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Airline hub optimization – Screening bank structures to boost hub performance

White paper

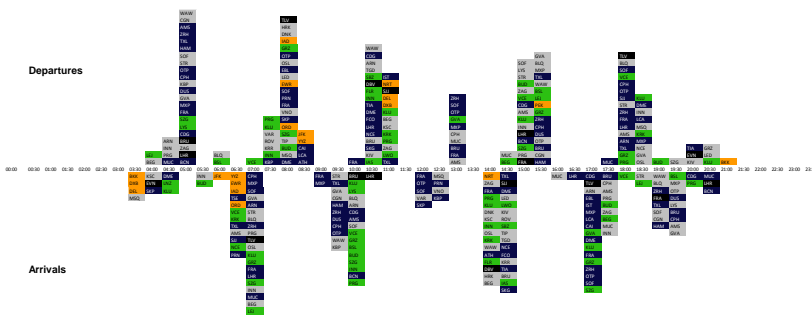


Düsseldorf / Frankfurt, October 06, 2014

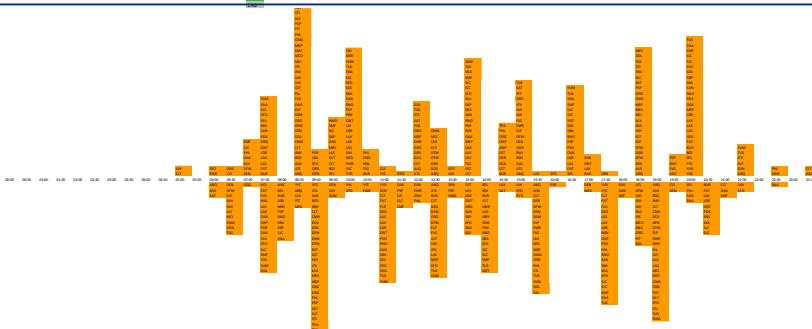
Executive Summary

- For **airlines** operating in a **hub & spoke model**, shape and efficiency of their **network** are the predominant drivers of succeeding in global markets, and earning money
- Within this network, the **operational layout** of its **hub** (including chosen **bank structure** and schedule) determines how well the airline can **connect its passengers** – and **at what price** (cost and complexity)
- In daily work, the hub structure is the **result** of the network and fleet planning process – **not the other way round**. However, for a given network and fleet scenario, and hub environment, there are **more and less efficient bank structures**
- Thus, facing strategic or **structural changes** (such as fleet additions, entry of new competitors, or launch of new routes), airline executives often consider **fundamental changes** of their hub's **bank structure** to accommodate change, and rebalance capacity offering and production system in their hub
- Based on two consulting projects for major European hub carriers, **FATC** and **M2P Consulting** have developed a **proven approach** suited to either **validate a given bank structure** (number and shape of banks), or to calculate the impact of a **changed bank structure** on the performance of the hub and the network (connectivity, fleet productivity, market coverage, operational viability, profitability)
- This approach provides **unique insights**, since it **combines strategic overview** (interplay between fleet, destination portfolio, bank structure) with **deep operational knowledge** (efficiency of rotational patterns, operational stability)
- Furthermore, FATC and M2P have developed **easy-to-use tools** (wave stacker, connection scanner), enabling their clients to **adopt the methodology** and **repeat crucial analyses** whenever needed

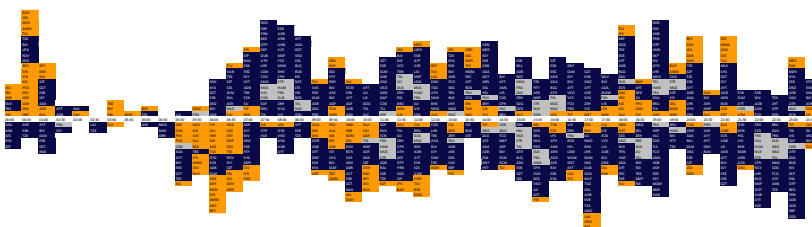
The bank structure of a hub determines the timing and connectivity of inbound and outbound flights – both for short- and long-haul traffic



