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Significance of first flight take-off delays: A case study of a low-cost hub in KL

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Abstract: **Keeping to the set time for the first flight of the day is important for low-cost operators, otherwise it leads to delay in the return journey and the subsequent ripple effects may lead to cancellation of later flights. This research, therefore, aims to investigate the likelihood of a delay in the first flight of the day by Low-Cost Carriers (LCC) operating out of KLIA2 and how significant those delays are.**

A sample of 61 first flights of the day operating out of KLIA2 per day was observed for a period of one month using secondary data to study the significance of delays beyond the allowed bench mark being 15 minutes' delay allowed without being considered as delay. Furthermore, a random selection of 30 passengers were interviewed to understand how they manage waiting time during such delays. A summary and significance test were undertaken to analyze the data for patterns and significance of delays.

Research findings confirm that it is indeed a concern; there are often delays confirming the first flight on any given day. There is also a discrete expression of concern on the issue of matches, especially for the first flight of the day, from pilots and latent support for a better system in place.

Although the evidence of delay is an issue, the research focused on scheduling as an issue; a match between flight and pilot that is controllable. Other issues could also contribute to delays such as technical problems. The researcher believes that an efficient system is able to reschedule a different combination of flight and pilot within the given 15 minutes' delay, which is an acceptable norm in this industry if an effective system is in place. Although the current research has not clearly correlated the schedule as an issue for the first flights, there is an indication that it does but not significantly for the current period. If left unchecked, it will become a routine for the operators to believe such delays are norms in this type of business and acceptable to the users, leading to a significant problem in the future.

Keywords: **First flight delay, Low-Cost Carriers, Flight crew, Flight Schedule.**

I. INTRODUCTION

In the low-cost airline industry, low customer costs, on-time arrival and on-time departure are key attributes to a successful airline operation.

In reality, however, unexpected events are the norm but within levels of "acceptable" delays. According to the Bureau of Transportation Statistics (2009), internal problems at carriers caused delayed arrivals of approximately one third of flights and a further one third of these late arrivals were caused by aircraft arriving late from its previous sector. Based on a report prepared for the US Senate Joint Economic Committee (2008), the total losses to carriers, air travelers and the US economy in 2007 is estimated at approximately $41 billion, split into $31 billion in direct costs and $10 billion in related overhangs.

In another study by the US Bureau of Transportation Statistics (2017), maintenance or crew problems, interior post-flight cleaning, baggage handling and refueling were among the reasons for delays, but airlines aren't required to report the reasons for their delays to the regulatory authorities by sub category and therefore there is no detailed visibility of the reasons provided.

Referring to data provided by the Bureau of Transportation Statistics, the root causes of 67.4% of all flight delays are “Late-arriving aircraft: A previous flight with the same aircraft arrived late, causing the present flight to depart late” and “airlines aren't required to report the reasons for their delays to government”.

Among the many cost triggers of significance, especially for low-cost airlines, is the delay of the first departure of the day. This delay will then snowball during the rest of the aircraft's flying time of the day and cause more delays or cancellations.

The current situation in the airline industry suggests a need to continuously monitor aircraft flight delays (Kafle & Zou, 2016). The issue of the first flight delays due to aircraft and pilot selection, although is an important consideration, especially for the first take-off of the day, is least emphasized by operators.

The aim of the research is to investigate if current practices of airline pilots and aircraft matching have an effect on first flight delays for LCCs and the necessary suggestions for improvement.

II. LITERATURE REVIEW

The deregulation of the U.S. airline industry in the 1970s led to the increased adoption of the LCC concept. The 1978 Airline Deregulation Act partly shifted control over air travel from the government to the private sector with pioneers like Southwest Airlines Co (LUV) leading the charge into mass market passenger travel as a commodity (Strassmann, 1990). As quoted in a Bloomberg article, the number of U.S. air travelers has grown from 207.5 million in 1974 to more than 721 million in 2010, with a significant drop in fares over the same time frame. In comparison, airline revenue per passenger mile moved down 61% from 33.3 cents (inflation-adjusted) in 1974 to 13 cents in 2010. On the other hand, the load factor (the percentage of filled seats) rose from about 50% in the early 1970s to 74% in the 2000s.

The Centre for Aviation CAPA (2015) states that while national airlines are losing their popularity with the advent of the LCC revolution (Kearney, 2016), it has spread worldwide the past three decades, to Europe in the 1990s and Asia in the 2000s. The rise of LCCs can be attributed to many creative approaches and developments since the 1970s (Dunn, 2014). National carriers' use of the ‘hub and spoke’ model also has some serious shortcomings that require the maintenance of complex infrastructure for interconnected systems with the attendant high costs. The LCCs, however, favored the point-to-point model when industry deregulation occurred, with its simplified infrastructure and reduced travel time for air travelers (Cook & Goodwin, 2008). This provides substantial cost savings by eliminating the intermediate stop at the hub and the duplication and investment of resources, with the added benefit of better aircraft utilization. The primary weakness of the point-to-point model is its limited reach, as only a limited number of city-pairs are available for point-to-point services to be viable, restricting the number of destinations that can be served.

