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Why is it the Right Time to Enter the Market?	Error! Bookmark not defined.

Glossary of Terms Used

Terms Used	Meaning
Flight	Aircraft that flies from A to B at a stipulated time
Route	Existing and new flight routes connecting two cities
Network	All existing routes of an airline
City pair	Origin-destination pair
ASM	Average Seat Mile – number of seats * miles travelled
CASM	Cost per Average Seat Mile
RASM	Revenue per Average Seat Mile

Airline Route Optimization using Data Analytics

Problem Statement

Airlines take over 12 months to plan a new route.

It is a highly manual process, involving integration of multiple data points and identification of possible destinations in a trial-and-error method. How to automate this process and reduce the time taken for planning from more than 12 months to just a few weeks?

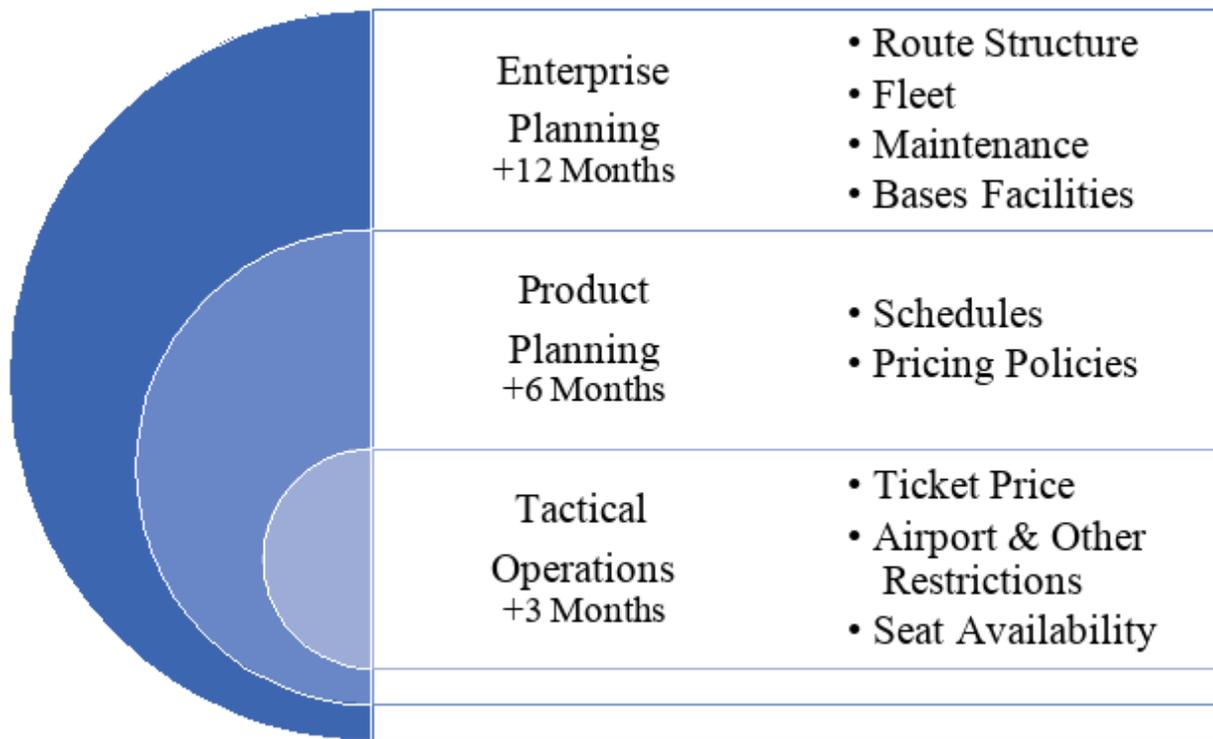


Figure: Schedule Planning & Operations Time Frame, Smith & Jacob 1997

Members of the network-planning department spend months combing through historic data to find relevant information and a way of using it to plan the best and most profitable routes. Planners usually identify a city pair, obtain data, and use the data to come up with a tentative schedule. They then identify other airline flights that cater to the same city pair, and plug the relevant values into an airline itinerary choice model. This process allows the route planners to estimate the market share for that city pair.

It is a trial and error method to find the ideal city pair with the most attractive market share estimations. Once a city pair is estimated to have a good market share that looks profitable, the Revenue Management team is intimated. The new destination is announced internally only after both the departments agree it would be profitable. Next step is to get an approval from the Ground Operations and Flight Operations teams in terms of the infrastructure and capabilities to fly to the new market. Once all the departments sign their approvals, obtain the required permits, ensure infrastructure is available etc. the destination is announced to the public.