- OS-VIE
- Clearly structured 7 bank model
- Small banks, no overlap



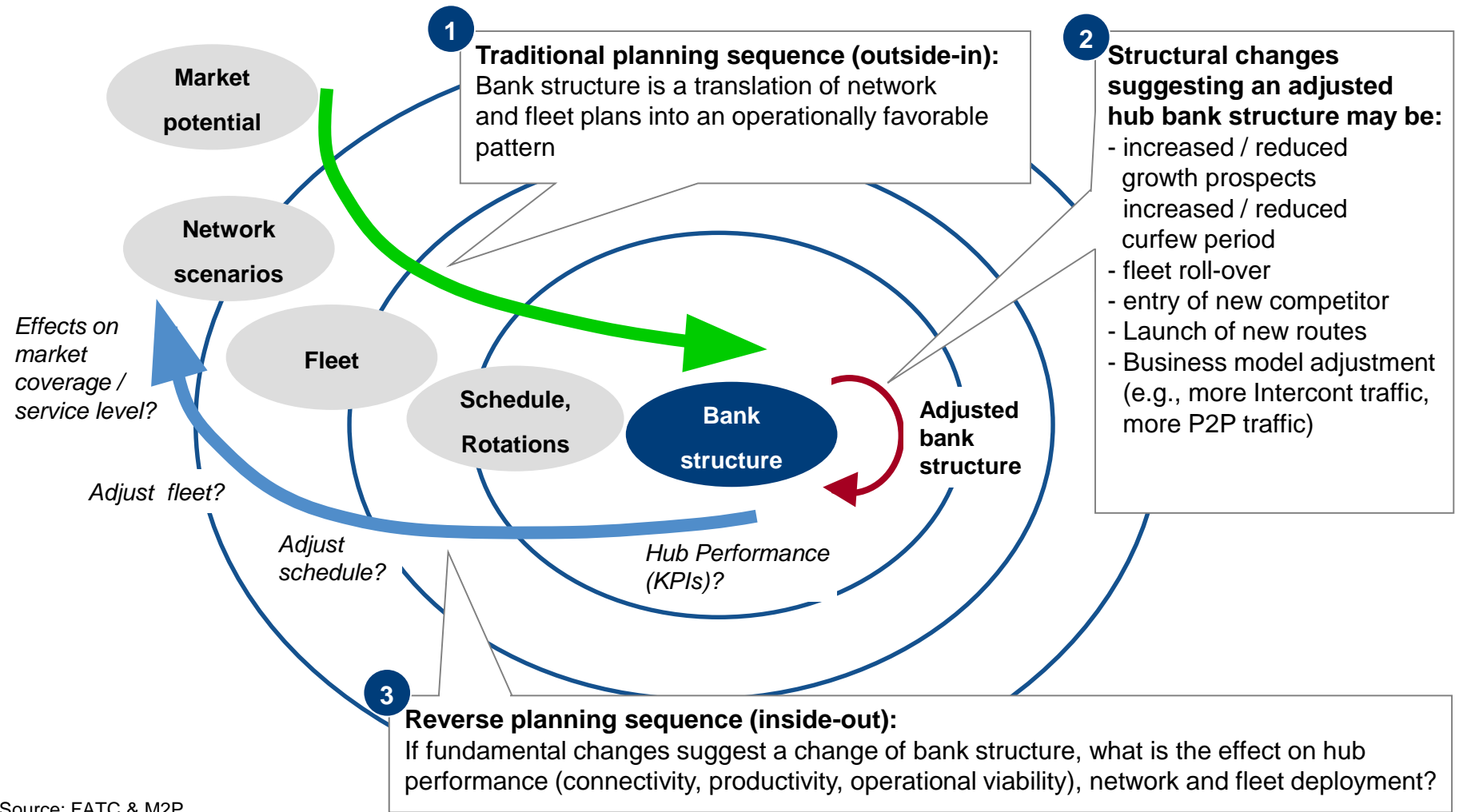
- US-PHX
- Rapid banking
- High peaks, constant capacity utilization