Low ticket pricing is now the biggest competitive factor and pulls for air travelers. This thriftiness also affects and encompasses business travelers, as companies increasingly seek to lower business costs. Further aggressive downward pressure on ticket prices may be on the horizon from the advent of ultra-low-cost carriers like Spirit Airlines Inc. (SAVE), which provides a passenger with a seat and nothing (Bloomberg, 2018).

The rise of the Internet and printed ticket issuance for free travel has been a boon for LCCs. It increased transparency of ticket pricing, works to the LCCs' advantage because of their lower ticket prices and ability to adapt to the technology. A key LCC advantage is the use of a single aircraft type in its fleet. This fleet uniformity leads to lower air and maintenance crew training and spares inventory costs. According to Forbes (2014), several innovative LCCs such as Southwest in the U.S. also derive considerable advantage from the high motivation levels of their employees. Attractive compensation and incentives like profit-sharing provide great financial motives and a strong corporate brand provides considerable pride in service. In addition, short-haul routes point to point routes by LCCs, which keep employees away from home for a few hours as in regular jobs is also a great positive for morale in comparison to a couple of days or longer for long-haul flights.

Issues Affecting Waiting Delays and Service Evaluation: Considerable research studies on waiting, delays and its cost implications have been conducted over the past thirty years (Scotland, 1991; Diaz & Ruiz, 2004; Tsoukalas, et al., 2008; Weiwei, et al., 2018). Researchers have advocated that service waits can be controlled by including techniques like operational management or perception management (Katk, Larson & Larson, 1991; Sinastava, et el., 2008; Ngege, 2011) qualities and satisfaction infused in management analysis (Naik, 2010; Munirat,, et al., 2015).

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Passenger airline delays are ubiquitous (Cheng, 2005) and lead to extended waiting for customers. Airspace congestion, severe weather, mechanical problems, and other sources cause substantial disruptions to a planned flight schedule and cause passenger delays and disruptions (Lan & Barnhart, 2006). Increasing the robustness of flight schedule planning can mitigate the impact of these delays in addition to reducing the potential likelihood of its occurrence with attendant cost reductions (Lan, Clarke & Barnhart, 2006). Tu, Ball and Jank (2008) have identified and studied the major factors influencing flight departure delays and developed a strategic departure delay prediction model. Kafle and Zou, (2016) proposed a novel analytical-econometric approach to improve overall system performance. This includes the assignment of a buffer to their flight schedules to mitigate delay propagation. The provision of excess slack in a planned schedule is undesirable, although slack is critical in operations as a means for mitigating the impact of disruption. Beygi, Cohn and Lapp, (2010) in their article demonstrated redistribution of existing slack in the planning process to reduce delay propagation by making minor modifications to the flight schedule while closely preserving the original aircraft and crew schedule rosters. This action has resulted in improvements in operational performance without significantly increasing planned costs under targeted conditions. conditions.

Gao (2007) and Lettovsky, (2000) developed, implemented, and tested an effective near-real time recovery plan to reassign crews from a disrupted crew schedule utilizing a fast crew-pairing generator. This was designed around partially flown crews, being reassigned to matching alternates, exploiting the fact that the planned schedule is optimal.

Others like Hansen, (2012) studied the impact and correlation between the carrier cost structure and its operational aspects. The results of estimations from a multitude of airline cost models revealed that both delay and schedule buffers imparted significant costs with activity outside scheduled windows increasing cost and inactivity within scheduled windows with minimal impact. Using these models, cost savings for airlines with "flawless" operational performance were estimated in the range of $7.1–13.5 billion. An interesting finding by researcher Forbes (2007) indicated that any exogenous shocks have cost implications, a study on a legislative change in take-off and landing restrictions at LaGuardia Airport provides an opportunity to study the effect of an exogenous shock to product quality on prices in the airline industry. The elasticity of price response varies with the degree of competition in the market. The findings indicated a price fall of $1.42 on average for each additional minute of a flight delay, and that the price response is substantially larger in more competitive markets.

In order for service recovery to be effective, employee engagement is critical (Lettovský, & Nemhauser, 2000). Bamford and Xystouri (2005) suggested the involvement of factors that are external (to the customer) as well as internal (to the organization) and the significance, power and influence of employees on the delivery of quality service. Through comparison with other airlines, the findings reassert that service quality excellence can only be achieved through employee satisfaction, commitment and loyalty instilled by senior management commitment, focus and drive.

