2

KEY PERFORMANCE INDICATORS

There are airlines with different business models (e.g., network carriers, low-cost carriers), sizes and geographic context. The identification of a single metric to assess the performance of an airline is an impossible task. Simple indicators, such as the number of aircraft in the fleet, the number of destinations served, the number of people transported, the number of employees or the total operational revenues are usually misleading performance measures. For instance, an airline A with a larger set of aircraft and serving double the destinations of a competitor airline B is not necessary more efficient, even if in the end of the year declares larger operational revenues. More comprehensive and integrated indicators are needed to help us understand the key aspects of airlines' performance.

A Key Performance Indicator (KPI) is a measure that both characterises (in whole or in part) and indicates (predicts) the performance of a system at an aggregate level. In the airline industry there exist standard KPIs, accepted and used by stakeholders as common measures to assess and compare airlines performance. This chapter presents some of these standard KPIs. The KPIs are divided in five categories: traffic based, financial based, load factor, productivity based and operations based. These categories are not conclusive or irrefutable. They just present one way of dividing the multiple KPIs covered in this text. In addition, the list of KPIs is not exhaustive. Other indicators can be used to assess performance. The KPIs presented are, nevertheless, the most widely used in the airline industry and are the ones to be covered in this course.

The chapter is divided in six sections: one for each category of KPIs and a final section that presents an overview of the interdependence of some of the KPIs discussed in the other sections.

2.1. TRAFFIC BASED INDICATORS

There are two main traffic indicators that are used in airline industry. One is used to quantify the airline supply, while the other measures the airline output that is actually consumed. These indicators can be used with similar formulations for passengers services (the first two presented) or for cargo operations (the last two presented). For passengers services we have:

- **Available Seat Kilometer (*ASK*)**[1] is the number of seats made available per flown kilometer. This is the most common measure of the airline output, and gives us an idea of the capacity offered and the distance travelled.

  Example: if an airline operates one flight over a distance of 1 000 km with a 120-seat aircraft, the respective ASK for this flight is 120 000 units

- **Revenue Passenger Kilometer (*RPK*)** is the number of revenue passengers transported per flown kilometer. This is the most common measure of airline output actually consumed, and gives us the ideas of number of passengers transported and the distance travelled.

  Example: if the same airline from the previous flight only transports 90 passengers, the respective RPK for this flight is 90 000 units

[1] or, alternatively, some carriers use miles as unit distance and in that case we have Available Seat Mile (ASM). The same happens for any other KPI which uses distance as reference.

For cargo flows, we have the same type of indicators.

- **Available Tonnes Kilometer (*ATK*)** is the number of tonnes capacity made available per flown kilometer.
- **Freight Tonnes Kilometer (*FTK*)** [2] is the number of freight tonnes transported 1 kilometer.

2.2. FINANCIAL BASED INDICATORS

Financial based indicators are indicators that can give us an idea of how an airline is doing in terms of revenues and operating expenses. The basic indicators are the ones that assess these money flows by unit of operation (i.e., ASK, RPK, ATK and FTK). In terms of costs, these indicators are called unit costs indicators, while for revenues they are called unit revenues. This type of indicators is presented below for passenger services. Similar indicators could be used for cargo operations.

- **Cost per ASK (*CASK*) or Unit Cost** is the amount of operational costs incurred for each ASK supplied. That is, a CASK equal to 1 means that an airline pays 1 monetary unit per each ASK unit operated. CASK give us an idea of the average cost of operating one seat in one kilometer.

  Example: in the same example from the previous section, if the airline incurs $ 24 000 of expenses to operate the mentioned flight, the CASK is equal to 0.2 $ /ASK (i.e., 24 000/120 000).

- **Revenue per ASK (*RASK*) or Unit Revenue** is the amount of operational revenue collected per ASK supplied. That is, a RASK equal to 1 means that an airline makes 1 monetary unit per each ASK unit operated. RASK give us an idea of the average operational revenue made per seat-kilometer offered.

  Example: if the airline receives $ 30 000 from the sales of the tickets to the 90 passengers, the RASK is equal to 0.25 $ /ASK (i.e., 30 000/120 000).

- **Yield or Revenue per RPK** is the amount of operational revenue collected per RPK operated. That is, a yield equal to 1 means that an airline makes 1 monetary unit per each RPK unit operated. Yield give us an idea of the average fare paid by a costumer to fly 1 kilometer.

  Example: if the airline receives $ 30 000 from the sales of the tickets to the 90 passengers, the RASK is equal to 0.33 $ /RPK (i.e., 30 000/90 000).

