

THE EFFECTS OF GOAL BASED DYNAMIC PRICING AND REVENUE
MANAGEMENT STRATEGIES ON THE AIRLINE REVENUE EFFICIENCY:
THE IMPACTS OF DYNAMIC PRICING STRATEGIES AND APPROACHES
FOR THE CASE OF TURKISH AIRLINES



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YEDITEPE UNIVERSITY

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BY



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PLAGIARISM

I hereby declare that all the information in this thesis were obtained and presented according to the academic rules, regulations and ethical conduct. I have fully cited and referenced all the materials and results not original to this study.

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ABSTRACT

In this study, we aimed to investigate how to increase airline efficiency on revenue by using strategies developed as a result of analytical evaluations via implementing target-based dynamic pricing methods and tactics for airline perishable products in line with changing market conditions and needs. The main purpose of this study was to investigate airline revenue management functions and the impact of goal-based dynamic pricing on Turkish Airlines' flight revenue efficiency by implementing revenue management strategies and tactics as a result of depth data analysis. While checking critical instruments of RM and taking essential commercial actions in time for focused market, observing positive effects of changes on revenue by applying advantages of dynamic pricing method.

Considering the airline products, on the passenger side defined as tariff, the seat offered for the requested hour and relevant destinations, the total capacity supplied, the volume of demand, the number of days remaining to departure date on related segment, the frequency of flight for related destinations, the characteristics of the relevant routes, changing dynamics of focused market, seasonal revenue management strategies and pricing tools are used to increase efficiency of airline revenue and profitability depending on market potential, the quality of the products and products range in order to satisfying market needs, correct timing for applying the commercial strategies and tactics, economic conditions of market, passengers travel habits and purchasing behavior and competitive conditions in targeted market.

The data for the study were obtained primarily from the measurements related to dynamic pricing to be provided from the revenue management practices implemented by Turkish Airlines' regional subsidiary airlines between November and

December 2019 and January and February 2020, for some selected group of routes.

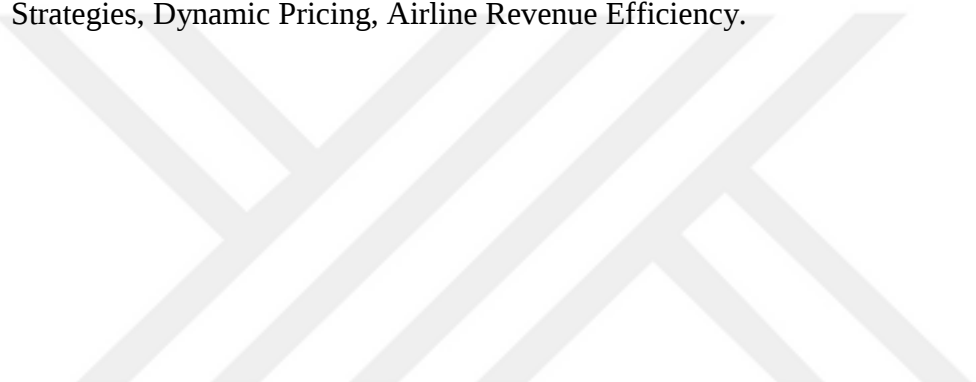
The number of sales and revenue of previous year for selected segment group are implemented by the system for reference year. Capacity distributions made according to previous year booking figures after depth data analysis, among reservation classes defined into dynamic pricing scales. Before sales open for reference year flights, the seat allocation arranged by RMS. These expected average figures for selected group flight segments compared to final figures after implementing the reference year RM tactics and dynamic pricing strategies applied according to changing market dynamics while reading the RM critical instruments properly and implementing necessary RM actions in time in order to have efficient commercial results via putting into practice dynamic pricing advantage.

The average one-way sales and income distribution values for the determined segment groups were taken from the results of the previous year and are automatically implemented by the system for the reference year. Capacity allocation is distributed among the reservation classes defined in the dynamic pricing scale for both different flights groups as a result of past year and various analyzes. The capacity distribution is adjusted by RMS for each flight leg before flights are released for reference year. The results showed that the distribution of the selected groups between the reservation classes per average direction and the total occupancy and income to be obtained according to this distribution. They were compared with the values of the selected segment groups in the same period of time for the reference year. Dynamic pricing advantages and timely implementation of the RM tactics determined by analyzing critical RM instruments effectively contribute to achieving the actual values. In the analysis, the effect of dynamic pricing on revenue efficiency was tried to measure by comparing the average values of selected flights segments to be obtained from the

capacity distribution included both selected flight group before open to sale, and after applied RM strategies by using dynamic pricing advantages.

As a result of all analysis, target based dynamic pricing provides to airlines having more efficient results from same amount of resource due to offering the airline companies ability to sell higher price without breaking current price structure and market dynamics.

Keywords: Airline Industry, Yield Management, Revenue Management, Pricing Strategies, Dynamic Pricing, Airline Revenue Efficiency.



ÖZET

Bu çalışmada, değişen pazar koşulları ve ihtiyaçlar doğrultusunda *havayolu işletmelerinde hedef bazlı dinamik fiyatlandırma* kullanılarak, analitik değerlendirmeler sonucunda geliştirilen *stratejiler aracılığı* ile *havayolu gelir verimliliğinin* ne şekilde artırıldığı konusu araştırılmıştır. Bu tez çalışmasının amacı, Türkiye'nin bayrak taşıyıcı havayolu Türk Havayolları gelir yönetimi uygulamaları incelenerek, gelir yönetimi fonksiyonları ve hedef bazlı dinamik fiyatlandırma stratejilerinin incelenerek uçuş gelirlerine etkisinin araştırılmasıdır. Ayrıca, dinamik fiyatlandırmanın hangi parametreler ışığında etkin kullanılması durumunda, gelir verimliliğinin artırdığı incelenmiştir.

Havayolu işletmelerinin ürünü dikkate alındığında; tarife olarak tanımlanan, yolcu tarafında talep edilen saat için planlanan uçuştaki arz edilen toplam koltuk sayısı, satışa söz konu olan koltuk, ilgili destinasyonda(varış noktası) arz edilen toplam sezonluk kapasite, ilgili uçuş saatine olan talep yoğunluğu ve uçuşa kalan gün sayısı, belirlenen uçuş noktaları arasındaki uçuş sıklığı, ilgili destinasyonun karakteristik özellikleri, hedef pazardaki değişen dinamikler, mevsimsel değişiklikler dikkate alınarak, derin analizler sonucu oluşturulan RM strateji ve fiyatlandırma taktikleri incelenmiştir. Pazarın potansiyeli, ürün kalitesi ve pazarın ihtiyacını karşılayan ürün yelpazesinin genişliği, ticari stratejilerin zamanında uygulamaya alınması, pazar ekonomisini etkileyen kontrol edilebilir veya kontrol edilemeyen değişkenler, yolcuların seyahat etme ve satın alma alışkanlıkları ve hedef pazardaki rekabet koşullarına bağlı olarak dinamik fiyatlandırma gelir verimliliğini ve şirket karlılığını artırmada kullanılan önemli bir araçtır.

Bu çalışmada yer alan veriler, Türk Hava Yollarında gelir yönetimi yaklaşımının en önemli enstrümanlarından dinamik fiyatlandırma aracının ticari hedefler doğrultusunda, gelir yönetimi parametrelerinin değişen pazar dinamiklerine göre derin analizler sonucu belirlenen strateji uygulamaları sonucu elde edilen ölçümlere göre sağlanmıştır. Türk Hava Yollarının iştiraklerinden, bölgesel taşımacılık yapan havayoluna ait veriler kullanılmıştır. Kullanılan veriler benzer özellikler gösteren 2 farklı hat gruplarının, belirli zaman aralığındaki uçuşlarının ortalama taşınan yolcu ve gelirlerin envanter değerlerinden oluşmaktadır. Veri tarihleri ilk hat grubu için 2019 yılının Kasım ve Aralık aylarını, ikinci hat grubu için ise 2020 yılının Ocak ve Şubat aylarını kapsamaktadır. Hat grupları belirlenirken uçuş süresi, haftalık uçuş sayısı, Pazar özellikleri, rekabet koşulları gibi kriterler göz önüne alınarak, homojen hat grupları oluşturulmasına özen gösterilmiştir. Tarih aralıkları belirlenirken de, özel talep ivmesinin olmadığı off-peak (düşük talebin olduğu) sezon içerisinde, farklı özelliklere sahip olan hat gruplarının, farklı talep dönemlerindeki dinamik fiyatlandırma aracının Pazar koşullarına göre stratejik kullanımı sonucu gelir verimliliğini artırma eğilimi ölçümlenmeye çalışılmıştır. Elde edilen sonuçlar, değişen koşullara bağlı geliştirilen parametreler ve taktiklere göre referans yılı sonuçlarının önceki yıllarda elde edilen sonuçlarla kıyaslanmıştır.

Belirlenen hat grupları için ortalama tek yön satış ve gelir dağılımı değerleri geçen yıl sonuçlarından alınarak, referans yılı için sistem tarafından otomatik olarak uygulamaya alınmaktadır. (Gelir yönetimi sistemlerinin çalışma mantığı veri tarihçesini baz alarak, gelecek dönem için çalışma yapmasıdır). Kapasite dağılımı, geçen yıl gerçekleşen sonuçlar ve çeşitli analizler sonucunda her iki farklı hat grubu için dinamik fiyatlandırma skalası içerisinde tanımlanan rezervasyon sınıfları arasında dağıtılmaktadır. Kapasite dağılımı referans yılı için, uçuşlar satışa açılmadan önce her

uçuş bacağı için RMS tarafından ayarlanmaktadır. İlk tablolar seçilmiş olan hat gruplarının ortalama yön başına rezervasyon sınıfları arasındaki dağılımı ve bu dağılıma göre elde edilecek toplam doluluk ve geliri göstermektedir. Bu veriler, aynı tarih aralığındaki seçilmiş aynı hat gruplarının referans yılı için gerçekleşen sonuçları ile kıyaslanmıştır. Gerçekleşen değerlerin elde edilebilmesinde, kritik RM enstrümanlarının etkin bir şekilde analiz edilerek belirlenen RM taktiklerinin, belirlenen uçuş dönemi için ilgili hatlarda havayolunun bozulabilir nitelikteki ürünleri için, zamanında uygulamaya alınması ve dinamik fiyatlandırma aracının amaçlar doğrultusunda etkin kullanımı katkı sağlamaktadır. Analizde, her iki hat grubu içinde yer alan uçuşların satışa açılmadan önceki kapasite dağılımından elde edilecek ortalama uçuş hattı değerleri ile, dinamik fiyatlandırma avantajı kullanılarak uygulanan RM stratejileri sonucunda elde edilen sonuçlar kıyaslanarak, dinamik fiyatlandırmanın gelir verimliliğine etkisi ölçümlenmeye çalışılmıştır.

Tüm analizler sonucunda, hedef bazlı dinamik fiyatlandırma, havayolu şirketlerine mevcut fiyat yapısını ve piyasa dinamiklerini bozmadan daha yüksek fiyattan satma olanağı sunması nedeniyle, aynı miktarda kaynaktan daha verimli sonuçlar elde edilmesine olanak sağlamaktadır.

Anahtar Kelimeler: Hava Taşımacılığı Sektörü, Karlılık Yönetimi, Gelir Yönetimi, Fiyatlama Stratejileri, Dinamik Fiyatlama, Havayolu Gelir Verimliliği.

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ABBREVIATIONS

A/C	Aircraft
AI	Artificial Intelligence
ASM	Available Seat per Mile
ATN	Air Transportation Network
ATPCO	The Airline Tariff Publishing Company
CRM	Customer Relation Management
CRS	Central Reservation System
FAA	Federal Aviation Administration
GDS	Global Distribution System
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
KPI	Key Performance Indicator
LCC	Low Cost Carrier
NDC	New Distribution Capability
O&D	Origin & Destination
PAD	Passenger Available for Disembarking
PMS	Property Management System
RASM	Revenue Available Seat per Mile
RM	Revenue Management
RMS	Revenue Management Systems
SLF	Seat Load Factor
TK	Turkish Airlines
YM	Yield Management

1. INTRODUCTION

Airline industry is one of the most crucial sectors around the world. Millions of people prefer to use air transportation services due to faster and comfortable travel option and reliability. Year by year, expanding demand on air travel options because of abolition of borders for globalization, airlines had to increased capacity of their seats.

Airlines have been empowering heavily in developing sophisticated systems for demand forecasting, capacity and inventory control, route management and steering, pricing, implementation of price rules and regulations, creation of ancillary revenue products such as paid meal or internet on plane. Also, Air travel companies have to adjust the prices for related destinations by tracking competitors' market price to get more share in the potential market. The development Revenue Management Systems have been benefiting any airline companies in the world in terms of competitive advantage and managing commercial efficiency in the market. However, technology is considered only as a tool for building a more comprehensive strategy for airline business and efficient use of resources in order to have more revenue. Revenue management is discipline with pricing tool requires a much more comprehensive systematical view in order to reach company targeted goals for sustainability and improvement of product range with proper capacity allocation and customer experience with application of best pricing strategies and services on air travel.

Each airline around the world have consider importance of pricing methodologies and strategies in revenue management approach to have more efficient financial results with using same resources.

The history of revenue management goes back as early as 1980s when regulations in the American Airline industry were reshaped and that initiated revolutionary RM applications for the airline companies around the world. Airline companies have been investing several millions of dollars to purchase and implement computer software program based on the previous data variables such as seat availability, total supply and demand, prices, destinations, seat load factor, and seasonality. Afterwards, other sectors such as hotel and accommodation started operating revenue management strategy as its elements including market segmentation, varieties of pricing method and inventory management and capacity distribution, demand and load factor forecast and overbooking, started becoming more complicated than applied models before. Much more criteria taken into account in order to gain more revenues using same amount of resources.

The main purpose of revenue management in airline industry is increasing demands for the products and determine future availability for product estimation accordingly (Boyd & Bilegan, 2003). In addition, it aims to “sell product to the right customer at the right time for the right price” (Yeoman & McMahon-Beattie, 2017). Revenue management is an exceptionally significant concept and is closely related to the dynamic pricing of each concept of air transportation such as passengers and air freights (Özdoğan, 2002). It often helps airline companies to predict consumer demand to maximize revenue growth and improve pricing elasticity, inventory management and capacity distribution for each specific flight legs or market depend on major variable factors according to seasonal trends.

Dynamic pricing (surge price, offered price) is defined as a strategy with that companies are able to determine flexible prices for their products based on the market conditions and demand curve for offered product (Friedman & Lewis, 1999). Such a

strategy often helps businesses to maximize the revenues gained from their products or services as well as customer satisfactions.

Dynamic pricing method can be design and applied according to some specific criteria defined from companies according to “revenue expectation from the products or services served to targeted market, supply and demand analysis, sustainability of product in the market, seasonality, competition factor, and price sensitivity and economic situation of market, travel habits of customers” (Spacey, 2017). Various applications of dynamic pricing have been utilized including ‘value-based, price-based, competitor-based, market-based, time-based, and goal-based’. The goal-based dynamic pricing involves emphasizing importance of commercial purposes when dynamic pricing is concerned.

Goal based dynamic pricing and defined flexible revenue management tactics are important concepts to increase an airline’s commercial efficiency in the competitive market.

The aim of this study is to explore application of revenue management discipline for Turkish Airlines, and analysis of goal based dynamic pricing impact on airline revenue efficiency via examination of changing revenue management strategies, tactical methods, analysis of airline revenue management functions and critical instruments, and implemented dynamic pricing methods for the flag carrier. The main purpose of this study was to analyze the effects of goal-based dynamic pricing methods on revenue management efficiency of Turkish Airlines.

Current research was designed to examine dynamic pricing strategies and method determined changing parameters in the market to maximize amount or revenues gaining from airline products focus on analysis of flag carrier of Turkish aviation industry.

This study was designed as a case study approach, a types of qualitative research methodology. Data were collected through in-depth interview with RM team participants who were working at Turkish Airlines as managers and specialists. The interviews were conducted at the Turkish Airlines head quarter in Yesilkoy via revenue management team in February 2020.

The following definitions are constructed to identify some miscellaneous concepts of this study needed to clarify for the readers.

Revenue management (RM): RM is described as a science of maximizing revenue and profit for various businesses as airline, shipping, other types of transportation (railway, seaway, highway), accommodation, shipping and cargo sectors according to certain software program and defined revenue management tools and market conditions (Jones, 2013).

Revenue Management is a process for companies supported by information technologies in order to forecast customers behaviors vigorously at micro level with using client data analysis systematically. Revenue management discipline focus on selling right product to right customer at right time with right price to maximize amount of company' revenue. (Cross, 1997).

Yield management (YM): YM is known as seat inventory control, allocation distribution. It also is defined as a major application of revenue management for services based on the bookings or cancellations of reservation, and no-show restrictions in order to increase profit from same number of used sources for the creation same amount of product of services. (Subramanian, Stidham & Lautenbacher, 1999).

Overbooking: Overbooking is extra ticket sale or situation when number of tickets sold is higher than actual capacity or offered capacity for any flight route.

Reservation Cancellation: Reservation cancellation is the act of cancelling or changing the booking date for the issued tickets.

Research data is limited to Turkish airlines' findings as a result of revenue management application supported by goal based dynamic pricing method. The study is limited to the time frame indicated for selected domestic flight segments. The findings are limited to the measurements related to dynamic pricing to be obtained from the revenue management practices implemented in Turkish Airlines for selected domestic routes in defined time frame and comparison of reference data for same group of flight segment at last year in same period implemented particular dynamic pricing tactics as a result of revenue management factors analysis.

This study was conducted to emphasize the positive impact of dynamic pricing, one of the crucial instruments of revenue management approach, on airline revenue efficiency as a result of its target-based implementation in the light of accurate analyzes.

By examining the revenue management practices of Turkish Airlines within the framework of basic criteria of RM discipline and air travel market dynamics; The role of dynamic pricing in increasing efficiency will be demonstrated by measuring the effect of goal-based dynamic pricing on airline revenue efficiency for selected flights groups of Turkish Airlines operated in a certain time period.

This study consists of four parts. In the first part, while gave an overview of the World air transport and air transport in Turkey, the deregulation period of air travel industry, network planning for airline business, fleet planning, electronic ticketing and sales channel distribution systems has been elucidated.

In second part, history and purpose of revenue management, implementation of RM discipline for various sectors, revenue management solution systems and yield management topics explained.

In third part, airline revenue management has been evaluated as versatile and detailed information was given about basic concepts, history, purposes, applications, efficiency, components, methods of airline revenue management approach, pricing strategies, ancillary revenue categories.

In last section, revenue management practices in Turkish Airlines were analyzed as a result of face-to-face interview, which parameter take into account when determining dynamic pricing strategies. In addition, data were obtained from Turkish Airlines to measure impact of dynamic pricing on the revenue of Turkish Airlines subsidiary airline. For selected routes that have two different characteristics which were homogeneously determined on the basis of certain period of time separately for different selected group, by comparing the results within dynamic pricing structure and seat allocations of related flights before open to sale and the revenues of flights completed after dynamic pricing strategies and RM tactics applied. The impact of dynamic pricing on Turkish Airlines subsidiary airline has been evaluated.

