager rely on to get the job done when it comes to contributing to
292 safety. A detailed description and examples of the safety-related practices of middle managers in the
293 safety aviation industry are provided in a previous study developed by the authors (Callari et al.,
294 2019).

295 Mindset

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

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

305 *"I have been in aviation for so long, it goes into the blood, it becomes a*
306 *reflex."*

307 *"Safety becomes second nature, you think about safety all the time."*

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

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

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

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

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

333 **Immediate Working Environment**

334 The middle manager's immediate working environment refers to the specific middle manager's
335 unit/department environment in which they operate, with its peculiar practices and culture³. To
336 support this, the middle managers provided examples taken from their daily activity, and the way
337 they coordinate their teams. Safety-related issues are discussed in formal meetings, but they are
338 also discussed informally by middle managers with peers and/or staff. Safety is discussed as a cross-
339 cutting topic; it is an embedded element in the agenda, not a specific topic for discussion. Current
340 challenges to pursue safety in operations include: time availability within the teams, budget, the
341 competency available within the unit/department, the existence of a trusting and 'Just Culture', and
342 the support from the unit's management to create and develop these conditions.

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

346 *"People within the teams address the topics in depth. They don't want to be*
347 *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.

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

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

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

363 *“I encourage reporting within the team, even with small stuff & low level.*
364 *I’d rather know what’s going on. I do not interfere with the low level stuff to*
365 *give them local empowerment, but on major investigations I’m heavily*
366 *involved.”*

367 **Organisational Environment**

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

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

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

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

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

387 *“Top issues in my organisation: management of staff and resources, and*
 388 *sometimes HR department is disconnected with the operations.”*

389 *“Air safety is present in the culture. The closest to the aircraft, the more*
 390 *present the subject (safety). It is present as well in Engineering (aircraft*
 391 *design), but is it in Finance?”*

392 **External Environment**

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

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

403 *“The customer was nervous but we kept the aircraft for the evening to*
 404 *change the tyres. In that case, the pressure comes from the customer*
 405 *itself.”*

406 **4.2 The interplay between middle managers’ individual / environmental**
 407 **dimensions and their safety-related practices**

408 This section reports on the results of the explanatory analysis performed on the study codebook,
 409 and specifically, what helped, or conversely hindered, the middle managers’ contribution to safety.

410 Figure 3 presents the identified (type of) relationship emerging from the data between two
 411 codes/themes.

Relationships												Search Project	
From Name	From Folder	Type	To Name	To Folder	Direction	Files	Referen	Created On	Created	Modified On	Modified		
MINDSET	Nodes\Codin	Associa	SAFETY-RELATED PRACTICES	Nodes\CodingF	-----	37	83	22/03/2018 1	TC	23/08/2019 1	TC		
MINDSET	Nodes\Codin	Associa	ORGANISATIONAL ENVIRONM	Nodes\CodingF	-----	29	49	09/11/2017 1	TC	21/11/2017 1	TC		
ORGANISATIONAL ENVIRONM	Nodes\Codin	Associa	SAFETY-RELATED PRACTICES	Nodes\CodingF	-----	27	57	22/03/2018 1	TC	23/08/2019 1	TC		
ORGANISATIONAL ENVIRONM	Nodes\Codin	Associa	PRACTICE_MANAGING INFOR	Nodes\CodingF	-----	25	48	20/10/2017 1	TC	15/11/2017 1	TC		
EXTERNAL ENVIRONMENT	Nodes\Codin	Associa	IMMEDIATE WORKING ENVIR	Nodes\CodingF	-----	22	24	09/11/2017 1	TC	15/11/2017 1	TC		
MINDSET	Nodes\Codin	Associa	IMMEDIATE WORKING ENVIR	Nodes\CodingF	-----	22	38	21/11/2017 1	TC	21/11/2017 1	TC		
EXTERNAL ENVIRONMENT	Nodes\Codin	Associa	ORGANISATIONAL ENVIRONM	Nodes\CodingF	-----	21	27	19/10/2017 1	TC	15/11/2017 1	TC		
ORGANISATIONAL ENVIRONM	Nodes\Codin	Associa	IMMEDIATE WORKING ENVIR	Nodes\CodingF	-----	21	32	10/11/2017 1	TC	15/11/2017 1	TC		
MINDSET	Nodes\Codin	Associa	PRACTICE_INFLUENCING OTHE	Nodes\CodingF	-----	21	32	15/11/2017 0	TC	21/11/2017 1	TC		
MINDSET	Nodes\Codin	Associa	PRACTICE_MANAGING INFOR	Nodes\CodingF	-----	20	28	15/11/2017 0	TC	15/11/2017 1	TC		
MINDSET	Nodes\Codin	Associa	PRACTICE_MAKING DECISION	Nodes\CodingF	-----	19	27	15/11/2017 0	TC	15/11/2017 1	TC		
EXTERNAL ENVIRONMENT	Nodes\Codin	Associa	SAFETY-RELATED PRACTICES	Nodes\CodingF	-----	14	17	22/03/2018 1	TC	23/08/2019 1	TC		
IMMEDIATE WORKING ENVIR	Nodes\Codin	Associa	PRACTICE_MANAGING INFOR	Nodes\CodingF	-----	12	14	15/11/2017 0	TC	15/11/2017 1	TC		
IMMEDIATE WORKING ENVIR	Nodes\Codin	Associa	SAFETY-RELATED PRACTICES	Nodes\CodingF	-----	12	14	22/03/2018 1	TC	15/11/2017 1	TC		
EXTERNAL ENVIRONMENT	Nodes\Codin	Associa	PRACTICE_MANAGING INFOR	Nodes\CodingF	-----	11	13	20/10/2017 1	TC	15/11/2017 1	TC		
MINDSET	Nodes\Codin	Associa	EXTERNAL ENVIRONMENT	Nodes\CodingF	-----	7	8	21/11/2017 1	TC	21/11/2017 1	TC		

