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How airline business models impact working conditions of flight crew members

Abstract

This literature research investigates the working conditions, fatigue, mental health, and working conditions of pilots of network carriers (NWCs) and low-cost carriers (LCCs). According to the McKinsey 7S model, different management strategies entail different HRM practices and working conditions. This research paper provides a holistic overview of previous research by investigating the working conditions, actual rosters, stress levels, sleep problems, fatigue, ad mental health of LCC and NWC flight crew members. Basically, LCC pilots have lower income, younger age, less flight experience, more demanding rosters, more sleep difficulties, and experience more fatigue. Moreover, it seems that LCC working conditions are more related with anxiety due to insecure and atypical contractual conditions. Consequently, the research paper confirms that different management strategies result in different working conditions (e.g., atypical contracts, higher work-related stress, more job insecurity, different levels of fatigue, sleep problems, and potential impairment of mental health), consistently to the detriment of LCC pilots. Lastly, LCC pilots reported more safety issues and more fatigue-related incidents compared with NWC pilots.

Keywords: airline business models, professional pilots, fatigue, health, stress, working conditions

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Highlights

a. Low-cost carrier (LCC) pilots had more demanding working conditions.

b. LCC pilots had more atypical contracts (e.g., self-employment and zero-hours contracts).

c. Accordingly, LCC pilots reported more work-related and psychosocial stress.

d. LCC pilots also reported more fatigue, sleep problems, and mental health issues.

e. These conditions can lead to high stress in LCC pilots and consequent lower safety standards.

Introduction

According to the McKinsey 7S model[1] strategy is the cornerstone a company (Figure 1). If management strategies are consistently designed and implemented, they have the potential to affect not only employee skills but also required staff and management styles, company structure, systems, skills, and shared values. Therefore, if an airline sticks to its strategy of implementing a unique business model, it will be reflected in resulting differentiated working conditions that are clearly distinguishable and measurable.[2,3]

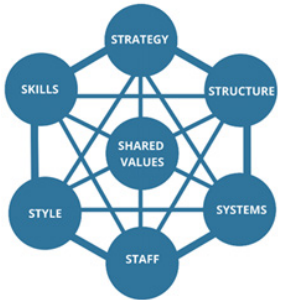

Figure 1 McKinsey 7S model.

Previous studies have compared low-cost carriers (LCCs) and network carriers (NWCs) regarding management strategies[4–6] and also looked at their effects on flight operations,[4] working and employment conditions, and safety culture.[7,8] Table 1 provides an overview of several core differences between NWCs and LCCs. One study also compared the fatigue levels of short- and long-haul pilots of LCCs and NWCs.[9] The present study was designed to compare rosters and working conditions of LCC and NWC pilots and, going further than previous studies, to measure work-related and psychosocial stress, sleep restrictions, and other fatigue risks associated with flight duties, sleep problems, fatigue, and mental health issues (e.g., overall well-being and symptoms of depression and anxiety) of two groups of pilots (flight crew members): international pilots flying for NWC carriers and pilots flying for LCCs. This literature research investigates whether there are discernible differences between NWCs and LCCs in terms of HR strategies that affect pilots' working conditions.

Literature review

The NWC model, also called the full-service carrier or flag carrier model, has two variants. The first is the traditional airline model (e.g., Lufthansa), where the airline also has business units such as IT, maintenance, ground handling, etc. The second is the aviation business model (e.g., SWISS), where the airline operates a core airline business, including major business functions, and outsources most other services.[10] According to Michael Porter's Generic Strategies[11] the NWC model is based on a differentiation strategy with a typically broad scope, both geographically and regarding services. The differentiation is based on services, classes, and amenities. The NWC offers high-quality and comprehensive services both in the air and on the ground for short-, medium-, and long-haul flights. NWCs usually train and employ flight crew members ab initio, which means that aspiring pilots are provided with training from the novice pilot level through the attainment of their frozen airline transport license (fATPL). Ab initio pilot training used to be free; however, today's prospective pilots must usually co-finance their pilot training. Many new pilots receive a pre-contract and, eventually, an unlimited employment contract from their NWC, including seniority benefits.

