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Single Pilot Operations and Public Acceptance: A Mixed Methods Study conducted in Greece

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It is estimated that by 2035, airline passenger traffic and freight volume will be double. Despite a brief pause to this expansion imposed by COVID-19, air regulators and the aviation industry *per se* are working in order to cope with the predicted overload (ICAO, 2023; Murray & Green, 2022). Apart from technical issues, the industry is faced also with a significant lack of pilots, estimated to manifest itself around 2040, when approximately half a million of extra pilots will be needed worldwide to serve the commercial transport needs (Caraway, 2020). However, the high expenses associated with becoming a new pilot in the industry, as well as the comparatively low wages, make it difficult to quickly resolve this issue (Lutte, 2014).

In addition, the already existing pilots form a substantial cost to the airline companies. That said, it is underlined that approximately 25% of the total operating cost of a short-haul flight is bound with pilots expenses such as salary, training, assessments, etc. (Harris, 2007). Pilots' cost is contributing $60 billion annually to the airlines worldwide (Stewart & Harris, 2019). One of the measures to be taken by regulators and companies is the halving of the commercial transport flight-crew from two to one (Comerford et al., 2013). Nevertheless, despite the availability of advanced technology, most scientists agree that a single pilot in the cockpit without additional safety measures can result in degradation of flight safety and an increase in the likelihood of accidents (Faulhaber, 2021).

To avoid such disruptions, the industry is investigating numerous configurations to enable the removal of the second pilot from the cockpit without degrading the quality of safety. The range of configurations investigated includes options such as a ground-based pilot providing assistance to the onboard pilot, as well as replacing the second pilot with advanced automation systems (Myers & Starr, 2021). Certain research proposals have asserted that current technology is nearing the capability to implement the Single Pilot Operations (SPO) concept (Harris, 2023; Minaskan et al., 2021; Vance et al., 2019); nonetheless, the acceptance of this initiative by passengers is still questionable.

Literature Review

Currently, all transport airplanes used for commercial travelling purposes are required by law to have a minimum of two pilots onboard, according to regulations set by the Federal Aviation Administration (FAA, 2015) and the European Union Aviation Safety Agency (EASA, 2017). This requirement defines the Multi-Crew Operations Concept, whereas the Single Pilot Operations (SPO) concept requires only one pilot onboard.

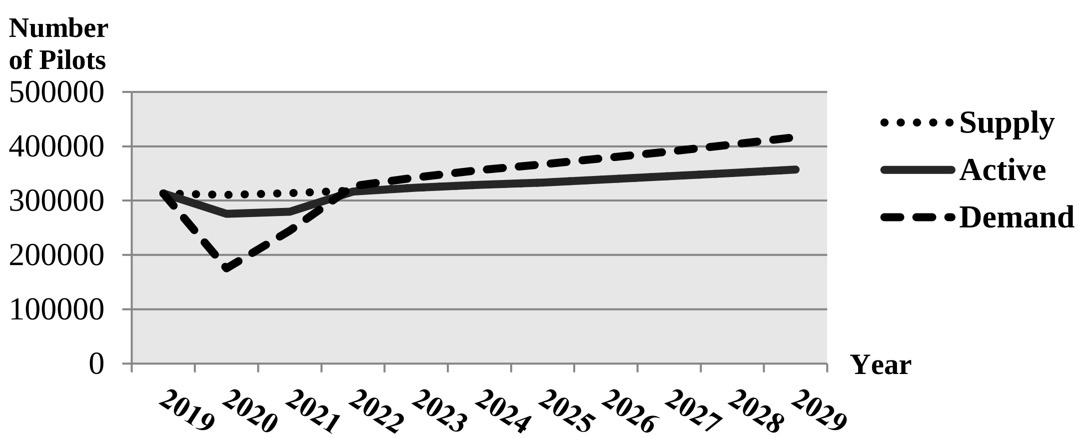
Expected Benefits

The primary driver behind SPO is cost savings (Comerford et al., 2013; Schmid & Korn, 2018). However, according to reports, the extent of cost savings can vary for different types of commercial flights. Malik and Gollnick's (2016) research suggests that short-haul operations may experience annual cost savings of 4-7%, while long-haul flights may not experience any significant savings, and may even face increased costs due to the need for sophisticated SPO equipment. Therefore, it is expected that the SPO-associated cost savings will have a more significant impact on short regional flights rather than long-haul ones, since these flights are more affected by personnel expenses (Stanton et al., 2016). In this regard, public acceptance of such flights may be critical, as passengers may react differently to this type of flight.

Although cost is the main driver of the SPO initiative, it is worth noting that it is not the only reason. According to many experts, there is an anticipated shortage of pilots in the next decade, the consequences of which have to be mitigated (Caraway, 2020; Greenberg, 2022; Murray & Green, 2022). It is true that this shortage was temporarily delayed due to the COVID-19 pandemic (Figure 1), which led many airlines to halt their flight operations and lay off a significant number of pilots (Kioulepoglou & Blundell, 2022). Nonetheless, with the COVID-19 pandemic's impact gradually subsiding, travel activity is returning to pre-pandemic levels and is expected to soar in the coming years, all else being equal (Malnick, 2021). Therefore, according to Murray & Green (2022), despite the pandemic's disruption, the anticipated pilot shortage is projected to hover around 60,000 pilots worldwide by 2030 (Figure 1). Put another way, in addition to the higher costs associated with the multi-crew concept, scheduling problems are expected to arise, which could have significant implications for aircraft manning and scheduling. It is believed that reducing the flight crew to half may alleviate this trend and greatly ease the burden on the industry (Moehle & Clauss, 2015).

Figure 1

Global Pilot Shortage Prediction (Murray & Green, 2022)



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Anticipated Risks

Air travel is considered the safest mode of transportation, despite the increasing volume of air traffic around the world (Stoop & Kahan, 2005). This impressive safety record is the result of numerous efforts, including the use of reliable airframes, sophisticated engineering and high human performance (Harris, 2011). Additionally, when it comes to human performance, it is underlined that the cooperation of the flight crew is essential to achieving effectiveness throughout the flight (Tarnow, 2000). Through the prism of public acceptance, removal of the second pilot might trigger safety concerns to many passengers, the most critical of which are referenced below.

Task Saturation

It is commonly accepted knowledge among aviators that high levels of workload can render the pilots susceptible to errors (Svensson et al., 1997). In this context, when the workload becomes high, the flight crew shares it by delegating tasks to one another. This collaborative effort between the crew members is known as Crew Resource Management (CRM) and is critical for the safety of the flight (Kanki, 2010). Having said that, implementation of SPO, might render the remaining pilot vulnerable to high levels of workload, a situation known as task saturation (Hoover, 2008).

Automation Overreliance

Replacement of the second pilot with increased automation may have two possible effects. The first is the elimination of mistakes due to sophisticated automation systems. The second is the causation of mishaps due to automation-related issues (Taylor et al., 2020) such as system's mismanagement, complacency errors, boredom and loss of situational awareness (Li et al., 2018).

What renders the situation even more ominous is the tendency of the highly automated aircraft to deteriorate the pilots' manual flying skills, a phenomenon which is usually referred to as "Skill-fade effect". This deterioration occurs as a result of the limited opportunities for manual flight that exist in highly automated environments. A gradual decay of their manual flying skills (Ebbatson, 2009) may lead to inferior performance should the situation mandates manual flying *e.g.* an emergency, let alone in a SPO cockpit where assistance from a second pilot will be unavailable.

Lack of Stimuli

Removal of the second pilot from the cockpit leaves the Captain alone, only to communicate *via* machines with the ground. Although it is argued that situational awareness may remain unaffected from this change (Harris, 2022), it is underlined that the absence of non-verbal communication with the adjacent pilot may deteriorate the flight performance even further (Segal, 1994). Remarkably, researchers suggest that non-verbal communication makes up more than 65% of human interaction (Kaps & Voges, 2007; Phutela, 2015); the absence of it may reasonably lead to confusion and poor decision-making (Katz et al., 2006).

Security Threats

Replacement of the second pilot with ground agents, might introduce new opportunities for terrorism (ALPA, 2019; Schmid & Korn, 2017). The point is that should the ground-air network is proven to be vulnerable to electronic attacks, significant safety risks may be introduced, such as frequency jamming, encryption failures, communication failures, or hacking takeovers (Myers & Starr, 2021; Schmid & Korn, 2017). Even datalink delays of less than a second, may have a tremendous impact on the conduct of the flight and could possibly result in further deterioration of the pilot's situational awareness than it would be without the ground assistance.

