

Investigating professional values among pilots, cabin crew, ground staff, and managers to develop aviation safety management systems

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ABSTRACT

Professional culture differences resulting from occupational training and experiences are widely known to affect the behaviours of groups and individuals. Yet a research gap exists on whether professional differences can influence safety-relevant core values held within individuals which are typically considered a product of national culture. The present study compared the core values of pilots, cabin crew, non-managerial ground staff, and airline managers by evaluating whether professional culture influenced levels of agreement towards cultural concepts relevant to safety. Results from $N = 317$ aviation professionals found significant differences between the four professional groups on attitudes towards power distance, individualism, time orientation, and indulgence vs. restraint. Social and physical distance to headquarters, confined work environments, and loyalty to work interfaces affected core cultural values of power distance and individualism among pilots and cabin crew. Frontline pilots and managers opposed on time-orientation, highlighting the potential for conflicts on decision making due to differences in the perceived balance between safety and performance. Professional culture also influenced sociological preferences related to values of indulgence vs. restraint. The findings support the usage of core values as a basis for human behaviour analysis and highlights the importance to include cultural ergonomics concepts when devising organisational safety management strategies.

1. Introduction

The globalised aviation industry is a melting pot of cultures. Locals and expatriates from different national cultures can work together in large international airlines, and each airline will have its own organisational culture. However, it is plausible that cultural identities and values of aviation professionals will be based more so on their own chosen professions. Extensive international standardisation in aviation ensures that professional groups within the industry will have globally similar training and occupational experiences regardless of their national origins or employing organisation. The concept of culture can be defined in many ways, in a broad sense it represents “the way we do things here”, and “the way of doing things” are reflective of norms and values established by the interaction of a group of people with the environment (Helmreich and Merritt, 2019; ICAO, 2004). Whilst these values have typically been associated with national culture, there is evidence to suggest that professional culture can also moderate ‘the way things are done’. Human factors interventions should be extended to all professional groups in the aviation industry and be applicable to both

current and future requirements (Chen et al., 2017). An understanding of differences in cultural characteristics between people engaged in different professions may thus be valuable in devising organisational management strategies within large, complex, culturally diverse organisations. The present study focuses on evaluating whether intrinsic cultural values related to work styles vary across different professional groups in the aviation sector.

1.1. Cultural values vs. cultural practices

To identify differences between professional culture groups, the starting point is to make the distinction between cultural *practices* and cultural *values*. *Practices* are the observable, extrinsic parts of culture which can change rapidly in response to external changes (Hofstede et al., 2010). For example, over the past half century, advanced automation has completely revised on-the-job *practices* of airline pilots from inner-loop ‘flyers’ to higher-level cockpit and systems managers (Harris, 2007). *Values*, on the other hand, are the core feelings and preferences that are carried within individuals and are considerably more stable and

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less affected by external elements (Hofstede et al., 2010). To date, cultural behaviours in aviation were typically assessed on observable practices. Examples include crew resource management or non-technical skills (NOTES) markers (Flin et al., 2003); technical competencies (ICAO, 2013); flight, maintenance resources, and team management attitudes (Chan and Li, 2020; Helmreich and Merritt, 2019; Taylor, 2000); and/or communicated safety behaviours (Kaminska et al., 2021). This focus on assessing observable practices is debatable. Firstly, changes in practice may be superficial. For example, people may change their practices (the way they do things) due to organisational influences (Hofstede et al., 2010). Yet, in the real-world, individuals may revert to more intrinsic, deeply rooted values-driven beliefs and behaviours in stressful situations (Edwards et al., 2013; Naevestad, 2009). As Safety Culture at the organisational-level is driven by the safety attitudes of each individual member in the system, more deep-seated values will likely prevail as the driver of safety concerns (Hudson, 1999). Secondly, future developments may also make markers based on present generation practices less relevant. Markers on multi-crew coordination, for example, may become irrelevant in future single-pilot airliners (Chan and Li, 2021). To accurately predict real-world behaviours, it is perhaps more accurate to evaluate the individual-level values which provide the backdrop for operational policies and procedures and are less affected by superficial interventions and contextual variables (Sexton and Kline, 2017). To illustrate, core values on the acceptance of ambiguity and uncertainty are known to affect the practical integration of safety cultures in high-reliability domains such as nuclear power and air traffic control (Naevestad, 2009; Noort et al., 2016). However, little is known about the how these values are affected by cross-occupation differences in professional culture within the same industrial domain. A research gap therefore exists in the comparison of core values among different professional culture groups within the airline and aviation environment.

1.2. The three layers of culture in aviation

Aviation professionals' attitudes and behaviours at work are shaped by three dynamic cultures (Helmreich, 1999). The first is national culture, which is highly resistant to change as individuals are surrounded by this culture from birth. The second is organisational culture, reflective of organisational values, policies, and work practices, which forms the elements of organisational safety culture and safety management systems. The third is professional culture, representing occupational norms, values and beliefs that are acquired through professional training and common equipment (Helmreich, 1999; Morley and Harris, 2006). The majority of an organisation's employees can be expected to be acculturated to the nation where the company is headquartered (Yorio et al., 2019). On the other hand, professional culture is considered as a standalone element as it is acquired through occupationally specific experiences. In aviation, extensive international conventions and regulations ensure that professional groups will have similar training and experiences, regardless of where they work or which company they work for (Dahlstrom and Heemstra, 2009). Standards for personnel licensing are prescribed by Annex 1 to the Convention on International Civil Aviation, which at the time of writing had been ratified by all 193 UN member states (Annex 1 to the Convention on International Civil Aviation - Personnel Licensing, 2020). Competencies required for pilot selection and training are also, to a large extent, internationally defined (IFALPA, 2012). Attempts to cater to cultural differences in aviation are also generally profession-specific, which in practice will widen differences between professional groups. For example, cockpit design changes to suit pilots' nationality traits will only affect pilots (Harris and Li, 2008).