Training for new flight crew members is characterized by an emphasis on stability, confidence, and security.

Table 1 Comparison of aviation business models: network carriers (NWCs) versus low-cost carriers (LCCs)

Characteristics	NWC	LCC
Generic Strategy	Differentiation	Cost Leadership
Scale	Large/often intercontinental/ traditional airline business model with many supporting business units	Regional/continental/ virtual airline business model with single core flight operation and small overhead/ outsourced supporting functions
Network	Hub and spoke; short haul and long haul; primary airports; various aircraft types; frequent schedules	Point-to-point; short haul; secondary airports; single aircraft type
Market/Pricing	Inelastic markets; business travelers and "visit friends & relatives" passengers; price discrimination with various tariffs	Elastic markets;VFR and vacation passengers; yield management; modular pricing; ancillary revenues
Operational	Hub and spoke leads to several waves at the hub with a lot of required labor/ comprehensive services on the ground and in the air/high-quality image/longer turnaround times/ prearranged seating.	Only point-to-point operation with no guaranteed connection/ few or no services/low-cost image/free seating/ ticketless booking
Distribution	Complex reservation systems/travel agents/ website	Mainly website
Efficiency	Reduced efficiency due to rigid system/ reduced aircraft utilization	Flat hierarchy/high utilization of aircraft and labor

After obtaining their ATPL, pilots of a traditional NWC usually sign an unlimited employment contract with clearly regulated and legally protected working conditions. Within NWCs, seniority rules are in place that regulate promotion levels, transitions to the next aircraft type, salaries, and social retirement plans. Pilots' labor contracts are usually negotiated by the pilot unions, and NWC pilots are traditionally assigned to one hub-and-spoke home-base airport. Hunter[12] describes the working conditions at NWCs associated with greater job security, increased compliance with labor laws, and fewer working hours compared with LCC contracts. Moreover, NWC pilots usually receive higher salaries and more paid leave, negotiated by pilot unions. [12] The International Transport Workers Federation[4] reported that NWC pilots earned 5%–40% more, had 10%–35% fewer block hours, and had 5%–20% more days off or vacation entitlements compared with LCC pilots (Figure 2). LCCs are known for their optimized cost-benefit ratio[2] and mainly operate regional and short-haul flights. [13] Today, various subtypes of LCC exist, including the ultra-LCC model of Ryanair, the classical model of Southwest, or the hybrid version of Easy Jet[14,15] with minimal management overhead.[10,16] LCCs operate single point-to-point routes with minimal turnaround or ground times. This is associated with increases in time pressure, work-related stress, flight hours, and sectors (take-offs and landings) during long flight duty days. Furthermore, LCC pilots must cope with a higher workload due to multiple short-haul or regional flights per flight duty,[17] restricted sleep and other fatigue risks due to flight duties,[18,19] higher fatigue levels,[9] and more frequent burnout.[20] LCCs usually recruit pilots with self-funded pilot training, which costs on average €100,000 through the attainment of their fATPL,[7] plus about €30,000 for their type rating to learn how to fly an Airbus A319 or Boeing B737. Stress and pressure are further exacerbated by the fact that many inexperienced LCC pilots are employed by temporary employment agencies or intermediaries such as agencies, brokers, or employment agencies, where no employment contract between the LCC pilot and the air operator exists. [7] Many new "self-employed" LCC pilots must possess their own "pilot service company" in country A while living in country B and maintaining their home base in country C. Moreover, these self-employed pilots receive no paid sick leave, vacation time, or compensation for gaps in employment. Furthermore, when operators schedule only a few flights per month, these are operated by their more senior staff pilots. Many LCC pilots are, in any case, reluctant to take sick leave or days off due to severe fatigue because they cannot afford to lose income.[21,22] "A pilot with a temporary contract could feel pressured and worry about certain factors such as sickness, vacation, career progression, etc., as opposed to a pilot with a direct, permanent contract". [7] This state of affairs can also affect flight safety negatively.[23] Brannigan et al.,[7] reported that 15% of all LCC pilots were employed by temporary employment agencies and 69% by intermediaries, with an accordingly limited work contract, compared with only 3% and 16% of NWC pilots, respectively. Consequently, NWC pilots who had a traditional unlimited work contract with their employer reported greater job security and higher job satisfaction than did LCC pilots employed through an agency or intermediary. An atypical form of employment is pay-to-fly (P2F), whereby an air operator requires pilots to pay for their line training on board regular, revenue-earning flights, while these pilots-in-training do not earn a salary.[7,24,25] LCC pilots are normally assigned to one home base; nevertheless, they are frequently reassigned to a different one as a repercussion of sick or fatigue leave or fatigue reports.[7] Long commuting times are demanding, as are time pressure and high workloads. In markets with low profit margins, fierce competition, and maximum productivity, self-employment arrangements are widely employed as an option. The European Cockpit Association[25] reported similar conditions. Only about half of the pilots surveyed (53%) were directly employed by their air operator; 15% were self-employed; 11% were flying for an airline under their own limited liability company (LLC); and 17% had a temporary agency contract. Self-employment is the most common form of atypical employment: 70% of self-employed pilots work for LCCs. Ryanair has a 60% share of atypically employed pilots. Although self-employed, the company's pilots are not allowed to work for another air operator or to choose when or how many hours to fly. Finally, in the LLC model, 57% of all posted and surveyed pilots were living in or flying out of a home base in another EU member state.