2. AIR TRANSPORTATION INDUSTRY

Air transportation as a faster and reliable travel option, have been becoming more crucial for global transportation industry. When passengers commuting from one destination to another with an airline, they are protected by 9 important '*freedoms of the air*', which was initiated in 1944 and enforced by the ICAO (Sheffield, 2019).

The first freedom of air is related to scheduled international air travel service granted by a country or state to fly across its lands without landing. In other words, an airline could overfly another country's airspace under the specific permissions and regulations. This is essential to keep right of countries revenue get from their airspace. The other freedom of air contains refueling of an aircraft without any restrictions in another country. Third privileges approve carrying passengers of any airline company transport from home country to another. This privilege is also valid for carried passengers of airlines travel from any another country to their home country.

An airline has also right taking a passenger from its own country, deposit them at the destination country, and carry passengers onto any other international destinations. Sixth privilege of an airline is that it can carry passengers from an international flight point to another destination in foreign countries with touching ground in the home country. In addition, an airline could carry passengers from one international place to another so long as it overflies its home country. Eight freedom of air traffic is also called '*Cabotage*' it is generally used outside Europe. An airline could carry passengers from one destination in a country to another place in the same country if it originates in the airline's home country. Final privilege is known as '*stand-alone cabotage*'. Any airline could originate in a foreign country and carry passengers from one place to another flight point in a foreign country. This privilege,

of course, depends on the regulations and air traffic permissions in the specific foreign country.

Above mentioned privileges are important steps for the commercial airline companies towards protecting their commercial rights of the country. In addition, it creates airline tariffs aligned with these rules and regulations.

2.1. Air Transportation in the World

Commercial air transportation was historically initiated following the World War I since airplanes were intensively used for bombing. First government regulation was established called the air commerce act of 1926 in the united states (Wensveen, 2018).

There are currently operating around 5000-5500 airline companies around the world national and international according to the data obtained from ICAO/IATA reports. Of them about 800 commercial airlines are operating scheduled flights.

Figure 2.1 indicates that how increase rapidly carried passengers via air travel between the year 1970 and 2018 in the World.

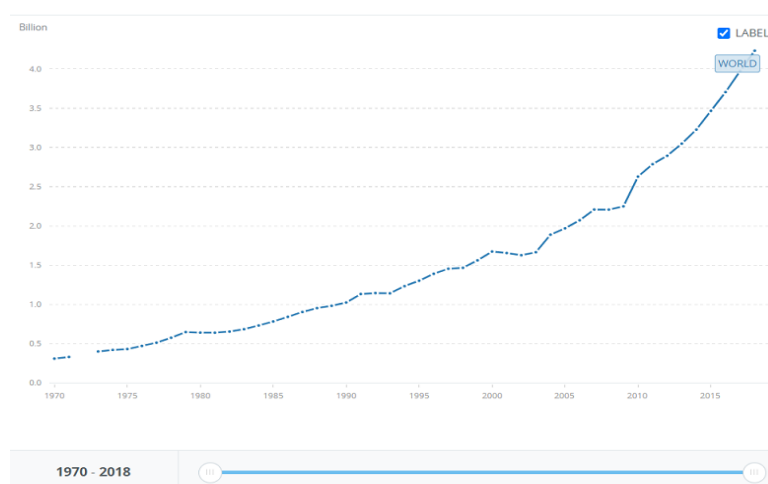


Figure 2.1. Carried Air Travel Passenger in the World Between 1970 and 2018

(Source: The World Bank. 2018. <https://data.worldbank.org/indicator>)

Total passengers carried by the airlines around the World in the last half century according to data obtained from World Bank (The World Bank, 2018) is more than 4.2 billion in 2018 as illustrated in the Figure 2.1.



Figure 2.2. Number of Passengers Carried by the Countries by 2018

(Source: The World Bank.2018. <https://data.worldbank.org/indicator>)

Figure 2.2 illustrates the most airline passengers by countries in the world (The World Bank, 2018). Top five countries where people prefer to travel with airlines mostly, could be listed as United States, China, Ireland, United Kingdom and India.

2.2. Air Transportation in Turkey

Aviation industry were initially started in Turkey when Turkish Aircraft Association was founded in 1925. First public air passenger travel was initiated with small planes in 1933. Turkish Airlines was founded in the same year and started domestic and international air transport operation (Gerede,2010).

Turkish air transportation quickly improved in terms of the number of passengers due to low fuel costs following 2005 (Gerede,2010). In addition, geographical conditions which has long destinations, market potential, population density could list as key factors of development of air transportation in Turkey. After following years, the airline industry's growth and strength, the deregulation gave this private firm to operate domestic routes independently. As a result of this decision, the air traffic grew rapidly for both domestic and international flights. New Flight destinations opened between city pairs had more travel potential via airlines, cycles for existing routes grew because of the competition and decreasing of airline ticket price (Sarılğan, 2016). Carried air passenger volume was increased, expeditiously due to market depth. For example, number of airplane passengers tripled between 2009-2017 compared to air travelers in 2005, due to mainly deregulation and other improved conditions in Turkey (Europa, 2016). Aviation in recent years, Turkey had become the top ninth country regarding number of air travel passengers in the World by the year of 2017 (City Population, 2017). Passenger volume are still raising year by year, in deepen Turkish market due to effect of changing customer travel habits, developed technology and geographical conditions and competitive fares.

According to Turkish Civil Aviation Authority, airline companies carried about 85 million domestic passengers in 2015 (Caber, 2018). Turkish Airlines and Anadolu Jet were the top company with the most passengers (53%). Private airline companies' market shares were less than 50%, Pegasus with 27% and Onur Air with 8%. Other airlines (Sun Express and others) shared the remaining 12%. Most of the airlines mainly preferred Istanbul, Ankara and Izmir cities as a hub for their flight operation due to population, airports equipment and local transportation network.

One of the recent and most comprehensive research was conducted regarding customer-based market positions of domestic airlines in Turkey by Caber (2018). The researcher investigated comparative market position maps to explore the positions of airline companies in Turkey. 202 university students were attended to this study. The findings showed that Turkish Airlines was dominating the air transportation sector compared to its rival companies based on quality, price, and favorite air travel choice.

2.3. Airline Deregulation

Deregulation is defined as governmental control absence about price and entry restrictions on airline transportation. Jiao Xiangyu (2014) recently discussed situation of airlines before and after deregulation acts. The airline deregulation act is known as United States federal law in 1978 removing governmental control for airline companies in aviation business market (Jiao, 2014). Such elastic regulations made air travel easier, accessible, effective, and affordable for every potential customer starting from United States. Similar acts around the world immediately occurred in other countries by following deregulation for air transportation in USA. These steps introduced free and open market in terms of fares, flight destinations, schedule, and market entry of private airlines had followed a distinctive strategy. For example, Turkish aviation market fully deregulated air traffic policies that completely reshaped Turkish air transportation industry in 2003 (Cetin & Benk, 2011). After deregulation in Turkish aviation market, the number of private airlines, aircrafts in their fleet and scheduled flights has increased rapidly for domestic market. This act was provided more flight alternatives for prospective customers. (Sarılğan, 2016).

Also, customer tendency has increased preferring air travel option due to competitive price, availability of alternative flights in the market. In addition,

deregulation act creates different strategic business model for airline companies in the market such as Low-Cost Carriers to prepare faster, reliable and accessible services for particular group of passenger segment. Moreover, LCC got charter airlines market pie because of reducing ticket price for travel destinations and change the nature of product of traditional airlines (Sarılğan, 2016).

Following deregulation in air travel market, many airline companies were found, and number of people started flying with airlines much more than other transportation options due to time saving and reliability of air transport. Also, more people were able afford airline ticket price after deregulation. In addition, studies (Goetz & Vowles, 2009) revealed that airline industries offered more flights frequencies for existing destinations, increased flight range, more alternative flight options and new destinations, as same safety conditions with cheapest fares due to rise of competition in the market. As a result of volume increase in air transportation, more employment was created for aviation industry.

2.4. Airline Transportation Network (ATN) Planning

Air transportation network (ATN) can be described as the combination of travel networks of airports and special programs networks. There is no scale to connect any destination each other in the World to provide better transport (Guimera et al., 2004). ATN is structured based on computer models and algorithms to maximize any possible complications in the optimal network design.

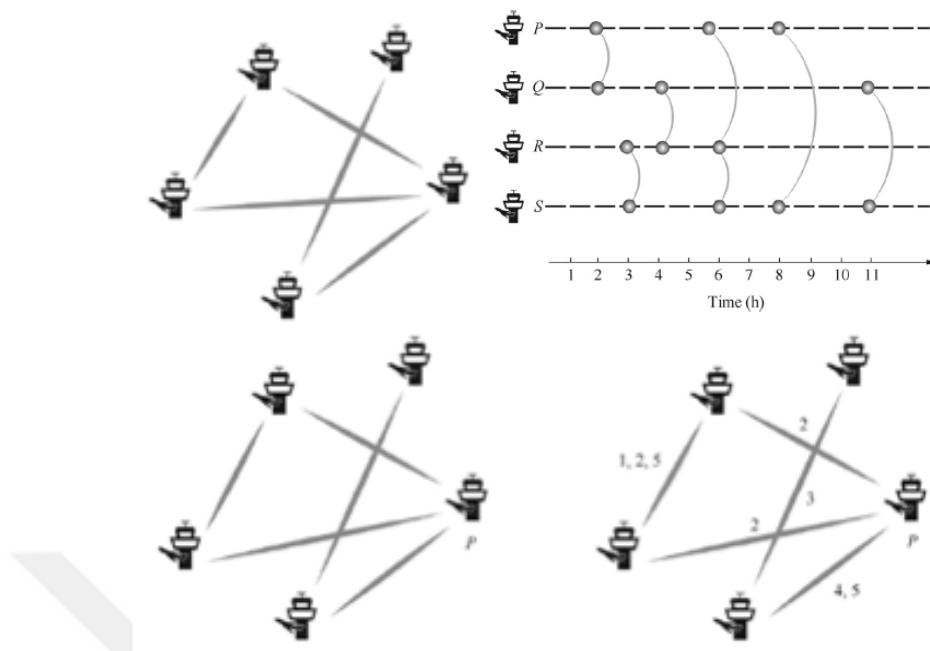


Figure 2.3. Diagrams of a Simple Undirected Static Airport Network, Airport Temporal Network, Static Network, and Temporal Network (top left to bottom right) (Source: Dynamics of air transport networks: A review from a complex systems perspective,” by Rocha, 2017, *Chinese Journal of Aeronautics*, 30(2), 469-478).

Figure 2.3. representation demonstrated the evaluation of ATN by technological development enhancing connection needs to provide better communication network, decreasing human factors for possible incidents and accidents.

ATN was considered a dynamic system at various scales started from second part of showed timeline during many years (Rocha, 2017). It described both the system’s implementation and evolution. Researchers and engineers have been conducting studies and experiments to create better and optimal ATN that benefits to

the airline companies, and the environment. Therefore, it is important to pursue an evolutionary innovations and advances in ATN.

2.5. Airline Fleet Planning

Fleet planning is one of the most important and complicated procedures in the airline industry regarding airline product planning process (Clark, 2016). It consists of two steps: “Which aircrafts are required? and When to get them?”. Answering these questions resolves such selection standard that involving financial and technical requirements, operational and environmental performance, and cabin comfort. Component commonality of airplane is another significant factor to generate proper fleet for related flight region for airlines. Newer and more efficient airplanes are needed in terms of ‘When?’ question.

Clark (2016) discussed how fleet selection process should take place in his book. It was suggested that since every airline differs in terms of market, history, philosophy, and fleet requirements, business model and strategy. It is nontrivial process to determine any standard list for fleet planning. However, no matter how big or small an airline is, some principles were suggested. A fleet selection process could be achieved according to the below attributes (Clark, 2016):

1. *The network (routes, traffic right, and airport slots, flight destination priority according to define some financial expectations and business model),*
2. *The staff (have license related aircraft type, knowledge and experience efficiency, and motivation),*
3. *The brand (market perception and expectations, strategy and company product types),*

4. *The fleet (the model of aircraft; technical conditions and capacity, technological system availability and comfort, comply with regional needs and satisfy the market volume).*

2.6. Electronic Airline Ticket

Airline electronic ticket (e-ticket) was created by the airline companies in 1994 and can be defined as just a reservation in computer system of an airlines. E-tickets have been mandatory for IATA members airlines since 2008. A sample of an e-ticket is illustrated in the figure 2.4. It has been an essential part of the airline travelers for reaching their destinations since 2000 when the paper airline tickets were started to be replaced by e-ticket.



Figure 2.4. A Sample Electronic Ticket

(Source: Nergiz, 2019. Havayolu 101. <https://www.havayolu101.com>)

Although still some paper tickets are used for different kind of travelers such as PAD¹ airlines can charge additional fees if requested for printed ticket. Most of

¹ PAD Passenger Available for Disembarking

airlines have been started using e-ticket for all over the World in the last decade, to keep their passengers and revenue data electronically to manage their business effectively by analyze expeditiously.

A sample electronic ticket is demonstrated in the figure 2.4. E-ticket typically included passenger's personal information (name, surname, gender etc...) departure and arrival codes, names of airports, planned departure and arrival times, fare type and symbol of fare class, flight date and time, flight number. It is very important for to keep e-tickets in their smart phones or other devices at all times the passengers at the airports to make easier controlling process by the employees to prevent any complication during journey.

2.7. Airline Sales Channel Distribution

Airline sales channel distributions system has significant role for air travel business which affect nearly each side of travel (passenger safety for payments, satisfaction due to accessibility, serving ancillary products, fares and options, fare rules and regulations due to affordability, reporting and analysis data due to measurements and planning etc...) starting from reservation part of journey until travel completed, for some cases cover a period of time after flight operation. Such systems are known as a barrier to entry in air transport business. Therefore, high tech programs and devices, developed digital programs were started integrating to airlines business model in order to offer more alternative flights for each destination with cheaper price.

Also, manage to resources and making correct analysis to produce ideal product in order to sell right person at right time with best price for business

sustainability. Most airlines are required to pay high expenditures for their distribution channel but, in the long term their rate of return will be higher due to better resource and data management. Additionally, the management of complexity and high volume of business. Especially, low-cost carriers (LCC) prefer various distributions channels such as direct sales channel, which is their own software program, to satisfy their local market needs, NDC (New Distribution Capability) which is new global sales system created by IATA with lowest commission rate compared to other global reservation system. GDS (Global Distribution System) which is most common has strong network, and consolidators in order to reach wide range of customers in global run. Their strategy focused on increasing volume to reach ideal market depth. (Moral, 1998).

3. REVENUE MANAGEMENT

In recent years, revenue management is one of the crucial methods applied by many organizations in order to increase their income and profitability. All commercial functions of companies are implementing modern income management approaches to generate revenue maximization by understanding value cycle and optimally timing the availability and price of product for each micro-market segment. Customer demand analysis, market segmentation, optimization, balancing supply and demand, market base pricing, are the main concept of revenue management function (Cross, 2005). Market segmentation is the key for market base pricing and revenue growth.

In these perspectives, various concepts are discussed in this section including yield management, history of revenue management, purpose of revenue management, applications of revenue management, and revenue management system (RMS).

3.1. The Function of Revenue Management

Revenue management is described as a strategy or techniques to maximize the amount of revenue from the offered products of services in order to rise profitability of the business via various applications and used for perishable commodity such as airline seats, hotel rooms, rental cars, marine transport, e-commerce, retail business for textile, railways products such as wagon or seat and cruise ship cabins. It is “selling the right product to the right kind of customer, at the right time, at the right place to maximize revenue” (Kimes, 1989). Four main features of the revenue management are illustrated in Figure 3.1. It is essential to implement them all together during operations for the same purpose related to focus business.

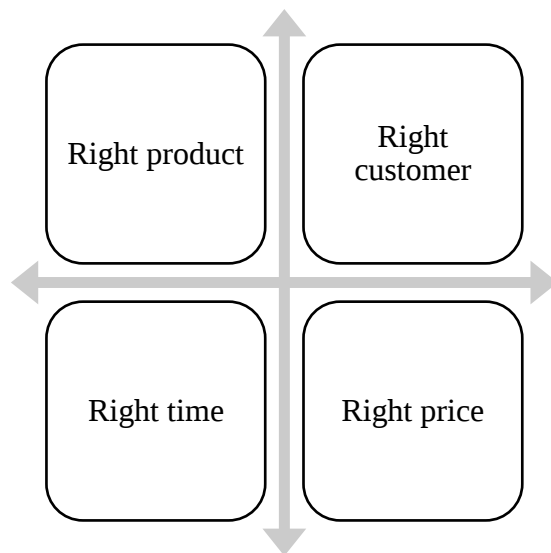


Figure 3.1. Four Important Features of Revenue Management

(Source: “Yield management: A tool for capacity-considered service firms” by Kimes, 1989. *Journal of operations management*, 8(4), p. 352)

For example, if a customer purchases an airline ticket many days before to the departure date, he/she will probably pay much lower prices than other passengers who wait for the last minutes to make reservations for requested travel date (Kimes, 1989). Price is inelastic for late booking market segment (Cross, 2005). System could assign different numeric or alphabetic figure for each fare class with different time of purchase; ‘Y, B, M, Q’. Each designated reservation class indicates a standard fare (the value) and defined rules designed into the system according to fare nesting for the specific air travel destinations and period of time. The price for the same flight can offer lower price according to the number of days before to travel date for advance purchase. The potential customers of offered flights would be pay lower prices as the date gap between flight ticket purchase and travel date. Airline ticket price would increase, the time get closer to travel date.

The rate of price increase determined according to analysis of demand curves related flight, minimum days to departure date, seat availability, passenger purchasing behavior, quality of product, price of competitors in the market, brand image of mentioned airlines company, elasticity of rules and conditions to provide customer loyalty and increasing service quality, schedule range and some other benefits and alternatives provided by airlines. After made some numerical analysis, RM team can be generated matrix using two main function of revenue management dynamics for right capacity distribution between defined fare classes to maximize the revenue of flight leg. Dynamic pricing strategies would be applied using these two main functions of revenue management tools such as minimum days to departure and seat availability of related route. It is mostly managerial strategies and tactical, mathematical, related rather than automated system capability.

The concept of RM is based on the assumption that different customers are willing to pay different prices for the same product and that by differentiating the price according to customer characteristics, overall revenue can be maximized (Yeoman et al., 2011).

Revenue Management is applicable in various sectors (Goksen, S.,2011). In capacity-constrained service firms the unit of inventory is time, whether it is a restaurant reservation or a hotel bedroom. Firms are selling a time slot for a specific purpose, which cannot be stored if it is not sold. (Yeoman et al., 2011) Also, any other transportation options who has perishable capacity such as marine or railway transportation use revenue management application for revenue growth with implementing advantages of dynamic pricing approach.