At the receiving end, consumers suffer as a result of such delays and have an adverse effect on consumer behavior. Diaz and Ruiz (2002) studied the relationships that exist among the attributions, the affect and behavioral intentions of consumers who suffer delays in services. They considered two different affective dimensions: anger (emotional reaction) and satisfaction with the service (cognitive and emotional evaluation). The methodology employed is based on structural equation modelling and empirical application in the airline industry. The findings demonstrate the existence of the sequence "attribution-affect-behavioral intention", with anger being the mediator in the relationship between the attribution of control to behavioral intention (propensity to complain and repurchase intentions). Similarly, Diaz (2002) presented a model of the wait experience, which assesses the effects of delay duration, attribution of the delay, and the degree to which time is filled, on affective and evaluative reactions to the delay. An empirical test of the model with delayed airline passengers reveals that delays do affect service evaluations; however, this impact is mediated by negative affective reactions to the delay. The degree to which the service provider is perceived to have control and the degree to which the delayed air travelers' time is filled also indirectly affect service evaluations, mediated by the air traveler's affective reactions to uncertainty and anger.

Current Practices in Matching Pilot and Aircraft for LCC Operators in Malaysia

The criteria used to match aircraft and pilots is complex as it contains rules that are governed by international and national aircrew regulations; aircraft availability and human factors forming the most decisive criteria.

These criteria are sifted and meshed to produce a crew and aircraft rostering schedule at least 30 days in advance of utilization. In addition, instantaneous, daily and weekly schedule changes are made to the system due to evolving short-term issues from no-show of aircrew to unpredictable last-minute weather changes.

In the current practices section, these are split into parts one, two and three. Part one describes the current criteria used in selecting the aircraft. Part two is a selection of flight crew and part three is the decision and execution of ad-hoc changes to the crew and aircraft roster schedule. This data crunching is not manually handled but based on off the shelf support software systems in line with operator rules and policies.

Aircraft Schedule

A key component of low-cost carrier fleets is the use of common standard aircraft composed of one or two aircraft types which have fleet uniformity (Dunn, 2014). This greatly simplifies the maintenance, training and spares cycle. In most cases, it is a case of selecting the available serviceable aircraft, rather than selecting the right aircraft type (ibid).

An aircraft can be classed in one of three states at all times in the low-cost carrier fleet. These are Serviceable, In Maintenance and Aircraft on Ground (IATA, 2013a, b). The first two states are known in advance and form the basis of planning and scheduling. The third state is unscheduled corrective maintenance brought on by ad-hoc incidents, pre-flight check failures and failure to complete scheduled maintenance tasks as required. An AOG situation is thus undesirable and feeds into corrections required in the crew and aircraft rostering schedule (Kinnison, et al., 2011).

Aircraft scheduling by LCC operators is nominally done one month in advance of requirements. The aircraft selection criteria will be based on the following criteria, but only, as per Table 1, items 2, 3 and 4 are parent processes that affect the first flight operations. Item 1 is a 'constant' that cannot be changed to suit operations or improve matches for purposes of research here (ibid).

Table 1: Selection criteria of aircraft for operations

Criteria	Description
1. Sectors Serviced	This is governed by the routes in service and described as "sectors" in airline parlance. Sectors are set by commercial requirements and approved by both national and destination authorities and here to describe external constraints to the selection process. LCC aircraft flight times vary between less than an hour to up to five hours per sector for a narrow body type jet aircraft. An LCC aircraft can fly between four and eight sectors per day of operations, with varying flight crews (if necessary) until the next maintenance cycle is required.
2. Serviceability	In service with no scheduled maintenance plan blocking usage with Extended Diversion Time Operations (EDTO) as a subset.
3. In maintenance	out of service and in scheduled maintenance
4. Aircraft on Ground	Out of service and in corrective maintenance. A day before the actual departure, the engineering team will advise operation control on the current aircraft status as one criterion that might change the aircraft selection if there's Aircraft on Ground (unscheduled maintenance). If this happens, another aircraft will be selected for that particular day.

Source: Kinnison, Harry; Siddiqui, Tariq (2011). Aviation Maintenance Management

Current Practices in Pilot Management for First Flight

In current practice, the airline rostering schedule will be issued one month in advance and each crew member will have a copy. The selection criteria are fully dictated by the airline and crew must fit their time off and other private matters around the schedule (Gopalakrishnan & Johnson, 2003).

The conditions for crew rostering guidance are stipulated in Flight and Duty Time Limitation and Rest Requirement found in the Flight Operation Directive – Organization Requirement for Air Operations, Subpart FTL (Flight and duty time limitations and rest requirements) by the Malaysia regulatory authority, Civil Aviation Authority of Malaysia (CAAM). One last point to note is that while conditions are stated as shall, these are fully understood in the aviation industry as mandatory compliance set by the Civil Aviation Authority of Malaysia. These are listed as presented below in the document (CAAM, Flight Operations, 2018):

1. An operator shall publish a monthly roster not less than 7 days in advance before the end of the month.

2. An operator shall prepare duty rosters sufficiently in advance to provide the opportunity for the crew to plan adequate pre-duty rest.