Pilots and cabin crew have the greatest distance to the organisation as they work away from base and far from the central headquarters. They report for duty at the airport and work irregular hours, which means that they will not see company posters at headquarters and are unlikely to join company events such as award ceremonies. Their

Table 1

Working styles and core values as defined by Hofstede's cultural dimensions (adapted from Hofstede et al., 2010).

Dimension	High	Low
Power Distance (PD)	Acceptance of a hierarchical order between people, where everybody has a place.	Desire for equal distribution of power and demands justification of inequalities.
Individualism-Collectivism (IDV)	Preference to take care of oneself and their immediate family only.	Unquestioned loyalty towards strong, cohesive in-groups.
Masculinity-Femininity (MAS)	Achievement, assertiveness, and competition.	Cooperation, modesty, and caring for others.
Uncertainty Avoidance (UA)	Uncomfortable with uncertainty and ambiguity, desires strong codes of behaviour and intolerant of unorthodox ideas.	More relaxed attitudes. Practice is more important than principles.
Long- vs. Short-Term Orientation (LTO)	Fosters adaptation, perseverance, and thrift. Oriented towards future rewards.	Look towards the past, preferring to maintain traditions whilst being suspicious of societal changes.
Indulgence vs. Restraint (IVR)	Relatively free gratification of desires.	Human drives suppressed by strict social norms and regulations.

cultural identities are therefore based more so on their profession than on their employment within an organisation (Dahlstrom and Heemstra, 2009). This divergence of work practices among different professional groups can mitigate the influence of organisational factors, as more specific behavioural safety programs were known to have less persistency than wider, organisational interventions (Ray et al., 1993). Differences in status, hierarchy, and administrative separation across different departments are also known to create divergent values, norms, and interactions between pilots, cabin crew, and other staff members (Bienenfeld and Grote, 2012; Kim and Park, 2014). Pilots and cabin crew sociological environments differ due to job requirements, relative age, gender, and even workload throughout different phases of flight (Chute and Wiener, 1996; Ng et al., 2011). Cultural values are also known to differ between those with the ability to manage organisational strategies and those without such an ability (Schein, 2016). In the airline environment, managers need to balance conflicting objectives through controlling latent risks, whereas non-managers are primarily driven by the avoidance of active failures (Wiegmann and Shappell, 2016). One's position in the organisational hierarchy can create different perceptions of safety through factors such as respect towards management (Tear et al., 2020). In practice, differences between managerial and non-managerial staff members can result in variations in how things are done, as well as in the opinion and acceptance of different training and operational methodologies (Schein, 2016; Wikander and Dahlström, 2016).

1.3. Conceptualising core cultural values across aviation professions

Hofstede's Cultural Dimensions of Power Distance (PD), Individualism-Collectivism (IDV), Masculinity-Femininity (MAS), Uncertainty Avoidance (UA), Long-vs.-Short-Term Orientation (LTO), and Indulgence vs. Restraint (IVR) have been extensively used to measure individuals' core values based on comparative differences (Hofstede et al., 2010, see Table 1). Whilst these dimensions were most prominently used to compare values at the national or country-level, what the dimensions actually measure are values – the “collective programming of the mind that distinguishes the members of one group or category of people from others” (Hofstede et al., 2010). A review of adapted uses of the Cultural Dimensions framework in its first 25 years of inception found that in the majority of research projects, the framework was validated in professional group comparisons of values (Kirkman et al., 2006). This makes the Cultural

Dimensions framework particularly suitable for comparing values across aviation professions as the dimensions can detect *values* which are altered by professional differences whilst remaining minimally affected by variations in organisational *practices* such as company procedures. Additionally, on-the-job practices in aviation are extensively controlled by internationally and industrially standardised procedures and shared training experiences. These procedures and training programs are known to mitigate national culture differences (Helmreich and Merritt, 2019), but they differed primarily across professional and occupational boundaries (Dahlstrom and Heemstra, 2009). This presents an opportunity to expand the reach of the Cultural Dimensions framework to compare deep-seated *values* across professional groups.

There is evidence to suggest that professional culture can create groupwise differences on the six dimensions. For PD, pilots were found to have higher PD than non-pilots (Mjøs, 2004), and air traffic controllers' PD were found to be moderated by their level of expertise and occupational proximity to supervisory levels (Tear et al., 2020). As PD symbolises the acceptance of unequal power distributions, it was also speculated that the hierarchical chain of command in air crew (pilot and cabin crew) professions will lead to comparatively higher PD values (Hörmann, 2001). For IDV, pilots had higher IDV than non-pilots, and differences between pilots from different countries appeared to be smaller than that of the non-pilot population (Merritt, 2000). However, more recent changes in multi-crew cooperation and crew resource management training requirements may possibly moderate some of these IDV tendencies among the air pilot group (Adanov et al., 2020; Metscher et al., 2009). The acceptance of uncertainty (UA) was considered to be influenced by professional usage of standardised checklists, manuals, and procedures (Merritt and Maurino, 2004). Differences in time orientation can also lead to conflict in following procedures. For example, the trade-off between time efficiency and thoroughness may impact the balance between safety and performance in flight operations (Hollnagel, 2017; Klein, 2004; Shappell and Wiegmann, 2009).