LCC pilots are commonly prohibited from joining pilot unions and receiving a higher share of variable performance-related earnings; moreover,[9] reported higher fatigue for short-haul pilots of LCC carriers. Furthermore, a higher workload and more duty and flight hours have been shown to lead to increased sickness and inappropriate presenteeism,[22,26] decreased flight safety,[27–29] and high levels of fatigue among pilots.[23,30–32] The safety culture at LCCs and carriers was perceived to be inferior to safety culture at NWCs.[8] Many pilots reported experiencing repercussions after fatigue reports.[28] Severe

unexpected fatigue on flight duty was reported by 90% of pilots, while only 50% had reported being "not fit to fly" due to fatigue in the previous year.[33,34] The differences between NWCs and LCCs have narrowed over the past decade, accompanied by a consequent deterioration in working conditions and pay.[5–7] Nevertheless, LCCs and NWCs can still be distinguished. So far, only one study has analyzed fatigue in short- and long-haul pilots and pilots of LCCs and NWCs,[9] finding that 75% of short-haul pilots of LCCs reported severe fatigue, while 80% reported considerable performance decrements due to fatigue. LCC pilots reported high fatigue more frequently than did NWC pilots; they also reported higher levels of fatigue and having to use "commander's discretion" more often than did NWC pilots. In addition to higher fatigue scores, LCC pilots also reported diminished physical and psychological health[9] in line with the theory of allostasis.[35–37] Despite cutting-edge technology, fatigue-related performance decrements were identified as a threat to modern flight safety.[27,28,38–40] In the 1980s, professional pilots flew an average of 46 hours/month,[40] while present flight time limitations[41] allow up to 100 flight hours and 1,000 flight hours per year (Table 2). A high level of fatigue was causal in or contributed to several plane crashes and accidents, including China Airlines 006,[42] Korean Air 801[43] American Airlines 1420,[44] and the TransAsia crashes. Furthermore, a high level of fatigue, combined with precarious working conditions, contributed to the Colgan Air 3407 crash. Fatigue has already been identified in the literature as a considerable threat to aviation and flight safety.[27,28,38,39] Impaired mental health or stressful life events have played a substantial role in 17 commercial aviation accidents and incidents in past decade, in which 576 persons were killed.[45]