Relevant Theories

Until the early 1990s, little attention was given to public acceptance of innovations (Wüstenhagen et al., 2007). However, stakeholders have since recognized its significance, as several cases have demonstrated the negative consequences that can result when the public rejects a new technology. Examples of such cases include the siting of wind turbines, the use of nuclear energy, and the development of genetically modified foods (Chapin & Chapin, 1994; Dale, 2004). In these instances, public opposition impeded the progress of business, regardless of the industry's plans. To that end, two innovation-related theories underpin this study's theoretical framework concerning public acceptance of SPO.

Diffusion of Innovations Theory

According to Rogers' theory proposed in 1983, people are initially hesitant to embrace a new product until a sufficient number of users have communicated its effectiveness and safety. Subsequently, the product's acceptance is a matter of time. Rogers also posited that potential customers can be categorized into distinct groups, each of which requires a different amount of time to mature and eventually adopt a new innovation. The first group, called "The Innovators," accounts for only 2.5% of future consumers and consists of individuals who are keen to try out new products as soon as they are introduced. The other groups, such as "The Early Adopters," "The Early Majority," and "The Late Majority," follow the first group as time progresses, until the least receptive group, "The Laggards," finally decides to embrace the new technology. Given that SPO is an innovative concept, it is reasonable to assume that the public's inclination to adopt it might be currently limited.

Resistance to Innovations Theory

Ram and Sheth (1989) pointed out that any new innovation will face some level of resistance from the public upon its release. Afterwards, the innovation will either fail to spread or overcome this resistance and eventually succeed. The barriers to success are functional or psychological in nature. Functional barriers are further divided into usage barriers (low perceived usefulness), value barriers (low performance-to-price ratio), and risk barriers (physical or economic risks associated with the use of the innovation). It is possible that SPO may face risk barriers, particularly in terms of a perceived safety gap resulting from the removal of the second pilot from the cockpit.

Psychological barriers can be classified into traditional barriers, where people resist adopting new innovations that deviate from their usual habits, and image barriers, where people have a negative attitude towards a product due to prejudice. In that sense, it is also reasonable for the public to be concerned with SPO as it might be used to always having two pilots onboard and also be prejudiced as a result of the multiple accidents that aviation has suffered in the past (Shappell et al., 2017).

Perceptions towards SPO

The SPO concept started to be systematically studied during the last two decades (Lachter et al., 2017; Schmid & Stanton, 2019). Thus, limited research has been conducted, and even less attention has been given to the public's attitude towards it. Interestingly, the industry and scientific community have embraced the concept, whereas the Air Line Pilots Association (ALPA) has criticized it, mostly due to reasonable safety concerns. The main points of ALPA highlight that technology is not ready, the safety risks outweigh the expected benefits and even from a financial aspect, the necessary equipment upgrade would be too expensive to be compensated by the reduced cost of single-seated airplanes (ALPA, 2019). Nevertheless, while manufacturers and scientists are making progress in developing SPO, authors have emphasized that in addition to technical issues solving, it is crucial to investigate the public acceptance of this initiative (Matessa et al., 2017).

One of the most commendable attempts regarding the public acceptance of SPO, was made by Stewart & Harris in 2019, who investigated a sample of 117 UK citizens concerning their attitudes towards single-piloted aircraft. Factors such as the state of the pilot, trust in technology, ticket price and airlines reputation were among the most important factors of public acceptance. Nonetheless, participants appeared to be concerned regarding the removal of the second pilot. To a similar wavelength, Kioulepoglou and Makris interviewed a purposefully selected sample of 12 Greek participants (2023) and detected seven qualitative factors that reportedly shape participants' perception towards SPO *i.e*. airlines reputation, passengers' knowledge regarding SPO, social pressure, safety track record of SPO over time, flight duration, urgency to travel and ticket price. Overall, the interviewees of this study expressed multiple concerns regarding the SPO, the majority of which was associated with safety issues.

SPO Configurations

Researchers have put significant effort into designing the operational framework of the SPO, referred to as Concept of Operations (ConOps) or Configurations. Their primary objective has been to address the safety issues arising from the absence of the second pilot in the cockpit. Most researchers agree that the second pilot can either be completely replaced by smart automation systems or be displaced to the ground and act as a ground operator. The literature presents the following noteworthy solutions.

Simple Removal of the Second Pilot

In this configuration, the second pilot is eliminated from the cockpit, and all their duties and responsibilities are transferred to the remaining pilot, namely the Captain. From a financial perspective, opting for this choice is the most straightforward and lucrative for airlines. It eliminates the need for system upgrades, specialized training designs, and highly sophisticated equipment (Stanton et al., 2014). However, this solution has been heavily criticized as it provides no means to mitigate the risks created by the absence of the second pilot such as task saturation of the pilot and pilot's incapacitation possibility (Neis et al., 2018).

Replacement by Advanced Technology

This solution aims to replace the second pilot with advanced technology. In essence, highly sophisticated equipment will take on all the current duties and responsibilities of the second flight crew (Graham et al., 2014; Harris, 2007). Prominent technologies in this context encompass advanced automation systems and/or artificial intelligence, which contribute to enhanced decision-making capabilities. However, a significant drawback of this option is the limited availability of mature technology at this level, along with concerns regarding the authority and potential flaws of automation systems (Deutsch et al., 2005). On top of that, it may take considerable time and financial resources to test and integrate such systems (Schutte, 2015).

Ground Operator (Permanent Link)

Considering the current limitations of technology in fully replacing the second pilot, an alternative proposal involves relocating the second pilot to the ground instead of eliminating their role entirely. This concept entails a Ground Operator (GO) in permanent link with the aircraft, responsible for assuming all the duties and responsibilities currently assigned to the second pilot such as instrument monitoring and flying. Nonetheless, concerns of this proposal include the GOs' expertise and the kind of interference between those and the Captain in order to avert confusion (Vu et al., 2018). It has been also acknowledged that cost may be another barrier due to the increased number of required GOs and their salary/training expenses (Malik & Gollnick, 2016).

Ground Operator (On Demand)

In this configuration, the GO will not be assigned exclusively to a single flight but will provide basic assistance, to multiple aircraft simultaneously. Initially, it was estimated that a single Ground Operator (GO) could monitor more than 20 flights simultaneously (Bilimoria et al., 2014). However, due to various difficulties encountered at higher GO-to-aircraft ratios, this number was subsequently reduced to 12 flights (Huddlestone et al., 2017). It is emphasized that in the event of an emergency situation, the GO is expected to prioritize their attention solely on the distressed aircraft and assume full control of it until the Captain is able to resume responsibilities. From a financial standpoint, this option has been assessed as cost-effective, and researchers frequently view it as a reasonable compromise between cost, safety, and level of required technology (Myers & Starr, 2021).

Ground Operator (Harbour Pilot)

Since the majority of incidents and accidents occur during the takeoff and landing phases (Ebbatson, 2009) a logical proposal emerged to replace the second pilot with a dedicated GO specifically assigned to handle takeoffs and landings, also known as Harbour Pilot (Koltz et al., 2015). Harbour Pilots, unlike typical GOs, are stationed exclusively at the airport they serve, giving them expertise in navigating aircraft within their terminal airspace (Harris, 2022). This provides an advantage compared to other GO solutions. However, as Koltz et al. pointed out in 2015, additional communication upgrades between the Captain and the Harbour Pilot need to be established to ensure feasibility of such configurations.

Back-up Pilot onboard

Lastly, another proposed solution involved replacing the second pilot with a capable individual onboard the aircraft such as a flight attendant or a commuting pilot (Comerford et al., 2013; Neis et al., 2018). The concept behind this solution is that the back-up pilot could support the Captain in situations of high workload, uncertain decision-making, or even complete incapacitation. However, apart from the primary drawback of always requiring a qualified person onboard, an additional requirement is the availability of at least one GO to assist in such scenarios, along with a higher level of automation that can potentially lead to increased costs (Malik & Gollnick, 2016).