- TK-IST
- Random hubbing
- No overall structure maximizing utilization

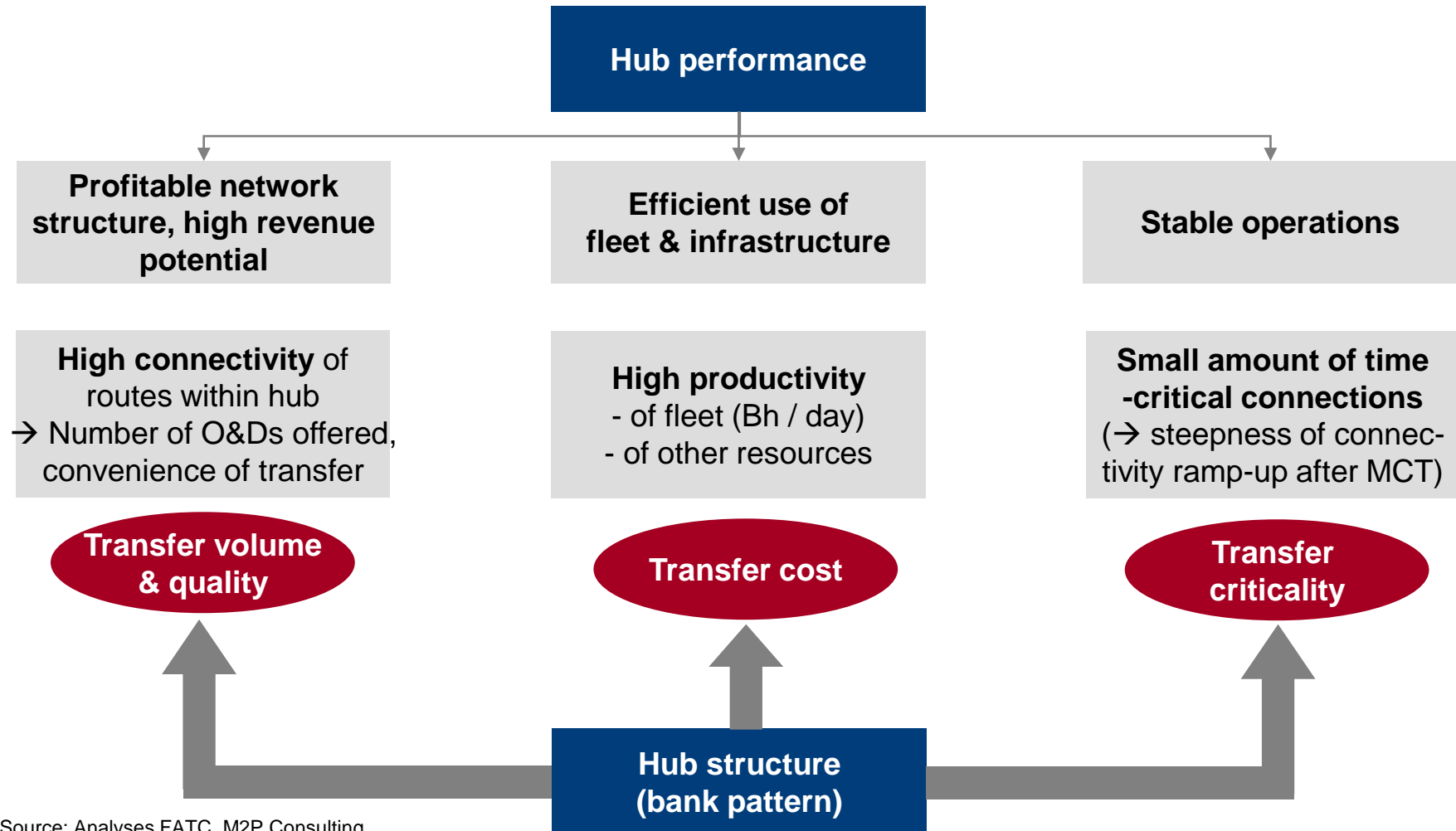
Source: Analyses FATC, M2P Consulting

A reverse perspective on network planning may add value by analyzing the effects of a hub structure change on network and fleet