Li and Harris (2006) argued that differences in Hofstede's values such as PD, IDV, and UA can be considered as both causes and consequences of human factors issues, as they concurrently influence the methods by which safety is achieved, as well as the actioned behaviours which may have an effect on safety outcomes. As the establishment of airline-level Safety Cultures relates to how safety is perceived, valued, and prioritised by every individual member within the organisation, an awareness of how values differ across different professional backgrounds can provide airline management with the foundation from which effective values-driven safety management strategies can be built to promote Safety Cultures at the organisational level (Piers et al., 2009). For example, one way to promote high performance teamwork is to select a more effective communication mode based on the level of diversity within the team (Nam et al., 2009).

Nevertheless, it has been questioned whether the Cultural Dimensions are directly replicable in the aviation context. The occupational context of aviation professionals may be different to that of the context of the technology sector workers which were used by Hofstede for the development of the original formulae. For example, in the volatile and seniority-based aviation industry (Mizzi et al., 2022), it can be reasoned that certain items, such as "security of employment", should perhaps have a different weight. Previous studies have attempted to solve this problem by excluding the item equivalence requirement (Merritt, 2000), but doing so will make the results inapplicable for groupwise comparisons as people from different groups may give different weights to the items making up each dimension. Alternatively, other studies have compared responses on an item-by-item basis (Chan and Li, 2022; Sherman et al., 1997), but this method is also undesirable as it conceals the interrelations between the items which constitute each cultural dimension index. A further review of literature on organisational, behavioural, and social science research suggests the utilisation of conceptual definitions (Podsakoff et al., 2016). This required the

transformation of the 24 items making up Hofstede's framework into six statements describing *conceptualisations* of cultural preferences, each representative of a particular Cultural Dimension. The focus is on conceptual, descriptive, construct validity based on six dimensional concepts.

1.4. Motivation & hypothesis

In the literature review, a research gap to compare cultural values among people of different professional culture backgrounds within aviation was identified. A deeper understanding of these cultural values can provide airline management with the foundation on which informed, flexible and learning characteristics of organisational Safety Cultures can be built upon (Hudson, 1999). Being more informed about the cultural values of the intended recipients can be useful for the creation of flexible organisational management strategies. For example, flexible crew resource management (CRM) course content which enables greater emphasis on interpersonal communications will benefit crew members with high IDV values and thereby ease their transition into the Safety Culture objectives (Adanov et al., 2020). Similarly, in large, international airline organisations, learning opportunities such as facilitated discussions where employees from different groups can learn to navigate their own cultural values within the multicultural work environment have been proposed as a way to fit diverse groups into wider, airline-level Safety Cultures (Dahlstrom and Heemstra, 2009).

To categorise groups for comparison, it was recognised that the factors of distance to the organisation, the sociological environment, and position in the organisational hierarchy can result in variations in professional culture. Thus, the objective of the present study was to compare pilots, cabin crew, non-managerial ground staff, and airline managers to evaluate if the groups differed in their levels of agreement with conceptualisations of culture on six dimensions. This study aims to assess the core cultural values carried within individuals among different professional groups. A total of six hypotheses were evaluated as follows:

- H1. There is a significant difference among the four professional groups on levels of agreement with conceptualisations of PD.
- H2. There is a significant difference among the four professional groups on levels of agreement with conceptualisations of IDV.
- H3. There is a significant difference among the four professional groups on levels of agreement with conceptualisations of MAS.
- H4. There is a significant difference among the four professional groups on levels of agreement with conceptualisations of UA.
- H5. There is a significant difference among the four professional groups on levels of agreement with conceptualisations of LTO.
- H6. There is a significant difference among the four professional groups on levels of agreement with conceptualisations of IVR.

2. Method

2.1. Participants

Three-hundred and seventeen ($N = 317$) aviation professionals (mean age = 41.50, $SD = 9.75$) were recruited by convenience sampling through airline employee union and aviation safety professionals' association memberships. The first round of data collection was from November 2020 to February 2021, involving members of an airline employee union from a large airline group. The group had both full-service and low-cost operations, with employees based across Australasian, European, and North American locations. The second round of data collection ran from March to April 2021, involving members of a North American aviation safety consortium. The consortium included a wide range of members, from domestic low-cost carriers to international

To what extent do you agree or disagree with each of the following statements?

Please select one answer per row by moving the bar next to each item.

	1 Strongly disagree	2 Somewhat disagree	3 Neither agree nor disagree	4 Somewhat agree	5 Strongly agree
1. "In my opinion, my boss does not need to consult me when making decisions, and it doesn't matter whether my boss is someone I can personally respect. There should only ever be one boss directing my work requirements."					
2. "My ideal job is one that is interesting for me and gives me enough time off for personal and family life. It doesn't matter what other people think about my job."					
3. "I don't care if my co-workers are pleasant to work with, as long as I get recognition for good performance. It's important that I get a promotion at work, even if it means I'll have to relocate to a less desirable area."					
4. "I think that a good manager needs to know everything about the job, and that rules should never, ever be broken, even if breaking the rule is in the best interests of the company."					
5. "It is important to prepare for the future through persistence, perseverance, and saving. I am willing to delay short-term success for long-term gain."					
6. "I like to keep time free for fun, and other people can rarely prevent me from doing what I really want to. I consider myself a happy person."					