Current Study

This study was built upon prior research of the authors that investigated public acceptance of SPO from a qualitative perspective, involving a purposeful sample of 12 Greek interviewees (Kioulepoglou & Makris, 2023). Based on the findings of this research, a new scale was developed so as to capture the passengers' attitudes based on quantitative means. This questionnaire sought to answer the following research questions:

- "*What are the most critical factors to affecting passengers' decision to travel with a SPO aircraft?*"
- "*Which SPO configurations are the most preferable to the public?*"

Research Methodology

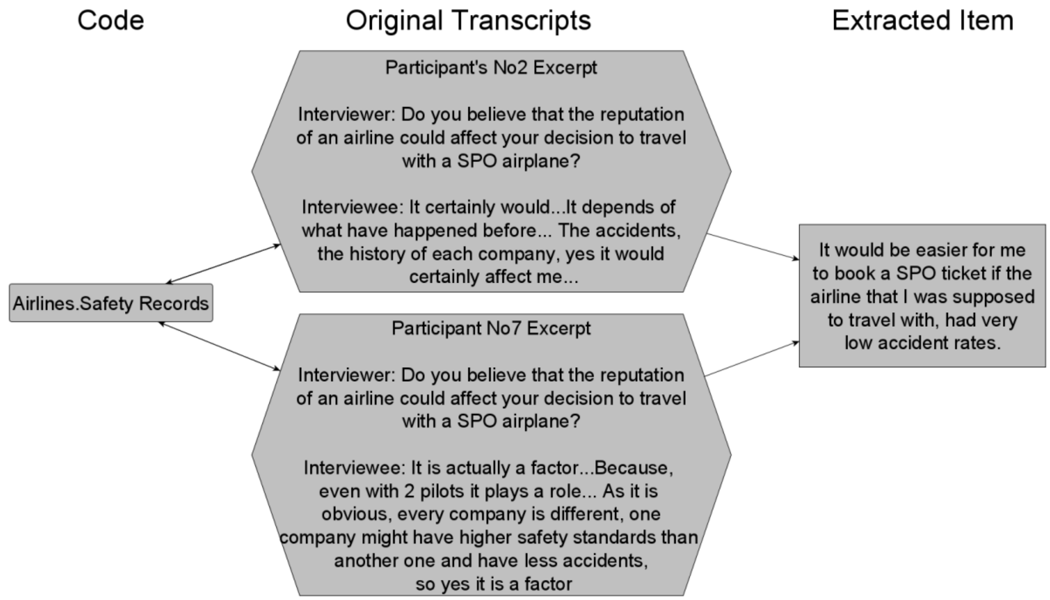
The questionnaire commences with a typical set of demographic questions such as age, gender, marital status, parental status and affiliation to aviation. Then, the first part follows with the main focus being on factors that affect passengers' intention to travel with a SPO airplane. Finally, the second part closes the questionnaire, by exploring the passengers' preference among the six SPO configurations proposed by the industry. Statistical analysis included various strategies such as Descriptive Statistics, Exploratory Factor Analysis (EFA), Analysis of Variance (ANOVA), as analysed below.

Scale Development Procedure

The extraction of the scale items was based on previous study which yielded seven qualitative factors (themes), each of which was associated with two or three codes (a map of this thematic analysis is available in Appendix A). Items' development was achieved by reflecting between those codes and the *InVivo* narratives of the interviewees (Bearss et al., 2015). This backward reflection on the transcripts ensured that the attitudes of the passengers will be illustrated in the questionnaire with minimum distortion (Rowan & Wulff, 2007; Figure 2). This reflective procedure led to the development of a 20-item scale. Afterwards, each of these items was associated with a seven-point semantic differential scale (Bizer, 2004; Osgood et al., 1957; Tullis & Albert, 2013) to determine the degree of agreement based on the participants' ratings.

Figure 2

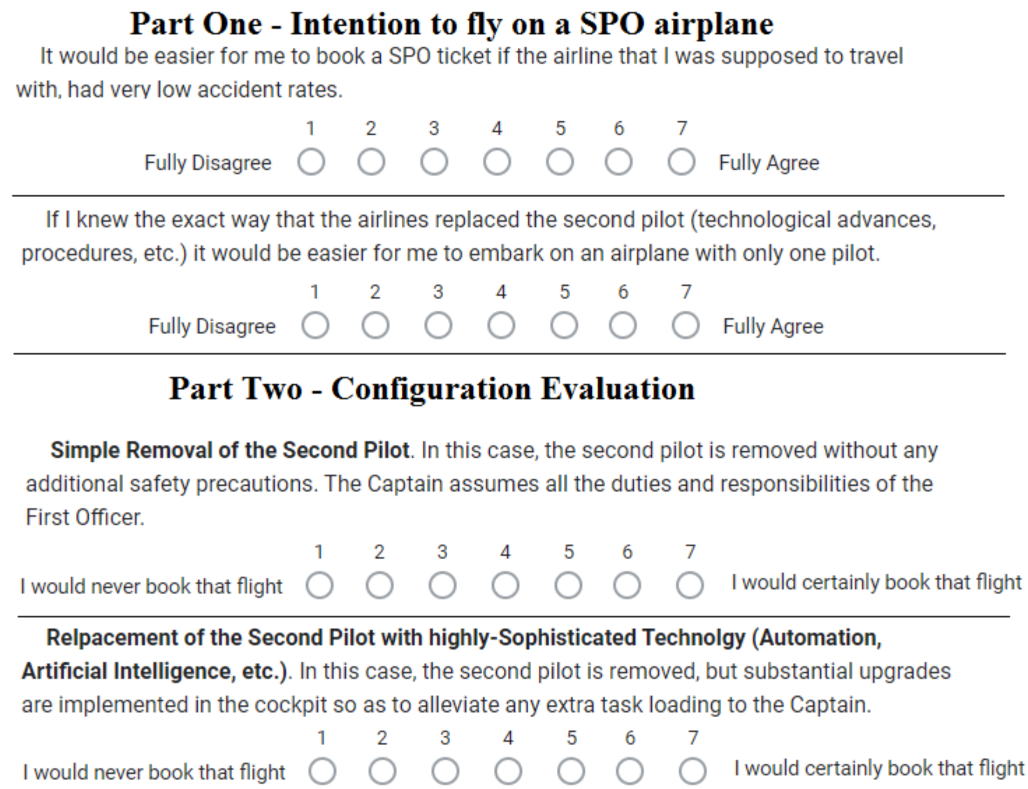
Items Extraction Method Example



The second part of the scale was composed by the six proposed SPO configurations, a brief explanation of what each of these was entailing and a seven point differential scale ranging from 1 (I would never book that flight) to 7 (I would certainly book that flight). An excerpt of both parts of the questionnaire is available in Figure 3, whilst the entire questionnaire is available in Appendix B. Finally, since all participants were native Greek speakers, the use of the Greek language throughout the entire questionnaire was preferred so as to facilitate comprehension and clarity for the respondents. The translation in English took place after the data gathering was over.

Figure 3

SPO Questionnaire Excerpt



Part One - Intention to fly on a SPO airplane

It would be easier for me to book a SPO ticket if the airline that I was supposed to travel with, had very low accident rates.

Fully Disagree 1 2 3 4 5 6 7 Fully Agree

If I knew the exact way that the airlines replaced the second pilot (technological advances, procedures, etc.) it would be easier for me to embark on an airplane with only one pilot.

Fully Disagree 1 2 3 4 5 6 7 Fully Agree

Part Two - Configuration Evaluation

Simple Removal of the Second Pilot. In this case, the second pilot is removed without any additional safety precautions. The Captain assumes all the duties and responsibilities of the First Officer.

I would never book that flight 1 2 3 4 5 6 7 I would certainly book that flight

Relpacement of the Second Pilot with highly-Sophisticated Technolgy (Automation, Artificial Intelligence, etc.). In this case, the second pilot is removed, but substantial upgrades are implemented in the cockpit so as to alleviate any extra task loading to the Captain.

I would never book that flight 1 2 3 4 5 6 7 I would certainly book that flight

Procedure and Analysis

Initially, all participants were sent an invitation through electronic means, clearly stating that participation was voluntary and that data handling adheres to the General Data Protection Regulation (GDPR). Approximately 700 questionnaires were distributed electronically, primarily through emails.

Pilot Run and Data Cleansing

Before starting the main data collection, a random group of 48 participants was selected to conduct a pilot run of the entire questionnaire. This step was essential to identify any inconsistencies that might have been overlooked. After making minor corrections, such as fixing typographical errors and restructuring lengthy sentences, the main data gathering phase was initiated. Single-sided responses (same answer to all questions) were deemed invalid and excluded from the dataset. To facilitate the identification of such occurrences, certain questions in the questionnaire were formulated with a negative meaning (Jozsa & Morgan, 2017).

Descriptive Statistics

After collecting and cleansing the data, the main statistical analysis was performed using SPSS v.25. Descriptive statistics were utilized to present the demographics and participants' responses by employing simple mean and standard deviation of raw scores. In the descriptive analysis, no reverse scoring was applied to negative-meaning questions in order to facilitate comprehension of the answers.