3. An operator shall establish minimum periods of notification of duty for the operating crew, or where this is not practicable due to the nature of the operation, must establish in advance minimum periods of notification of days off, during which a crew member will not be required for any duties.

4. An operator shall ensure training for Rostering Staff shall include guidance on the effects of disturbing Circadian Rhythms and sleep deprivation.

5. Away from a base, the operator must provide for crew members both the opportunity and facilities for adequate pre-flight rest, in scheduled accommodation.

6. An operator shall ensure that the employment of a crew member on an irregular basis, then the operator shall ensure that the crew member satisfies the provisions of the company-approved Flight Time Limitation scheme.

The flight time limitation is the most important criterion in establishing the monthly roster for the flight crew. Crew flight times and duty periods are subject to the following, with the proviso that flight worthiness and maximum regulation hours are not exceeded (CAAM, Flight Operations, 2018):

1. 55 hours on any 7 consecutive days, but may be increased to 60 hours, when a rostered duty covering a series of duty periods, once commenced, is subject to unforeseen delays;

2. 95 hours on any 14 consecutive days; and

3. 190 hours in 28 consecutive days.

4. during the period of 12 months, expiring at the end of the previous month exceeds 900 hours

Other criteria to be taken into consideration are positioning and travelling, split duty, standby duty and duties at the airport, and rest period, which is well described in the Flight Operation Directive (CAAM, Flight Operations, 2018).

Current Practices in Pilot and aircraft rostering schedule change

Once the aircraft and crew roster is released with a 30 day notice it is considered the definitive document for flight schedules. The LCC schedulers will monitor the roster plan every 3 days and make the necessary changes as required.

Any changes to the individual flight crew times will be captured by the system with changes and notifications sent to the related flight crews. In addition, the engineering team will also provide an update if the aircraft selected for the next day's flight is unavailable due to the aircraft in ground conditions. These are monitored and confirmed one day in advance of the specific first flight. In an ideal scenario, the day-to-day data updates on aircraft and flight crews should match the plan and not deviate substantially on the approach of the 30-day start of the new schedule. The system notifies all relevant parties only if changes occur outside the bounds of the initial aircraft and crew roster and specific to affected parties.

Currently, to match the flight crew and aircraft for the first take-off, the software system automatically selects the flight crew and aircraft based on rules and inputs by schedulers. The rules and conditions are opaque and not available for further analysis of system efficiency on time and resource management.

"Low-cost flight" and "first flight delay" as a combination is required to address the research subject and the search for a match at the following scholarly linked websites, including UM Library Online Databases and Google Scholar presents no simultaneous matching items. This research is focused on providing and understanding the problem and offering best practices as a solution to the current practices.

III. METHODOLOGY

A. Quantitative Analysis technique:

There were 61 flights operating daily out of KLIA2, of which three are minor operators (Jetstar, Cebu Pacific and Tigerair), the balance of fifty-eight are from the major operators (AirAsia, 2017). Based on a thirty-day observation, a total of 1830

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first day flights were observed. The data is summarized to give the 'mean delay' for each destination outside of KLIA2 of first flights for a period of 30 days and there are 61 first take-off flights in one day.

B. Qualitative Analysis technique:

Fifty air crew (pilots) were identified through a snowballing technique and only those having a minimum of two years on the job and are willing to participate were selected. This group is dependent and does come under the jurisdiction of the airline operators.

The Instrument: Seven questions were designed in this section:

Q1: Have you piloted the first flight of the day?

Q2: Do you encounter delays regularly on the first flight of the day?

Q3: Do you believe the first flight delay will cause subsequent delays for the day?

Q4: Have you ever encountered a last-minute request to fill in for another pilot's absence?

Q5: Do you think this will cause some delay in departure?

Q6: How did you handle it?

Q7: What would you expect differently in hindsight from the time schedule?

IV. SUMMARY STATISTICS OF FIRST FLIGHT OF THE DAY

A. Quantitative Data Analysis

In Table 4.1, Table 4.2 and 4.3 will show the one-month data collected for 61 aircraft that departs from KLIA2. The data collected is the **duration of delays between the actual departure of the aircraft against the scheduled departure**.