Fig. 1. Survey section used to evaluate participants' levels of agreement with statements of conceptualisations of culture based on the six Cultural Dimensions of PD (1), IDV (2), MAS (3), UA (4), LTO (5), and IVR (6). A higher level of agreement with each conceptual statement is representative of greater preference for the relevant cultural dimension.

airlines and business aircraft operators. Membership for these groups were not open to the general public, thus ensuring that respondents were representative of their professions. Ethics approval for research was provided by the Cranfield University Ethics Committee (CURES 12950/2021). Anonymous data was collected. The data did not contain identifying information and was only available to the research team.

2.2. Instruments

Data collection was by a survey hosted on the Qualtrics platform (<https://eu.qualtrics.com>). The first section of the survey contained demographic and occupational items. The second section of the survey included items which assessed participants' levels of agreement with six conceptualisations of culture, representative of *Power Distance* (PD), *Individualism-Collectivism* (IDV), *Masculinity-Femininity* (MAS), *Uncertainty Avoidance* (UA), *Long-vs.-Short-Term Orientation* (LTO), and *Indulgence-vs.-Restraint* (IVR) dimensions. The cultural concept statements were developed by three industry experts (a pilot, a cabin crew member, and an aviation academic) following Podsakoff, MacKenzie & Podsakoff's (2016) four step process: (1) Potential and representative attributes for each dimension were drawn from previous literature [Values Survey

Module (Hofstede et al., 2010)]; (2) The attributes were filtered based on their relevance to the context of aviation industry professionals; (3) Preliminary concepts were developed for each dimension in the format of preferred working styles; and (4) The concepts were refined and presented in a descriptive, journalistic format. The statements were then reviewed by the experts and the final conceptual statements are presented in Fig. 1.

2.3. Research design

The survey was distributed within airline employee union and aviation safety professionals' association memberships through internal, official communications that were not shared outside of their membership. Interested members were given a standard briefing which specified the research purpose, and advised that the survey was anonymous, voluntary, and would take approximately 10 min. Participants who were interested to proceed were then directed to a web-based interface where the procedure continued as follows: (1) An information page which briefed participants on the purpose of research, data handling, and participant rights; (2) A consent page; (3) If consent was given then the webpage redirected to demographic questions used to summarise

Table 2

Levels of agreement with cultural concepts by professional group (5 = strongly agree; 1 = strongly disagree).

Professional Group		PD	IDV	MAS	UA	LTO	IVR
Pilots (n = 222)	Median	2.5	2.3	2.3	2.4	2.6	2.9
	SD	0.6	0.8	0.5	0.6	0.8	0.6
Cabin Crew (n = 32)	Median	2.0	5.0	2.0	2.0	4.0	4.0
	SD	1.2	0.9	0.9	1.3	0.8	0.8
Ground Staff (n = 30)	Median	2.0	4.0	2.0	2.0	4.0	4.0
	SD	1.0	1.2	1.0	1.2	1.0	1.0
Airline Managers (n = 33)	Median	2.0	4.0	2.0	2.0	4.0	4.0
	SD	1.2	1.3	1.1	1.0	1.2	1.1

respondents into professional groups of either Pilots, Cabin Crew, Non-Manual Ground Staff, or Airline Managers. The Pilot and Cabin Crew groups included respondents who indicated that they were pilots, cabin crew, or their relevant ranks (e.g. Captain, First Officer, Chief Purser, Flight Purser, etc.). The Airline Managers category included participants who indicated that they were in the *training, standards, and management team*, but were not aircrew. Participants who were neither pilots nor cabin crew, and were not in managerial positions (i.e. they worked in the airline but were neither aircrew nor managers) were put into the Non-Manual Ground Staff category. This included occupations such as cargo agents, business developers, maintenance, and line service personnel. The participants were also asked to enter their age. (4) Participants were then required to rate their level of agreement, on 5-point scales ranging from 1 (strongly disagree) to 5 (strongly agree), with conceptual statements reflecting archetypal work cultures. Each statement was representative of one of the six cultural dimensions (see Fig. 1). High levels of agreement were considered to reflect greater preference for more hierarchical power distance between subordinates and superiors (high PD), more individualistic (high IDV), performance driven (high MAS), uncertainty avoidant (high UA), long-term oriented (high LTO), and indulgence-gratifying values (high IVR).

2.4. Statistical analysis

Data collected were analysed using IBM SPSS (version 28). The professional culture variable (the independent variable) had four levels including Pilots (1); Cabin Crew (2); Non-Manual Ground Staff (3); and Airline Managers (4). The dependent variables for hypothesis 1 thru 6 were levels of agreement with the cultural concepts representative of PD, IDV, MAS, UA, LTO, and IVR respectively. As the responses were based on Likert-style levels-of-agreement, the data was at the ordinal level as it may well take a bigger shift for someone to move from a score of 1 (strongly disagree) to 2 (somewhat disagree), than from 4 (somewhat disagree) to 5 (strongly agree). This necessitated non-parametric, rank-based comparisons. As Shapiro-Wilks tests for normality found that the scores might not be normally distributed ($p < .05$), Kruskal-Wallis H tests were used to test for differences between the medians among the four professional groups for all six hypotheses. Where the Kruskal-Wallis tests showed a significant main effect, effect sizes (Epsilon square ϵ^2) were calculated, and Dunn-Bonferroni post-hoc tests were performed to identify pairwise differences between each pair of professional groups. The use of Dunn's pairwise tests following significant Kruskal-Wallis results was regarded by previous literature to provide reasonably consistent comparisons for ordinal, non-parametric datasets of unequal sample sizes (Elliott and Hynan, 2011).