Revenue management is a business practice designed to optimize the revenue potential of a given asset through all market conditions. The process that most practitioners follow today involves a continuous cycle of six basic steps:

Step 1: Tracking:

The best decisions are often a blend of intuition and science. In order to understand the impact of these decisions, it is critical that factual data be gathered and used to help make even better decisions in the future.

Step 2: Forecasting

Predicting future demand based on past results is a good starting point to developing a strategy. Of course changes in market conditions, competitive supply, capacity constraints, special events, floating holidays, weather conditions, economic climate and other external factors necessitate some additional thought around true demand potential.

Step 3: Pricing

Those without an understanding or appreciation for the scope of the discipline often equate revenue management to simply changing prices, or worse discounting. The reality is that pricing in some service business such as hospitality and aviation today is far more complex than this.

Basic economic theory would dictate that equilibrium pricing, where the demand curves meets the supply curve, would be optimal. Unfortunately, inventory (i.e. rooms, airline seats, cars, spa appointments etc...) is perishable so this approach would under-utilize a given resource's potential.

Like the airlines that experimented with different fare classes based on advance purchase windows, hotels also attempt to fence demand by placing certain conditions around what customers can obtain what rates. Those fences can consist of differences

in policies, booking channels, length of stay, stay patterns, advance purchase deadlines, affinity groups and more. Other pricing considerations and techniques may include such elements as:

- Competitive price positioning,
- Bracketing (pricing above and below a competitor simultaneously),
- Increasing or decreasing granularity (changing pricing steps between products),
- AB testing,
- Unbundling,
- Dynamic packaging,
- Value adds,
- Volume concessions,
- Up-selling,
- Ancillary revenue potential,
- Theoretical Value (for gaming operations),
- And much more...,
- The end game is always to optimize the revenue potential for a given asset.

This extends beyond the core product offering.

Step 4: Inventory Management

Inventory management simply means opening or restricting inventory for sale based on certain conditions. Once future demand has been forecasted and pricing strategies determined, resource allocation or inventory management in the case of hotel rooms comes or airline seats into play.

Step 5: Distribution

Distribution refers to how guests find and book a property. Mobile application, Online Travel Agencies, Global Distribution Systems and Internet Booking Engines are all examples of distribution channels. Each may offer a different value proposition, but each requires that a revenue management professional think through how to best leverage the potential that each represents.

Costs and production performance also vary considerably by channel, so clearly understanding those elements is very important in determining a distribution strategy.

Step 6: Communication:

A company culture that supports revenue management efforts is a vital. Without it, the impact of applying revenue management principles will be significantly diminished. Despite the best intentions and careful planning, a sound strategy can be easily derailed if key stakeholders don't understand the role they play or don't believe in the approach. (Revenue Matters, 2020)

3.2. Yield Management

Yield management, controlling customer demand through the use of variable pricing and capacity management to enhance profitability, has been examined extensively in the services (Kimes and Chase, 1998). However, its focus on profitability rather than just increasing amount of revenue. In addition, it has been used by several companies longer than revenue management concepts due to determine of sustainability of companies. On the other hand, it could be defined as cost-based pricing strategy utilized by the companies in airline industry, accommodation industry, and other tourism related businesses, car rental, retail business in textile, e-commerce companies. It basically, aims to create maximum

revenue in parallel with profit from same number of perishable products or services (Revfine, 2020).

Kimes and Chase (1998) defined yield management as managing four distinct services: Calendar, Clock, Capacity, Cost, known as 4C. Those elements are controlled to manage a fifth service which called as customer demand to maximize profitability of the company in defined time period. They suggested a strong business strategy defined according to changing market needs and dynamics for each specific related timeline to reach effective yield management applications for any related business sectors which implemented to their business yield management approach.

There is an example shown at below at Table 3.1. contains four separate quadrants according to predictability and unpredictability of customer demand for airline business which is one of the service sector had applied yield management approach intensively, based on fixed and dynamic price categories. The quadrants could be explained as the phases of the modern yield management figures for the airline industry.

Table 3.1.

Yield Management Strategies for Airline Revenue Maximization

		Price	
		Fixed	Variable
Duration	Predictable	Quadrant 1: Before deregulation	Quadrant 2: Immediately after deregulation
	Unpredictable	Quadrant 3: None identified	Quadrant 4: Hub-and-scope system

(Source: “The strategic levers of yield management,” by Kimes and Chase, 1998, p. 156)

Many airline companies are mostly operating in the area of quadrant 1. The prices are fixed, and durations are predictable. Immediately after deregulations are forced, many companies merged to build stronger companies financially than before due to changing application of pricing method. That initiatives attempt led to creation of variable price alternatives for airline transportation. Especially, airlines in the US and many airline companies around the world had to move to quadrant 2 the phase of dynamic price implication. Such changes forced smaller airline companies to go bankrupt due to their uncompetitive structures and loss of power in the market for long term period. However, after deregulation, a distinctive trend started called Hub-and-scope system to carry more passenger and increasing market share. This system includes connections flights with partnering competitors or other airlines focused different market in order to increase the number of passengers carried on the same flight. Also, raising yield efficiency on the related flight legs and offer wide range of product for their potential customers. This operation strategy created origin-destinations and operational issues, so many airline companies preferred to switch back to quadrant 2.

In the hotel industry, the process of determining right hotel room pricing is called “yield management strategy”. The concept of yield management can be summarized in 3 R’s which refer to giving the right rate to right customer at the right time. Yield Management for hotels, it only encompasses the revenue generated through the room charges or occupancy, whereas Revenue Management involves a whole lot more than just occupancy. The aim of yield management in the accommodation

business is not to simply vary the room rates or to raise the occupancy percentage. More precisely, it is to maximize the average revenue per available room, per night. It is defined as RevPAR². Here is a basic yield management formula (Revenue-Hub, 2020). The formula applicable for many service business had limited and perishable product capacity.

$$\text{Yield \%} = \text{Achieved Revenue} * 100 / \text{Potential Revenue}$$

The term revenue management refers to a business practice designed to optimize the revenue potential of an asset through all market conditions. It is important to note that yield management principles remain as a fundamental component of revenue management and several conditions must exist for it to apply. Those conditions are as follows:

- 
- A fixed amount of resources are available for sale at any given time,
 - Resources are perishable (after a given point in time, resources are not sellable,)
 - Different customers are willing to pay a different price for the same resources,
 - There is some ability to predict future demand for resources (Revenue-Hub, 2020).

3.3. History of Revenue Management

Revenue management is the practice of dynamic pricing to help solve supply-allocation problems for many services business started in USA in early 1980s. The supply-allocation problem consider the travel industries: airlines, hotels, marine and railway transportation, rental car companies. They have a fixed supply of seats,

² RevPAR Revenue Available per Room

rooms, and cars, respectively. The key to their profitability is high utilization, as soon as a plane takes off, every empty seat is money lost, and any amount of money for those empty seats is better than no money. So, revenue management allows the price of a seat to fall when a plane isn't filling up fast enough. In the same way, the price of a hotel room is allowed to sky-rocket when demand exceeds supply (Hines, A.,2007). The airlines are credited for developing the foundational science behind revenue management. A decade later fledgling revenue management practices in aviation sector, began within the hospitality industry (Revenue Matter, 2020).

RM for aviation business (aka, yield management) was originally introduced when American Airlines first implemented a computer reservation software (SABRE), which was designed to manage reservation inventory in 1966 (Chiang, Chen & Xu, 2007). Yet, other significant studies did not start until the airline deregulation act of 1978.

This act allowed airline companies to regulate their ticket prices more freely that later caused flexible operating procedures especially for the airline business industry. Innovative technological developments, involving computer programs for controlling and decision-making procedures, were most important elements for the new business strategy. Today, this system is generally accepted and implemented by all airline companies as well as hotels, car rentals and other industries related to travelling and tourism. New reservation and inventory systems are presently developed by the computer technology companies. Revenue management strategies can provide to maximize the flights and non-flights revenue with using same resources and create more benefits from the potential markets using some revenue management and pricing tactics defined as organization and changing market needs as

well as job opportunities for the airline professionals around the world (Revfine, 2020).

3.4. Purpose of Revenue Management

Main purpose of the revenue management is moderately stress-free; to maximize revenue and profit with using same amount of resources. Also, to manage the inventory, availability of services offered by the company for targeted group of customer segment effectively through advanced computer technologies.

Technological advancement within this context has an even shorter history and RM is a phenomena of the twenty-first century (Yeoman, 2016). Airline acts imposed by the FAA in the US, airlines were allowed to operate more flexible regarding tickets' prices, fare rules, capacity distribution, inventory management, reservation control and related revenue management systems, other travel and tourism (hotels, car rentals) started to implement revised versions of the strategy tailored for the specific sector dynamics (IDeaS,2005).

In addition, in order to increase revenue and profits of the company, revenue management methods are also utilized to rise customer satisfaction such as time of purchase and variable price with particular dynamic pricing strategies, market segmentation, minimize the commercial risks to be guaranteed for perishable products of airline business. The practices of RM, the evolution into the hotel and other industries, the development of theories and new applications in a multi-disciplinary field, the impact of technology, and the internet and movement towards pricings (Yeoman, 2016). Associated factors were also adopted by other similar sectors focused commercial efficiency, to create positive customer perception and obtaining demand increase for the product or services. For example, film sectors offer discounted movie prices and special offers for specific days or times to reach wide

range of customer and increase the number of customers. This development created campaign management figures.

3.5. Applications of Revenue Management

First implementation of revenue management appeared in airline business in the late 1960s. In the following years, it has been adapted by other sectors especially related to travel accommodations. It is widely used in three important travel industry: air travel, hotel, and car rental (Chiang, Chen & Xu, 2007). In addition, several other sectors presently implement similar strategies. They are as follows ‘restaurants, hospitals, car rentals, casinos, manufacturing, sales management, railways, cargo and freight, apartment renting, and subscriptions services.

These aforementioned sectors could be classified into two distinct areas as traditional and non-traditional applications. Airlines, hotels, car rentals, tour operators, cargos, and cruises are considered as traditional (Simchi-Levi et al., 2008). Other sectors are classified as non-traditional application areas for RM.

The above sectors are using RM share similar characteristics including perishable services, demand fluctuations in time, and required fixed expenses to operate flexible pricing, seating, and other factors with their own specific areas and conditions. In addition, business environment is another factor for RM applications. They could be listed as follows:

- The capacity for these sectors is usually limited and easily perishable.
- They require commitments since future demand could not be completely forecasted.
- The companies could offer distinguished services based on the various customer subdivisions (market segmentation).

- Similar units of capacity could be employed to provide different services or price categories for the same flight.
- Companies mainly focus on profit maximization with offering flexible schedule, and capacity distribution (Te Doni et al., 2017).

3.6. Revenue Management Systems (RMS)

Software system in service industry, have limited perishable capacity, comprises one of the fundamental features of revenue management initiatives. Basically, a system could be described as software regarding bookings and making reservations, reservation control, inventory control, capacity distribution and price management, reporting and other related issues for revenue management approach.

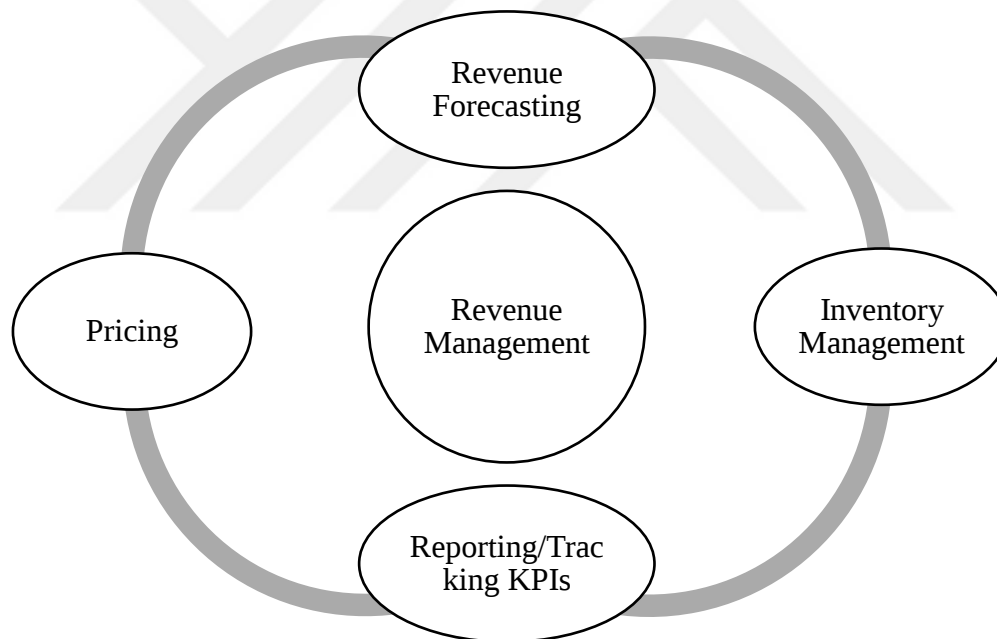


Figure 3.2. Four important steps of Revenue Management System

(Source: “U.S. Patent No. 5,652,867” by Barlow et al., 1997)

Figure 3.2. represents four important steps and elements of the RMS (Barlow et al. 1997). The first step is production of the revenue for the near future years of planning. Later, the airline company should create a pricing strategy in order to make

better revenue forecast. It is affected by various factors including macroeconomic indicators, date, time, destination, market competition, and demand. They should manage inventory to provide fares and availabilities of product according to the market conditions such as seasonality, service preferred time, total supply and demands. RMS obtain for the users linked forecasting, optimization and reservations management into a single entity (Emerald, 2016). Existing RMS base their recommendations on historic observations and do not explicitly consider competition. This means that RMS recommendations often are not appropriate for real-time competitive situations (Fiig et al., 2015, 2016). After development of dynamic pricing which is an extension of RMS that dynamically calculates the optimal price, taking into account the airline's strategy, customer-specific information and real-time alternative offerings. By optimizing the contribution within the shopping session, DP³ has a more current and detailed view of demand and can improve RMS performance. DP also referred as surge pricing, demand pricing or time-based pricing allows prices to respond to current market conditions (Yeoman & McMahonBettie, 2017). In the last step of the RMS, key performance indicator (KPI) should be reviewed and assessed to evaluate and track the performance. At the end of the evaluation process, a report could be generated for better analyze of future business.

More than 200 Revenue Management Systems are currently employed among the airline companies for both passengers and cargo worldwide (Secomandi, 2002). since they have first introduced 20 years ago (Weatherford, 2009). Such systems help airline professionals to design or charge agreements concerning how their firms would provide inventory management or redesigning of services to their customers

³ DP Dynamic Pricing

satisfaction and to have more passenger and share in the market for managing of company growth over a period of time.

A study regarding RM software systems was recently conducted (Weatherford, 2009), which investigated satisfactions of RM software by implementing a survey from six different vendors. Vendors were chosen according to recommendation of airlines. The length of use for RM systems were found around eight years for airlines business. Approximately, 97% of the airlines included in the study were using RM systems. Overall, satisfaction airlines for service providers, usability factors of system, friendliness, and all other benefits of the systems were calculated 3.34 (out of 5). Most of them had purchased separate group modules decided according to company scale, business model, and market conditions.

Top companies in air transportation utilize both in-house and outsource vendor RMS (Gorin, 2018). For example, KLM, American, Delta, United, and British airlines use in-house RMS technology. On the other hand, Lufthansa (PROS/LSY) and Iberia (PROS) use outsourced RMS technologies. Three major properties are taken into consideration when purchasing RMS: “speed, flexibility, cost, control”. Control consists of sub factors such as science, algorithm and data; roadmap and features; confidentiality; security and minimizing risks caused by employees.

RMS providers claims that obtain many benefits for both tourism and travel sector. For Airline industry PROS, one of the most popular vendors, states that their RMS increase revenue and time management efficiency for inventory control, protect revenue with advanced forecasting, determine the fare mix to maximize revenue, incorporate willingness-to-pay, and forecast current market trends and customer purchasing behaviors (PROS, 2019).

In addition, RMS provides benefits for accommodation business. The software used to predict customer demand, to optimize inventory and price availability, and maximize hotel revenue. RMS considers a wide range of data, historical and futuristic, to make automated forecasts related to the budget and revenue. RMS obtains high accuracy data, better operational efficiency, improved RevPAR, intelligent reporting, integration with CRM⁴, PMS⁵, CRS⁶, open pricing and cloud technology for hotel management. Some of RMS for accommodation sector, can be listed as IDEaS most leading provider, Pace gives hotels real-time forecasting, price sensitivity analysis, and automation, Room Price Genie best for small and medium size hotels, LodglQ which is powerful cloud base program, Cloudbeds integral part of PIE (Price Intelligence Engine), Lybra makes smart and data-driven decision in a few seconds, Climber is automatically detects new revenue opportunities and recommends on-time actions (Hotel Minder, 2020).

⁴ CRM Customer Relation Management

⁵ PMS Project Management System

⁶ CRS Central Reservation System

4. AIRLINE REVENUE MANAGEMENT

Revenue management has significant role for the companies in various sectors such as transportation and accommodation (Ahn, Luo & Shebalov, 2020). In this section, airline revenue management system and applications are discussed based on the previous literature. Initially, Turkish Airlines, as first implementer of revenue management discipline in Turkish aviation industry; Commercial Airlines, revenue management approach applicable for their business for revenue maximization and Airline Alliances which is significant corporation between airlines for creation of power strength, cost reduction, gaining additional revenue from various market have no flight operation before. Airlines Alliances was discussed in this section due to part of dynamic pricing with other related part of airline revenue management. Additionally, its components, RM methods, and a list of RM concepts are discussed in this section.

4.1. Turkish Airlines

Turkish Airlines is the biggest and national flag carrier airline in Turkish aviation business. It was founded as “National Airlines” in 1933 and renamed as Turkish Airlines in 1946. First international travel was completed between Ankara and Athens in 1947 with DC-10⁷ model aircraft. Domestic night travels were started between Istanbul, Ankara, and Izmir in 1955. Its logo represents the wild goose, the only bird that can fly intercontinental at a height of 9,000 meters. 49% of TK⁸ shares belong to private owners while 51% belongs to the Turkish government (Airlines, 2013).

⁷ McDonnell Douglas company long haul aircraft produces between 1968-1988

⁸ TK is the IATA Code of Turkish Airlines

It ranks among the fastest growing country in the last two decades (Airlines, 2013). According to 2018 statistics, it has 254 owned and 59 rental airplanes. It serves 49 domestic and 255 international destinations in 120 countries (Aslanov, 2019). TK is the leader of both domestic and international air transportation in Turkish aviation market. Also, the airline that flies the most countries in the world.

TK ranked 18th best airline according to customer votes by the Skytrax in 2018 (Aslanov, 2019). It was ranked as best 4th airline in 2015. Above 70 million passengers were carried by TK in 2018.

THY started domestic airline market for commercial competition through deregulation in 2003 (Orhan & Gereke, 2013). After deregulation of Turkish Aviation Industry, other commercial airline companies started domestic competition with THY. Therefore, Turkish Airlines initiated a new strategy in competing with the new airline companies. They adapted Porter's competition strategies and new innovative methods to gain competitive edge in the market.