Table 4.1 Aircraft number 1-20 first flight for 30 days' delay summary

AIRCRAFT		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
DELAY	Day 01	49	72	15	0	30	0	0	54	0	0	25	63	11	0	0	36	65	35	28	9
	Day 02	27	33	25	23	0	20	21	31	0	0	23	29	35	0	23	0	36	19	9	17
	Day 03	11	16	11	16	0	0	33	0	13	0	7	18	15	0	0	0	17	54	24	15
	Day 04	16	23	15	16	0	16	30	27	0	0	14	18	9	0	29	0	16	17	16	14
	Day 05	73	0	15	0	0	0	20	17	0	0	16	17	21	0	0	0	15	17	19	14
	Day 06	76	31	14	0	16	0	26	0	0	0	7	29	14	22	0	0	19	54	14	17
	Day 07	39	29	21	16	26	0	9	17	8	0	27	17	16	19	0	0	22	17	11	15
	Day 08	18	19	17	16	22	21	96	37	0	0	16	57	19	15	0	0	51	29	34	9
	Day 09	9	34	16	10	22	17	19	18	15	0	36	14	12	0	15	0	55	27	6	10
	Day 10	27	23	21	0	15	24	38	15	0	0	0	24	18	0	20	0	12	21	19	19
	Day 11	19	19	13	19	24	14	32	58	17	18	12	28	8	29	19	20	48	24	38	17
	Day 12	16	30	10	17	25	0	18	0	27	0	16	20	14	0	28	23	19	9	24	3
	Day 13	17	20	31	0	17	16	49	36	0	0	27	27	7	19	0	0	24	17	28	28
	Day 14	10	26	16	8	16	0	27	17	0	0	22	22	8	21	10	0	36	17	12	5
	Day 15	13	0	10	0	27	11	31	37	0	0	17	17	10	0	0	0	34	32	16	8
	Day 16	31	27	22	17	13	11	30	15	12		7	25	23	0	0		50	16	21	12
	Day 17	0	37	14	0	32	0	46	21	0	0	34	0	5	19	0	0	54	22	0	0
	Day 18	0	38	0	0	0	0	25	33	0	0	33	0	0	27	0	0	13	11	0	11
	Day 19	15	21	0	0	0	0	24	20	9	0	21	18	19	26	0	13	33	26	0	12
	Day 20	33	36	23	0	8	13	25	0	4	0	29	37	0	14	0	16	28	12	0	26
	Day 21	58	18	11	0	10	9	26	12	0	0	23	36	17	18	0	37	13	14	0	0
	Day 22	20	0	11	0	15	0	0	0	0	0	33	18	9	0	0	24	0	0	0	12
	Day 23	11	0	12	19	0	0	0	0	0	21	9	10	0	0	0	23	0	0	27	24
	Day 24	13	0	16	13	0	0	0	0	0	0	20	26	0	0	0	0	0	0	33	13
	Day 25	39	0	16	17	0	0	0	0	20	0	13	50	0	0	0	15	0	0	64	10
	Day 26	25	0	0	37	0	0	0	0	0	18	0	25	0	0	0	33	0	0	19	28
	Day 27	25	0	11	21	0	0	0	0	0	25	0	31	0	0	0	28	0	0	44	9
	Day 28	20	0	25	25	0	0	0	0	0	12	18	31	0	0	0	24	0	0	16	21
	Day 29	0	0	8	0	0	0	0	0	0	40	13	0	0	0	0	0	0	0	0	0
	Day 30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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Table 4.2 Aircraft number 21-40 first flight for 30 days' delay summary

AIRCRAFT		21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
DELAY	Day 01	10	21	33	115	38	66	0	0	12	26	86	15	0	0	35	0	8	46	86	40
	Day 02	22	30	38	15	27	22	18	62	33	27	16	0	0	35	7	45	19	34	35	47
	Day 03	34	46	42	21	24	49	14	20	14	22	37	16	0	14	18	45	8	35	13	24
	Day 04	13	26	11	19	18	24	0	20	14	11	23	0	13	2	22	23	10	25	12	20
	Day 05	17	18	12	18	24	17	0	24	9	14	15	13	12	14	11	39	11	17	27	20
	Day 06	12	21	8	23	8	26	20	17	13	12	29	15	17	7	51	37	15	5	15	20
	Day 07	17	17	16	21	33	21	20	25	26	15	20	0	28	40	16	27	15	17	16	18
	Day 08	16	64	22	46	18	18	11	26	15	19	26	8	27	18	16	18	16	14	38	30
	Day 09	25	16	20	17	34	13		14	19	10	27	0	13	7	13	18	22	72	22	32
	Day 10	8	18	10	17	19	20	20	22	22	17	63	9	0	4	19	25	13	21	23	13
	Day 11	18	18	20	16	25	40	17	21	24	27	53	0	8	11	15	18	152	14	15	19
	Day 12	9	22	14	15	23	10	0	35	26	20	15	11	11	21	10	16	18	13	82	30
	Day 13	15	16	10	34	19	50	11	33	16	12	0	32	28	13	10	17	17	19	11	19
	Day 14	12	14	14	21	23	10	36	22	34	13	0	23	13	4	7	21	0	37	15	29
	Day 15	24	26	13	21	36	18	0	41	21	14	0	0	18	27	14	21	0	30	26	36
	Day 16	23	23	0	25	9	18	0	25	24	16	0	25		19	27	39	0	37	24	14
	Day 17	18	0	25	0	26	0	18	30	0	0	0	19	11	0	27	0	0	0	0	0
	Day 18	8	0	13	0	32	0	7	24	0	0	0	0	37	0	17	20	0	0	0	0
	Day 19	8	18	28	19	24	16	27	26	20	16	0	0	21	0	29	26	0	12	18	0
	Day 20	15	16	12	47	27	21	19	22	12	40	0	8	23	9	21	19	0	14	19	0
	Day 21	14	8	18	23	13	13	21	22	12	23	0	2	14	0	29	20	0	30	55	0
	Day 22	0	9	0	9	0	16	0	0	15	20	0	18	0	0	0	0	0	15	11	0
	Day 23	0	21	0	15	0	16	0	0	28	22	0	43	0	17	0	0	90	15	17	19
	Day 24	0	25	0	18	0	19	0	0	19	9	0	26	0	12	0	0	0	33	20	14
	Day 25	0	18	0	22	0	13	0	0	31	19	0	16	0	0	0	0	0	8	32	21
	Day 26	0	10	0	39	0	29	0	0	8	31	14	12	0	13	0	0	0	22	0	29
	Day 27	0	14	0	29	0	19	0	0	17	32		30	0	14	0	0	17	21	11	26
	Day 28	0	22	0	30	0	17	0	0	9	9	74	25	0	12	0	0	0	49	22	16
	Day 29	0	0	0	0	0	0	0	0	0	0	0	25	0	0	0	0	0	0	0	0
	Day 30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 4.3 Aircraft number 41-61 first flight for 30 days' delay summary