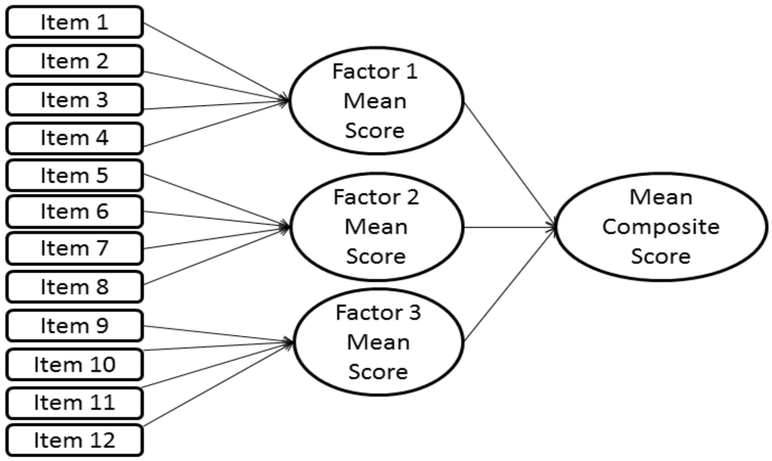
Exploratory Factor Analysis

Afterwards, with regard to the first part of the questionnaire, Exploratory Factor Analysis (EFA) was used to specify certain underlying factors that affect a passenger's decision to travel with a SPO aircraft and also to exclude items that explain inadequate variance on the scale (Watkins, 2018). With regard to factor retention, rotation and items exclusion, several authors' guidelines were followed (Costello & Osborne, 2005; Field, 2018; Howard, 2016; Samuels, 2017; Slocum-Gori & Zumbo, 2011). As a rule of thumb, factors with an eigenvalue above 1 were retained, cross-loadings (differences of less than .20) were not accepted, and loadings of less than .30 on any factor were considered insufficient. At this point, the questionnaire's reliability was determined by estimating the Cronbach α measure of internal consistency for each of the retained factors (Bonett & Wright, 2015; Kottner & Streiner, 2010).

Composite Scores

Finally, a composite score was extracted for every participant based on the mean of all of their answers (DiStefano et al., 2009). It is underlined that more sophisticated scores' calculation techniques such as Regression-based, Bartlett's or Anderson-Rubin's (Estabrook & Neale, 2013), were found to correlate heavily with the simple mean scores (approximately .95). In light of this, both choices were considered equally valid (McNeish & Wolf, 2020) and the simple mean scores were preferred as they retain the 1-7 scale properties and facilitate reader comprehension (Warmbrod, 2014). It is also underlined that items excluded from the EFA were also excluded from the score calculations and negative-meaning items were reverse-scored. The score calculation technique is illustrated in Figure 4.

Figure 4
Score Calculation Technique



SPO Configuration and Public Preference

Concerning the second part of the questionnaire, Analysis of Variance (ANOVA) with subsequent post-hoc tests were used to investigate significant differences in passengers' preference regarding the six proposed configurations of the industry regarding SPO. The null along with the alternative hypothesis are specified below:

- H_0: Proposed Configuration means will not significantly differ ($\mu_1=\mu_2=\mu_3=\mu_4=\mu_5=\mu_6$).
- H_A: Proposed Configuration means will significantly differ (at least one).

Bootstrapping as a Confirmatory Method

To address minor deviations from parametric assumptions, such as normality, the Bias-Corrected and Accelerated (BCa) Confidence Intervals were also computed as a confirmatory method to ANOVA and post-hoc tests. The application of bootstrapping served to provide additional validation as it has been found to be robust in cases of specific assumptions violation (Alfons et al., 2022; Erceg-Hurn & Mirosevich, 2008; Rasmussen, 1987). In that way, the bootstrapped confidence intervals confirmed or questioned the significance tests so as to avoid biased inferences (Gilleland, 2020). It is noted that B=2000 repetitions were executed for each interval estimation (Andrews & Buchinsky, 2000; Pattengale et al., 2010).

Sampling Strategy

Due to the impracticality of employing random sampling techniques, a convenient sampling strategy was adopted (Saunders et al., 2019). As a result, a significant number of participants were recruited from the social and work networks of the authors. However, since the eligibility criteria for participation (having taken at least five flights as a passenger in the last five years) were not highly restrictive, snowball sampling instances also occurred (Browne, 2007; Coolican, 2018).

Participants

Out of the 700 invitations that were sent, 434 responses were received (62% response rate). Among those responses, 20 were deemed inappropriate for analysis due to being single-sided, and therefore, they were excluded from the dataset. As a result, 414 cases were retained for analysis (Table 1).

Table 1

Sociodemographic Characteristics of Participants

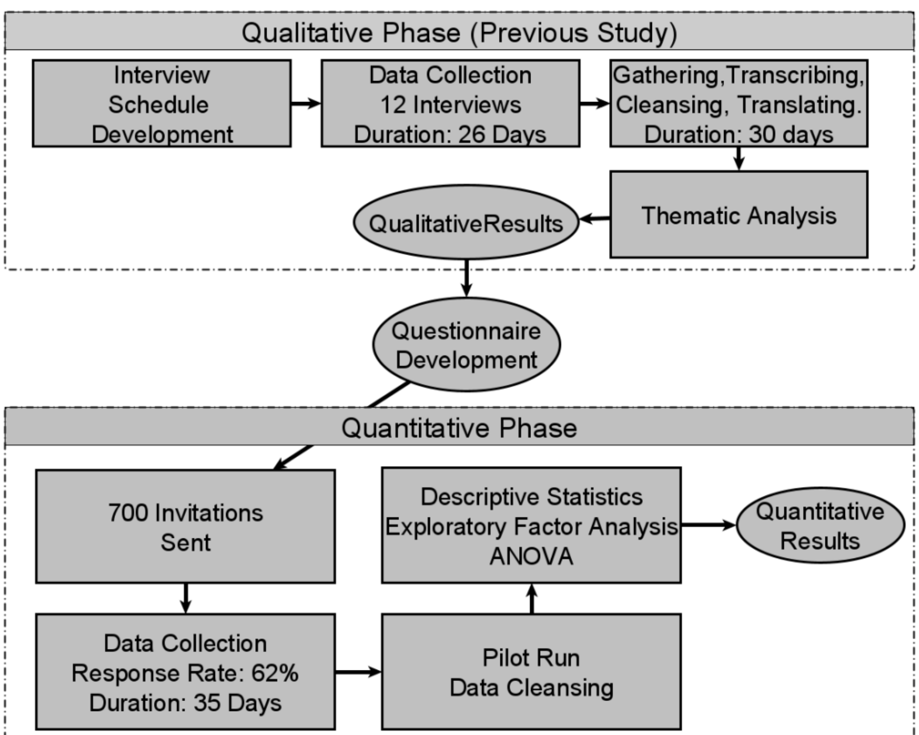
	N	%
Gender		
Male	305	73.67%
Female	109	26.33%
Age		
18-25	117	28.26%
26-35	133	32.13%
36-45	115	27.78%
46-55	45	10.87%
56-65	3	0.72%
66+	1	0.24%
Marital status		
Married	161	38.89%
Non-Married	253	61.11%
Parental Status		
Kids	144	34.78%
No Kids	270	65.22%
Education Level		
School	47	11.35%
Bachelor’s Degree	257	62.08%
Master’s Degree	96	23.19%
PhD or Higher	14	3.38%
Relation to Aviation		
None	218	52.66%
Working in an Airport	99	23.91%
Amateur Pilot	36	8.70%
Professional Pilot	61	14.73%
Flights per Year, *Mean (SD)*	4.91, *(6.96)*	

The majority of participants (59.91%) fell within the age range of 26 to 45 years, while only four participants were aged above 56 years. Around 65% of the sample consisted of individuals who were neither married nor had children at the time of the study. Among the participants, 26.33% were females. More than 80% of the participants held at least a bachelor's degree, with only 14 out of the 414 having a PhD. Additionally, approximately half of the participants had no prior affiliation or involvement with aviation. Moreover, the average number of flights per year, as reported by the participants, was approximately five, with a Standard Deviation of 6.96. Additionally, it is noteworthy that a significant portion of the participants, specifically 61 out of 414 (14.73%), were professional pilots.