In a related study by Sarilgan (2001), Vice President of the revenue management of Turkish Airlines was interviewed about the strategies TK follow in terms of revenue management and pricing. THY used 'Airmax' as the software solution program for revenue management approach. TK followed up market trends and development to make real-time forecasts for future planning and intelligence reporting system to make strong analysis. The process contains after make product planning, capacity distribution and seat allocation, inventory control, setting marketing and price strategy for each particular destination. The RM team have to act quick concerning pricing fluctuations via got benefit from revenue management support system.

RM Team of Turkish Airlines were trained by trainers of RMS service provider in Istanbul to managing big data, making accurate analysis and taking better decision for implementing RM approach according to focus market dynamics. They later started using Super Airmax and SAGE systems as revenue management solution software (Sarilgan, 2001). The revenue management system would be replaced with most technological options in the market over the years according to changing company needs and future business strategy. Currently, THY use PROS⁹ for their revenue management solution system.

4.2. Commercial Airlines

Airplanes have been used since first power airplanes aired in 1903 by the wright brothers in North Carolina, USA. Commercial air traffic had started during 1960s in the USA and later, aviation industry grew at a higher speed in the upcoming decades (Eriksson & Steenhuis, 2015).

The first carrier, KLM¹⁰, was founded and started operating national air travels in Netherlands 1919. First transcontinental non-stop flight was completed in 1923. In 1926, first legal air commerce act of 1926 authorized the US government to appoint and develop air navigation systems, allow pilots and airplanes for commercial flights. First jet engine aircrafts started operation in 1952 in England with DH 106 Comet type aircraft by BOAC¹¹(Nergiz, 2019).

Few people were able to fly during 1960 and 1970s except rich people and governmental officers due to limited capacity of aircraft, safety factors, high cost of plane tickets, travelling habits and lack of knowledge about air travel. Today, airlines focus on providing more flight alternatives for potential customers around the world

⁹ PROS The brand Revenue Management System for airlines business revenue solution

¹⁰ KLM Royal Dutch Airlines & Air France Joint Venture

¹¹ BOAC British Overseas Airways Corporation

to contribute development of air transportation industry (Davis, 2016). Because of development of air transportation, the airlines try to improve new tactical strategy or updated their service option to satisfy the market needs and to get more share in deepen market. The number of air departures rapidly increased to 38 million in recent years, with a total of 4.3 Billion passengers according to report of International Civil Aviation Organization (ICAO). In Turkey, air transportation was started with Turkish Airlines in 1933. After deregulation act private airlines get right had operation for domestic business. Each airline increased number of passengers, destinations and flight frequencies year by year after deregulation due to price elasticity, market development. By end of 2018, Turkish Airlines carried more than 75 million passengers and reached more than 80% seat load factor (DHMI, 2019). According to forecasts of Boeing and Airbus Companies, growth in aviation business would be continue until the year of 2030 (Boeing, 2019).

On the other hand, according to IATA reports while world aviation business has growth only 5%, Turkish aviation market reached 30% growth (SHGM, 2019).

The revenue management discipline is most crucial instrument of commercial airlines in order to maximize their revenue from both increased demand capacity. In addition, dynamic pricing tool has significant role for reaching targeted goals of airlines. Also, DP has supported the improvement of RMS systems during the duration of aviation industry growth.

4.3. Airline Alliances

Airline companies started working together and forming alliances after 1990s revolution acts of deregulation due to increasing rivalry in air transportation industry. An airline alliance could be defined as collaboration of two or more airlines at

considerable level for common interest. An alliance is generally formed to provide marketing, labeling to assist travelers creating inter-airline networks within a country or across the world.

Today, there are three major global airline alliances in the world: “SkyTeam, Star Alliance, One World”. Turkish airline is a member of the Star Alliance group. Star Alliance consists of 27 major airline companies. SkyTeam has 20 airline companies. The smallest airline alliance is One World with 15 airlines. The aim of all alliances to create more benefits both companies for cost reduction and their passengers serving more alternatives in global market. In addition, decreasing airlines some operational expenses and get power in rivalry at focused market, get more experience from different markets which had no flight operation before, with using common resources of alliances (Discala, 2018).

Airline Alliances have grown exponentially over the last decades. As a result of technological development and air travel market depth, the growth expectation for upcoming years would be faster than last decade (Oum et al., 2001). Many governments and airlines believe that it is crucial, and the best solution to accomplish free trade challenges in the aviation world (Oum et al., 2001). One of the critical parts of pricing, implementing dynamic pricing approach for particular business markets had not experienced before, for the partners flights in alliance group.

4.4. Airline Revenue Management

Topic of revenue management is a holistic and systematic strategy or an approach to achieve the highest revenue from the services produced with fixed capacity (Shaw, 2016). RM has been primarily used in airline companies and over

time has been adopted by other service sectors like accommodation business, marine and railway transportation, car rental, any retail business such as textile and e-commerce.

RM fundamentally focused on capacity control and seating, pricing, and booking services and assets that have perishable features for airlines business (Talluri & Van Ryzin, 2006). Since offering the services with such properties are time-dependent, it is impossible to evaluate the product which is unused or delayed to another scheduled flight.

Many studies were conducted about revenue management discipline in airline industry. For example, Lancaster (2003) explored the financial risk of airline revenue management. The researcher discussed how to balance risk and reward when making profits or achieving objectives. The study focused on how airline companies recognize possible issues affecting revenue management approach. Applications of risk management measurements and methods for airline revenue practices were also discussed in the study. The results revealed that risk management measurements and methods could be applied to the practice of airline revenue management practice. In recent year, possible financial risks calculated by RMS and applied to revenue management approach.

4.4.1. Fundamental Concepts of the Airline Revenue Management

Researchers and specialists often discuss about more comprehensive revenue management approach for airline industry to create more revenue resources in competitive work environment. However, they need to clearly understand that efficient revenue management strategies and seasonal tactics encompass cargo flights, passenger flights, flight schedule, hub, connections, layover, market analysis, supply

and demand, forecasting, fare rules and restrictions, pricing models and strategy, corporate strategy and roles, bundle and additional services, ancillary revenue categories, strategic cooperation and alliances, load factor analysis, big data management, system management, reporting, distribution channels, campaign management etc. For example, ‘layover’ refers to an overnight stop, due to delay or flight changes between connected flights.

In this subsection, we will briefly discuss fundamental concepts of revenue management in the airline industry.

4.4.1.1. Market

Market is generally described as the position in the economy where all kinds of good, services, and products are sold or bought or exchanged through trades. It is accepted one of the fundamental elements in the discipline of economy, particularly marketing. According to the idea of market, individuals, organizations, countries constitute market where exchange activities and transactions are done. The market could occur at various places such as fairs, exhibitions, stock exchanges, and district or farmer markets. The basic concept of market definition in the aviation industry does not differ, at least concerning the essential characteristics, from the general concept of market definition that is used in Competition Law all over the world. However, specific aspects and principles of the aviation sector have been adopted and utilized by competition authorities and courts for defining the relevant aviation market. Market definition takes into account both the demand and supply considerations (Aviation & Competition, 2019).

In any competition analysis is the definition of the relevant market. There are two fundamental dimensions of market definition:

- the product market; and
- the geographic market

Market definition is a tool to identify and define the boundaries of competition between firms. The main purpose of market definition is to identify in a systematic way the competitive constraints that the undertakings involved face. A relevant product market comprises all those products or services which are regarded as interchangeable or substitutable by the consumer, by reason of the products' characteristics, their prices and their intended use(Aviation &Competition, 2019).

The relevant geographic market comprises the area in which the undertakings concerned are involved in the supply and demand of products or services, in which the conditions of competition are sufficiently homogeneous and which can be distinguished from neighbouring areas because the conditions of competition are appreciably different in those area(Aviation &Competition, 2019).

In recent years, market become more competitive compared to mays years before. There are many factors affect the market comprehensively. Mainly, FAA regulations in 1990s and had active role of Low-Cost Carrier concept in the market. Also, other concept of airlines business model which are regional carriers or airlines has differentiation strategy. In addition, with effect of deregulations act 1-4 dedicate before (deregulation date can be chance depend on region in the world for aviation) , many airlines had increased the number of flights for focused marked, and they also expanded their products range by breaking into new market. Such kind of improvement in aviation, increased the demand for air travel market. Due to effect of rapid growth, and arisen of RM discipline, current airline market is having its most competitive period.

Because of such competitive environment, airline companies have to develop new strategies and products to attract new customer's attention to get more shares in the market by expanding their business. It is also important company sustainability in long run. Airlines had to update their offers deal with air freight, cargo and air mail, inflight products such as drinks, meals, entertainment and any other special services. The effects of such a transition has been seen until today. For example, in 2019, Anadolu Jet¹² started offering sandwiches and drinks with a cost.

Another concern of airline company satisfaction of passengers needs to have more loyal customers. In order to catch global aviation trends, airline companies should always be updated with the necessary digital actions and programs into their RM systems including pricing, seat availability etc., and find an effective and suitable solution for the customer issues on time.

4.4.1.2. Offering

Due to that fact that more people discover the new destinations, mostly they prefer to airline transportation for time saving, safety and comfort. Day by day, air traffic increase between far destinations. As a result of volume increase, effect of globalization and digitalization, airlines have to offer more alternatives, and give new form for their products for passenger satisfaction. Actually, while the airlines were offering more concepts into focus business, they always care about reasonable limits setting their achievable goals.

Changing market dynamics force the airlines offer more reliable and comprehensive services such as widen products range, but they have to consider financial return of the offerings. Such kind of analysis has significant role for decision

¹² Anadolu Jet is Low Cost Carrier & Trademarks of Turkish Airlines

making process in terms of revenue management discipline. For example: if airlines allow passengers to carry more and heavier baggage, each extra kilo will be increase of fuel consumption. As a result of this, cost of flight will be higher than expected. In this case, it would be difficult to manage revenues of mentioned flight.

Especially, in domestic business airline companies offer limited services and products to reduce their expenses in competitive environment. The revenues earning possibility would be less than international business due to market conditions.

4.4.1.3. Demand

Demand is one of the major elements of airline operation. It is deterministic component of airline business performance management measurement. However, it would be evaluated along with total supplied seats in the market. Year by year, people desire to discover more culture, lifestyle and destinations. Due to such kind of and more reasons, Airline industry has been growing with an incredible rate of increase in demand. This sharp demand growth in aviation business, greatly affects each element of the airline travel including capacity schedule, frequency planning, forecasting criteria, booking figures, and all service details.

However, while such kind of demand growth continues rapidly in aviation, this sensitive sector affected by economic crisis, any terrorist attempt, any kind of pandemic, regional restrictions, accidents caused by technical errors made by manufacturer for preferred aircraft models, fact of nature quite easily. In this case, demand curve would be drop down dramatically, such kind of situation would rise expenses of airlines and reduce the profit margin eventually.

4.4.1.4. Day to departure

Day to departure, refers to the number of days remain to flight travel date. The meaning of departure is, the airplane has already left the airport and aircraft has already airborne after take-off run. The number of days remaining to departure has crucial role in RM discipline. This information show that, airline product is perishable, and we have to manage capacity and fare distribution effectively earlier than travel date to reduce performance risks of related routes. On departure day, airlines have to implement to operational procedures of airports and aviation authority. Each successive airplane waiting for departure time have to be ready and completed all paper works minimum 30 minutes before flight time. The time limit of nonuniformity according to airlines, regional restrictions and special conditions of market, airlines or airports.

4.4.1.5. Price Sensitivity

Price sensitivity measures the amount of degree which customers has purchase intention form served price for airline products or services. It is also described as price elasticity of demand. This point out that, how customers demand pattern affect air travel efficiency due to customer buying behavior based on price factor.

Airlines always take into account the price sensitivity of market as defining your fare levels and implementing revenue management strategy due to time and risk management factors.

A study by Garrow, Jones, and Parker (2007) showed that, price is main factors of customer decision process for buying airline ticket. They used online channels for data collection from the participants. They utilized the case, as benefitted from search engines to make estimation on multinomial and nested logit models in the USA

market. The models investigated in the study produced a new structure provide information about customer purchasing tendency for airline travel services. They offered some innovative approaches in terms of the customers' preferred departure date and time were discussed.

4.4.1.6. Overbooking

Overbooking occurs when airlines sell more seats than airplane capacity. This action not practiced randomly managed by inventory control side. RM team determined the how many additional seats would sell on related flights after route performance history analysis. Overbooking is necessary to increase commercial efficiency of each segment.

This is not called as a problem in aviation business, RM team member calculate every possibility and should find alternative solution both for operational excellence and revenue maximization. However, sometimes when overbooking occurred, can create expense issue for airlines if the passengers did not attend to planned flight. When overbooking possibility become a current issue, airplane was full and there was a no-show potential as well.

Overbooking is considered an adjustment related to its risks and expenses between airline image and potential revenue loss from unsold seats (Cleaz-Savoyen, 2005). Below figure summarizes overbooking models currently in use.

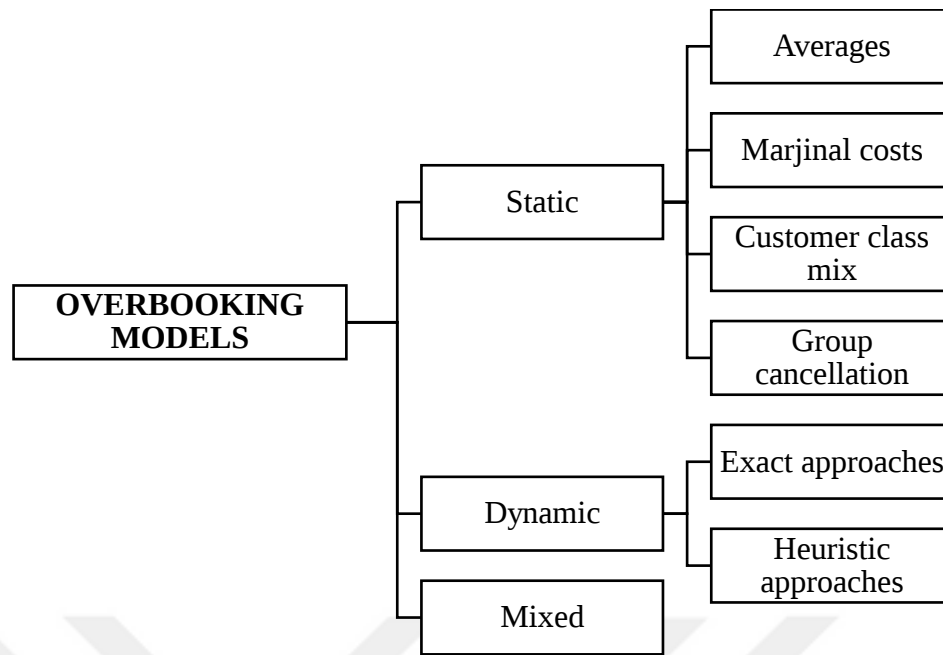


Figure 4.1. Proposed Overbooking Models by the Research of Revenue Management

(Source: “Estimation, forecasting, and overbooking,” by Chávez, 2018)

Some overbooking models were developed to reduce the revenue lost due to no-show possibility. It was typically used to be 15 – 25% of the total bookings at the beginning of this model implementation, afterwards this rate could drop down to around 10% compared to introductions of the overbooking models. (Cleaz-Savoyen, 2005). The rate of OVB¹³ can determine by analysts depend on many factors such as historical data of no-shows for related flight leg.

There is no specific standard of this overbooking rate. The given numbers would not be true all of the flights, airlines, regions. There are many parameters affecting the rate of overbookings. Some of them would be listed as; characteristic of flight segment, number of alternative flights for related destination, seasonality, regional demand increase depend on any reason such as festivals, average number of

¹³ OVB overbooking

no-shows, booking cancellation, any other private reason of passengers, to be late for check-in, not obey the air travel rules and restrictions.

4.4.1.7. Reservation Cancellation

The main concept of revenue management approach for airline business is selling similar seats with different prices level for revenue maximization and good resource management to have more profitable results (Subramanian, Stidham, Lautenbacher, 1999).

Yield management process included seat inventory control and aimed to have more profit from same flight segment. It is considered in revenue management function. Another issue of air travel affecting flight revenues is reservation cancellation caused to seat inventory problem and created price setting difficulties.

In order to reduce capacity management and fare distribution problem, RM teams developed some preventive methods systematically to minimize the impacts of reservation cancellation on flight revenue. For example, airlines can implement restricted fare rules when passenger demanded reservations changes or cancel. They will charge some or all amount of ticket price in case of cancellations depend on duration remain to travel date, load factor of related flight segment, and face group conditions.

4.4.1.8. No-Show/Go-Show

No-show can cause problem on capacity management, and revenues as well. Passengers who purchased airline ticket much earlier than travel date, but not attended to flight on travel day. Such kind of passengers called as No-show. The name of passengers on flight list, they have already bought the tickets, but they did not show

up within departure time at the airport. To reduce risk of No-show on flight performance and revenue, airlines makes overbookings.

Go-show is the passenger has not reservation on flight but, waited at the airport coming earlier than flight time and took no-show passenger place or made last minute reservation if there is availability on related flight. Sometimes, go-show has reservation for late flight but, go-show passenger arrives at the airport much earlier than his/her flight time and wishes to attend any earlier flight instead of the scheduled flights s/he had reservation. Go-show passenger can provide revenue transfers from one flight to another.

For both cases, passengers have to pay penalty fees, which can change depend on company price rules and regulations, except for acceptable emergency reasons. No-show or go-show, similar to reservation cancellation, sometimes can requires different amount refunds or not depend on fare rules of travel ticket. (Subramanian, Stidham, Lautenbacher, 1999).

4.4.1.9. Flight Cancellation

It is basically described as airline is forced or wishes to cancel a scheduled flight for number of reasons such as bad weather, emergencies, technical problems, and commercial reason, etc. There are two side of flight cancellation on revenue management. On negative side, flight cancellation can cause revenue diminishing, decreasing commercial performance, operational efficiency and utilization; on positive side, it would provide reduction of operational expenses in case of unexpected situation such as bad weather conditions.

If airline companies cancel a flight for a particular reason, they have to provide a seat on next available flight for customers who protected by legally under

passenger rights. Additionally, for some cases airlines can obtain some extra benefits for related passengers due to flight cancellation such as discount coupon, hotel accommodation, refreshment etc. They are also making full refund of ticket prices or reservation change for next available flight depend on customer decision.

4.4.2. History of Airline Revenue Management

Revenue management was initially developed and started using around 1960s. The most comprehensive recent study was conducted by McGill and Van Ryzin (1999). They reviewed around 200 previous references on the concept of revenue management. Revenue management consists of four major areas – forecasting, seat inventory control, pricing and overbooking. Airlines have the longest history of implementing revenue management strategies among the service industry.

First revenue management practice in airline industry was launched by American Airlines about four decades ago in the US (Spiewak, 2017). It was described as an approach built on the idea that every customer is unique, and inventory is perishable (Spiewak, 2017). The airline company focused on maximizing revenue and profits by analytical inventory strategies, which later created Low Cost Carriers or low-fare carrier concept.