AIRCRAFT		41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61
DELAY	Day 01	0	27	49	6	12	0	65	24	0	35	0	63	50	45	0	80	0	0	0	15	70
	Day 02	18	38	45	0	14	16	7	0	36	47	36	29	31	54	0	17	0	38	0	16	31
	Day 03	65	15	22	0	14	0	18	28	16	15	19	18	90	15	10	73	0	14	0	17	23
	Day 04	65	16	8	5	17	13	14	21	14	35	13	18	20	20	18	34	0	10	2	17	14
	Day 05	26	23	15	0	14	15	23	32	20	31	6	17	15	18	17	11	0	23	0	26	28
	Day 06	13	36	25	0	14	0	18	0	34	49	18	29	20	92	18	52	0	20	0	7	21
	Day 07	14	27	36	11	11	8	33	0	14	16	30	17	25	32	13	15	0	15	0	48	26
	Day 08	66	23	29	16	17	0	0	0	41	25	0	57	14	16	23	16	0	20	0	25	21
	Day 09	32	22	14	0	29	9	13	32	21	11	26	14	15	16	22	9	0	22	0	42	15
	Day 10	0	24	48	6	33	0	10	26	24	28	41	24	15	52	22	19	0	18	0	9	23
	Day 11	0	16	11	10	15	11	7		26	28	55	28	37	35	47	30	0	11	0	17	15
	Day 12	0	21	20	14	21	32	16	0	20	17	15	20	20	17	15	11	23	28	0	13	23
	Day 13	0	19	13	0	15	23	0	21	25	18	23	27	57	17	22	11	0	14	0	24	21
	Day 14	0	20	11	0	13	0	11	0	17	34	23	22	34	32	21	45	0	20	0	14	23
	Day 15	0	34	38	8	19	25	22	29	34	21	31	17	67	20	19	13	0	22	0	25	25
	Day 16	0	0	17	11	24	19	20	27	11	30	11	25	39	13	27	68	0	12	0	0	22
	Day 17	0	0	0	0	17	0	20	0	0	0	0	0	0	0	23	0	0	0	0	0	24
	Day 18	0	0	0	0	28	0	9	0	0	0	0	0	0	0	0	0	20	0	0	19	12
	Day 19	0	18	0	0	10	8	24	0	0	30	0	18	0	0	9	0	30	0	0	15	13
	Day 20	0	13	0	3	32	2	47	0	0	25	0	37	0	0	19	14	13	0	0	16	19
	Day 21	0	29	0	0	21	18	24	10	0	22	0	36	0	0	18	34	21	0	0	37	24
	Day 22	0	18	0	0	12	43	0	0	0	20	0	18	0	0	0	30	19	0	0	21	0
	Day 23	0	33	24	10	0	26	0	0	30	84	14	10	50	22	0	27	0	28	17	20	0
	Day 24	0	26	19	10	0	16	0	0	19	30	18	26	24	27	0	12	0	20	24	36	0
	Day 25	0	24	16	7	0	12	0	0	17	44	33	50	23	13	0	45	0	36	23	19	0
	Day 26	0	25	19	12	0	30	0	0	69	28	39	25	56	17	0	40	0	27	26	12	0
	Day 27	0	30	7	0	0	25	0	0	22	20	60	31	43	30	0	16	0	13	0	0	0
	Day 28	0	14	17	8	0	25	0	0	19	33	20	31	24	22	0	36	0	56	22	0	0
	Day 29	0	17	0	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Day 30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

An analysis was done on the average delayed time in minutes with the following conditions:

1. In In absolute terms, i.e., no delay (delay time =0 minutes).
2. In relative terms, i.e., the industrial standard means of delay, 15 minutes or more

For absolute terms (delay time = 0 minutes), of the 61 first flights of the day to 61 destinations, both domestic and international, over the observation period, none had a mean on the dot, although there were times when individual departing flights were on time, but on average none of the first flights departed on time.