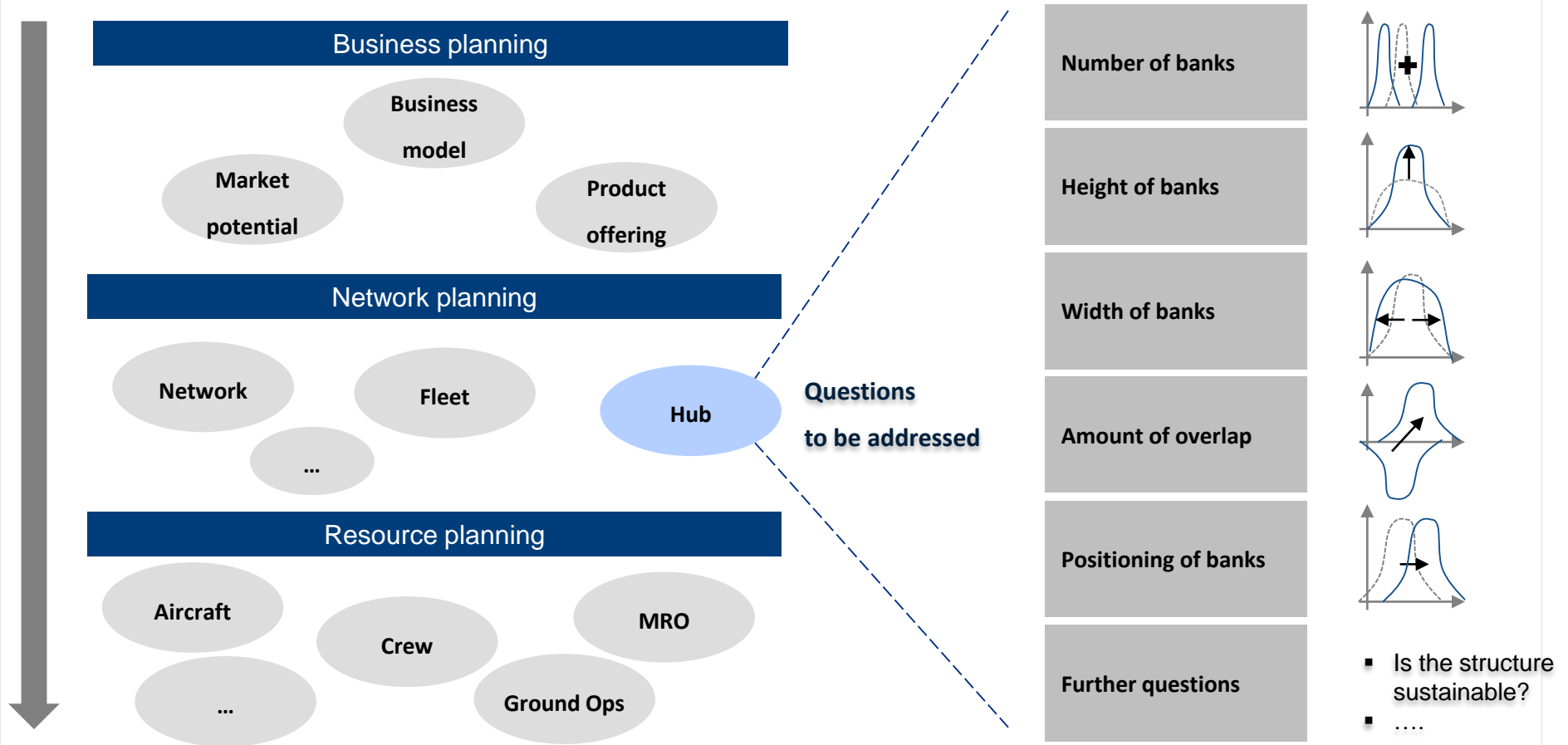
Source: FATC & M2P

Hub performance is determined by its bank structure – impact on connectivity, fleet productivity, and operational stability



Source: Analyses FATC, M2P Consulting

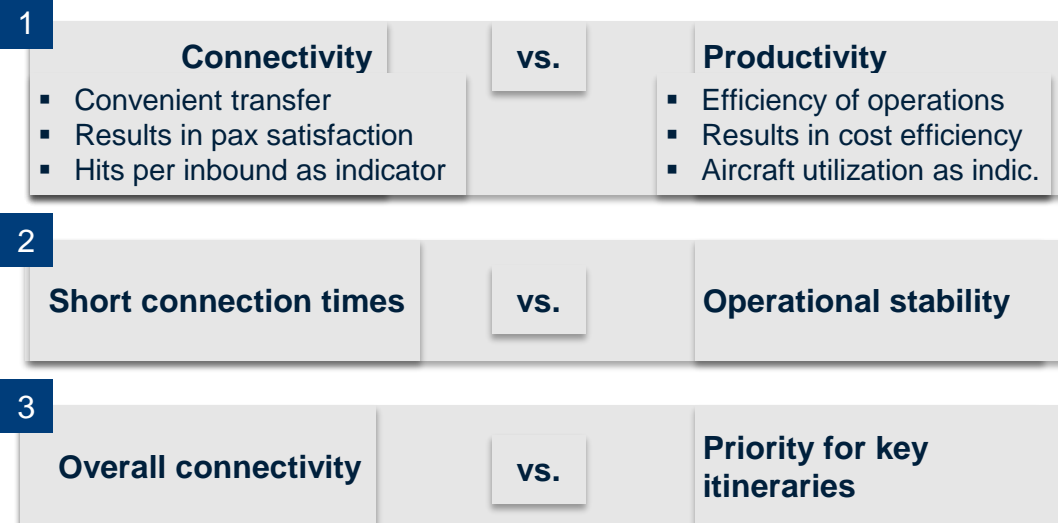
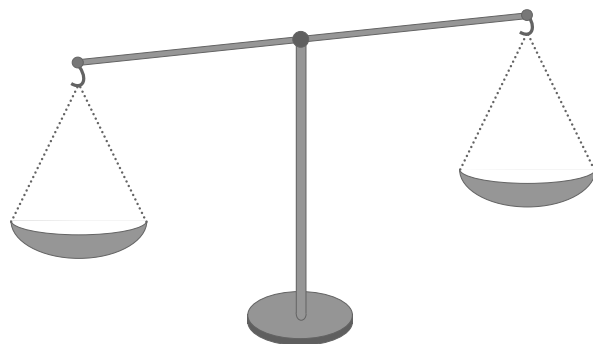
The bank structure of a hub is one aspect within the network planning process and fundamentally influences main performance indicators