Solution – Use route optimization to automate the route planning process

Automate the initial process of selecting a potential destination based on ideal flight timings, aircraft specifications and estimate the resulting market share.

Destination Identification

Create a version of route optimization that will take into consideration multiple steps of data to forecast the potential profitable destinations for an airline. This tool should help the airline build its network at a much faster rate, as it drastically reduces time taken to identify city pairs and corresponding market shares. This allows the airline can grow into new markets faster, and hence attracts more customers; which increases the need to expand into new territories.

Fleet Identification

Apart from identifying profitable destinations, something that will add value to the airline are fleet predictions. By taking into consideration the market share and possible load factors, the tool can predict the number of flights to the destination city, and the type of aircraft used to maximize the load factors.

Maintenance Routes

Take into account the maintenance bases for the airline and plan routes to ensure the aircraft can get serviced at the right time. This can be done by chalking out the hours flown and airports where maintenance is done. The flights can be halted at the specified airports for their A level checks.

Competitor Flight Insights

Another useful insight is to see the competitor's most profitable flights. Once all the historical data is fed in to the system, and run with a certain set of constraints, route optimization can show the most profitable flights – be it flights that flew at full or maximum capacity or flights that had the highest fares. This helps the planners look at the factors that helped maximize returns.

Phase II

Apart from identifying new city pairs for the airline to fly to, with a few customizations, the route optimization solution can predict the best possible flight schedules. It can help avoid certain weather conditions that follow a pattern.

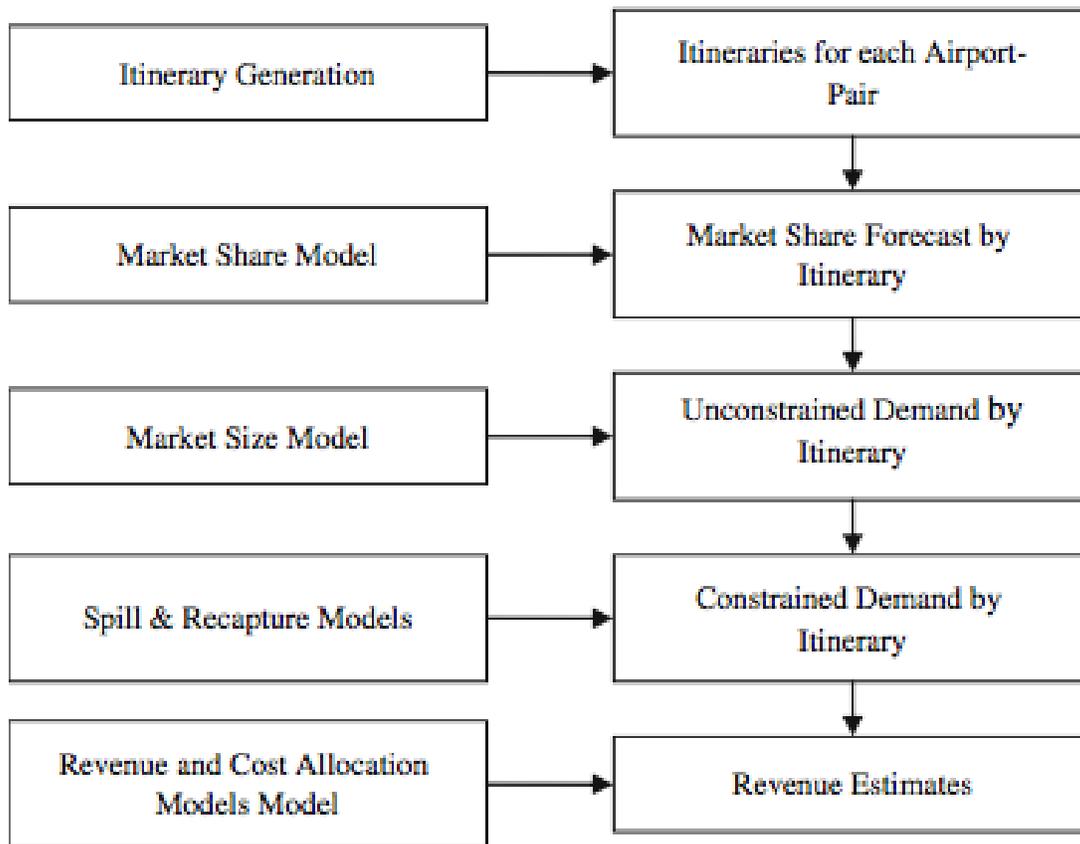
Phase III

It can identify existing non-profitable routes and suggest modifications to improve the load factors and profits.