On average, fourteen destinations had a mean departure time delayed by more than 20 minutes (23%), twenty-two had a mean delay between more than 15 minutes but less than twenty (36%) and the rest (25) less than 15 minutes but more than

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zero (41%). Further, this means 59% of the first flight of the day departs late, as compared to the technical definition of late (late beyond 15 minutes). Table 4.4 shows the summary of the delay.

Table 4.4 Summarized of the delay

More than 20min delay	More than 15 min and less than or equal to 20min delay	Less than 15 minutes but more than zero delay
n=14	n=22	n=25
Domestic n=4	Domestic n=9	Domestic n=12
International n=10	International n=13	International n=13

n* - the number of first flight departure with an average delay time

4.1 Significance Test

Having in mind the importance and potential for impact of within 15 minutes' departure for no delay position, the main hypothesis is presented as follows. Significant tests were undertaken on those flights that had more than an average 20 minutes' delay. The hypothesis:

The null hypothesis; H_O: μ= 15 minutes

(That is the time of departure of the first flight is 15 minutes of announced time; i.e. the population mean equals the hypothesized mean*)*

The alternate hypothesis; H_1: μ > 15 minutes

(That is the time of departure of the first flight is more than 15 minutes of announced time; i.e. the population mean differs from the hypothesized mean*)*

Testing Assumption:

For small sample n ≤ 30, the use of t-test, for a normal population the use of again of the t-test.

Testing significance:

a. Alpha, α =0.05 and 0.01

Test statistic: $t = \frac{\bar{x} - \mu}{s/\sqrt{n}}$

Test Results: Using one tailed test is shown in Table 4.5

Table 4.5 T test using one tailed test

#	Average delay	Standard Deviation	Given mean	The sample mean - given mean	Test Statistic	Comparing critical region with one tailed Alpha (0.05)	Critical value (0.05 & 29)
1	24.52	18.84	15.00	9.52	7.58	Significant	1.699
2	19.10	16.86	15.00	4.10	3.65	Significant	1.699
3	20.93	20.42	15.00	5.93	4.36	Significant	1.699
4	22.94	14.93	15.00	7.94	7.97	Significant	1.699
5	21.45	19.75	15.00	6.45	4.90	Significant	1.699
6	22.61	20.62	15.00	7.61	5.54	Significant	1.699
7	21.35	16.10	15.00	6.35	5.92	Significant	1.699
8	21.71	20.46	15.00	6.71	4.92	Significant	1.699
9	20.57	9.60	15.00	5.57	8.70	Significant	1.699
10	25.35	16.76	15.00	10.35	9.27	Significant	1.699
11	23.16	14.94	15.00	8.16	8.19	Significant	1.699
12	25.19	22.73	15.00	10.19	6.73	Significant	1.699
13	20.58	20.02	15.00	5.58	4.18	Significant	1.699
14	24.90	21.63	15.00	9.90	6.87	Significant	1.699

Of the 14 flights having means more than 20 minutes late, 14 flights had significant variance from the technically defined 15minutes allowance (23%).

Answering Research Question 1 "Is the ***delay in first flights take-off significant for LCCs?"***

None of the 61 first flights of the day were able to maintain an on-the-dot time take-off throughout the 30 days' observations. Less than 50 percent of flights were able to keep within the 15-minute delay allowed by international standards. Twenty-three percent of flights have an average of more than 20 minutes' delay and officials classified it as "delay". A t-test showed the delay was significant for all 14 flights with more than 20 minutes' delay. **Overall, the first flight take-off is a cause of concern for flights out of KLIA2.**

Summary: The result does not take into account the deliberate omission of data on some days. Although this figure does not raise the alarm at the moment, there is plenty of room to improve on this report.

B. Qualitative Data Analysis

Five questions were designed in this section and the responses are as follows:

Q1: Have you piloted the first flight of the day?

Q2: Do you encounter delays regularly on the first flight of the day?

Q3: Do you believe the first flight delay will cause subsequent delays for the day?

Q4: Have you ever encountered a last-minute request to fill in for another pilot's absence?

Q5: Do you think this will cause some delay in departure?

Table 4.6 summarized the interview conducted with 50 pilots that have flown the first flight of the day. Figure 4.5 shows the pilot's expectation from rostering crew to improve on the first flight departure of the day.

Table 4.6: LCC Flight Crew Interview Summary

FLIGHT CREW	YES	NO	SOMETIMES	OCCASIONALLY
Have you piloted the first flight of the day?	50	0	0	0
Do you encounter delays regularly in first flight of the day?	21	0	16	13
Do you believe, first flight delay will cause subsequent delays for the day?	50	0	0	0
Have you ever encountered a last minute request to fill in for another's pilot absence?	35	5	10	0
Do you think this will cause some delay in departure?	50	0	0	0

Q6: How did you handle it?