Ethical Considerations

All participants explicitly declared their willingness to participate through electronic means. All the collected data were securely stored and analyzed in compliance with the General Data Protection Regulation (GDPR) and ethical considerations outlined by the British Psychological Society. Ethical approval was obtained from the University of Peloponnese. Additionally, a summary of the research flow is provided in Figure 5 to facilitate understanding of the methods employed.

Figure 5
Research Flow Diagram



Results

Descriptive Statistics

Descriptive statistics for the first part of the questionnaire can be found in Table 2. Reverse scoring was not applied in this table to aid comprehension. In terms of the mean scores across the items, the majority fell within the range of 3.00 to 4.00. It is important to note that this range can be considered relatively low, considering that the median of the 7-point differential scale was 4.00. In other words, upon initial examination, participants' inclination to travel with a SPO aircraft appeared to be situated somewhere between neutrality and negativity.

Table 2

Raw Means and Std. Deviations of Participants' Scores

Items	Mean	Std. Dev
1. It would be easier for me to book a SPO ticket if the airline…	4.16	1.95
2. A well-regarded airline company can help me ease off my…	3.71	1.79
3. A well-regarded airline company would never replace the …	4.10	1.81
4. The aircraft type of the airline company would…	3.65	1.93
5. Short-haul flights could be conducted even…	3.64	1.84
6. I would not embark on an airplane with only one pilot if…*	5.48	1.72
7. If the academic community could explain to me that even if the…	3.83	1.80
8. If I knew the exact way that the airlines replaced the…	4.16	1.73
9. Before I embark into a SPO airplane it would be absolutely…	3.86	1.67
10. If my close relatives would have flown with a SPO aircraft and…	2.99	1.53
11. I would get affected from my social circle concerning my…	4.20	1.71
12. I would book a SPO ticket if it was half the price…	3.47	1.75
13. I would always choose to fly with 2 pilots, regardless of…*	4.83	1.83
14. I would demand the presence of 2 pilots in the cockpit, in…*	5.55	1.58
15. After 1 year of successful SPO flights (without accidents)…	3.93	1.58
16. I don't want to be the first to embark on a SPO flight.*	5.37	1.73
17. From the moment that the second pilot is removed, even…*	4.33	1.83
18. I would book a SPO ticket despite certain concerns that I…	4.69	1.55
19. I would not book a SPO ticket if travelling was not so…*	4.77	1.78
20. The necessity of travelling (*e.g.* travelling for vacations…	4.23	1.86

**Questions with negative meaning are not reverse-scored.*

The highest scores were observed in Items 6, 14 and 16; all of them describing the reluctance to travel with a single pilot on long-haul flights or being one of the first SPO passengers. It is worth noting that a high score on these questions indicates a lower intention to fly, given their negative connotations. Conversely, the lowest mean score (2.99) was reported for Item 10, which reflected participants' resistance to being influenced by their relatives regarding their intention to fly with an SPO aircraft.

The standard deviation for all items was consistently low, ranging from 1.53 to 1.95. This indicates a favorable level of stability and suggests limited variability in the responses across the items, which is a positive aspect for subsequent analyses concerning value dispersion (Lee et al., 2015). The internal consistency of the scale was assessed using Cronbach's α measure, resulting in an estimated value of .894, which is considered high (Taber, 2018).

Exploratory Factor Analysis

Given the exploratory nature of the study, it was deemed necessary to perform an EFA on the first part of the questionnaire. This step aimed to identify any problematic items (requiring exclusion) and also explore potential underlying constructs, as described in the Methods section.

To that end, an initial assessment of the EFA assumptions was performed. According to Gunawan et al. (2021), the sample size was adequately big (N=414) and the Kaiser-Meyer-Olkin measure of sampling adequacy for the data set was “Marvelous” with a KMO index of .906 (Kaiser & Rice, 1974). Bartlett’s test of sphericity, was also significant [χ^2 (136) = 2823.35, $p<.001$], indicating the appropriateness of executing EFA on this sample (Williams et al., 2010).

Next, the determinant of the R Matrix was estimated at .001 (much higher than the critical value of 0.00001) which is an indication of the absence of multicollinearity in the dataset (Field, 2018). The Principal Axis Factoring method was selected for the analysis, and the Promax Oblique rotation was chosen due to the presence of moderate correlations among the factors formed (Osborne, 2015). As the EFA procedure progressed, three items (Items 10, 12, and 20) were excluded due to cross-loadings and poor factor loadings. As a result, a three-factor model was formed, consisting of a total of 17 items. This model explained 55.81% of the variance (Table 3).

The items belonging to the first factor appeared to capture concerns related to the SPO initiative that are not easily addressable by the industry. For example, “I don’t want to be the first to embark…” or “I would always choose to fly with 2 pilots, regardless of the ticket price…” are statements that express innate fears associated with testing new things (Dearing & Cox, 2018), thus the first factor was named “Inherent Concerns”.

On the other hand, the majority of factor 2 is items that express a need to guarantee safety before accepting SPO. For example, "After 1 year of successful SPO, I would book…" or "If I knew the exact way that the airlines replaced the second pilot…" are signs of logical concerns of the public, associated with the novelty of the situation that can be possibly eliminated as long as the safety of the SPO venture is proven. In light of that, the second factor was named "Safety Awareness".

Table 3

Factor Analysis of the first part of the Questionnaire

Items	Factor Loading		
	1	2	3
Factor 1: **Inherent Concerns**			
19. I would not book a SPO ticket if travelling was not so important…	**.779**	.131	-.101
14. I would demand the presence of 2 pilots in the cockpit, in long-haul flights (*e.g.* Athens - New York), no matter how low is the price of a SPO ticket.	**.772**	-.048	.046
16. I don't want to be the first to embark on a SPO flight.	**.727**	-.139	.028
13. I would always choose to fly with 2 pilots, regardless of the ticket price, because it is a matter of safety, with which I don't negotiate.	**.698**	.156	-.113
17. From the moment that the second pilot is removed, even a single accident would be enough for me to abstain from flying again with 1 pilot in the cockpit.	**.655**	.083	-.065
6. I would not embark on an airplane with only one pilot if the flight duration was prolonged (*e.g.*, Athens - New York).	**.604**	-.152	.170
Factor 2: **Safety Awareness**			
8. If I knew the exact way that the airlines replaced the second pilot (technological advances, procedures, etc.) it would be easier for me to …	.066	**.743**	.003
7. If the academic community could explain to me that even if the remaining pilot loses their senses, the airplane would eventually land safely …	.144	**.648**	.026
11. I would get affected from my social circle concerning my decision to whether I would book a SPO flight, only if those people were field experts.	-.092	**.642**	-.071
15. After 1 year of successful SPO flights (without accidents), I would book…	.012	**.568**	.148

9. Before I embark into a SPO airplane it would be absolutely necessary for me to have all available means (research, statistical data, etc.) to convince myself…	-.181	**.522**	.301
5. Short-haul flights (*e.g.*, Athens - Heraklion) could be conducted even with 1 pilot in the cockpit. In this case I wouldn't have any concerns…	.018	**.508**	.193
18. I would book a SPO ticket despite certain concerns that I might had, if the importance of travelling was significant (*e.g.*, personal/business issues).	.013	**.353**	.027
Factor 3: **Airlines Reputation**			
2. A well-regarded airline company can help me ease off my concerns regarding SPO and eventually book a SPO ticket.	.046	.051	**.777**
1. It would be easier for me to book a SPO ticket if the airline that I was supposed to travel with, had very low accident rates.	.200	-.062	**.711**
4. The aircraft type of the airline company (Airbus, Boeing, etc.) would affect me substantially to determine if I would book a SPO ticket or not.	-.156	.127	**.475**
3. A well-regarded airline company would never replace the second pilot without reassuring the safety of their customers…	-.023	.052	**.471**
Eigenvalues	6.28	2.11	1.10
% of Variance (Cumulative)	36.94	49.36	55.82
Cronbach's α	.730	.828	.854

The final set of items was exclusively related to the reputation of the airlines. Items such as "A well-regarded airline company would never replace the second pilot without reassuring safety…" or "It would be easier for me to book a SPO ticket if the airline…" shows a tendency of the public to alleviate their fears just by trusting the "name" of the travelling company. Unsurprisingly, the name of the final factor is "Airlines Reputation". Finally, Cronbach's α coefficients were computed as .730, .828, and .854 for factors 1, 2, and 3, respectively, indicating increased reliability for each factor (Taber, 2018).

Composite Scores Analysis

Following the identification of three factors through the EFA, the next step involved calculating participants' scores for each factor in order to examine potential differences among demographic groups such as age and gender (Table 4). Additionally, a composite score was computed by taking the mean of all items to evaluate the overall intention to accept SPO.