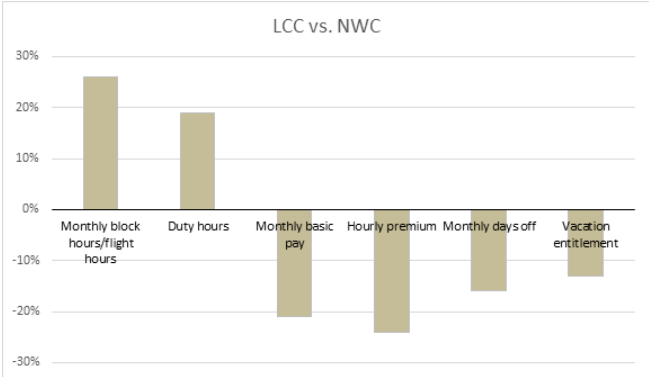

Figure 2 Average differences between LCC flight crew members (FCM) and NWC FCM of the ITF study.[5]

Table 2 Basic overview of the most basic Flight Time Limitations (FTL) of the European aviation safety agency (EASA), Civil Aviation Safety Authority (CASA), and Federal Aviation Administration

Flight time limitations in effect until March 2019					
			EASA FTL: ORO.FTL.210	**CASA FTL 48.1**	**FAA Part 121**
Duty period or duty hours*/pilot (multi-pilot operation)	Max. duty hours		13 duty hours	14 duty hours	14 duty hours
Max. duty hours/month	190 duty hours	200 duty hours			
Commander's discretion** (Extension of max. duty hours)	max. 13 duty hours	max. 14 duty hours	max. 14 duty hours		
	(plus max. 2 duty hours)	(plus max. 1 duty hour)	(plus max. 2 duty hours)		
Augmented Crews§	Depending on time of day		FDP > 9–13 duty hours	FDP > 8–14 duty hours	FDP > 9–14 duty hours
Flight hours†/pilot (multi -pilot operation)	In any 28 consecutive days		100 flight hours	100 flight hours	100 flight hours
In any calendar year	900 flight hours		1,000 flight hours		
In any 12 consec. months	1,000 flight hours	1,000 flight hours			
Minimum rest‡	Before flight duty		10 hours (exceptions)	10 hours (exceptions)	10 hours

Note: FDP; flight duty period

* "Duty period' [duty hours] means a period which starts when a crew member is required by an operator to report for or to commence a duty and ends when that person is free of all duties, including post-flight duty" (EASA FTL, 2014, p. 21).
** "Commander's discretion may be used to modify the limits on the maximum daily FDP (basic or with extension due to in-flight rest), duty, and rest periods in the case of unforeseen circumstances in flight operations beyond the operator's control, which start at or after the reporting time" (EASA FTL, 2014, p. 21).
§"Augmented flight crew' means a flight crew which comprises more than the minimum number required to operate the aircraft, allowing each flight crew member to leave the assigned post, for the purpose of in-flight rest, and to be replaced by another appropriately qualified flight crew member" (EASA FTL, 2014, p. 21).
† "Flight time' [flight hours] means the time between an aircraft first moving from its parking place for the purpose of taking off until it comes to rest on the designated parking position and all engines or propellers are shut down" (EASA FTL, 2014, p. 21).
‡ "Rest period' means a continuous, uninterrupted, and defined period of time following duty or prior to duty, during which a crew member is free of all duties, standby, and reserve" (EASA FTL, 2014, p. 21).

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The ICAO defines fatigue as follows: "A physiological state of reduced mental or physical performance capability resulting from sleep loss, extended wakefulness, circadian phase, and/or workload (mental and/or physical activity) that can impair a person's alertness and ability to adequately perform safety-related operational duties." Commission Regulation (EU) 2018/1042 links pilots' fatigue and health with flight safety. Here, beyond the basic alertness/sleepiness dichotomy, we use the term fatigue to describe long-term, accumulated fatigue of the kind that can deleteriously affect an individual's job performance, workplace safety, and private life, in line with the definitions of the International Classification of Diseases (ICD-11) and Shahid et al.[46] Here is a simple example applicable to pilots and shift-workers: Acute sleepiness is one symptom of fatigue, and it can be compensated for by a sufficiently long period of good-quality sleep. However, accumulated fatigue can reach a level where legally prescribed breaks (nights, weekends, holidays) are insufficient to allow the individual to recover. [46]