All respondents said it is part of the job function and they will try their best to be at the airport as per the required time.

Q7: What would you expect differently in hindsight from time scheduler?

All respondents said better management of their rostering plan is required and to have more standby crew options available as well as early notification.

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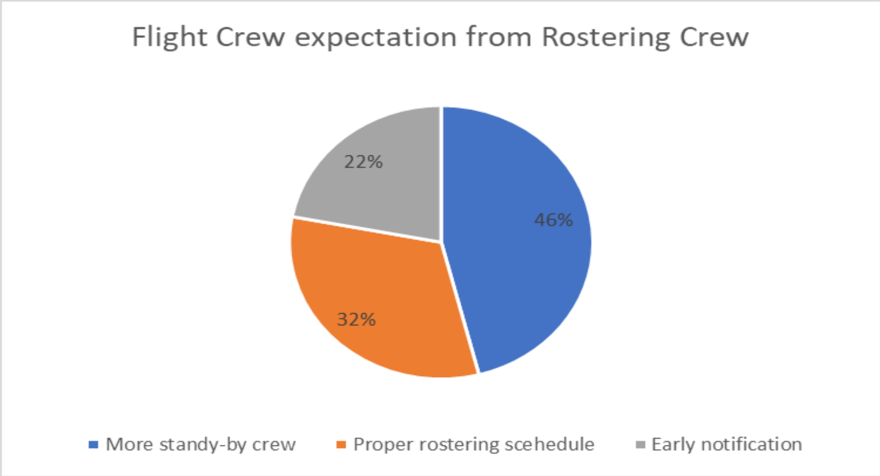

Figure 2: Flight Crew expectation from Rostering Crew

4.2 Best Practice – Proposed Solution

This research has looked into the current practices of pilot reporting and has proposed to design and develop a best practice solution for effective management of first flight.

4.2.1 Current Practice

Answering Research Question 2 "What are the current practices in use in matching pilots and aircraft for LCCs?"

In current practice for KLIA2 LCC operators, the flight crew duty reporting time starts 60 minutes before the aircraft departure. The minimum duty reporting time is 60 minutes by regulations.

This requirement for the duty reporting time is mandated in the Flight Operation – Operating Manual A of all LCC operators and in fact all operators in Malaysia.

Flight crew have a minimum of 9 and a maximum of 14 hours of flight duty daily.

1. The flight duty time depends on the start time of the duty period.

2. Total sectors were flown by the flight crew for the day.

3. For the first flight, an early morning departure that starts between 6 and 759am, the minimum flight duty time is 9 hrs. and maximum duty time is 13 hrs.

If the flight crew exceeds the flight time, they are required to step down and another flight crew will be needed to fly the next flight.

4.2.2 Best practice test proposed

What are the best practical solutions to optimum time management for first flight for LCCs?

Based on the current practice as well as the result of the data analysis, below is the proposed best practice solution for flight reporting.

1. To have a 15-minute incremental increase in reporting time buffer specifically for first flight departure from the standard duty reporting time.

2. For the purpose of sampling, the daily flight duty time is capped at 9 hours.

3. Based on the quantitative analysis, on average 14 out of 61 flights have a significant delay (more than 20 mins). To choose those flights to sample and to do analysis on the outcome of the incremental buffer of the duty reporting time.

4. To run the model for 2 weeks.

5. To compare and verify current practice against the best practice model for improvements if the duty reporting time is 75 minutes before the first flight departure.

6. To repeat the same test and have an increase to a 30-minute reporting time buffer specifically for the first flight departure from the standard duty reporting time.

Major Findings: The findings indicate

i. Only a handful of flights were able to keep up within the announced departure time, but for many other first flight departures this was an issue; both for the principal operator and other minor operators of LCCs outside of KLIA2.

ii. Some of the delays are attributed to matching pilots and flights for the first flight of the day by operators of LCCs out of KLIA2.

V. CONCLUSION

Research findings confirmed that it is indeed a concern; there are often delays in the first flight on any given day. There is also a discrete expression of concern on the issue of matches, especially for the first flight of the day, from pilots and latent support for a better system in place.

Although the evidence of delay is an issue, the research focused on scheduling as an issue; a match between flight and pilot that is controllable. Other issues could also contribute to delays such as technical problems. The researcher believes that an efficient system is able to reschedule a different combination of flight and pilot within the given 15 minutes' delay, which is an acceptable norm in this industry if an effective system is in place. Although the current research has not clearly correlated the schedule as an issue for the first flights, there is an indication that it does but not significantly for the current period. If left unchecked, it will become a routine for the operators to believe such delays are norms in this type of business and acceptable to the users, leading to a significant problem in the future.

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