In the recent years, airline industry has been widely accepted RM models and it became the most important progress in air transportation and history of transportation. LCC¹⁴s shares have been rapidly growing since its creation and now reached more than 25% of total airline revenue (Spiewak, 2017). Some airlines are implementing innovative pricing strategies and tactics depend on market structure and analysis in their RM approach.

¹⁴ LCC Low-Cost Carriers

Today, modern RM systems include revised approaches such as predictable revenue outcomes, dynamic and flexible pricing (old: based-available rate), setting increased net revenue as the primary goal (old: increased seat or room occupancy), automated pricing and inventory management (old: manual or semi-automatic), integrated to property management system (old: separate), automated rate distribution and optimization (old: manual), application to all property revenue streams (old: guest rooms only).

In the future, revenue management approaches are expected to grow rapidly and become more complex and more efficient, flexible, integrated systems are likely to emerge by optimizing all the revenue sources including ancillary sales, connected flight and alliances, fees and taxes, and merchandising that will lead to financial profits for airlines (Altexsoft, 2019). They probably will focus on revenue per passenger or seat rather than revenue per segment. Integration is the key factor in terms of inspiring total revenue management strategies.

4.4.3. Purposes of Airline Revenue Management

The main goal of implementing revenue management discipline into the airline industry is getting maximum revenue from same product; in addition, to reach wide range of customer segment in order to increase seat load factor and to create affordable air travel options for different group of passengers segment.

Particularly, airline revenue management strategy can validate three major dimensions of the airline industry: schedule, product, pricing/ancillary. RM is able to help evaluating bookings and competitive fares in relation with other major factors directly related to revenue. Strategically, some of the airlines focus on ancillary services sales rather than flights revenues due to business model and tactical roles in

the targeted market. They try to reduce the base fares for their product packages including limited services, then implement ancillary service categories to get more revenue.

In addition, RM is a kind of commercial structure for implementing corporate strategy and defined business model of company. Therefore, it is aligned with corporate identity and long-term business strategy to promote the company in targeted market. Such a business strategy integration comes in various forms – customer selection, branding, market share, ancillary service categories, and cash flow (Jain & Bacon, 2016). RM is specifically designated to sell their seats to customers at possible most expensive price earlier than travel date minimizing commercial risks. Due to the fact that airline needs to maximize its revenue, it is important to treat each customer as a unique case about the perishable airline product.

4.4.4. Applications of Airline Revenue Management

Because of competitive advantages of LCCs in 1985 in the market, American Airlines had to develop and implement RM program to get more share. Since, other airlines were not able to compete with this new technology, they had to become bankrupt. AA¹⁵ later won Edelman Award for best application of management science in airline industry in 1991.

Airlines use various revenue management systems around the world. Top airline companies RM solution software of listed below at Table 4.1:

Table 4.1.

Revenue Management Solutions at Top 10 Airline Groups Worldwide

¹⁵ AA Amerikan Airlines

Airline	RMS
American Airlines	In-house
Delta Air Lines	In-house
United Continental	In-house
Lufthansa	PROS/LSY
Air France-KLM	In-house
International Airline Group (IAG)	Mixed
British Airways	In-house
Iberia / Iberia Express	PROS
<u>Vueling</u>	<u>AirRM</u>
Aer Lingus	Sabre
Southwest Airlines	PROS
China Southern Airlines	PROS
China Eastern Airlines	PROS
All Nippon Airways	PROS

(Source: “An overviews of the commercial market,” by Boeing, 2019.

<https://www.boeing.com.tr>)

Although RM was initially developed for the purpose of airline industry, following its success in the applications of AA other business sectors started integrating it to maximize their revenue and gain more profits. Traditional areas of RM application consist of airline, hotel, car rental, tour operator, cargo, and cruise. Non-traditional areas are as follows: healthcare, broadcast, restaurants, apparel, and manufacturing.

4.4.5. Airline Revenue Management Efficiency

Airline revenue management efficiency could be described as sophisticated and important viewpoints of organizations such as airlines and hotels (Legoh  rel, Fyall & Poutier, 2013). It is very useful to assess how well the employees and other parts of

the organizations are functioning. Airline RM efficiency are measured in terms of rate efficiency and sell out efficiency.

Rate efficiency is the indicator of daily rate achievements that can be compared to the average daily purchases and revenue. Sell-out efficiency is another indicator for how many tickets are sold in a certain time period.

Airline revenue management plays crucial role in terms of economic efficiency (Botimer, 1996). Price discrimination is also known as a vital component in RM efficiency in airline companies. Early justifications of price discrimination which applied with dynamic pricing method in airline industry was implemented to generate more revenue to cover fixed operational expenses.

It is necessary to create a balance between flight operation expenditures and totals expenses. For example, some airlines started to develop cost reduction strategies caused by aircraft leasing, they took some critical preventive measures as increasing flight frequency and total capacity on same routes to hit the targeted budget goals. Such kind of strategic attempt can improve the financial performance efficiency of airlines.

In order to have more efficient commercial results, some of airlines apply technical methods with using advantage of their technologic resources while others got benefits of non-technical or pure efficiency approaches. Overall, after checked some financial reports and data analysis of business, management team can determine the how did they have efficient results comparing their total revenues and expenses from flight operation (Joo & Fowler, 2014).

4.5. Components of Airline Revenue Management

RM consists of six crucial components in order to maximize revenue in aviation industry. (Figure 4.2). All of the components are interrelated to each other.

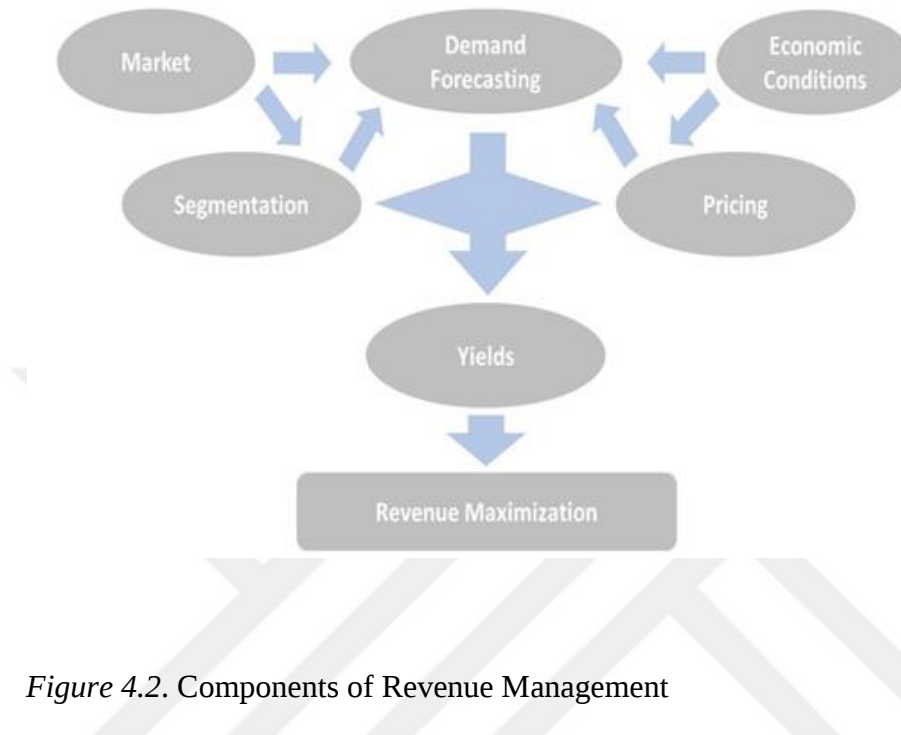


Figure 4.2. Components of Revenue Management

(Source: “Machine learning redefines revenue management and dynamic pricing in hotel industry”, by Altexsoft, 2019. <https://www.altexsoft.com>)

Market, economic conditions, segmentations, and pricing contribute to demand forecasting for any service or product, which eventually create yields and revenue maximization. During the process, market affects segmentation, economic conditions and segmentation separately effect pricing.

4.5.1. Dynamic Pricing

Dynamic pricing is described as a methodology of offering different fare levels for the same or similar product. Such kind of dynamic pricing method aimed to earn

more revenues from various customers segments with using different amount of capacity between price levels. Capacity allocation between the fare class can be determined after analysis of some critical pricing instruments as booking speed, rivalry, product types and range, price flexibility, economic conditions, customer segment and seasonality.

Private airlines utilize various types of differential pricing approaches. Such approaches could be listed as (Mohammed, 2005):

- Helping customers to overcome obstacles (discounts, sales, price compliance, frequency of sales, coupons and promotions, corporate price and flexibility booking figures),
- Customer characteristics (age, price sensibility, income level, membership, loyalty status, purchase history, place of residence, personal buying behavior),
- Selling features (discount on bulk products, package sizes and conditions, secondary product or service, discount of fixed price campaign for selected routes, length of journey),
- Selling Strategy (measuring, bargaining, dynamic pricing, promoted with limited capacity for limited time duration, restricted ticket rules and sales channel).

Mohammed (2005) described dynamic pricing as selling product starting from lowest prices to reach a greater number of customers than expected. Afterward, increasing the fare level according to rate of demand for same products. Above approaches could be summarized in a multi-price strategy, which includes specific promo prices affordable from each customer segment, acceptable market price levels and higher price group used in case of higher demand rate or specific terms of air traffic. Also, focused market specific conditions taken into account while applying the

dynamic pricing method capacity distribution. In another words, “value-based pricing is an innovative pricing plans, focused on different customer segment with using different level of fare to increase level of share” (Mohammed, 2005).

4.5.2. Seat Inventory Control

Airlines around the globe use various types of strategies and methods to offer the best fares for their customers for revenue maximization. While they are implementing their strategy fits with their market conditions, the RM team arranged the seat allocation for each flight leg, capacity distribution between defined fare class according to their market strategy known as seat inventory control (Williamson, 1992).

There existed studies that conducted on seat inventory control concept. For example, in a recent study by Feng & Xiao (2001), the researchers discussed the airline seat inventory control problem regarding one hub, one destination or multiple origins. They presented a stochastic control model and developed optimal control rules. It was explained as offering various fares on each route, time-dependent demands, and controlling booking in regard to extended network.

4.6. Pricing Strategies for Airline Industry

Pricing strategies of the airline companies has significant role for increasing amount of revenue and effective using of company resources. Pricing strategies often lead to changes figures to have more profitable outcomes in revenue management for airline business. Efficient revenue results depend on flexible pricing strategies comply with changing business environment and targeted market dynamics; types of products offered by companies in related market. Airline companies examine pricing strategies

for air travel industry with the factors including inventory management, capacity allocation, reservation control procedures, seat load factor, demand figure analysis, seat availability, pricing figures and fare rules, tactics and strategies would changes according to seasonal demand curve, customer purchasing behavior, booking speed, reservation and options rules, booking regulations, desire to buy bundle fare or any other ancillary revenue category' services etc...

4.6.1. Capacity Control

Capacity control is applied in pricing strategies for each reservation class and assigning predicted amount of capacity for satisfying customer demands, increasing the load factor of flights, and maximize the revenue of each offered flight for related routes in the market. The management of capacity supplied for related destinations are used as first the instrument of revenue management discipline (Çetiner, 2013). It belongs to the quantity-based approach instead of price-based approach capacity distribution for each reservation class. Quantity-based approach generally considered for the pricing strategies to be make efficient route management and distribute the capacity ideally according to customer purchasing behavior in the market for each flight segment. Main idea is offering the same product with different prices for each flights leg according to variability of the products purchasing time and the number of days remaining to travel date.

Dynamic pricing strategies and capacity distribution for each fare class are interrelated and could be considered cooperatively (Yu et al., 2017). Today, many airlines manage total seat capacity offered each flight segment since the seats in the same cabin, initially reserved for various purposes from particular customer segment. Such opportunity offers easy reallocations between flights or different groups of

passengers (Çetiner, 2013). Although some airlines prefer applying dynamic pricing strategy to have more effective financial results, some other airlines developed a capacity control policy to reach their targeted revenue goals (Talluri and van Ryzin, 2004). In general, airlines offer various seat availability to the market for potential customers during the booking period of each destination in order to maximize flight revenue.

4.6.2. Seat Load Factor

The airline seat load factor and its processes the use of the capacity distribution in the travel industry for related destinations airline' products offered. When the flight duty was completed final number of sold seats indicate performance of each route. It basically point out demand rate, number of passengers carried on each flight on planned date. Also, it indicated that offered flight schedule satisfy the market needs or not. It represents percentages of the seats purchased by passengers according to airline company offered capacity for same flight. Seat load factor demonstrates commercial performance of the routes as a result of applied revenue management strategies and tactics. In addition, the load factor affected by seasonality, demand fluctuation, accessibility of products, sales channel and payment method alternatives, total capacity in the market offered by competitors, flight schedule, flight frequency of competitors and unexpected reasons such as bad weather conditions, regional restrictions.

The following seat load factor formula is generally used by many airline companies (Jenatabadi & Ismail, 2007):

$$Load\ Factor = \sum_{i=1}^r \left(\frac{Number\ of\ carried\ passenger * distance}{Available\ seat * distance} \right) * 100\%$$

For example, if the distance supposed to be 1000 km between two destinations airlines organized flight operation, the aircraft has 200 available seats assumed and the number of passengers carried on flight is 150. The load factor of this specific flight travel could be calculated by using the above formula:

$$\text{Load factor} = 150 * 1000 / 200 * 1000 = 75\%$$

4.6.3. Demand Management/Optimization/Forecasting

Demand management is another key factor for pricing strategies in the airline business for revenue management approach. It can be variable strategic options depend on market dynamics and economy .It is defined as regular essential applications for offered airline products in the market and is used to better understand the customer buying behaviors in the previous period of time. This analysis obtains prediction of future purchasing for offered airline product. As a result of this intelligent analysis, airlines had an experience on effective resource planning and management. There are many analyze in the airline revenue management discipline to offer better alternative for satisfying customer needs and maximizing the revenue of flight. Such deeply analysis can be used for setting business strategy, forecasting, making proper decision for optimization, flight cancellation or redesigning of flight schedule. It presents challenges for inventory management to decreasing expenses, demand management, setting best pricing strategy and seat allocation, revenue increase and better resource management.

Such challenges includes irregular demands, causal factors, promotional demands, seasonal demand variability for the producing characteristics and ‘non-

standard forecasting processes, unexpected situation in the potential market and lack of sufficient data of previous flights, cancellation of flight frequencies or wrong schedule planning to make better analysis for the characteristic of optimization process.

If certain thresholds are not met for these characteristics, the airline company could generate inadequate inventory level (Ballou, Gilbert & Mukherjee, 2000). For such reasons, companies should focus on market intelligence that utilizes collaboration and to establish forecast for future flights to provide sustainability with using market intelligence and other specific dynamics of market. Companies should be able to analyze optimization process that possess significant time and revenue advantageous against their rival companies without such optimization. Ballou, Gilbert & Mukherjee (2000), listed the benefits of forecasting as follows:

- High accuracy and high demand management for products,
- Designing products according to historical tendencies,
- Improved demand planning efficiency,
- High level of clear conceptualization of effectiveness in promotions.

4.6.4. Airline Capacity Distribution Method

The capacity distribution plays an integral role for airline companies in terms of revenue management practice. Seat allocations method between the reservation promotes main success of creating low fares and various price alternatives for different segment of customer group. Capacity distribution method can be determined by analysts as a result of deeply analysis.

Andersson (2006) conducted a yield management project in Scandinavian airlines systems (SAS) to investigate passenger choice analysis while focus on seat

capacity control panel. Customers were found to be often susceptible to choose a different airline due to price discrimination or willing to pay higher fare for a different reservation class. Airlines should offer many price options including different rules after capacity distribution determined as result of some specific analysis and forecasts. The researchers interviewed with the customers and studied booking transactions. Finally, they revealed that SAS heuristics practices and revising the capacity distribution method and raised issues required to be resolved prior to implementation. According to changing parameters for capacity distribution, they released that potential customers reaction is different.

4.6.5. Seat Inventory Control

Seat inventory control described as the effort for balancing reduced and full-fare prices for a flight to maximize total allocation of passengers and load related issues (Belobaba, 1987). Load factors are subject to rise whenever more seats are offered at discount rates. On the other hand, offering ideal number of seats at lower prices for each segment, to support the volume of flight, would lead to increased revenue per passenger and total revenue efficiency per flight. However, would cause loss of total revenue for the airline company, but the airline company reach the expected seat load factor with applying revenue management practice. Seat management allow airlines to control company yields and total revenue on a flight-by-flight basis (Belobaba, 1987).

Lee & Herch (1993) suggested a model for dynamic airline seat inventory control in terms of multiple seat bookings. Multiple seat bookings were described practical difficulty in the airline seat inventory. There exists two strategies for the seat allocation problem: nested and non-nested. These two strategies have critical role for

designing capacity distribution rules to find best version of seat allocation between fare classes for revenue maximization.

4.6.6. Pricing Tactics and Rules

Price is considered as a big factor that influence customer purchase behaviors especially in the air travel industry, therefore many airline companies use dynamic pricing tactics in order to gain more revenue. It is also identified as pricing strategies that they benefit increased amount of sales and revenues, raise a bid for commercial performance efficiency of flights. In addition, to managing greater market shares to lead market expectation with their product and services offers.

Airlines' pricing tactics and other initiatives started with the deregulation acts in 1978. Prior to that revolution, air travel was controlled by a single national carrier. We were called monopolistic market before deregulation period. Deregulation act basically reshaped the whole airline industry business model and strategy. Air travel options had become more affordable due to competition.

Today, airlines use specific tactics and rules to determine air travel fares such as gathering information about customer profiles, which detailed market analysis, (leisure or business) and got benefit from technological development and digital platform (Boyd, 2009). Especially, Low Cost Carriers utilize artificial intelligence (AI) technology for offering basic economic fare, and special promo fare, offered time to time to support volume of some destinations with specific campaign or actions, with minimal service and amenities.

4.7. Ancillary Revenue Management

Ancillary revenue products are defined as a revenue from non-ticket air travel sources such as amenities, services, and baggage fees (Hao, 2014). It is considered extremely significant for LCCs around the globe. Such revenue attempts pose many challenges for airlines in terms of revenue management and capacity allocation. In addition to the base transportation service, other services are considered extra amenities. Ancillary revenue categories should be incorporated with revenue management tools. Airline companies are expected to pay a specific amount of money for any additional services such as meal, from the customers purchased ticket.

Total airline ancillary revenue around the world reached approximately 93 billion dollars, 10% of total global air travel revenue, in 2018 according to IATA reports (O'Connell & Williams, 2016). It included baggage, meals and drinks, in-flight entertainments and sales, cargo fees or any other special services such as internet. These additional revenue categories had play crucial roles corresponding to the airline industry total revenue and transportation of high value and perishable goods for the customers (O'Connell & Williams, 2016).

4.8. Airline Revenue Management Methods

Today, airlines can implement various forms of revenue management approaches depend on critical instruments of focused market. Briefly, we would like to review some of the updated approaches. Traditional RM strategies were established to increase amount airline revenues using limited fare class and rules with applying stable distribution method, which depends on independence demands.