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

414 **The 'Mindset-Safety-related Practices' interrelation**

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

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

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

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

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

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

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

445

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

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

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

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

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

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

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

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

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

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

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

491

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

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

505 **The ‘Organisational Environment-Safety-related Practices’ interrelation**

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

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

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

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

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

527

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

534 *“The increase in information and speed to get the information is a*
535 *challenge. Discriminating between important and non-important*
536 *information becomes a real challenge.”*

537 *“We are overwhelmed with HR & financial tasks to the detriment of time*
538 *spent to understand things.”*

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

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

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

555 *“Organisational decisions are always more on product and business. It is*
556 *very difficult to trade off safety and business. You always need evidence*
557 *and knowledge supporting the leverage of safety argument against*
558 *operational arguments”*

559 The 'External Environment-Safety-related Practices' interrelation

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

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

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

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

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

580

581 4.3 The interplays among the individual and environmental dimensions

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

593 *“My responsibility is to remind my teams that understanding everything*
594 *that is safety-related is key.”*

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

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

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

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

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

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

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

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

628 *“This [the frameworks, processes, procedures] may have diluted reflection*
629 *and reduced the sense of responsibility a bit too much. (...) People tend to*
630 *rush to processes and think less by themselves. “Why did you write this?”*

631 *Because it's written in the template." But without understanding why it is*
632 *so."*

633 The interplay between the external environment and the immediate working environment is
634 sometimes unexpected. Setting targets and monitoring what organisations do by Authorities, may, in
635 some cases, turn out to have a negative influence on the middle manager's immediate working
636 environment. Indeed, it may lead to too much reliance on the Authority as a front-line actor to
637 ensure safety ("tell us if what we've done is fine") as opposed to considering the Authority as a
638 redundancy or an ultimate independent safety net ("just checking because we already convinced
639 ourselves that it is fine").

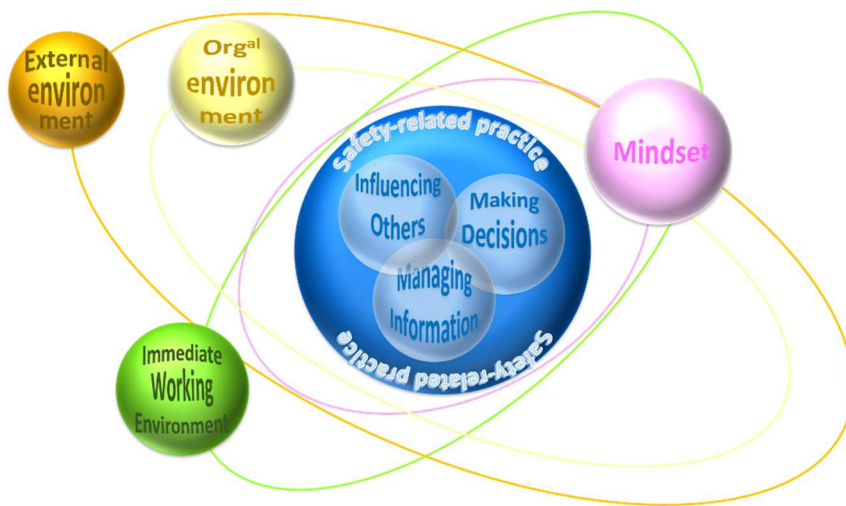
640 5. Discussion

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

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

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

665 The data-driven approach adopted, relying on a thorough and robust analysis of interview material,
666 led to the identification of recurring dimensions (internal and external to the organisation) that
667 interplay with middle managers' safety-related practices to either support or hinder their
668 contribution to safety. These dimensions and the various aspects they involve are interrelated not
669 only with the middle managers' safety-related practices directly, but also with one another. As such,
670 they create a sort of 'safety-related universe' (Figure 4) in relation to which the middle managers'
671 contribution to safety emerges.