3. Results

3.1. Sample characteristics

Three-hundred and seventeen ($N = 317$) aviation professionals participated in the current research. Descriptive statistics for levels of agreement with each cultural concept are presented in Table 2.

Table 3

Kruskal-Wallis H Test results comparing four professional groups.

Cultural Concept	df	H	p	ϵ^2
PD	3	14.27	0.003**	0.05
IDV	3	97.76	<0.001***	0.31
MAS	3	6.69	0.083	0.02
UA	3	1.88	0.597	0.01
LTO	3	75.29	<0.001***	0.24
IVR	3	77.90	<0.001***	0.25

** $p < .01$; *** $p < .001$.

Professional groups were represented by 222 aircraft pilots (mean age = 42.1, $SD = 9.9$); 32 cabin crew (mean age = 39.4, $SD = 5.9$); 30 non-managerial ground staff (mean age = 39.3, $SD = 12.0$); and 33 airline managers (mean age = 42.0, $SD = 9.5$). The subsample sizes for all four groups were sufficient for between-group comparisons of values and sentiments across based on the six dimensions, as they exceeded Hofstede & Minkov's suggested minimum of 20 per group to ensure that outlying answers by single respondents would not affect overall results (Hofstede et al., 2010).

3.2. Testing differences between professions on aviation professionals' cultural concepts

Kruskal-Wallis test results provided evidence of differences between professional groups (pilots vs. cabin crew vs. non-managerial ground staff vs. managers) on their levels of agreement towards cultural concepts representing the six cultural dimensions (see Table 3).

The results found statistically significant evidence of moderate differences in levels of agreement with high PD concepts between the four professional groups (pilots, cabin crew, non-managerial ground staff, and managers), $H(3) = 14.28$, $p = .003$, $\epsilon^2 = 0.05$ (see Fig. 2a). Therefore, the first research hypothesis (H1: There is a significant difference among the four professional groups on PD) was accepted. Pilots had the highest level of agreement towards high PD concepts, followed closely by cabin crew, non-managerial ground staff, and managers (see Table 2). Dunn's pairwise tests with Bonferroni correction found significant differences between pilots and managers. Pilots ($M = 2.5$, $SD = 0.6$) > managers ($M = 2.0$, $SD = 1.2$), adjusted $p < .001$. Differences between the other pairs were non-significant.

Similarly, test results showed significant, relatively strong differences in IDV between the four professional groups, $H(3) = 97.76$, $p < .001$, $\epsilon^2 = 0.31$ (see Fig. 2b), thus accepting the second research hypothesis (H2: There is a significant difference among the four professional groups on IDV). In this case, cabin crew had the strongest level of agreement with individualistic concepts ($M = 5.0$, $SD = 0.9$), followed by non-managerial ground staff ($M = 4.0$, $SD = 1.2$), managers ($M = 4.0$, $SD = 1.3$), and lastly pilots ($M = 2.3$, $SD = 0.8$). Dunn's post hoc tests conducted on professional pairs found pilots to be a unique group when compared to the other three professions. Cabin crew > pilots (adjusted $p < .001$); non-managerial ground staff > pilots (adjusted $p < .001$); and managers > pilots (adjusted $p < .001$).

There was also statistically significant evidence of relatively strong differences between professional groups on levels of agreement with high LTO concepts, $H(3) = 75.29$, $p < .001$, $\epsilon^2 = 0.24$ (see Fig. 2c), thus accepting the fifth research hypothesis (H5: There is a significant difference among the four professional groups on LTO). Pilots had the lowest level of agreement with longer-term oriented cultural concepts ($M = 2.6$, $SD = 0.8$) compared to the other three groups (see Table 2). Dunn's post hoc tests also found pilots to be a unique group on LTO, with evidence of significant pairwise differences between pilots and cabin crew (cabin crew > pilots, adjusted $p < .001$); non-managerial ground staff > pilots (adjusted $p < .001$), and managers > pilots (adjusted $p < .001$). No evidence of significant differences between the other pairs were found.