4.8.1. Priced-Based Revenue Management

Models for price-based revenue management are commonly classified as dynamic, static, and price discrimination models.

4.8.1.1. Dynamic Model

Dynamic pricing model is suggested to be the core element of the RM (Li & Peng, 2007). Several studies have been conducted on dynamic models. Some researchers assume that, the air travel markets are monopolistic, and fares should be evaluated in this regard. Some other airlines manipulate and utilize this system with offering fixed prices for their air travel services. Other research assume customer demands as a stochastic steps of utility-maximizing customers RM (Li & Peng, 2007). Li and Peng (2007) proposed a continuous-time dynamic pricing model for two different flights with stochastic control theory and game theory. In addition, the condition of the equilibrium solution and corresponding properties were investigated.

Dynamic pricing models heavily depend on AI¹⁶ systems as most of the work is being done by using automated system. Also, it offers sustainable high performance and profitable system including speediness, competitiveness, and consistency.

In a relevant study, Sierag (2016) discussed price-based RM approach and proposed a price-based RM model that promotes flexible products in the airline systems with major addition for group reservations (Sierag, 2016). He claims that although dynamic programming causes the dimensionality difficulties, it could be the solution under stochastic demand of the problem. It was also indicated that if there exists a certainty in demand, the heuristics model works better, but flexible products should not be neglected as they may cause substantial revenue loss. On the other

¹⁶ AI Artificial Intelligence

hand, dynamic pricing approach would be offer various price level for different customer segment. In some cases, it would be better to have more volume; for some other cases would gain more revenue depend on demand fluctuation. The dynamic pricing method also, make some contribution development of revenue management solution software.

4.8.1.2. Static Model

Unlike dynamic model, static model is also used in airline pricing strategies. It is also known as 'single price' and represents out-of-date prices, which were proposed to provide enough levels of profits and protect earnings in old times. However, it is today accepted as lost revenue. Also, there is no possibility of increase additional revenue with serving same amount of product when possible cost increased released unpredictably.

In this model, fares of different seat and cabin classes for particular routes are pre-determined and customers are free to purchase the tickets at the specified price or not. Customers know that how much money will pay for requested ticket, starting from opened to sales of flight until the travel date. This would cause critical commercial risk for airlines. If the airlines cannot reach the targeted seat load factor before flight, they will lose much revenue, this will be crucial issue for sustainability of flight operation. Static model is currently considered as outdated strategy and mostly replaced by the dynamic models 15 years ago when airline revenue management efforts emerged. Airline companies sometimes utilize this approach in their upper-class seats, business and first cabin for specific destinations that mainly serve air travel services for particular segment of passengers.

4.8.1.3. Price Discrimination

Price discrimination provides a type of selling strategy that specifically targets different levels of prices for a specific service or product. The price is determined according to what the seller offers for the customers to agree with the worth of it. It occurs based on seller's attitudes toward their customers and the position in the market. Also, tactical strategy and commercial expectations has significant role to define the price scale for related market. Some customers are willing to pay more or less for travel ticket of different destinations in different time of reservation they made.

In addition to other industries, airline industry preferred to use a revised type of price discrimination system. For example, special discounts (senior citizen discounts, loyal passengers or big travel groups), coupons for lower tickets for selected destination to strength in the market , corporate agreements or alliances, network marketing strategy and loyalty programs are offered when selling the air travel tickets can make applicable for specific period of time if it is necessary.

Airline industry has probably the most diverse price discrimination system since airline companies offer tickets many weeks before the travel date. Therefore, when demand is high for a particular flight, the prices go up rapidly as the date approaches. It is not desirable sold all tickets long before travel date. If all tickets had sold out from higher price before many days before travel date, airlines can organize additional flight if they have gap in their schedule. If the demand of flight tickets is lower than expected, that tickets would not selling good price. In this case, the company would need to reduce the ticket prices to try to create more selling but, this approach would not be best option for each case. Selling strategy, push or pull, can

determined after evaluation of special conditions of each route for specific time period. There are three types of price discrimination, based on the flexibility of the air travel fares, exist: first-degree, second-degree, and third degree. It can be taken different name for airlines has different strategy and market position, diversified travel packages.

4.8.2. Quantity-Based Revenue Management

Quantity-based revenue management depends on the historical data of the prices and use different forms of RM methods for demand forecast and set correct price for upcoming flights. It is quite different from the price-based revenue strategy as it is related to the number of tickets sold, not the prices of the air travel expense.

On the other hand, similar to the cases in price-based RM, quantity-based RM gives high values on the issues such as no-show probabilities and buy seats up if this management tactics creates valuable results for airlines (Tresse, 2012). Since airlines can offer limited number of seats for same aircraft to prevent revenue dilution of related routes. Airline company should consider selling as many seats as possible before the flight to reduce financial risks and guaranteed some amount of revenue before flight. Usually, airlines set their selling strategy based on customers segments, who prefer discount prices showed buying behavior much earlier before travel date or someone who are willing to pay much higher price due to being last minute buyer for the same flight.

Although quantity-based method serves a great benefit for profitability for airline companies, it could cause some possible problems in terms of finding optimal allocation of financial resources for different cabin classes (e.g. economy, first, business). In order to prevent possible lower revenue risks and serve more quality

services for right passenger segment, most airline companies started offering various fare options such as premium economy, economy flex, economy saver, economy flex plus.

4.8.3. Models for Demand Distributions

Demand distribution is shaped and characterized products by revenue management approach and schedule optimization needs for redesigning airline business model (Swan, 2002). Some studies demonstrated that, when airlines had high demands rate for their products, as a resulted of sold ticked diagram analysis the outcome often generates Gamma and Normal shape (Figure 4.3).

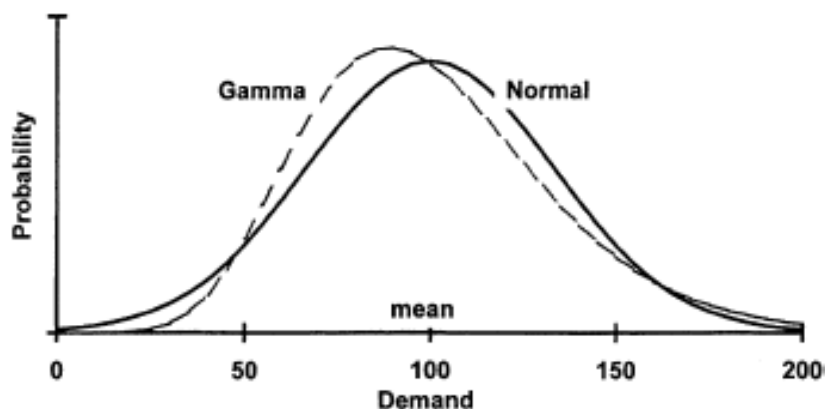


Figure 4.3. Normal and Gamma Shapes

(Source: “Airline demand distributions: passenger revenue management and spill,” by Swan, 2002. *Transportation Research Part E: Logistics and Transportation Review*, 38(3-4), p. 260)

Both forms of distributions methods could be used for different purposes. The Gamma shape can dominate if the Normal distribution provides the shape of the distribution. The studies showed that the Gamma shape is best form to support having efficient revenue results. On the other hand, Normal shape is a kind of bulk

distribution model having lower performance rate (Swan, 2002). In conclusion, it is important to use mixed methodology, Gamma and Normal shapes together depend on the specific conditions of companies and potential markets, to generate higher revenue as well as various characteristics of the cases.

4.8.4. Models for Arriving Process

Developed arriving process model creates crucial benefit from both passengers and company to shorten waiting time and supporting on time performance of airlines. Such kind of user friendly and faster arrival process implicitly comply with customer needs and would be increase passenger satisfaction and loyalty. It could also be considered with queueing models during departure process. In a study by Darabkh et al. (2012), Such an arriving process model was implemented via computer programming. Received messages in this networking process are divided into smaller frames with transmitting on the network.

The transmissions are generally avoided probably from network congestions. A proposed buffering model delivers convolutional closed attached with an adaptive behavior (Darabkh et al., 2012). This model could reduce the number of frames eliminated due to insufficient buffering size with a closed-form expression. Such an expression refers to the buffer occupancy level in the network operator elements with decoders of adaptive behavior. Therefore, it is important to develop useful and resourceful approaches to offer various models for arriving process.

In a related research, Weatherford, Bodily, & Pfeifer (1993) suggested a model for arriving process with offering evaluation of various decision rules in the perishable asset RM settings. The supposed proposed method aims to calculate probabilities required to maximize the usage of an optimum decision rule for the

perishable asset RM situations that possess two price classes and diversion. The results of this study implied the important understanding of the difference in the expected influences among the rules relative to changes in the model's input parameters. It also contributes the managerial insights.

4.8.5. Data Management (Analysis, Forecast, Planning, Optimization)

Airlines are required to manage huge amounts of data regarding their service, number of bookings and total amount of revenues, detailed information about their customers and flight experience, product design and settings rules, regulations. Airlines need to gather information from various data resources to notice situation of big frame. In order to manage big data, make correctly analysis to take a decision timely to reach targeted goals, airlines have to receive support from developed software systems comply with company strategy and needs, analysts set best possible version of capacity distribution between fare classes to reach higher revenue performance. Many airlines get support from professional consultant companies to make correct data analysis, to determine future strategy of company fits well with market needs.

Some models have been offered for managing demand data and forecasting future expectation for both amount of bookings and revenues. Additionally, measuring the position of competitor in the market to define best attack timely. For example, Ghobrial (1992) offered an econometric model for the comprehensive demand analysis for airline companies. The researcher used an econometric model for the aggregate demand of an airline using data between the proposed model and designed model. Some critical details of product such as expenses, flight range and frequency, was used to estimate the demand of an airline using data between the years

of 1976 and 1984. The results demonstrated that the demand was elastic nearly an average of 28% with yield for the specific airlines such as American, US Air, Delta.



5. THE IMPACTS OF DYNAMIC PRICING STRATEGIES and APPROACHES ON AIRLINES REVENUE EFFICIENCY THE CASE OF TURKISH AIRLINES

This study was designed to investigate the impacts of dynamic pricing strategies and approaches on airline products in terms of analysis of Turkish Airlines flight revenue. In this regard, necessary information and data were collected through in-depth interviews with three managers currently employed at Turkish Airlines. Face to face interview held on February 4, 2019 at Head Quarter of Turkish Airlines in Yesilkoy. The research questions located in Appendix A, asked the participants in the interview to make clear evaluation about Turkish Airlines revenue management implementation. According to received answers and shared data, it is tried to detect process and implementation of revenue management, calculate the effect of dynamic pricing method on revenue efficiency for selected flight group in defined period. Shared data and implemented dynamic price inventory belong to one of the subsidiary airlines of flag carrier.

The study included both implementation of revenue management approach and data of subsidiary airlines domestic flights, showed effect of dynamic pricing on revenue. The study results are presented and briefly discussed in this and following conclusion sections based on the examination of the Turkish Airline' dynamic pricing strategies, methods and tactics that determined changing parameters in the airline market in order to maximize its revenue gaining from airline products. Pseudonyms are used to protect the identities of the participants as P1, P2, and P3. 'He' or 'She' is preferred for gender identifications.

P1 is employed at Turkish Airlines for route management and pricing functions. She is responsible for implementation of Turkish Airlines RM strategies and tactics to improve the commercial performance of flight operations in focus market. It is crucial having experiences on the capacity control, statistical analysis and reporting, pricing, airline agreements and alliances, reservation control and sales function to make better practice for revenue management discipline. Revenue management team explained that how change implementation of revenue management practice according to changing market needs and company volume during Turkish Airlines inventory management history. Because of widen network range and increasing volume of capacity supplied as a flag carrier, Turkish Airlines had to change inventory management system to have more effective business outcomes than before, while decreasing labor effect, minimize the inventory control difficulties due to capacity increase, taking proper commercial decision timely using power of intelligence report provided by developed system. Also, aiming revenue increase from same extent of resources. In addition, increasing of total supplied seats caused to adversity of capacity control.

Rivalry in global airline market put pressure on airlines for creation of additional revenues on same flight. Due to such reasons, and many other factors airlines integrated revenue management solution system to inventory in order to manage their revenue effectively. Additionally, preventing possible mistakes due to human factor causing revenue dilution, airlines had to follow systematic approach by implementing revenue management system.

P2 is responsible for development of RMS, searching new products, and implementations process of new systems. In addition, inventory management, booking control, reporting system integration, recovery and necessary developments.

Making some analysis in global market in order to catch changing digital trends and offering more effective RMS tools for the company to maximize profitability through the advantages of information technologies.

Turkish Airlines preferred to use PROS as a revenue management solution system included O&D ¹⁷ module, as inventory and reservation system using TROYA for domestic routes, GDS ¹⁸ for international routes. All inventory and reservation systems connected with PROS revenue solutions software. Data transfer has significant role among all related systems set to work RMS effectively for making accurate analysis, prediction and implementation of revenue management tactics for related flights in defined time period.

Team Manager of revenue management is responsible for increasing revenue efficiency of Turkish Airlines with efficient use of all RM tools (pricing, system management, special price agreements and alliances, inventory control, route management, reporting and analysis), setting business strategy for each flight term according to changing market conditions, company targeted goals and rivalry.

Three research questions were guided this study:

1) What are the revenue management functions for airline business and which tools can affect the revenue efficiency for any selected group of flight segments?

What is the impact of dynamic pricing for increasing revenue efficiency?

2) How can Turkish Airlines' revenue management strategies and tactics effect revenue maximization in targeted year with implementation of dynamic pricing methods?

3) What are the differences between Turkish Airlines' total amount of expected revenue provided by RMS according to previous year results and gained

¹⁷ O&D Origin & Destinations

¹⁸ GDS Global Distribution System

revenue from reference year applying some specific RM practices and strategies taking into account dynamic pricing flexibility, critical RM instruments, observing passenger purchasing behaviors in focus market using analytical data effectively and taking action in time?

The interview questions located in Appendix A asked to participants in order to find answers for listed research questions. Afterwards, content analysis was made according to the answers obtained.

First research question was regarding the revenue management functions and measuring some RM strategies affecting Turkish Airlines some specific routes and analyzing impacts of dynamic pricing on revenue efficiency.

P1 is one of the interview participants, described RM as “a discipline including some specific strategies and tactics depend on many factors related to focused market such as seasonality, to maximize both amount of revenue and company profitability with effective resource management”

P1 also listed the factors that affect revenue management strategies and practice of Turkish Airlines as follows:

- Market analysis, setting goals and defining strategies according to changing market needs,
- Network Planning (number of destinations and flight frequencies of routes),
- Company’ product types and range,
(number of flight points for long-haul and short-haul plane and weekly flights frequencies for each flight region, number of direct and connected routes),
- Inventory control and capacity management,
- Route management policies,
- Seat allocation and timely update for each fare level,

- Total supplies seats / demand curve analysis,
- Forecasting and optimization,
- Critical analysis of booking speed and price change,
- Flexibility of dynamic pricing,
- Pricing rules and regulations,
- Options rules and parameters,
- Reservation rules and control functions (reissue, refund, double reservation, incomplete PNR¹⁹ in option),
- All marketing promotional activities and campaigns,
- Company business strategies for each function,
- Sales strategies, sales and distribution channels options,
- Corporate relations, partnerships, special agreements and alliances,
- Loyalty programs and customer experience analysis,
- Alternative payments methods or tools,
- The range of ancillary revenue categories and type of alternative services,
- CRM policies and flexibilities obtained by service provider,
- Company position in the market and brand awareness.

Not only Turkish Airlines, but also most of airlines in the World take into account listed criteria while they set their revenue management strategies depend on business models, company volume, many other regional factors.

Airline product is perishable. It is necessary to follow up each factor carefully in order to reach company goals. The most decisive factors are enormous capacity increase and difficulties of inventory control for determining proper systems in order to have efficient management of revenue.

¹⁹ PNR Passenger Name Record in reservation system

Changing commercial approach of airlines and aim to get more share in competitive global environment force the airlines preferring more technological system for effective business management. In recent years, any destination in the World can be potential market for each airline. In addition, to increase connected passengers implementing hub and spoke strategy via Istanbul become more crucial than having more load factor in local market for profitability being as global brand.

Specifically, for the first years of air transportation in Turkey, Turkish Airlines had been using basic inventory and price system because of the limited capacity and price issues, but lately regarding the effect of globalization, changing market conditions, differentiation of potential customer needs, demand increase of some passenger segments, technological development, widen product range of company, capacity increase, Turkish Airlines decided to utilize more technological and convenient systems in order to enhance their amount of revenue having more benefit from dynamic pricing advantages.

P1 also indicated that, many tools exist into the system to increase the ability of selling each price level applied by Turkish Airlines, after deeply market analysis. Mainly, these can be listed as follows:

- Quality of airline product (satisfying customer needs),
- Demand analysis for each destination,
- Speed of reservation,
- Days remained to departure date,
- Seat load factor for each flight leg and route,
- Total seat capacity served for each cabin,
- Passenger segmentations (business, leisure, etc...),
- Rules and regulations of each price categories,

- Flexibility of pricing strategies,
- Ancillary product or service group,
- Market conditions (economic situation, total supplied capacity, position of competitor, customer buying power),
- Competitor's products, prices, applications and promotional activities,
- Product accessibility, sales channel options,
- Easy payment methods,
- Implementing power of digitalization to create sales push,
- Follow up innovative trends and technological development.

P1 also discussed about the effects of the dynamic pricing on the revenue efficiency of Turkish Airlines. The factors taking into account for dynamic pricing implementation of Turkish Airlines mainly can be listed as follows:

- Cost analysis (at planning stage),
- Demand analysis (seat sold analysis, and future expectation),
- Competition analysis (not only focus market, but also all related destinations),
- Fuel charge, airport tax, service fee (updated monthly, seasonally or yearly),
- Aircraft type analysis (decided according to A/C availability, volume expectation, costs, customer segment, licensed crew availability for related A/C type, airport condition etc...),
- Business strategies on related routes (fare rules, flexibility),
- Connected passenger expectation,
- Market strategy,
- Company general business strategy.

Later, prices are generally determined according to focus market dynamics. For new flight destinations, price scales are based on competitors' price and position in the market, if the competitor has already had flight operation in new potential market. If there is no competition for new flight destination, price scale determined according to analysis of similar market depend on flight duration, flight range, cost structure, traffic flow, flight frequency, demand estimation, characteristics of near region and purchasing power of potential market. Price rules and regulations are defined into the system, depend on price structure, market conditions, passenger segmentation and changing market needs. Price flexibility is arranged according to the company competitiveness and market share. Each cabin class price is determined according to volume prediction of the potential market for each customer segment. Demand analysis of each segment had critical role for choosing right aircraft type. Also, it would be support to flight performance and profitability.

On the other hand, ancillary revenue categories are becoming major issues for Turkish Airlines for future planning, similar to low-cost carriers due to increasing competition and cost factors. THY is currently selling only XL²⁰ seats for ancillary service categories. Moreover, internet offer is another ancillary product for some long-haul flights.