Descriptive results of this analysis revealed a distinction between male and female participants. The male group exhibited a higher intention to accept SPO, as indicated by higher mean scores across all factors, particularly in the Inherent

Concerns factor (3.09 versus 2.57) when compared to the female group. Concerning the Inherent Concerns factor, the difference between males and females was significant [t(412) = 3.56, p < .001, BCa CI: (0.249,0.796)]. Similarly, the difference in the Composite Score between Males and Females was also significant [t(412) = 2.24, p=.028, BCa CI: (0.032,0.480)].

Table 4
Factor and Composite Scores in 1-7 Scale

	Variable of Interest			
	Factor 1 Inherent Concerns	Factor 2 Safety Awareness	Factor 3 Airlines Reputation	Composite Score
Total Mean Score	2.95	4.04	3.93	3.61
Gender				
Male	3.09	4.08	3.92	3.69
Female	2.57	3.94	3.84	3.44
Age				
18-25	3.24	4.22	4.04	3.84
26-35	3.13	4.25	4.10	3.82
36-45	2.60	3.74	3.67	3.33
46-55	2.73	3.85	3.63	3.41
56+*	1.25	2.53	2.75	2.13
Marital status				
Married	2.67	3.79	3.65	3.36
Non-Married	3.14	4.20	4.06	3.79
Parental Status				
Kids	2.69	3.78	3.61	3.36
No Kids	3.09	4.18	4.06	3.77
Education Level				
School	2.92	4.21	4.06	3.73
Bachelor’s Degree	3.06	4.05	3.87	3.65
Master’s Degree	2.64	3.92	3.86	3.45
PhD or Higher	3.26	4.24	4.21	3.89
Relation to Aviation				
None	2.78	3.96	3.78	3.50
Aviation Employee	3.22	4.40	4.18	3.93
Amateur Pilot	3.26	4.08	4.02	3.78
Professional Pilot	2.97	3.73	3.80	3.48

**Note.* Only four participants were above 56 years old and only 14 participants were PhD holders.

Regarding Age and participants' intention to accept SPO, it appeared that older participants had lower scores compared to younger ones. Notably, the composite score was 3.84 in the 18-25 age group, 3.82 in the 26-35 group, and dropped below 3.5 in individuals above 36 years of age.

It is also evident that Marital Status has played a role, as indicated by the mean score differences of approximately 0.40-0.50 between married and non-married individuals in Table 6. As a reference, the difference in the Composite Score was significant [$t(412) = -4.161$, $p < .001$, BCa CI: (-0.667,-0.218)]. Similar effects were demonstrated in the three EFA factors as well, with all of the differences between married and non-married participants being significant at the .05 level, two-tailed (Appendix C).

Concerning Parental Status, this has played a role similar to that of Marital Status. In essence, parents were more unlikely to accept the SPO initiative in relation to the non-parents. The differences in scores were in the same range as Marital Status *i.e.* approximately 0.40 to 0.50. Likewise, all of these differences were significant at the .05 level, two-tailed (Appendix C).

On the other hand, Educational Level appeared to be a weak predictor of as there was no clear pattern in the results. The lowest scores were observed among MSc holders (3.89 Composite Score), while the group of PhD holders had the highest Composite Score across all groups (3.89). However, it should be noted that only 14 participants were PhD holders, so conclusions regarding this group may have limited generalizability.

The degree of relation to aviation as a predictor did also not follow a linear pattern. Nevertheless, an interesting aspect regarding the means of these groups is that professional pilots, despite showing low scores on every factor, did not display any significant differences compared to participants who had no relation to aviation at all [$t(277) = 0.17$, $p = .864$, BCa CI: (-0.273,0.325)]. On the contrary, participants that used to work in an airport and amateur pilots had considerably higher scores on all four scales.

SPO Configuration and Public Preference

Descriptive results revealed that the most preferred configuration was the Permanent Link between the single pilot and a Ground Operator, with a mean score of 4.19 out of 7. The "Replacement by Advanced Technology" configuration ranked second, with a slightly lower mean score of 4.14.

The next three configurations *i.e.*, Ground Operator On Demand, Harbour Pilot and Backup Pilot onboard, fell below the 4-points threshold in terms of user preference (shaping mean scores of 3.31, 3.58 and 3.73 respectively). Lastly, the “Simple Removal of the Second Pilot” was participants’ least-preferred SPO configuration with a mean score of 2.73. A summary of these statistics is provided in Table 5 and is also visually depicted in Figure 6.

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Table 5

Descriptive Statistics on SPO Configurations Preference

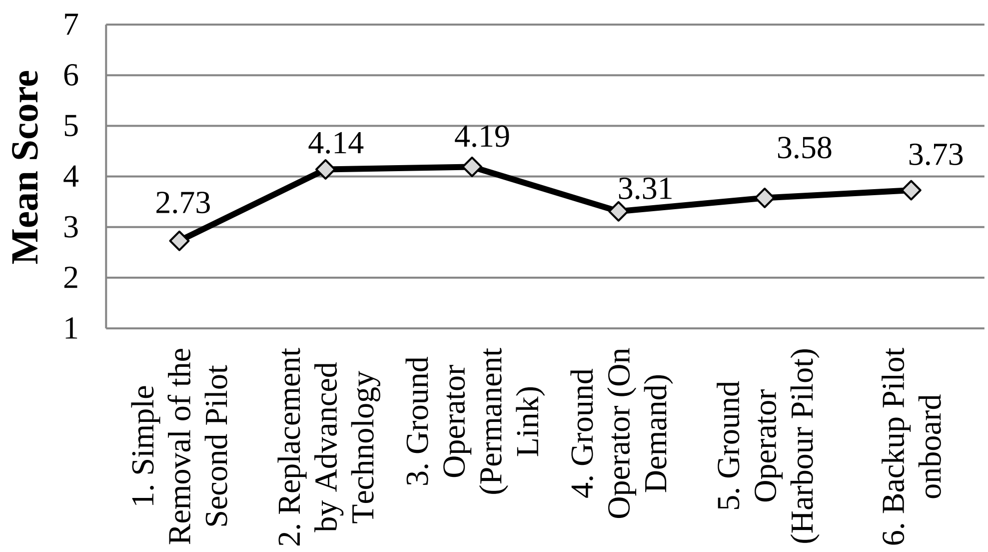
SPO Configuration	Mean Score*	Std. Deviation
1. Simple Removal of the Second Pilot	2.73	1.61
2. Replacement by Advanced Technology	4.14	1.69
3. Ground Operator (Permanent Link)	4.19	1.73
4. Ground Operator (On Demand)	3.31	1.69
5. Ground Operator (Harbour Pilot)	3.58	1.69
6. Backup Pilot onboard	3.73	1.82

*Rated on a 1-7 Differential Scale.

Furthermore, One-way ANOVA was performed to assess the significance of differences across the six configurations, followed by post-hoc tests to evaluate significant differences between each configuration. Analysis of variance showed significant differences between the six SPO configurations, $F(5, 2478) = 42.45$, $p < .001$, $\eta_p^2 = .08$, leading to the rejection of the Null Hypothesis H_0 and retention of the Alternative Hypothesis H_A (*cf.* Methods section). Also, as a result of similar variances and equal group sizes (N=414), Tukey's HSD post-hoc test was deemed the most suitable to conduct (Field, 2018; Nanda et al., 2021) to assess the significance of differences between the six groups.

Figure 6

Illustration of Mean Scores across SPO Configurations



Not surprisingly, Tukey's HSD Test for multiple comparisons showed that the mean value of scores was not significantly different between configurations 2 and 3 [p = .998, 95% BCa C.I. = (-0.28, 0.17)]. Configuration pairs of 4-5 [p =.211, 95% BCa C.I. = (-0.49, 0.05)] and 5-6 [p=.795, 95% BCa C.I. = (-0.39, 0.09)] were found not to have significant differences between them, yet configuration 4 was significantly different than 6 [p=.005, 95% BCa C.I. = (-0.65, -0.19)]. Additionally, Configuration 1 was significantly the lowest-scored category. Finally, no differentiation occurred between the bootstrapped intervals and the post-hoc tests which strengthens the validity of the results. For more detailed results of the post-hoc tests, you can refer to Appendix D.

Discussion

According to the results of this study, it appears that the general opinion of the public towards the SPO initiative in Greece, is predominantly skeptical at the moment. It should be noted that participants expressed an average intention of 3.61 (mean of all items) on a scale of 1-7 when it came to their willingness to travel using SPO.