672

673 **Figure 4: The middle managers' safety-related universe**

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

677 Regarding organisational aspects, middle managers confirm that they play an important role on their
678 contribution to safety. However, their views on this interplay with their safety-related practices
679 leads to distinguish between the middle manager's immediate working environment and the overall
680 environment of the middle manager's organisation itself because the culture, resources and
681 practices may vary from one group/department/division to another in large organisations as the
682 ones represented in this study. For example, as mentioned earlier, the proximity of people (thus of a
683 whole unit/department) to operations increases their sensitivity to safety and the safety impact of
684 their decisions and actions. The results overall show some convergence with the existing literature
685 on organisational factors that are favourable to safety (Schulman et al., 2004; Tappura et al., 2017).

686 Our research allowed for providing concrete illustrations of some of these organisational factors
687 directly derived from middle managers' actual experience and practices as both acting as managers
688 in the middle layer, but also as a staff member being managed by higher level managers. It is the
689 case for example of supporting and backing-up staff when safety is at stake (that was both practiced
690 by interviewees as managers and actually mentioned as supportive when coming from their
691 management above). In line with Schulman et al. (2004) our results confirmed and illustrated the
692 value of buffering contradictions between different organisational strategies by making sense of
693 them.

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

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

717 Finally, middle managers also identified the role of external actors, especially authorities, as
718 influencing their practices in relation to safety as well as their immediate working environment

719 although not always in a positive manner, thereby qualifying La Porte's argument on 'knowledgeable
720 watchers' as a way to maintain the culture of reliability (La Porte, 1996). Although providing a
721 general useful framework and an external watchfulness, some drifts were pointed out as possibly
722 negatively influencing practices (e.g. relying on the Authority as a referee).

723 Although middle managers didn't spontaneously relate it to organisational factors, it was overall
724 shared that being familiar with operations, one way or another, significantly supported middle
725 managers' safety mindset, and as such contributes to the middle managers' safety-related practices.
726 This aspect could also be seen from an organizational angle through career path management.

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

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

751 and middle managers' staff tendency to over-rely to Authorities as referee (i.e. between the external
752 environment and the immediate working environment) was highlighted.

753 Eventually, the interplay between the various aspects account for the dynamics and complexity that
754 middle managers were putting forward in their anecdotes and experience. Middle managers suggest
755 that their safety-related practices emerge not only from a set of individual, organisational and
756 external factors, but also from their interrelations with one another. Critically, characterising the
757 influence of a given aspect as always positive or negative on middle managers' contribution to safety
758 becomes challenging. Indeed, the example of the Authority addressed earlier provides a good
759 illustration. In line with La Porte (1996), the existence of knowledgeable 'watchers', as Authorities
760 are in the European civil aviation, is characterized as one of the conditions for an organization to
761 sustain a high-reliability performance. Yet, in some cases, it may lead middle managers' staff to over-
762 rely on them, thereby disabling the safety net they are supposed to represent. Identifying this
763 phenomenon and influencing his/her staff to think for themselves safety wise results from the
764 middle manager's mindset in terms of both his/her sensitivity to safety and understanding on
765 his/her role as a manager.

766 6. Conclusion

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

772 Moreover, the current findings show no example of negative interrelation between middle
773 managers mindset and their practices or between their immediate working environment and their
774 practices. Interestingly, middle managers' views on the organisational environment and external
775 environment was more critical with a number of factual examples of hindering aspects. This result
776 may derive from a possible bias related to the interviewees' sample consisting of volunteer middle
777 managers, thus already having a special interest in safety. As such, they may have described mainly
778 the supportive aspects of mindset. Similarly, the possibility of a psychological bias behind the mutual
779 support between middle managers' practices and their immediate working environment would be
780 worth exploring, since they may consider that this environment is partly under their sphere of
781 control and/or influence. Interviewing a wider set of middle managers would help determining
782 whether the views described here are representative or possibly too optimistic. Anyhow, considering

783 middle managers safety-related practices as emergent properties of a complex socio-technical
784 system seems a promising avenue to better understand and ultimately better support them.

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