If accumulated sleep debt[47] cannot be recovered before commencing flight duties, fatigue can impair the sensory, cognitive, physical, and behavioral functions of flight crews.[35,36,39,48,49] "Neurobehavioral performance effects of sleepiness reported by pilots include increasing pressure to fall asleep, degraded alertness, errors of omission and commission, deterioration in judgement and decision making, worsened mood, and deteriorating flying skills"[39,49] also reported fatigue-related performance decrements regarding divided attention, short-term memory, decision making, concentration, and deteriorated psychomotor and visual performance. While it is difficult to measure these multimodal performance decrements during active flight duties, micro-sleeps in the cockpit are valid manifestations of very high sleepiness and fatigue on the flight deck. Fatigue-related incapacitation during micro-sleep can be functionally similar to medical incapacitations such as heart attacks, cardiac arrhythmias, or strokes.[39] Micro-sleep is defined as "momentary loss of awareness when a person is fatigued or sleep-deprived, especially during monotonous tasks [for pilots, e.g., the cruise phase of flights, looking at monitors in the cockpit (PFD), monitoring flight parameters during uneventful flights, etc.]. Micro-sleep episodes can be noticed when the head literally drops forward and can last from less than one second to minutes".[50] Situational awareness is essential for flight safety, but when a pilot accidentally nods off or falls asleep, situational awareness is gone: at such times, the pilot will be "behind his plane," not knowing how much time has been missed, where he or she is exactly, what has happened, and what the next steps regarding checks and procedures are. After micro-sleep events, pilots need time to reorient themselves at the controls. If both pilots accidentally doze off at the same time, the redundancy that is essential for flight safety completely disappears.[39,51] Per 2,000 flight hours, 1.1 cases were reported in which both pilots fell asleep from fatigue or exhaustion without prior coordination.[39] Micro-sleeps in the cockpit are reported by 20%–45% of pilots.[23,52] Two-thirds of investigated pilots reported fatigue-related errors during active flight duty. Fatigue risk management (FRM) builds on both pilots' fatigue reports and the "standard methods of fatigue measurement"[53] to tackle preventing fatigue and fatigue risks due to flight operations. Despite these efforts, FRM may be less successful than expected.[28] Four of five pilots did not feel encouraged to file fatigue reports. Pilots also complained that fatigue reports were long and complicated, with almost no improvement afterward.

Pilot's health

Although pilot unions often complain about high fatigue levels, especially among LCC pilots, no studies have reported NWC and LCC pilots' working conditions, rosters, stress levels, sleep problems, effectively measured fatigue levels, overall well-being, symptoms of depression, anxiety, or common mental disorders up until today.

In this context, key symptoms of depressive disorders are depressive mood (e.g., feeling sad, irritable, empty) or anhedonia (loss of pleasure) accompanied by other cognitive, behavioral, or neurovegetative symptoms that significantly affect the individual's ability to function. Depression symptoms include little interest or pleasure in doing things, feeling down, depressed, or hopeless, trouble falling or staying asleep, or sleeping too much, feeling tired or having little energy, poor appetite or overeating, feeling bad about oneself, and trouble concentrating. According to International Classification of Diseases (revision 11, 6B00 Generalized Anxiety Disorder) represents excessive unreasonable fears, worries, and rumination without real life-threatening imminent stressors. Pilots must often cope with realistic existential threats and fears, e.g., of loss of Medical Class 1 due to fatigue, sleep problems, nascent burnout, or loss of career and livelihood. On an everyday basis, pilots must cope with real job-related risks associated with working several thousand feet above the ground in an environment that is hostile to life. Further, common mental disorders (CMDs) are frequently occurring, less severe psychological impairments, including psychosomatic complaints (such as headache and lack of appetite) and difficulties in concentration, decision-making, and irritability. CMDs are affected by living conditions and/or occupational stress and can be either transitory or long lasting.