However, it is important to note that these findings should not be immediately interpreted as a sign that the SPO initiative is bound to fail in gaining acceptance from the public. By considering the principles of the Theory of Diffusion (Rogers, 1983), it becomes clear that only around 2.5% of prospective consumers are typically open to trying a new product upon its initial launch. In light of this, it is underlined that whilst the SPO concept has not yet been introduced into the aviation industry, the public is quite unfamiliar with it and a substantial degree of reluctance may be originating from this fact *per se*. With that being said, it is crucial for both the industrial and academic communities to prioritize studying the factors that influence an individual's willingness to embrace the SPO initiative, rather than solely focusing on whether the general public will accept it or not.

Factors Affecting

Inherent Concerns, Safety Awareness and Airlines Reputation were the three shaping factors of one's attitude toward the SPO, as extracted from the EFA. The Inherent Concerns factor consists of items that indicate an internal inclination to resist the SPO initiative, such as the belief that "*We need 2 pilots at all costs*". It is hypothesized that these concerns will likely diminish as the SPO concept is introduced and its diffusion progresses into the aviation market, following a pattern commonly observed in similar situations (Ram & Sheth, 1989; Salawu et al., 2019).

On the other hand, Safety Awareness refers to the level of public's understanding regarding the safety aspects of the SPO initiative. As indicated by the findings, the availability of comprehensive SPO safety data, clear explanations of the procedures for replacing the second pilot, along with research and statistics, play a crucial role in influencing the public's intention to accept SPO. Qualitative findings demonstrated this concern also (Kioulepoglou & Makris, 2023), as there was a point in almost every session that the interviewee was stating: "*If I only knew the way that…*". In this rationale, it is considered crucial for the industry to adopt an integrated strategy that effectively promotes the SPO concept. In simpler terms, this study suggests that every future marketing strategy for SPO should incorporate safety-related information and relevant details to ensure its effectiveness. Ultimately, comparable outcomes have been documented in other studies of SPO and even pilotless aircraft, underscoring the significance of the Safety Awareness factor in the acceptance of such ventures (Bennett & Vijaygopal, 2021; Stewart & Harris, 2019).

Finally, the Airlines Reputation seems to be a critical factor on its own. Qualitative findings (Kioulepoglou & Makris, 2023) did also point out that passengers tend to link the safety levels of a company with its reputation. To that end, it is speculated that reputable airlines might experience greater advantages upon the introduction of single-pilot transports. Stewart and Harris (2019) did also acknowledge the airlines' reputation as a substantial factor which is a sign of increased leverage in a cross-cultural context.

Short-haul versus Long-haul

The qualitative findings from the previous study (Kioulepoglou & Makris, 2023) indicated a trend among passengers to perceive long-haul flights as more dangerous compared to short-haul ones. This tendency was similarly observed in the present study as well. Reportedly, items 5 and 6 (related to Flight Duration) received a score of only 3.08, indicating a reluctance to accept SPO for long-haul flights. Furthermore, considering that long-haul flights offer fewer economic advantages in relation to SPO (*cf.* Literature Review section), these findings may raise concerns for long-haul carriers regarding the implementation of SPO. Conversely, the prospects for short-haul flights might be even more promising as a result of this tendency observed among the participants.

SPO Configurations Preference

Among the six suggested SPO configurations, participants expressed higher ratings for options 2 (Replacement of the Second Pilot by Advanced Technology) and 3 (Ground Operator with Permanent Link). It is noteworthy that these two configurations did not show significant differences at the .05 level and received the highest scores, specifically 4.14 and 4.19 (approximately one whole unit higher than the other options on the 1-7 scale). This indicates a clear preference of the participants towards these particular configurations. As a result, it can be concluded that a combination of the aforementioned two configurations has the potential to maximize travelers' intention to accept single-piloted aircraft. Conversely, option number 1 (Simple Removal of the Second Pilot) received the lowest score (2.73 out of 7), indicating that passengers consider the role of the second pilot to be essential rather than superficial.

Conclusion

It was determined that the passengers' intention to accept SPO currently falls within a range of neutrality and negativity. However, this finding is considered reasonable when considering the Theory of Diffusion, which suggests that every new concept requires time for adoption (Rogers, 1983). EFA supported the existence of three underlying factors *i.e.* Inherent Concerns of the individual, the Safety Awareness of the public and the Airlines Reputation.

Passengers also reported that their favourite SPO configuration would be a ground operator in permanent interaction with the pilot, in conjunction with an upgraded cockpit to include cutting-edge technology such as sophisticated automation. As a secondary inference, the short-haul carriers may benefit more substantially than the long-haul ones, as a result of the public’s tendency to accept one pilot in short-haul flights easier.

It is recommended to take significant measures to ensure that the public perceives the SPO initiative as a safe endeavor rather than a reckless profit-oriented action, as safety stands as the primary barrier to accepting SPO. These measures encompass publishing unbiased research on SPO, providing access to relevant safety data, offering comprehensive explanations of the procedures replacing the second pilot, emphasizing the reputation of airline companies, and considering public preferences across the proposed SPO configurations. At this stage, an integrated marketing strategy is deemed crucial in addressing these aspects effectively.

Limitations and Future Research Perspectives

The sampling strategy employed in this project utilized a non-equal probability technique in the absence of a sampling frame. Furthermore, the sample consisted exclusively of individuals who were born and raised in Greece. Therefore, caution is advised when attempting to compare and contrast participants from different cultures or drawing general conclusions. Additionally, it should be noted that the measures used in this study, such as the questionnaire, were developed and conducted in the Greek language. The translated material served only publication purposes and has not undergone rigorous testing for validity and reliability in the English language, nor has it been subjected to sophisticated translation methods like backward/forward translation.

To date, this study is only second to Stewart and Harris' work regarding passengers' attitudes towards SPO in 2019. By drawing parallels between the two studies, it can be said that British and Greek participants are more or less on the same wavelength regarding their intention to accept SPO. Nevertheless, it is speculated that cross-cultural differences may be more apparent between individuals outside Europe (De Mooij & Hofstede, 2011; Galina et al., 2018) thus, addressing this research gap might be of great benefit. In this way, more robust conclusions could be drawn and a higher degree of generalizability could be achieved.

Disclosure Statement

No potential conflict of interest was reported by the authors.

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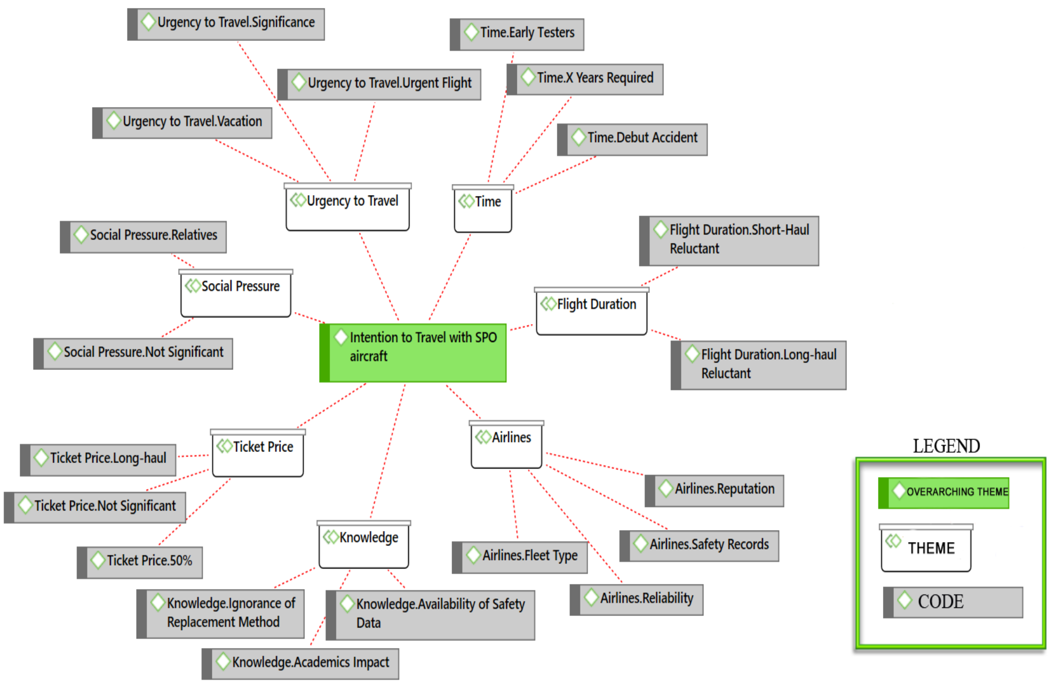
Appendix A
Thematic Map (Kioulepoglou & Makris, 2023)



Appendix B

The SPO Questionnaire
Part 1 (Intention to accept SPO)

Rate the following statements regarding SPO on a scale of 1 (Fully Disagree) to 7 (Fully Agree):

1. It would be easier for me to book a SPO ticket if the airline that I was supposed to travel with, had very low accident rates.
2. A well-regarded airline company can help me ease off my concerns regarding SPO and eventually book a SPO ticket.
3. A well-regarded airline company would never replace the second pilot without reassuring the safety of their customers. This fact per se is enough for me to trust this airline company and travel even with 1 pilot in the cockpit.
4. The aircraft type of the airline company (Airbus, Boeing, etc.) would affect me substantially to determine if I would book a SPO ticket or not.