Business Workflow

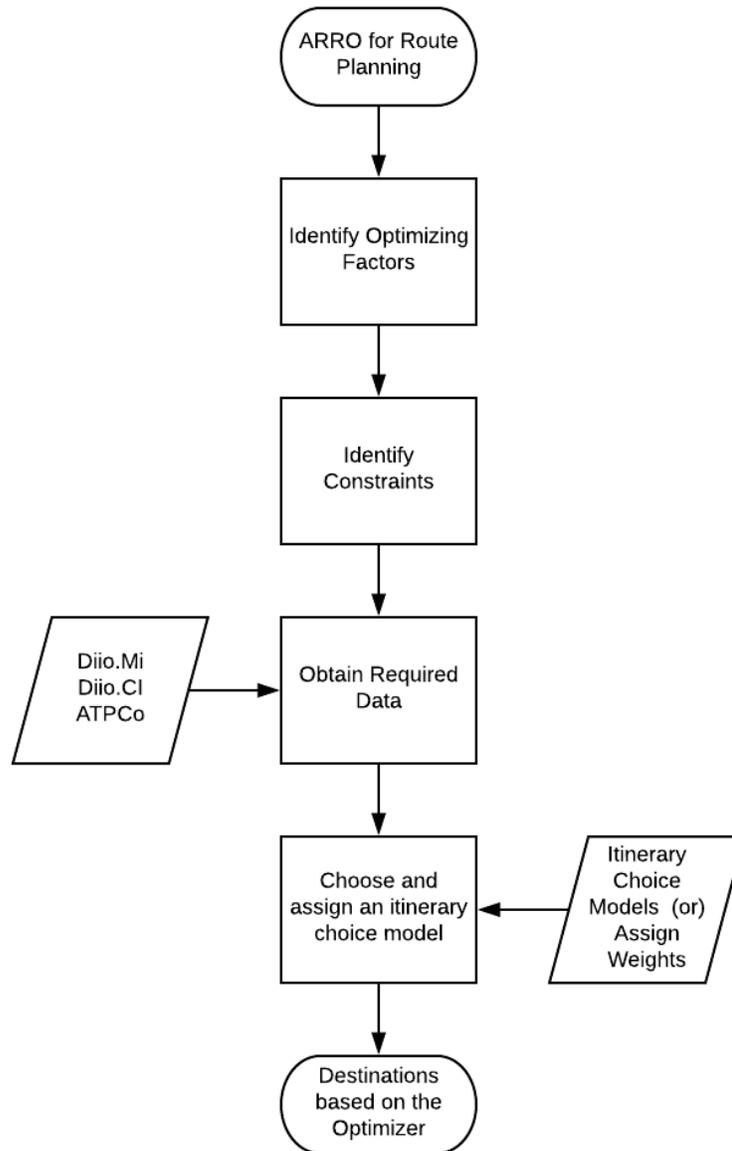
This shows the different kind of models used in the market.

The proposed version of the tool will use models to identify itineraries and determine the market size and forecast load factors based on the city-pair chosen.



In order to generate an itinerary and estimate the market share, there is a lot of information that is required. The constraints have to be selected carefully, as they determine the results.

This would be the process flow for route optimization



Identify and List the Optimizers

The primary goal of the tool is to identify a route based on the highest market share value. Based on the data required, there can be a set of constraints that optimize the routes to maximize the use of a type of aircraft or to cater to a particular city.

Here is a list of constraints that could be a part of the route optimization solution:

- Biggest Market Share
- Best Time Slot for Departure
- Type of Flight – Originator, Connector, Terminator
- Type of Aircraft – Mainline, Propeller etc.
- Origin or Destination City Preference (to improve hub presence)

Create a List of Constraints

The list of constraints will depend on the optimizers chosen and data required.

Here is a list of the most important constraints for each optimization:

- Biggest Market Share
 - Existing market share values
 - Flight schedules (all competing airlines)
 - Airline city presence
 - Load factors
- Best Time Slot for Departure
 - Flight schedules
 - Corresponding passenger load factors
 - Fares
 - Airport congestion details
 - Number of gates
 - Number of flights taking off in the same time frame
 - Airline city presence
- Type of Flight – Originator, Connector, Terminator
 - Similar to that of “Best time slot for departure”
 - Connecting flight options
 - Existing departures from destination
 - Demand
 - Capacity
 - Load factors
 - Fares
- Type of Aircraft – Mainline, Propeller etc.
 - Demand
 - Airport runway capacity (Runway length etc.)
 - Geographical restrictions (congestion near the airport doesn’t allow for mainline aircraft)