Jackson & Earl[9] analyzed the general fatigue and health perceptions of short- and long-haul LCC and NWC pilots but did not evaluate their rosters or working conditions in detail. Brannigan et al.[7] and Reader et al. [8] analyzed employment and working conditions of pilots flying for LCCs, NWCs, and other air operators regarding overall fatigue perception, flight safety, and safety culture parameters. Starting with the still scant body of research comparing NWCs and LCCs regarding pilots' actual rosters and working conditions, the aim of this study was to compare pilots' stress, sleep difficulties, fatigue levels, mental health, and overall well-being. Brannigan et al. [7] compared the working conditions and, especially, atypical employment conditions of pilots flying for LCCs and NWCs. They reported distinct differences between LCCs and NWCs regarding the following:

1. Safety culture (e.g., feeling pressure to fly even though the pilot is fatigued or otherwise unfit to fly, the existence of easy and clear ways to report safety-related issues to the company, fear of negative consequences to employment status if the pilot reports any problems),
2. Pilot fatigue, and
3. Stress in terms of time pressure (i.e., in/sufficient time for pre- and post-flight duties, legal rest times).

Discussion & conclusion

As explained, the differences between NWCs and LCCs have diminished as both operator types aim to maximize productivity.[15] One way to reduce costs and increase profits is flexible contracts and hourly pay, exclusively or in addition to a minimum regional salary, as reported by LCC pilots. [7] Strategic decisions and economic pressure have resulted in heavy workloads, increasing time constraints, and more demanding rosters, especially for LCC pilots. The impairment of LCC pilots' mental health and overall well-being is reported by several research papers.[9,21,22] LCC pilots predominantly fly regional and/or short-haul operations, which are associated with a high workload in terms of more take-offs and landings, more early starts,

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and thus more sleep restrictions and potential on-call flight duties on standby days.[18,19,34] One reason for this could be those existential stressors—such as high job insecurity, pressure from management to extend flight duties (commander's discretion), or working despite fatigue or health problems—are affecting the health and flight safety of LCC pilots as reported by several studies Johansson & Melin,[26] Little et al.[54] Furthermore, Little et al.[54] described the negative consequences of high job insecurity on mental health, especially symptoms of depression and anxiety. Additional factors like less experience, lower job security due to more atypical employment conditions, lower income, and poorer career opportunities (e.g., only regional and short-haul operations) aggregate the situation. Consequently, LCC pilots reported the decay of safety culture.[7,8]

EASA seems surprised that all operators used the utmost limits of FTL as goals to maximize productivity.[28,30] High levels of burnout in 32%[20] to 40% of active professional pilots[55] and high levels of fatigue in most pilots suggest that the present management and rostering strategies of air operators are not sustainable in terms of flight safety and pilots' health maintenance[7,8,33] Pilot workloads increased considerably, with an average of 47% more flight hours per month compared with the 1980s.[40]

The differences in management and working conditions for flight crews at NWCs and LCCs have narrowed over time and will be further eroded by economic pressures. Both groups of pilots raised concerns about flight-time limitations. Therefore, the aviation industry, civil aviation authorities, and air operators must implement more restrictive flight-time limitations before flight safety is further jeopardized. The maximum duration of flight duties per day, per month, and per year must be reduced. Doing so would be crucial to reducing the high levels of accumulated fatigue and health impairment among pilots and to lessening sick and fatigue leave. Loopholes such as the "commander's discretion" and FRM are often used to enable aircrew to work even longer than permitted by flight-time limitations. Extending the maximum legal duration of flight duties and reducing the minimum legal rest periods must be limited to rare occasions. Pilots must not fly when unfit due to high fatigue levels or physical or mental health problems in order to keep flight operations safe. The very sustainability of aviation seems to be at risk because fatigue and chronic exhaustion stand to increase even more under the current post-COVID-19 pandemic conditions—especially for LCC pilots but also for pilots in general. Finally, programs should be implemented to track conditions and developments within airline operators. Aeromedical examiners should be trained in the interactions of stress, sleep, fatigue, and physical and mental health. Regulators and aeromedical examiners must find a better way to deal with pilots' accumulated fatigue, burnout, and mental health issues in a non-punitive way that will not threaten to destroy pilots' careers.

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Conflict of interest

The Authors declares that there is no Conflict of interest.

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