Turkish Airlines RM team makes daily analysis by reviewing daily booking report for upcoming flights, and all other related reports regarding previous data comparison, advance reservation including availability, sold seat, seat load factor, total flight revenue, sales channel discrimination, and operational performance reports. In terms of such kind of analysis, THY also consider adapting "Demand Figure Analysis". to make forecast for future flights to take decision in time making

²⁰ XL Seats has wide seat distance

optimization for related flights or supporting with necessary marketing activities to decrease commercial risks of flight operation due to perishable property of airline product. As a result of all essential analysis, if the number of sold tickets is lower than expected, RM team prepare campaign plan to create sell push and generate higher volume for revenue efficiency. Depending on market situation and accurate timing, marketing team make applicable promotional activities to support the success of campaign for upcoming flights. In this case, if the team offer rational discount for campaign, dynamic pricing structure would protect the company towards possible financial risks. On the other hand, dynamic pricing obtains market segmentation within price differentiation. Each price level has different purchasing group depend on their income level or budget allocated for relevant air travel. Price discrimination is one of the significant factor to creation of additional volume and managing of demand fluctuation. In addition, the main components of revenue management approach are seat load factor and is unit price. Seat load factor always supported by using power of dynamic pricing tool. Each price level implemented by the system according to defined matrix rule included some parameters such as maximum days to remain departure date. Dynamic pricing method is managed in line with these critical parameters defined in inventory system.

Second question was regarding Turkish Airlines' revenue management strategies and tactics related to profit maximization in terms of dynamic pricing methods. First of all, P2 stated the following statement to explain current operations of THY for cycle²¹ increase “revenue management process could be described for increasing flight frequency of existing routes, market analysis, route profitability,

²¹ Cycle refer to frequency of flights on related routes

special restrictions, and other parameters are taken into account to make a decision to increase route frequency on the related flight region”.

Additionally, Turkish Airlines utilizes the systematic approach such kind of commercial decision due to the volume increase effect of flight operation. Forecast tools are used by the users for effective seat allocation for each segment between defined reservation classes in order to maximize flight revenue. All historic data analyzed for each segment of routes. While revenue analysts make prediction about performance tools of RM, both seat load factor and expected revenue, from each segment taking into account economic situation of market, total capacity supply of the company, growth expectation for related term, and special conditions of the market such as purchasing power, income level, travelling habit of passengers and competitive rivalry. All variables and possible risks evaluated by the system according to all analyzed data and figures. After that, most effective business scenarios are suggested by RMS for related time period. Analysts utilized the best scenario with using their experience and exact information coming from market related performance of the routes. As a result of multi-analysis, system can make capacity distribution automatically via defined business rules by specialists.

For new opening routes if there is no historic data currently available, analysts could develop approximation according to reference data of the similar routes.

Criteria of similarities can be different for the airlines has distinctive business model, have flight operation in various geographical conditions. In addition, economical condition of focused market and business strategy can be different for each airline.

Before starting flight operation, airlines are considering flight duration, cost issues, segmentation and purchasing power of customer, regional economic situation and volume expectation in order to determine price scales, rules and flexibilities.

Furthermore, new route strategies of the Turkish Airlines included such ways that ‘‘Potential market analysis calculated both load factor and profitability. Volume expectation of related destinations play major role in the first step of flight planning. After making demand analysis of market to estimate possible potential of routes, RM and network planning team focus on deciding days of week for flight operation and frequency of flights, flight hours, aircraft types and total supplied capacity of related routes and regions. On the other side, it is necessary to make bilateral check for related airports schedule due to slot issue in order to serve better product alternatives for potential customers in focus market.’’

The factors of increasing commercial efficiency are included specific dates of local market, special days, festivals, holidays, any sport contest, activities for Turkish Flag Carrier. All determinants deeply analysis by market, demand, flight and fare analysts. Each detail information has significant role to increase route management performance according to RM discipline perspective.

In addition, some airline implements price discrimination in their CRS for different sales channel in order to support revenue increase depend on many factors such as commission rate applied by sales channels, aim to push sales for some group of passenger segment etc.... In order not to disturb balance in the market and due to principle of equality, opposite of LLC, Turkish Airlines not use different pricing tactics for any sales channels, although system has different pricing model implementing capability for particular sales channel. Sometimes, such kind of tactics can be useful for having more share in the market. While supporting airlines’ own sales channel as a result, get more revenue due to factor of ticket service fee. However, GDS has strong power in the aviation sector and they collecting huge amount of commission from their users. Due to conditions of special agreement with

airlines, especially flag carriers, the airlines cannot implement the lower pricing strategy for their own sales channel. However, in near future these restrictions have to change because of intense competition in global run. In that time, advantages of price discrimination can be applicable for diversified reservation channel in order to use RM tools effectively to reach expected revenue for especially flag carriers.

Each airline had its own unique CRS to keep their booking figures in the system. The aiming of access the flights details of each airline, booking agents in the World demanded and received a single CRS. Customers called and travel agents booked their flights in the CRS. However, in the 1990s, the major CRSs, Sabre, Amadeus, and Galileo (now Travelport) became independent from the airlines that had created them four decades earlier. This is considered the beginning of the Global Distribution System era. In only a few years, these three major GDS companies emerged as formidable air travel distribution systems. Then, the internet happened. This technology created new opportunities for airlines to be more accessible for booking management. With the advent of the internet, online travel agencies (OTAs) were established and started to support airlines. While these agencies wanted to offer their customers every possible flight, they didn't necessarily want to go through the trouble of integrating with three GDSs. So, the GDS aggregators arrived and translated each GDS's language into a single common format. (Mindsay,2020).

Lately, NDC is a travel industry-supported program improved by IATA for the development and market adoption of a new, XML-based data transmission standard to transform the way the travel industry sells its products and address the shortcomings of the existing airline distribution system. When the program sufficiently developed, dependences of airlines to GDS would be decrease and each

airline can make price discrimination for each sales channel (IATA, 2020). More or less, NDC is a modern, more feature-rich way for airlines to share their product offerings. However, it should be noted that XML isn't new. It's already 20 years old.

Each airline has particular dynamic price scales in ATPCO in order to sell their ticket in the global market. Demands for the airline products would be vary based on preferred schedule. Dynamic pricing tools supported to increase the revenue efficiency due to instant and uncontrolled demand change in focused market for related routes. Moreover, the airline could also apply various types of price rules for each fare groups or reservation class in order to gain more revenue from same amount of resource and also protecting companies from perishable product financial risks. This flexibility is provided by dynamic pricing method.

Also, P1 and P2 regarding the effect of target-based dynamics pricing on total flight revenue related to the parameters stated that “target based dynamic pricing is efficient method to create maximum benefit from all possible positive or negative situations in the focused market. The method also protect company from possible cost increase and any changes effected to demand figures without breaking price structure. In addition, the method would make positive contribution on revenue growth using the same amount of resources. Dynamic pricing tools obtain for airlines high-priced sales capability in any case related to potential market.”

Third research question was regarding differences between Turkish Airlines’ total expected revenue, defined as a result of previous numbers and gained revenue from reference year, after specific implementations and strategies.

In general, revenue management follows market-oriented strategic approach instead of cost-oriented approach. If the demand figures lower than expected, RM team make optimization for related group of flights and made revision on budget for

related time period to prevent revenue dilution for related flight season. Updated budget figure linked to system to achieve targeted revenue via using power dynamic pricing methods without disruption market dynamics.

One of the important benefits of dynamic pricing is presenting large price scale and distinctive price rules for each fare group and cabin segment. This also, will be support volume increase due to serving diverse price level for particular customer group have unequal income level. If there exists an unexpected increase cost, dynamic pricing approach obtains for airlines ability of high price sell to protect company from cost increase. In addition to this, decreasing financial risks of flight operations due to possible variation of price, while attract particular customer group. Such attraction would affect the customer purchasing behavior and create volume increase for any planned destinations.

For cases of changing cost items, revenue management team can implement higher tax rate or can define new additional taxes into the system for related routes in order to prevent the company from cost increases. Determined strategies for the cost-related solutions are changeable according to main recourse of the problems and market conditions.

Study outcomes regarding goal-based dynamic pricing, the factors airline revenue efficiency, the flexibility of dynamic pricings methods, analysis of market dynamics and various factors affecting all listed items were listed in this section. The first outcomes of the main part analysis of this study supported to dynamic pricing effect on airline revenue efficiency.

Additionally, P1 and P2 stated that revenue management solution software has critical role on management or airlines revenue, due to uncontrolled capacity and demand volume. RMS evaluate all possible pricing and seat allocation strategies in

short time and implement the best option automatically to get more revenue from same amount of resource while getting benefit from dynamic pricing structure.

Revenue Management Systems are key factor for financial stability of airlines, serving as a tool for analyzing market trends and identifying the probability of future revenue growth. In World practice RMS solutions have been employed since 1980 and have obtained airlines with revenue growth of more than 6% according to IATA experts (Sirena, 2020).

Normally, it is quite difficult to analyze certain effects of RMS, there are many parameters would not be measured properly. The impact of the system is on airline revenue can changeable according to season, types of products, economic situation of market, special market conditions, booking speed and traffic increase due to any reason, company business model and product range. RMS tools also, provides advantage in terms of labor and time management. On the other hand, dynamic pricing method has significantly contributed to development of RMS.

As a result of meeting with THY RM team, to make accurate evaluation measuring impact of dynamic pricing on income, a homogeneous framework was determined. Turkish Airlines' subsidiary airline price scale and average inventory structure for various flight segments between January and February 2020 indicated in below table provided by THY. The group of segments listed in this part, are the long-distance non- competitive routes. The criteria of selected flight segments:

- Long distance domestic routes, has more than 1,5 hours flight duration, are chosen due to characteristic features, early booking behaviors, fluctuation on demand figure, low frequency, of the flights.
- Period of time; there was no specific date created high demand for chosen routes.

- There were no cycle changes (cancellation or additional flights) for listed routes in defined time period. It is substantial to make homogeneous comparison between the figures distributed among reservation classes before opened sale and after all flights have flown.
- International flights are not chosen to clear of measurement from impact of currency fluctuation and airport tax increase.
- Same type A/C was chosen for this evaluation due to the factor equality of capacity.
- Total 104 flight cycles used for this analysis.
- It is not included each single inventory numbers of related flights, data showed the average numbers of grouped flights inventory.
- For these flight groups, agency sales channel higher rate than online sales channels. This affect speed of last minutes booking figure due to late booking behavior of agencies customers.
- System prices included all taxes and base fare but not included service fee.
- A/C capacity was 189 seats for each single flight leg.
- These grouped flight legs not included connected pax due to differentiation of add-on fare value and rules.
- Snapshot dates are especially chosen from off-peak season to prevent the analysis from the higher demand effect depend on any reason.
- The selected group is non-competitive flights in order to exclude rivalry impact.

Table 5.1

Turkish Airlines' Subsidiary Airline Price Scale and Average Numbers (Expected)

Inventory for a Specific Time Frame on Various Flight Segments

Expected	Dates:01 Jan-20 Feb 2020 domestic long-distance routes				
Reserv. Class	System Level	Capacity	Allotments	Booked	TotalRevTL
Y	549,99	189	9	0	0
F	519,99	180	5	0	0
R	489,99	175	5	0	0
B	449,99	170	10	0	0
K	409,99	160	10	0	0
N	369,99	150	10	0	0
T	339,99	140	20	17	5779,83
G	319,99	120	20	20	6399,8
Q	299,99	100	15	15	4499,85
X	279,99	85	15	15	4199,85
O	259,99	70	15	15	3899,85
Z	239,99	55	15	15	3599,85
U	219,99	40	10	10	2199,9
P	199,99	30	10	10	1999,9
V	179,99	20	10	10	1799,9
E	159,99	10	8	8	1279,92
A	139,99	2	2	2	279,98
D	129,99		0		0
L	119,99		0		0
I	109,99			137	35.939 ₺

Total Rev TL		35.939 ₺		
SLF		72%		
UP		262 ₺		
Total A/C Capacity		189		
Non-Competitive Domestic Routes / Off-Peak Season Average Segment Analysis				

Table 5.1 illustrates that:

Non-competitive long-distance domestic flights average price scale and capacity distribution for each reservation class. Reservation classes defined into the system with using the letters shown one under the other in the table as Y, F, R, B, K... at the first column of the table.

Each reservation class refers to different price level. All price level divided in 3 groups to applied district price rules at the background of system. (included options, baggage limitation, re-issue and refund rate etc...). Second column of the table shows the system prices excluding service fee. Third column of the table demonstrated capacity distribution among defined reservation classes bottom to top cumulatively. Fourth of column indicated seat allotments for each reservation class in inventory for full capacity of A/C. Fifth column of the table included number of bookings from each reservation class. At the bottom number showed the total booked passengers for this average inventory of selected flight legs. Last column demonstrated the revenue provided from each reservation class according the number of sold seats. It is calculated as system level, referred to unit price, multiplied by number of booked from each row. At the bottom of sixth column number, there are total amount of average revenue gained from selected flights.

Unit price is average price of total sold seat. Calculated as total amount of average revenue (35.939£), divided by total sold seat (137 pax) is equal to 262£ for this inventory. Average SLF is shown in the table as 72% for selected flight group. It is expected number for related flights in defined time period calculated by system according to final booking figures of same selected flight group for same period in last year. SLF calculate as total sold seat (137 pax) divided by total capacity (189 pax) equal to 72% average occupancy of selected flight legs.

This table is also called “dynamic price scale”. The system analyzes last year booking figures and some critical details such as booking speed, time of purchasing of RM approach and evaluated all possible scenarios. Afterwards applied best options for capacity allocation before open to sale.

The seat allocation scenario would be updated by the analysts according to information coming from the potential market via changing business rules into RMS for related flights. Also, demand analysts can take initiative and change the allotment distribution according to their knowledge, experience, observation and forecasts for related term in case of uncalculated situations (additional demand expectation such as soldier deployment, festivals; lower demand expectation: terrorist attack, war, epidemic etc.) for short period of time or related year.

Fare analysts can also change the value of price level which had already applied via system and implement different price rules if it is essential according to depth analysis, in case of unexpected situation was observed for related flights. (For example, the value of F class is 519,99£ in the table, they can increase the value of this class to 539,99£ in case of not predictable higher demand. In addition to this, analysts can apply to promo class fare rules, most restricted one, for top level prices group to protect the company if there is no option to arrange additional flight in order to satisfy higher demand in the market due to lack of proper aircraft availability in the company fleet. On the other hand, U Class refer to 219,99£ in the table. If the analysts observed lower demand for related flights after critical analysis, depend on competition or any other reason affecting demand curve negatively the analysts can update the value of U class from 219,99 to 209,99£ to support the volume of flights by increasing the number of bookings).

The all figures in the table indicated that simulation of planning flights recommended numbers by system after evaluating all possible scenarios for reference year, using advantages of previous year financial results. The numbers showed in the table, referred to implemented numbers of each segment of selected flight group before open to sale.

Table 5.2

Turkish Airlines Subsidiary Airline Average Inventory Price Scale (Actual)

Actual	Dates:01 Jan-20 Feb 2020 domestic long-distance routes				
Reserv. Class	System Level	Capacity	Allotments	Booked	TotalRevTL
Y	549,99	189	8	0	
F	519,99	181	10	0	
R	489,99	171	10	0	
B	449,99	161	15	0	
K	409,99	146	16	16	6559,84
N	369,99	130	20	20	7399,8
T	339,99	110	15	15	5099,85
G	319,99	95	15	15	4799,85
Q	299,99	80	15	15	4499,85
X	279,99	65	15	15	4199,85
O	259,99	50	15	15	3899,85
Z	239,99	35	15	15	3599,85
U	219,99	20	10	10	2199,9
P	199,99	10	8	8	1599,92
V	179,99	2	2	2	359,98
E	159,99		0		
A	139,99		0		
D	129,99		0		
L	119,99		0		
I	109,99		0	146	44.219 ₺

Total		44.219 ₺		
SLF		77%		
UP		303 TL		
Total A/C Capacity		189		

Table 5.2 demonstrates the actual figures for the same selected flights legs indicated in Table 5.1. for same period of time. Cycle number is equal for both planned and actual flights. It means there is no change for production phase of flight operation (no additional flight, no cancellation).

It is indicated that at Table 5.2 capacity distribution and booking figures have seen converted to upward position as a result of reading RM critical instruments

effectively, after analysis all related data and get benefit from flexibility of dynamic pricing method.

(For changing prices in dynamic pricing scale, listed RM critical instruments has crucial role. Such tools be listed as speed of reservation, observing booking trends, steering of demand curve regularly during sales period, observing competitors position, applications, marketing activities in focus market, controlling flight schedule and product range satisfying markets needs or not, brand awareness and reliability of company, CRM policies and customer satisfaction, passenger interest for promotional activities or loyalty programs benefits, sales support projects, corporate benefits provided by airlines for their accounts, market depth, on-time performance and operational excellence of company etc...).

When the allotment distribution at Table 5.1 compared to capacity allocation at Table 5.2, it is observed that distribution had changed at the bottom level of reservation classes. The changing trends of capacity distribution observed as upward, as a result of this comparison. It would be new business rules updated by the system analysts due to higher demand figures, or any information coming from focused market supported to volume.

When the allotments changes controlled between 2 tables, it was observed that 2 bottom fare levels closed to sale and their allotment figures moved to upcoming 2 upper fare classes had higher value than closed fares.

Sequentially, from fare level U to Q system kept the amount of allotment same both at Table 5.1 and Table 5.2. Only five seats capacity decreased of two upper classes (G and T) than, add 10 more availabilities for the reservation class N. The capacity of N class raised from 10 to 20 seats. The allotments of reservation class K, last bookings had, increase from 10 to 16, to get more revenue by keeping the price

same. This price flexibility implemented in case of higher demand, high early booking rate, differentiated market condition and changing price perception in the market due to any reason.

Final figures at the table 5.2. states that, of THY subsidiary airline had actual 77% SLF, 303€ unit price, 44.219 € total average revenue from same group of flights. It created 8.280€ more revenues and 5% more SLF compared to figures at the Table 5.1. The new capacity distribution originated from the flexibility of dynamic pricing.

On the other hand, if the SLF is increased from 72% to 77% according to capacity distribution at Table 5.1. (keeping same capacity distribution figures among same price levels), not taking into account the critical instruments of RM and not implementing essential price change in time, company could earn 5.040€ less income compared to final figures at Table 5.2. Due to positive impact of dynamic pricing, providing airlines ability to sell ticket steep price, on revenue increase and implementation of RM tactics accurately, the result has been reached at Table 5.2.

Table 5.3. located below indicated that Turkish Airlines subsidiary airline selected competitive routes average segment inventory (expected) between 1st of November and 31st of December 2019.

In order to make accurate analysis, add-on fare (the fare used for connected pax) excluded from the table. The figures in the table is first template of selected short-range competitive group average segment (short-range flight duration is one hour or less). Flight dates were chosen from off-peak season, to make clarification of higher demand effects from the analysis.

There were no special situations, both positively and negatively, related to selected flight legs for related time period (no festivals, special holidays, closed

airports, any crisis). The figures point out that, particular dynamic price scale could be applied for competitive flight routes.