The ultimate goal of any airline, just like of any other private company in a competitive market, is to make profit. The operational profit [3] of an airline can be computed based on the previous KPIs. In fact, for a passenger carrier, the operational profit of a passenger airline can be defined as follows:

Operating profit = Operational Revenue – Operational Costs

or

Operating profit = (Revenue units – Cost units) x units travelled

or

Operating profit = RPK x Yield – ASK x CASK

This *basic airline profit equation* illustrates how the isolated use of any of the individual terms can lead to wrong conclusions (Belobaba [2]). For instance, a high yield value can be seen as an indicator of a successful and profitable airline. But if the airline is not transporting many people (i.e., presents a low RPK value), this will lead to low operational revenues. In general, yield is a poor indicator of airline performance per itself. In the same way, airlines aim for low unit costs or, what can be called, low costs of production. This is, in fact, a good indicator of the competitiveness of the company. Nevertheless, if yield or RPK values are low, meaning that the airline is not able to capture enough demand paying a reasonable price, the result could be that the operational revenues do not cover the total operating expenses.

Given this, the natural profit-maximization strategy followed by airlines necessarily involves the combination of revenues increase and costs reduction. However, it is important to recognise that the terms in the previous equation are dependent on each other. There are important interactions between them, so that no single term can be varied without affecting other terms and, consequently, the overall operating profit.

[2] some carriers divide freight traffic in cargo and baggage flows. In this case, the indicator focuses only on the cargo traffic and it can be called Cargo Tones Kilometer (CTK)

[3] we refer to operational profit because non air transport related profits, such as building mortgages, interests, taxes or foreign currency exchange losses, are not considered.

2.3. LOAD FACTOR INDICATORS

This type of indicators refer to the ratio between the number of seats taken (by revenue passengers) and the number of seats made available. That is, the proportion of airline output that is consumed. For a single flight, this indicator is simple defined as:

- **Load Factor (*LF*)** that is number of passengers divided by the number of seats of a flight. This is equivalent to say that is the RPK value divided by the ASK value.

  Example: in our example, the LF is equal to 75% (i.e., 90 000/120 000 or 90 passengers/ 120 seats).

In the case of multiple flights, there are two possible approaches to compute the equivalent indicator (both correct but giving slightly different results) (Belobaba [2]):

- **Average Leg Load Factor (*ALLF*)** that is the simple mean value of load factors in the set of flights considered.

  Example: in in our example we add a second flight with a LF of 60%, the ALLF would be equal to 67,5% (i.e., (60% + 75%)/2).

- **Average Network or System Load Factor (*ANLF*)** that is equivalent to the ration between the sum of RPK values divided by the sum of ASK values.

  Example: in our example, assuming that the new flight has a ASK equal to 100 000 units and a RPK equal to 60 000 units, the ANLF is equal to 68,2% (i.e., (90 000+60 000)/(120 000 + 100 000)).

The computation of the load factor can be important for airlines, not only to understand how much of the capacity produced by them is being used, but also because the load factor can give a good idea of how far the airline is from being (operationally) profitable or non-profitable. For this, the airlines need to calculate the so called **Break-even Load Factor (*BELF*)**. The BELF is the value of LF for which the revenues exactly cover the operational costs of the flight (or the set of flights). To obtain this BELF, we will make use of the definition of RASK and of a small trick:

$$RASK = Revenue/ASK \Leftrightarrow RASK = Revenue/ASK \times RPK/RPK \tag{2.1}$$

The term added in the end of the previous expression is equal to 1. It was added in order to get a relation between RASK and LF:

$$RASK = Revenue/RPK \times RPK/ASK \Leftrightarrow RASK = Yield \times LF \tag{2.2}$$

If then we assume that there is a break-even RASK – i.e, a RASK that is equal to CASK – we can re-write the previous expression as:

$$RASK = CASK = Yield \times BELF \tag{2.3}$$

The BELF is then equal to:

$$\mathbf{BELF} = CASK/Yield \tag{2.4}$$

In the case the airline does not have operational values from CASK and Yield, another way of computing the BELF is by using estimations of the Cost and Revenue of a flight for a given LF:

$$BELF = CASK/Yield \Leftrightarrow BELF = Cost/ASK \times RPK/Revenue \Leftrightarrow \mathbf{BELF} = LF \times Cost/Revenue \tag{2.5}$$

2.4. PRODUCTIVITY BASED INDICATORS

Productivity can be defined as the relation between the output created by a company (or a system) and the input necessary to generate that output. From the perspective of the operations of an airline, the primary output can be considered to be the value of ASK. Thus, several indicators can be computed by dividing the ASK value with the multiple units of inputs. Some examples are:

- **Aircraft Productivity** that reflects the average number of ASK in a given period of time (e.g., year, week, day) per aircraft in the fleet. This value can be computed based on the type of aircraft (and market) – e.g., for regional jets, narrow body airliner or wide body airliner.

- **Labour Productivity** that, similarly, reflects the average number of ASK produced in a given period of time (e.g., year, week, day) per employee involved in the operation of the airline.

Another common productivity indicator in the airline industry is the number of hours, on average in a given period of time (usually per week or day), an aircraft has been used for operations. This is called **Aircraft Utilization** and is assessed according to the number of *block hours*, referring to the time from the moment the aircraft is pushed back from the departure gate until the moment the doors of the aircraft are opened at the arrival gate.