Source: Analyses FATC & M2P Consulting

Optimising the hub structure means handling the trade-off between transfer quality and productivity – revenues vs. cost efficiency

Hub Structure objectives and drivers



Main drivers to determine position of scale

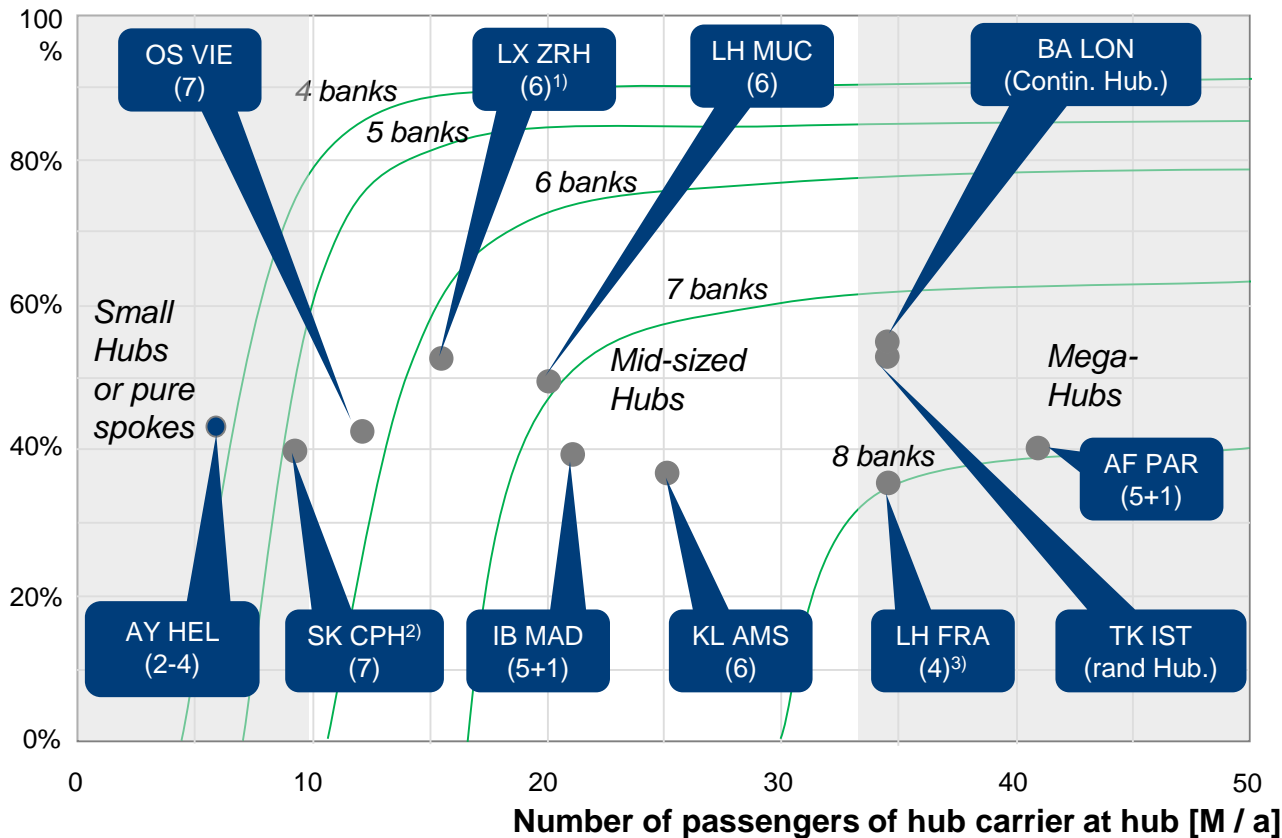
- **Business model**
- **Size (fleet / pax)**
- **Local passenger share**
- **Geographic location**
- **Destination portfolio**
 - Distribution / spread of distances and roundtrip times
 - Directionality of traffic flows
- **Business model and market approach**
 - Frequency patterns, time-of-day pref.
 - Intercontinental share
 - Business pax share / pax preferences
 - Differentiation / competitive positioning
- **Operational restrictions**
 - Airport infrastructure capacity, slots
 - Operating hours / night curfew
- **Planning philosophy / paradigm**
 - Rotational patterns, bank design