- Origin or Destination City Preference (to improve hub presence)
 - Hub city

Identify and Obtain Data Required

- Existing Destinations
- Airport Code (of existing destinations)
- For a city pair: historical and other airline flight details
- Origin City & Airport Code
 - Estimated Time of Departure
 - Actual Time of Departure
 - D14 Delays (actual departure more than 14 minutes late)
 - Reason for Departure Delay (weather, maintenance, congestion, other)
- Destination City & Airport Code
 - Estimated Time of Arrival
 - Actual Time of Arrival
 - A14 Delays (actual arrival more than 14 minutes late)
 - Reason for Arrival Delay (weather, maintenance, congestion, other)
- Direct or connecting
- Flight Type (Originator, Connector, Terminator)
- Other Airline Flights
 - Flight Number
 - Timings
 - Capacity
 - Market Share for that OD City Pair
 - Aircraft Tail Number
- Distance Travelled
- Aircraft Model Chosen
 - Seat Capacity
 - Fuel Tank Capacity
 - Cargo Capacity
 - Maximum Take-Off Weight (MTOW)
- Number of Passengers Travelled on all Flights
- Number of Fare Classes Provided in Other Flights
- Average Base Fare Paid
- Average Maximum Fare Paid
- Average fare paid
- Cost per Average Seat Kilometre (CASK) Estimate
- Revenue per Average Seat Kilometre (RASK) Estimate
- Historical Weather Report (Trends etc.)
- Airport Runway/Airspace Congestion
 - Timings

- Weather information – delays caused due to
 - Flooding
 - De-icing

All the information should be available on **Diio.Mi, Diio Ci and ATPCo.**

If it is for a city pair that has never been flown before, the closest city pair is considered. This could be the closest available city, market that has a similar traffic (business or leisure). The Network Planning team usually decides this.

Choose Itinerary Choice Model & Assign Weights

Estimating market share using Greg’s itinerary choice model

Explanatory Variables	Market	Itinerary 1	Itinerary 1
Level-of-Service			
Non-stop, direct, single connection in type of market (non-stop, direct, single connection)	Higher weightage for a non-stop itinerary in any kind of market	0 or 1	Weight if 1, else 0
Connection Quality			
Connection time brackets – airline specific	Shortest, and ideal wait time between connection gets highest weightage	0 or 1	Weight if 1, else 0
Carrier Attributes			
Point of Sale Weighted City Presence	Where the ticket was purchased, who has highest market presence there?	0 or 1	Weight if 1, else 0
Aircraft Size and Type			
Regional jet, propeller, mainline etc.	Type of aircraft determines available seats. More seats means higher weightage.	0 or 1	Weight if 1, else 0
Time of Day (Departures)			
2 hour time slots for flight departure	Depends on geographies and traffic/congestion	0 or 1	Weight if 1, else 0
Sum			Sum of all values
Exponential			Exponential of sum
Probability			0.xx
Market Share			% of probability

Choosing an itinerary choice model (ICM) is very important; the estimated market shares depend on the model and the weights. There are multiple itinerary choice models available for use. Some are currently used by various airlines.

These models are built keeping in mind various factors. They could be oriented multiple ways depending on:

- Airline
- Geographical region
- Time zones
- Type of market
- Type of carrier

The ICM weights will show the most ideal route option – based on time, aircraft type, type of market, number of competitor flights etc. Route optimization solution's goal should be to maximize the market share. It is possible to run the tool without any city information to see the ideal flight plan.

For example,

A direct mainline aircraft departing between 7AM and 9AM from the hub city will attract the highest number of passengers.

Route Optimization should be able to predict the same for a dummy route.

When real-life factors are taken into consideration, multiple things alter the most ideal flight plan.

An itinerary choice model must take into consideration the type of market the airline operates in, factors that have the highest impact on flight schedules, most preferred travel time slots, most prevalent type of aircraft etc.

For example,

A full service carrier (FSC) will have a smaller market share in a full low cost carrier (LCC) market. Not because the quality of the product, simply because of the price elasticity of the customers. A highly LCC dominated market shows that the customers in the market prefer to pay less for the product than the extended list of benefits of a FSC.

If there is a readily available ICM, the weight can be plugged into the tool. An ICM can be built with a thorough understanding of the market and based on the availability of the data (some of which might be proprietary data)

Optimize

The optimizers, constraints and required data are fed in to the tool. It should be able to generate one or more routes based on the requirement.