Comparing levels of agreement with indulgent (high IVR) concepts

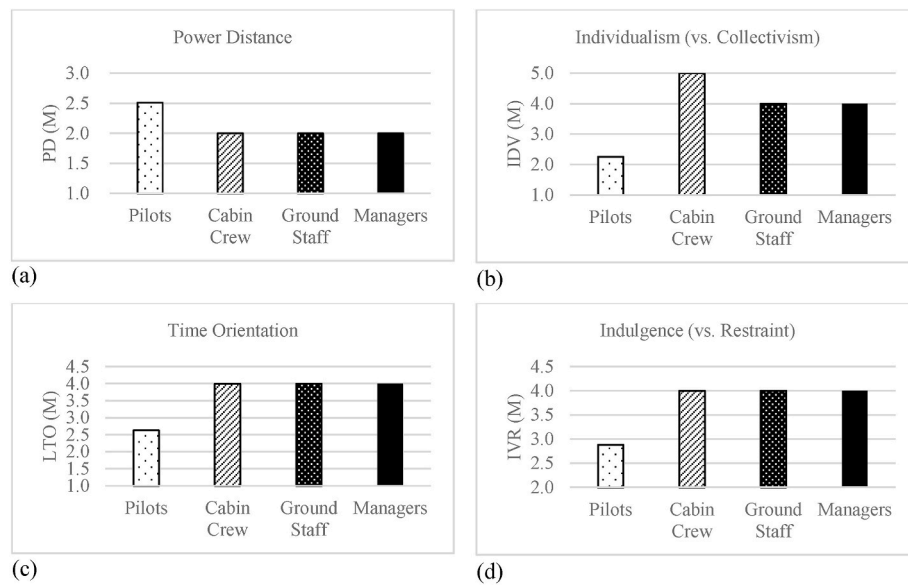


Fig. 2. Differences between the four professional groups on levels of agreement towards cultural concepts representative of Power Distance (a), Individualism-Collectivism (b), Long-vs.-Short-Term Orientation (c), and Indulgence-vs.-Restraint (d).

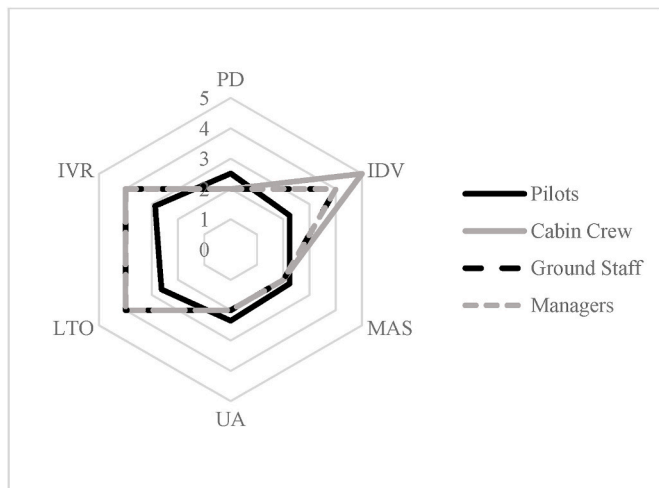


Fig. 3. Comparison of preferences among the four professional groups on conceptual representations of cultural dimensions.

between the four professions produced similar results of significant, relatively strong differences, $H(3) = 77.91$, $p < .001$, $\epsilon^2 = 0.25$ (see Fig. 2d). The sixth research hypothesis (H6: There is a significant difference among the four professional groups on IVR) was also accepted. Cabin crew had the highest level of agreement with the statement representing indulgent (high IVR) concepts ($M = 4.0$, $SD = 0.8$), whereas pilots had the lowest level of agreement ($M = 2.9$, $SD = 0.6$). Dunn's post hoc tests found that pilots differed from cabin crew (cabin crew > pilots, adjusted $p < .001$); non-managerial ground staff > pilots, adjusted $p < .001$; and managers > pilots (adjusted $p < .001$). Differences between the other pairs were non-significant. On the other hand, the results indicated non-significant differences ($p > .05$) between the four professional groups in relation to concepts representative of high MAS ($H(3) = 6.69$, $p = .08$) and high UA ($H(3) = 1.88$, $p = .60$). The third and fourth research hypotheses were therefore rejected.

4. Discussion

The ideal for crew resource management (CRM) and safety

management systems (SMS) at the organisational level is to systemically encourage information sharing, reduce individualistic tendencies, and to build a level of trust across the organisation (ICAO, 2018). The present research identified differences in core values among professional cultural groups, especially between pilots and other groups on PD, IDV, LTO, and IVR attitudes (see Fig. 3). The findings also suggest that changes in organisational practices have the potential to mitigate some of these professional culture differences. A reduction in physical and social distance to headquarters can reduce differences in the acceptance of power distance, and the creation of more intimate social and technological interfaces can mitigate individualistic tendencies and benefit flight and cabin crew CRM. Joint training programs at the interdepartmental level will also be beneficial, especially between frontline pilots and airline managers, to enable different professional groups to coordinate the time orientation of their decision making and minimise possibilities of conflict. Tailored training programs with an emphasis on professional culture strengths and weaknesses can help to achieve CRM goals (Cookson, 2017), and facilitated discussions of how new employees can navigate their own cultural values within multicultural work environments can help aviation professions fit better into airline-level Safety Cultures (Dahlstrom and Heemstra, 2009).