5. Short-haul flights (e.g. Athens - Heraklion) could be conducted even with 1 pilot in the cockpit. In this case I wouldn't have any concerns and would comfortably book a ticket.
6. I would not embark on an airplane with only one pilot if the flight duration was prolonged (e.g., Athens - New York).
7. If the academic community could explain to me that even if the remaining pilot loses their senses, the airplane would eventually land safely (through sophisticated technology) I would book a SPO ticket.
8. If I knew the exact way that the airlines replaced the second pilot (technological advances, procedures, etc.) it would be easier for me to embark on an airplane with only one pilot.
9. Before I embark into a SPO airplane it would be absolutely necessary for me to have all available means (research, statistical data, etc.) to convince myself that it is safe to travel this way. In light of this, I would book a ticket without any concerns.
10. If my close relatives would have flown with a SPO aircraft and told me that everything went fine, I would book a flight as well, because their opinion matters to me.
11. I would get affected from my social circle concerning my decision to whether I would book a SPO flight, only if those people were field experts.
12. I would book a SPO ticket if it was half the price (compared to 2 pilots ticket), regardless of any concerns that I might had.
13. I would always choose to fly with 2 pilots, regardless of the ticket price, because it is a matter of safety, with which I don't negotiate.
14. I would demand the presence of 2 pilots in the cockpit, in long-haul flights (e.g., Athens - New York), no matter how low is the price of a SPO ticket.
15. After 1 year of successful SPO flights (without accidents), I would book a SPO ticket too.
16. I don’t want to be the first to embark on a SPO flight.
17. From the moment that the second pilot is removed, even a single accident would be enough for me to abstain from flying again with 1 pilot in the cockpit.
18. I would book a SPO ticket despite certain concerns that I might had, if the importance of travelling was significant (e.g. personal/business issues).
19. I would not book a SPO ticket if travelling was not so important at that moment (e.g., travelling for vacations).
20. The necessity of travelling (e.g. travelling for vacations vs travelling for health reasons) plays a major part for me to decide whether I would accept a SPO flight or not.

Part 2 (SPO Configuration and Public Preference)

Rate on a scale of 1-7 how convenient would be for you to fly on this configuration (from a safety perspective, compared to the current 2-pilot flights). A brief explanation of the extreme values follows:

1 = I would never book a SPO flight if I knew that this configuration has been implemented.

7 = I would book a SPO flight in this configuration with the same convenience that I do (with 2 pilots).

1. **Simple Removal of the Second Pilot.** In this case, the second pilot is removed without any additional safety precautions. The Captain assumes all the duties and responsibilities of the First Officer.
2. **Replacement of the Second Pilot by Advanced Technology** (Automation, Artificial Intelligence, etc.). In this case, the second pilot is removed, but substantial upgrades are implemented in the cockpit so as to alleviate any extra task loading to the Captain.
3. **Ground Operator (Permanent Link)**. In this case the second pilot is displaced to the ground. This means that only one pilot remains in the cockpit, who is constantly connected and cooperating with the Ground Operator. Should an emergency situation arise, the Ground Operator can always assume control and land the aircraft safely.
4. **Ground Operator (On Demand)**. In this case the second pilot is removed from the cockpit. The remaining Captain assumes full responsibility. Nonetheless, should an emergency situation arises, a Ground Operator will always be vigilant to assume control of the aircraft and land it safely. This Ground Operator will be supposed to monitor 5 to 10 SPO airplanes simultaneously at any given time.
5. **Ground Operator (Harbour Pilot)**. In this case the second pilot is removed from the cockpit. The remaining Captain assumes full responsibility. Nonetheless, during the take-off and landing phases, which are admittedly the most dangerous phases of flight, a Ground Operator (Harbour Pilot) will be available to assume control of the aircraft and land it safely.
6. **Backup Pilot onboard**. In this case the second pilot is removed from the cockpit. The remaining Captain assumes full responsibility. The only safety redundancy, will be a qualified person among the passengers (possibly a flight attendant or a commuter pilot), that can assume flight duties should an emergency situation arises and land the aircraft safely.

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Appendix C
Miscellaneous

Table C1

Independent t-test Results (Criterion: Marital Status)

Construct	t	df	Sig. (2-tailed)	Mean Difference
Inherent Concerns	-3.545	412	.000	-.46791
Safety Awareness	-3.498	412	.001	-.41470
Airlines Reputation	-2.979	412	.003	-.41361
Composite Score	-4.161	412	.000	-.43322

Table C2

Independent t-test Results (Criterion: Parental Status)

Construct	t	df	Sig. (2-tailed)	Mean Difference
Inherent Concerns	-2.938	412	.003	-.39884
Safety Awareness	-3.272	412	.001	-.39775
Airlines Reputation	-3.215	412	.001	-.45613
Composite Score	-3.854	412	.000	-.41187

Appendix D
ANOVA post-hoc tests & Bootstrapped Intervals

Table D1

Tukey's HSD post-hoc tests across the six SPO Configurations

Reference Group	Compared Group	Mean Difference	Sig.	95% BCa CIs Lower Bound	95% BCa CIs Upper Bound
1. Simple Removal of the Second Pilot.	2. Replacement by Advanced…	-1.41	.000	-1.61	-1.19
	3. Ground Operator (Permanent…	-1.46	.000	-1.70	-1.24
	4. Ground Operator (On Demand)	-0.58	.000	-0.81	-0.36
	5. Ground Operator (Harbour…	-0.85	.000	-1.08	-0.61
	6. Backup Pilot onboard	-1.00	.000	-1.23	-0.76
2. Replacement by Advanced Technology	1. Simple Removal of the …	1.41	.000	1.18	1.63
	3. Ground Operator (Permanent…	-0.05	.998	-0.28	0.17
	4. Ground Operator (On Demand)	0.83	.000	0.60	1.05
	5. Ground Operator (Harbour…	0.56	.000	0.34	0.78
	6. Backup Pilot onboard	0.41	.008	0.15	0.64
3. Ground Operator (Permanent	1. Simple Removal of the…	1.46	.000	1.23	1.71
	2. Replacement by Advanced…	0.05	.998	-0.18	0.28
	4. Ground Operator (On Demand)	0.88	.000	0.64	1.12

Link)	5. Ground Operator (Harbour…	0.61	.000	0.37	0.86
	6. Backup Pilot onboard	0.46	.002	0.21	0.72
4. Ground Operator (On Demand)	1. Simple Removal of the…	0.58	.000	0.36	0.81
	2. Replacement by Advanced…	-0.83	.000	-1.05	-0.61
	3. Ground Operator (Permanent…	-0.88	.000	-1.11	-0.66
	5. Ground Operator (Harbour…	-0.27	.211	-0.49	0.05
	6. Backup Pilot onboard	-0.42	.005	-0.65	-0.19
5. Ground Operator (Harbour Pilot)	1. Simple Removal of the…	0.85	.000	0.62	1.08
	2. Replacement by Advanced…	-0.56	.000	-0.80	-0.32
	3. Ground Operator (Permanent…	-0.61	.000	-0.85	-0.38
	4. Ground Operator (On Demand)	0.27	.211	-0.04	0.51
	6. Backup Pilot onboard	-0.15	.795	-0.39	0.09
6. Backup Pilot onboard	1. Simple Removal of the …	1.00	.000	0.76	1.24
	2. Replacement by Advanced…	-0.41	.008	-0.65	-0.16
	3. Ground Operator (Permanent…	-0.46	.002	-0.69	-0.22
	4. Ground Operator (On Demand)	0.42	.005	0.18	0.66
	5. Ground Operator (Harbour…	0.15	.795	-0.09	0.39

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