Competitive routes are chosen to analyze the how dynamic pricing provide advantages on airline revenue although competition.

Table 5.3

Turkish Airlines Subsidiary Airline Competitive Routes Average Segment Inventory (expected) between 1st of November and 31st December 2019.

Expected	Dates:1 Nov-31 Dec 2019 domestic competitive routes				
Reservation Class	System Level	Capacity	Allotments	Booked	TotalRevTL
Y	449,99	189	9		0
F	409,99	180	5		0
R	369,99	175	4		0
B	339,99	171	17	0	0
K	309,99	154	7	0	0
N	289,99	147	15	0	0
T	269,99	132	9	0	0
G	249,99	123	7	7	1749,93
Q	229,99	116	13	13	2989,87
X	209,99	103	14	14	2939,86
O	189,99	89	14	14	2659,86
Z	169,99	75	12	12	2039,88
U	155,99	63	16	16	2495,84
P	139,99	47	12	12	1679,88
V	125,99	35	15	15	1889,85
E	115,99	20	10	10	1159,9
A	105,99	10	10	10	1059,9
D	95,99	0	0		
L	85,99		0		
I	69,99			123	20.665 ₺

Total Pax	123		
SLF	65%		
UP	168 ₺		
A/C Total Capacity	189		

* Add-on fare excluded

Features of competitive flights are late purchasing behavior due to number of alternative flight options and speed of last-minute reservation rate. Also, competitive flights have higher commercial risks due to listed reasons in at the beginning of paragraph. The most critical issues of these selected group are making accurate analysis, capacity planning and forecasts; observation of competitor' prices and each activity in the market.

System level prices can be implemented disparately both short-range and long-range flight routes. Table 5.1 and 5.3. showed differentiation. All rudiments located in the table 5.3. clarify above under table 5.1 in order to clear understanding of comparison.

For competitive market, product and operational performance of airlines are subordinated any other additional services provided by airlines. Planned schedule flights have to satisfy the passenger needs in focus market rather than competitor.

Reservation curves would be fluctuated due to alternative options and number of flight frequencies of competitive routes. It is essential to control all changer related to advance purchase until departure date. It is crucial to follow up price changes, volume of bookings, availability of each price level, market situation, competitor price and marketing actions in daily routine.

It is required sensitive pricing approach and depth analysis, attentive steering, temporization for setting capacity distribution to price level properly in order to reach targeted revenue goals. Additionally, having more share in the market due to competitive pressure and market force. Airlines in competitive rivalry have to set strong marketing and sales strategies (It would be local partnerships, back-to-back group sales, protocol fares, corporate agreements, incentives, campaigns and other activities implemented according to market trends) to get more benefits from the

potential market by increasing revenue. On the other hand, if airlines could not obtain better schedule than competitor for satisfying the potential customer there would possibility of losing market share.

Volume is one of the main constitute of revenue management. Due to this reason, volume increase required to set proper price strategy and capacity management to get better result than expected. Airlines would make flight optimization, if they do not have enough bookings some days before departure date because of perishability of airline product.

The study included 176 flight legs from selected flight group. Aircraft with capacity of 189 were used for this study. Each A/C capacity was equal to make homogeneous evaluation.

The tables provide information about all reservation classes defined into system and level of prices were included all taxes but excluded service fee. All campaign prices are excluded from the table, to keep away the study from special purpose applications effects (such kind of special campaigns and marketing activities would create additional demand or cause revenue dilution for related group of flights).

The figures at Table 5.3. prepared according analysis of bookings for same group of flight segments for same period in last year. THY estimated to have 65% SLF with 123 passengers, earning of 20.665£ when applying 168£ unit price for short distance selected competitive flight segments. The figures suggested by RMS after deeply analysis and evaluation of possible scenarios. The table does not show the critical instruments related to revenue management approach, and all implemented parameters working background of the system to increase revenue efficiency while applying best practice within the related conditions.

The table 5.4 demonstrated Turkish Airlines subsidiary airline selected competitive routes average inventory (actual numbers) for chosen time period, in off-peak season.

Table 5.4.

Turkish Airlines Subsidiary Airline Short-Distance Competitive Routes Average Segment Inventory(actual) between 1st November and 31st December 2019.

Actual	Dates: 1 Nov-31 Dec 2019 domestic competitive routes				
Reservation Class	System Level	Capacity	Allotments	Booked	TotalRevTL
Y	449,99	189	15	0	0
F	409,99	174	6	0	0
R	369,99	168	5	0	0
B	339,99	163	6	0	0
K	309,99	157	12	0	0
N	289,99	145	15	0	0
T	269,99	130	20	15	4049,85
G	249,99	110	20	20	4999,8
Q	229,99	90	10	10	2299,9
X	209,99	80	20	20	4199,8
O	189,99	60	10	10	1899,9
Z	169,99	50	10	10	1699,9
U	155,99	40	15	15	2339,85
P	139,99	25	10	10	1399,9
V	125,99	15	5	5	629,95
E	115,99	10	5	5	579,95
A	105,99	5	5	5	529,95
D	95,99		0		
L	85,99		0		
I	69,99			125	24.629 ₺

Total Pax	125		
SLF	66%		
UP	197 ₺		
Total Capacity	189		

* Add-on fare excluded

Table 5.4 indicated that, THY earned 24.629₺ average revenue from particular competitive flights as a result of final figures of chosen flights. In addition, unit price reached 197₺. There was slight increase on SLF raised from 65% to 66% carried with 125 passengers in each flight leg. The airline increased the unit price from 168₺ to 197₺ without losing any passenger for related flight segments. Also, it earned 3.964₺ more revenue, applying capability of dynamic pricing effectively, compared to capacity distribution results at Table 5.3.

If the allotment availability remained same as Table 5.3. the airline company would have 3.424₺ less earnings than existing revenue at Table 5.4. (the number of bookings were assumed being 125 passengers as equal at Table 5.4.).

Table 5.4. showed that allotment distribution moved upward position in comparison with Table 5.3. There would be many justifications of upward sloping trend behind the table. The reasons would be competitive price strategy or any cancellation of competitor flights, brand image of competitor's has damaged because of any reason such as safety.

Downward trend also possible for price changes depend on market condition and competitor actions. In the case of lower price trend, company make some flight optimization depend on business strategy. If the RM team applied long term and short-term commercial strategy to increase amount of revenue but, they would not reach the targeted goals in planned time they kept flight schedule. Sometimes, companies would set their commercial strategy on annual total profitability of all flights instead of each single flight average revenue. In any case, dynamic price structure would be support them to reach the targeted goals.

Time to time, company strategy would be change due to any reason in order to have revenue maximization from same amount of resources. Such kind of critical decisions has taken during product implementation phase after making intelligence analysis in order not to lose sales and share in the market. All possible scenarios applied within strategic plan, many days before departure date due to perishability features of airline product.

Some of price level differs from overall price structure has observed at the Table 5.4. because of rivalry effect. Dynamic pricing structure can be diversified for competitive routes to gain competitive advantages in the focused market. Dynamic price classes orderly defined into system within mathematical matrix. Each reservation class closed to sales automatically, when the assigned gross availability was over.

On the other hand, price rules can implement into system within some critical parameters. When the maximum days remain to departure is getting closer and seat load factor was still lower than expected, system would close to sale some fare group spontaneously such as promo group fare but, the analyst would update the rules if it is essential depend on tactical approach of RM policies of company.

The findings from analysis indicates that:

- There is a significant relationship between goal-based dynamic pricing and airline revenue efficiency for Turkish Airlines subsidiary company.
- When Table 5.1. and Table 5.2. were compared, it was observed that effective management of goal-based dynamic pricing supported to revenue increase of selected flight groups.

- Dynamic pricing tools enabled the implementation of upward position strategies for the airline keeping price structure same at Table 5.2.
- Dynamic price structure provided opportunity of price discrimination in order to have competitive advantages in competitive market due to limitative availability in limited sales period (It is shown at Table 5.4).
- Dynamic price tools provided to airlines applying dissimilar price rules to support creation of additional revenue for each flight segment.
- The amount of revenue gained from Turkish Airlines subsidiary airline was affected positively by applied goal-based dynamic pricing methods, tools, and tactics.
- The amount of total revenue of Turkish Airlines subsidiary company was affected positively by revenue management approaches inclusive of implemented strategy and tactical tools which were determined according to changing market dynamics, analysis of reservation journey of each single flight, observing advance booking figures and sales data regularly for selected flight groups, applying some essential parameters and dynamic-pricing tactics and controlling critical instrument of RM carefully.
- Dynamic price structure has crucial role increasing amount of revenue since it offered airlines opportunity to sell at higher price. Comparison between Table 5.1. and Table 5.2.; Table 5.3. and 5.4. proved the information within the gained revenue shown as final figures of both selected flight groups.
- According to the data illustrated in the Table 5.3. and Table 5.4. several factors could affect total amount of airline revenues in competitive market.

- Goal-based dynamic pricing method obtained not only price increase, but also beneficial to support volume via implementation of price reduction strategy or raising of availability for selling fare class.
- For both cases increasing or decreasing price level, goal-based dynamic pricing method would support revenue increase with effective and tactical use of RM tools.
- Lower price group available many months before departure date to support load factor of aircraft in order to decrease commercial risk of flight leg. Due to this reason, prices would be more elastic for early booking than late booking passengers.
- Early bookings from low prices would be create additional revenue due to no-show possibility of passengers purchasing low fare. In that case, analysts could sell the related capacity higher price than before, due to no-show factor to increase revenue.
- This is not defined as only price increase for any single product group. This is the method that more beneficial for perishable product group applying the power of goal-based dynamic price structure in order to raise revenue efficiency without breaking market dynamics.
- The efficiency of revenue for airline product can be measured according to RASM. It is obtained by dividing ASM. Generally, the higher the RASM, the more profitable the airline under question. Revenue is represented in cents and is not solely limited to ticket sales, as other factors of efficiency and profitability are taken into account.
- Finally, several factors including capacity offering, seat allocation, demand forecast, airline product range and frequency, price strategy and elasticity,

flexibility of reservation and price rules, understanding of passenger needs and purchasing power, schedule optimization, rivalry in potential market, providing alternatives purchasing tools, increasing sales channel options and availabilities, presenting ancillary revenue products or services etc..., all listed criteria affected the total amount of airline revenues gained from targeted market within implementation of dynamic pricing benefits and strategic revenue management tactics.



CONCLUSION

This study was designed to investigate the impacts of goal based dynamic pricing and tactical revenue management strategies on the Turkish Airlines revenue efficiency. The study was considered as a case study of Turkish Airlines. Data were collected officially, at the headquarter of the Turkish Airlines.

Data were provided from the airline included information about the subsidiary airline selected short haul competitive routes average segment inventory figures (expected and actual) between November and December 2019. In addition, subsidiary airline price scale and average inventory numbers (expected and actual) for a specific time frame on selected long-haul flight segments for non-competitive routes between January and February 2020.

Turkish Airlines has been utilizing basic inventory and price system at the beginning of revenue management implementation due to the limited capacity and price issues. Due to effect of passengers travelling habits, lower demand rate for air travel, but currently regarding the effect of globalization, changing market conditions and air traffic rules of air travel industry, understanding of potential customer needs in the focus market, demand explosion on some product segments, market depth, technological development and company' widen product range, business strategy and global rivalry, number of aircrafts production increase, capacity growth in global run, THY has to prefer more technological and effective systems to manage their inventory and all their RM functions effectively. Turkish Airlines also had to change RM approach due to improvement of information technologies related to aviation industry.

In order to get benefit from dynamic pricing approach and having higher amount of revenue from same amount of resources, also preventing the company from any negatives changes in the market, having competitive advantages in global run; depth analysis, attentive observation of booking figures, reading critical instruments of RM properly, marking meaningful prediction, reading advance booking report accurately, taking acceptable risks and proper action in time has significant role in order to increase amount of flight revenue (Table 5.2. proved to proper implication according to listed information).

Business strategies for competitive routes would be vary according to position company in the market, competitor promotional activities, brand awareness, product quality, service facilities, price elasticity, bilateral agreements with corporate accounts, sales channel and payment methods alternatives, instant actions in the market (Table 5.3). The dynamic price scale and allotment distribution organized in the light of such kind of information related to competitive market.

As a result of all analysis, target base dynamic pricing provided to airlines having more efficient results from same amount of resource because of offering for airlines ability to sell higher price without breaking current price structure and market dynamics. In order to have more effective commercial outcomes, companies should well-organized all algorithms with depth analysis, well-reading critical instruments of dynamic pricing method and market conditions, taking essential actions timely (Table 5.4).

Nowadays, class based dynamic pricing is applicable for airlines but in near future, personal price will be offered for each passenger. After depth analysis of each passenger travel history, system would be offer different price for each passenger on same flight according to their travel habits and personal features created during their

air travel journey. The special price would be include each flight product combination such as ticket fare, options, meal, excess baggage or additional equipment (skiing or golf, cabin pet etc...), seat selection, getting benefit from frequent flyer membership and any other developed service alternatives would be provided by system. Different products would be offered at distinctive price for each passenger profile in same flight. The flight services would be combined with non-flight services such as rent a car, hotel reservation, exhibition ticket price, local transportation in arrival destination etc... This upcoming system defined as offer optimization.

In order to implementing offer optimization approach, airlines need system infrastructure to analyze big data rapidly. Large scale airlines use many systems and distribution channels. All these systems integrated each other to provide information rapidly, between all system users in order to take proper decision in time. In addition, to prevent any operational problems and commercial mistakes, due to listed reasons and many others, it would be difficult to have fast transformation for air travel industry opposite of e-commerce sector but, in near future this evolution would be inevitable.

In conclusion, this thesis study confirmed the efficiency of the dynamic pricing for an airline case approach in Turkey. It also showed that, the goal based dynamic pricing and airline specific revenue management strategies positively affect the revenue efficiency for Turkish Airlines. The findings of the study nevertheless similar to the results of the previous research.

For upcoming research, researchers may measure the effect of the dynamic pricing on customer perception for air travel industry. In addition, growth in air passenger transportation has decline due to effects of epidemic in 2020. On the other hand, there is enormous development on air cargo transportation. It would be better to

make a research about implementation of RM process in air cargo business and how dynamic pricing approach effect the air cargo revenue. In recent years, airlines ancillary revenues more valuable than regular revenue categories. It would be better to analyze on airline ancillary revenue categories and how would affect the ancillary revenues for airline industry in near future in competitive global rivalry. The applicability of ancillary revenue categories for flag carrier airlines would be investigated. Additionally, research into what low-cost carriers should do increase of their ancillary revenue options. Moreover, research would be done airports revenue management methodology and how would be increased airports revenue in case of any global crisis. The impact of revenue management approach and pricing tools on marine or railway transportation would be investigated. Lastly, as I explained paragraph above, experts anticipated that in future dynamic pricing methodology would suggest a different price according to travel characteristic of each passenger. It would be called offer optimization. The effect of offer optimization method would be investigated on airline revenue and impacts of this new approach on air travel passenger would be discuss by researchers.

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APPENDIX A

INTERVIEW QUESTIONS

In the airline revenue management discipline, I am conducting a research that measures the impact of dynamic pricing on airline flight revenue efficiency. In this context, we wanted to examine Turkish Airlines, the pioneer of Turkish civil aviation history and flag carrier of Turkey, as a case study.

Revenue management tools, constituents of dynamic pricing, parameters affecting pricing method and amount of flight revenues, any other variables, systems and kind of reports used, revenue management approaches and tactics for ordinary and extraordinary situations encountered, RM strategies created for each targeted market and routes, technological development, digitalization and factors affecting RM strategies in order to have better commercial result in competitive global environment I would like to mention the effects of all listed categories on airlines revenue management discipline with your support.

Sencan TAŞCI

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I basically listed the topics we were interested in. However, we can enrich the content with additional questions when we move towards directions that we will add during the interview and whose details we do not know:

1. First of all, could you please briefly tell me about yourself? How did your career intersect with RM? What has contributed to you in your carrier journey?

2. Could you please define ‘‘what is the Revenue Management? What are the factors affecting this discipline? What would you like to say history of the revenue management in Turkish Airlines?
3. What are the RM dynamics? How are RM processes managed in Turkish Airlines?
4. Could you please give information about relationship and interaction between RM team with other departments in order to reach targeted goals?
5. What are the systems used for RM? Which of them are more effective for Turkish Airlines focused markets? Does TK have any new plans for systems or RM approach in the near future due to effect of digitalization and technological development?
6. Which reports are used for effective RM management, accurate estimation and reaching targeted goals?
7. What are the criteria creation of dynamic price structure? How can you make analysis at the beginning of price level generation?
8. How is the capacity distribution made in the dynamic price structure? Can you explain the analysis processes?
9. How is the price change managed in order to achieve more efficient commercial results with the same resource in the process after the capacity is distributed? What flexibility is provided under what conditions?
10. How do you measure dynamic pricing method’ efficiency for each routes?
11. Can you give information about the effect of irregular situations on revenue management and how these situations are managed?
12. Do you take into account overbooking (OVB), reservation cancellation, refund, re-issue, no-show, go-show rate while you make prediction or seating goals?
How do you manage the effect of such kind of reservation categories?

13. Within the revenue management: “ancillary revenue, corporate agreements, alliances and special price agreement, PADs (Passengers available for disembarking), connected passengers, could you talk about the impacts of these concepts on the revenue?
14. Historic data analysis and market conditions are implemented in RM tactics as strategies for each route. In this process, how do you manage changing expenses?
15. Is there a special pricing for the sales channels? Which criteria are taken as base?
16. What are the effects and possible risks of RMS on the revenue management?
17. Are there any important trends or developments that will affect the new RM discipline with the effect of digitalization?
18. What do you think about the effect of targeted dynamic pricing on flight total revenue, considering all the parameters?
19. In order to demonstrate the effect of dynamic pricing on airline total flight revenue efficiency, we will need data containing selected routes over a specified time period.

CURRICULUM VITAE

Sencan TAŞCI has been graduated from Air Transportation Management bachelor degree from Anadolu University. She attended Aviation Management program in 3rd year of bachelor at FH-Joanneum University in Austria. She started to her professional career at International Relations, Agreement, Alliances department at Turkish Airlines. After short period working experience for flag carrier, she attended to Revenue Management team at SunExpress Airlines. She had experience on route management and capacity control, pricing and distribution, revenue analysis, schedule planning, disposition for international routes, strategic planning and campaign management. After that, she joined to Sales and Marketing team for reporting and analysis functions. She was responsible for sales performance management and market analysis to serve better product into the market while implementing better price strategy. Then, she was responsible for managing of commercial projects focus on sales development and partnership.

After long term airline business experience, she transferred to business jet sector for setting business strategy, marketing, and management of digital channels. In addition, she supported to development of ancillary revenue management system for Air Cargo business. Finally, she worked for Istanbul Fast Ferries company as Revenue Management and Strategic Marketing manager. During her professional carrier she got training on Entrepreneurship and Innovation Management at Bosphorus University, Information Technologies from Middle East Technical University. Additionally, she got Project Management, RMS (Revenue Management Solution System), Digital Marketing, Brand Management training from reputable organizations.