4.1. Power distance moderated preferences for hierarchical structures

Professional differences in levels of agreement towards PD concepts among the four groups were moderate. As it was previously known that pilots had higher PD than non-pilots (Merritt, 2000; Mjøs, 2004), the present finding that pilots had the highest level of agreement with high PD cultural concepts (see Fig. 2a) was not surprising. However, it was noteworthy to find non-significant differences in pairwise comparison between the pilot and cabin crew groups. This was in spite of the fact that pilots and cabin crew varied in occupational and sociological characteristics, which should theoretically create dissimilar cultural values (Chute and Wiener, 1995). A plausible explanation is that pilots and cabin crew both work in a workplace that is physically and socially distant to the organisational headquarters, and limited exposure to the corporate environment and its influences encourages the creation of 'tribal' subcultures (Helmreich and Merritt, 2019). Further, as PD symbolises the extent to which subordinates expect and accept the unequal distribution of power, in professional cultures preferring higher PD it is reasonable to expect greater desire for and dependence on

guidance from superiors (Hofstede et al., 2010). Thus, the high PD preferences of pilots could reflect their occupational nature of a hierarchical chain of command and dependence on those in higher positions (e.g. Captains) to make final decisions (Hörmann, 2001). This has the potential to affect the perceived acceptability and feasibility of human factors interventions within the SMS (Chen et al., 2017). For example, management strategies involving hierarchical organisational/administrative approaches may be considered as highly acceptable by pilots who have greater preferences for high PD, whereas their manager colleagues with lower PD preferences may consider human/crew approaches to be more feasible.

4.2. Individualism-Collectivism preferences dependent on professional environments

The results showed a significant, moderate to strong difference on levels of agreement towards IDV concepts among the four groups. The finding that cabin crew most strongly agreed with individualistic concepts complements previous literature which recognised that cabin crew in general tend to be driven by individualistic goals, and that the frequent travels nature of the job creates a dissolution of collectivistic, interpersonal ties (Hazaz-Berger and Yair, 2011; Tungtapanpong and Wyatt, 2013). Moreover, it was interesting to find that cabin crew had more individualistic preferences than pilots (see Fig. 2b). The low level of agreement for high IDV concepts in the pilot group (which reflected a preference for collective values) appears contradictory to expectation, as both low-IDV leaning pilots and the high-IDV leaning cabin crew share the same adventurous travelling lifestyle. A possible speculation is that the pilots' collectivistic tendencies may be related to their work environment and interpersonal relations. Collectivistic values are associated with the importance of good working relationships, loyalty to cultural interfaces, and career stability within an organisation (Soeters and Boer, 2000). For cabin crew, good working relationships can be superficial as social encounters are more transient, the cultural distance with international passengers and crew can be large, and the comparatively spacious aircraft cabin may create social and physical separation (Hazaz-Berger and Yair, 2011). This corresponded with Helmreich and Merritt's (2019) research which found that crew members with higher IDV tended to be more self-reliant and communicated in a more direct, as-needed way. For pilots, social relationships in the confined cockpit are more personal, they develop greater loyalty to the technical cultural interface as they are typically only qualified on one aircraft type, and they typically have a longer-term career perspective (Merritt and Maurino, 2004; Metscher et al., 2009). Pilots operating in the current generation multi-crew cockpit environment will also likely be acculturated to collectivistic values through professional practices emphasising cross-checking and team building. Multi-Crew Cooperation courses, for example, are now a requirement for airline pilot certification (Adanov et al., 2020).

4.3. Deviations on time orientation between pilots and other groups

The results also found significant, moderate to strong differences among the four professional groups on levels of agreement towards high LTO concepts, with pilots least in agreement with high LTO concepts (see Fig. 2c). In pairwise comparisons pilots differed significantly with the other three professional groups. Differences in levels of agreement with time orientation concepts between groups have the potential to affect the balance between safety and performance (Klein, 2004). For example, pilots, who were less inclined to longer-term concepts, may place greater importance on short-term goals such as on-time departures and make the comparatively longer-term oriented cabin crew feel rushed and harm interpersonal CRM dynamics. Pilots may also choose to neglect non-essential upkeep maintenance for short-term time savings, trading-off for more time-consuming repairs in the long-term, which may potentially create conflict with the longer-term oriented

non-managerial ground staff and managers. This complements previous research which found pilots to be more inclined towards quick rule- or recognition-based decisions, whereas managers with a longer-term time orientation preferred rational, longer-term, novel strategies (Orasanu, 2010). These differences in preference for time orientation may affect the evaluation of human factors interventions on sustainability (Shappell and Wiegmann, 2009). The comparatively shorter-term oriented pilots, for example, may consider recommendations geared towards long-term goals to be less sustainable.

4.4. Indulgent attitudes associated with professional values

The results also portray significant differences in the levels of agreement towards indulgent (high IVR) cultural concepts among the professional groups. As the two poles of IVR are reflective of a desire for free gratification of needs versus considering thrift as a valuable trait (Hofstede et al., 2010), preferences for high or low IVR concepts will directly influence how organisational management strategies are evaluated on the criteria of cost and effectiveness. High levels of agreement towards indulgent (high IVR) concepts reflects a relatively free gratification of desires, to enjoy life, and to have fun (Hofstede et al., 2010). The high levels of agreement towards high IVR found in the cabin crew group complements existing knowledge on the transient work values of flight attendants. Hazaz-Berger and Yair (2011) argued that cabin attendants' occupational need to chaotically juggle between home and travel produces preferences for freedom, choice, agency, and self-fulfilment, creating an indulgent and unrestrained cabin crew professional culture. However, it was surprising to find that among the four professions, pilots had the lowest level of agreement with high IVR, indulgent concepts. Significant pairwise differences were also found between the pilot and cabin crew groups, which was unexpected as the two professions share the same transitory lifestyle. Their contrasting preferences in IVR must therefore be alternatively explained. It can be speculated that the IVR concept suffers from a lack of construct validity for pilots. Reviewing the survey statement representing the IVR cultural concept, indulgent values were represented by a higher level of agreement towards the importance of "free time for fun", being happy, and that "other people can rarely prevent me from doing what I really want to" (see Fig. 1(6)). However, as piloting is a highly technical, serious, and safety critical profession, the concept statement may lack conceptual equivalency. In the piloting profession, there is no room for "fun" or to pursue being a "happy person", and the ideal for crew resource management in multicrew environments is to give pilots the skillset to ensure that the other pilot does not "just do what they really want to" to the detriment of flight safety.