2.5. OPERATIONS BASED INDICATORS

There are several indicators that refer to the performance of the airline in terms of its daily operations. Among the most commonly used there are:

- **On Time Performance (*OTP*)** refers to the percentage of flights in a given period of time that arrive at the destination gate with no more than 15 minutes delay over the scheduled arrival time. This is a key indicator for airlines, in particular in the definition of their image and in the creation of a reliable relation with their customers. It reflects the frequency of flight delays or cancellations and is a measure of service quality.

- **Average delay** is the average difference between the scheduled time of a flight (or a set of flights) and the effective times of arrival (over a period of time). In most cases, to avoid the accumulation of time difference from early flights and the time differences from delayed flights, only flights that are delayed are considered in this indicator. In these cases, the indicator is called *Average delay per delayed flight*.

- **Number of missed connections** (at a hub) refers to the number of passengers that, in a given period of time, missed their connections between two flight of the airline given delays in the operation of the flights.

- **Cost of delay (and misconnections)** is the sum of costs related to delays introduced in passengers' itineraries, caused by delays in the airline operation or by cancellation of flights. These cost usually only include hard costs, i.e., cost related to the compensation offered to passengers in case of itinerary disruptions, including meals, communication, transportation and hotel accommodation. But other costs can be add, such as the soft cost related to the inconvenience cost perceived by the passenger, which relates with the chance of the passenger not flying with the airline again.

2.6. RELATION BETWEEN INDICATORS

The isolated use of the KPIs discussed in this chapter is not enough to analyse the performance of an airline. In fact, some of them are not even particularly useful on their own or can be misinterpreted. Nevertheless, a proper use of a combination of these KPIs will give a very good picture of the performance of an airline, in multiple aspects. Figure 2.1 presents a simple diagram with a summary of the relation between some of the KPIs previously discussed, which can help with the definition of an analysis framework. Two main streams are presented: the cost steam and the revenue stream. At a higher level stands the output produced and the output sold by the airline. The combination of both gives us the load factor (of a flight or of a set of flights). Following the cost stream, we can combine cost with ASK and obtain the 'unit cost' of an airline. In the opposite stream, if we combine the revenue with the RPK, we can obtain the revenue per passenger x kilometer or yield. The 'unit revenue' can be obtained by multiplying the yield by the load factor. Finally, the comparison between the 'unit cost' and the 'unit revenue' gives us the financial result (per unit output) of the operating performance of an airline.

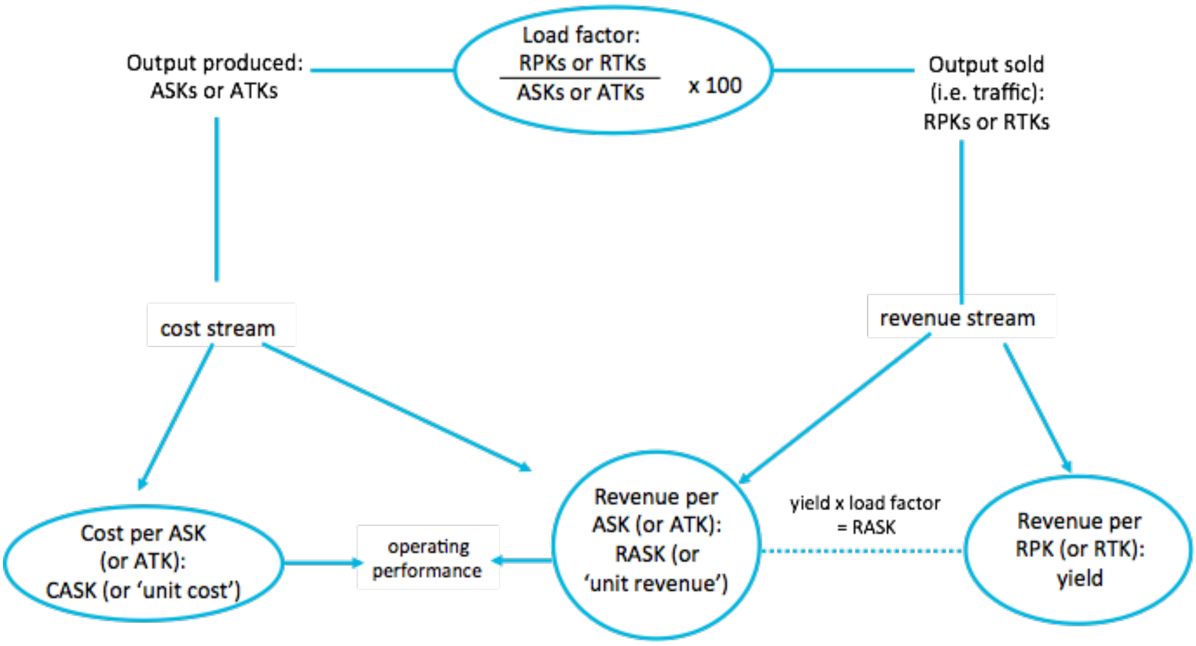

Figure 2.1: Relation between some indicators: the cost stream and the revenue stream (Holloway [3]).

Bibliography

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