4.5. Limitations of present research

A limitation of the present study is that the aspects of culture within professional groups are not discrete. There are numerous cultural variables within each professional group, such as national and organisational sub-cultures, which cannot be unambiguously controlled for using the current methodology. However, controlling for these will run the risk of committing the *ecological fallacy* of predicting the wider group's values from sub-group stereotypes. For example, if national culture were controlled by restricting the sample to a certain nationality, then we can never be sure whether differences detected are truly of differences between the professions, or if the detected differences were purely stereotypes of the national group surveyed (Williamson, 2002). Without the delineation of different aspects of culture, the six dimensions can only be interpreted as abstract, broad generalisations (Hofstede, 1993), and this is a limitation of the present methodology.

A possibility is to conduct multi-level analysis to take into account a wider number of cultural variables within occupational groups. However, as the current dataset was collected using a single online survey where the national and organisational backgrounds of respondents, as

well as response rates amongst the various populations surveyed were inadequately captured, it was difficult to assure that the respondent sample was sufficiently representative of the wider population to support multi-level analysis. This is a limitation in the current sampling method and reflects a need for follow-up studies with improved data discrimination. Additionally, as uneven and comparatively smaller sample sizes in some of the occupational groups surveyed in the present study limited the ability to control for extreme values, future studies with greater clarity on respondent characteristics may also improve representation among occupational groups.

The core values as evaluated in this study may also have been affected by variables beyond the control of the research team. The data in the present study was collected during the global Covid-19 pandemic, which decimated the aviation industry with a decline of 60% of air passenger traffic compared with pre-pandemic (2019) figures (ICAO, 2022). The high level of uncertainty in economic and industrial accounts may have had an impact on the participants' acceptance of uncertainty (UA). The desire for employment security, which was included in the IVR concept, may have been similarly affected. Additionally, long periods of operational grounding as well as mental and financial stresses associated with the pandemic were known to affect job engagement and motivation (Mizzi et al., 2022). It was suspected that these changes in engagement and motivation across different occupational groups could have been responsible for the unbalanced subsample sizes in the current study. Whilst statistical tests for significance nevertheless confirmed moderate to strong effect sizes in the results for the present sample, a possibility for future improvement may be to utilise longitudinal, repeated measures assessments through a longer time-period to provide enhanced clarity of how professional influences vary over time.

5. Conclusion

The current research found significant differences on levels of agreement towards cultural concepts representing the dimensions of Power Distance (PD), Individualism-Collectivism (IDV), Long-vs. Short-Term Orientation (LTO), and Indulgence vs. Restraint (IVR) between the professional culture groups of pilots, cabin crew, non-managerial ground staff, and airline managers. Greater physical and social distance to the organisational headquarters were related to higher levels of agreement with hierarchical (high PD) cultural concepts. Pilots had higher levels of agreement with high PD concepts than cabin crew, non-managerial ground staff, and airline managers. Professional cultures with loose interpersonal relations and physically separated work environments tended to agree with higher IDV concepts. Pilots had lower levels of agreement towards longer-term orientation concepts (LTO), and indulgent (high IVR) cultural values were associated with the transient lifestyle of the cabin crew professional culture. Post-hoc pairwise comparisons found significant differences between pilots and the other three professions, with pilots preferring less individualistic, shorter-term oriented, and more restrained cultural concepts.

The cultural concepts assessed in this study were considered to represent core cultural *values*, which are more stable and less affected by external factors than observable *practices*. The imperative finding was that an awareness of cultural ergonomics should extend beyond observable practices and additionally consider target users' intrinsic values. Values conventionally associated with national and organisational factors were found to be influenced by professional culture. The present research has also proven that core values can provide a basis to understand human performance even if extrinsic practices evolve in future technological systems. Organisational safety managers should have an awareness of aviation professionals' core values in order to generate safety intervention strategies that are considered as culturally feasible and acceptable by the target workforce. This will benefit the generation of organisational-level Safety Cultures by improving the effectiveness of organisational management and training strategies, as well as assist employees in navigating their own cultural values within

the values of the wider work environment.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data is available from the Cranfield Online Research Data Repository (CORD): <https://nam11.safelinks.protection.outlook.com/?url=https%3A%2F%2Fdoi.org%2F10.17862%2Fcranfield.rd.21201746&data=05%7C01%7C.chandan%40elsevier.com%7C20ac5c10ee1e40db10ab08daa8366816%7C9274ee3f94254109a27f9b15c10675d%7C0%7C0%7C638007248890027770%7CUnknown%7CTWFPbGZsb3d8eyJWJoiMC4wLjAwMDAiLCJQJjoiV2luMzIiLCJBTiI6IklhaWwILCJXVCi6Mn0%3D%7C3000%7C%7C%7C&sdata=SSicGgAYLsH2c1msKvnm8qjz3d4uSlibCpQLUKDsDk%3D&reserved=0>.

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Investigating professional values among pilots, cabin crew, ground staff, and managers to develop aviation safety management systems

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