Source: Analyses FATC & M2P Consulting

FATC and M2P have developed the „Meta Model“, illustrating the interdependency of hub size, local pax share, and favorable bank number

Local passenger share of hub carrier²

Conceptual

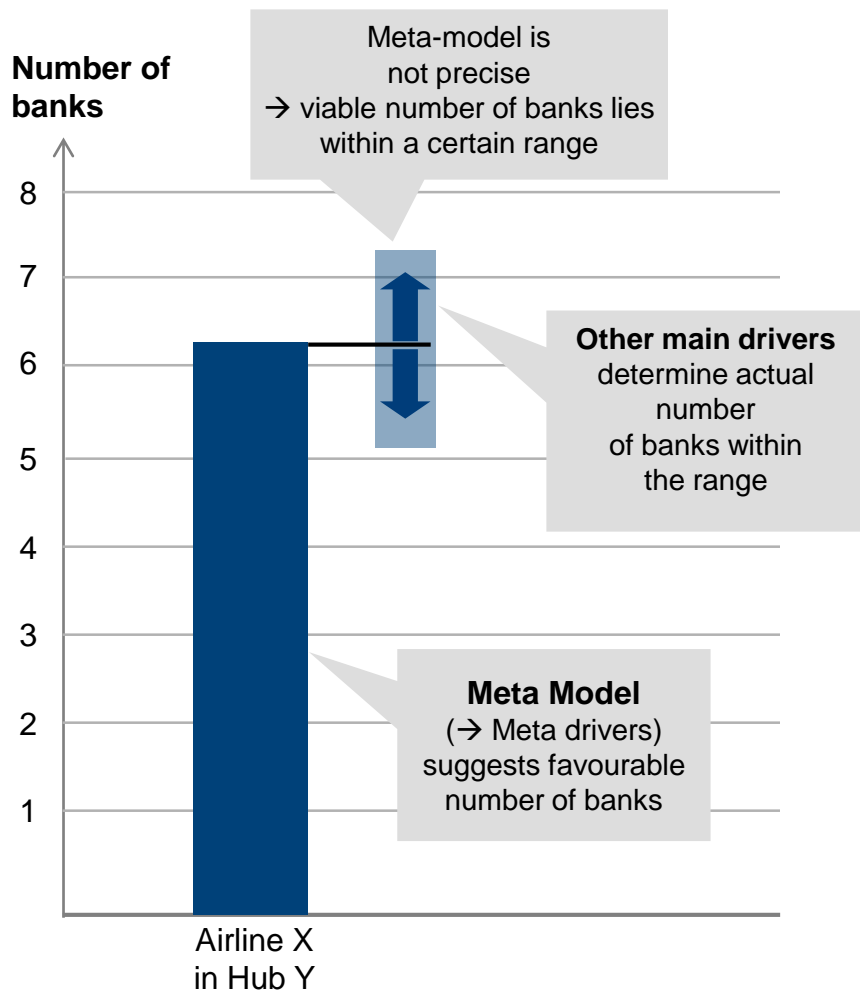


- The Meta-Modell represents a high level top down heuristic illustrating the quality of a bank structure for hubs
- Special effects such as separate Intercont banks or special banks for local pax were not considered
- For medium sized hubs (10...30 M pax of hub carrier), the heuristic indicates optimal bank structures for cont. operations between 5 and 8 banks
- The heuristic cannot be applied for mega hubs on the far right of the framework

Notes: 1) Number of actually operated banks 2) Local pax share estimated 3) Overlapping megabanks

Source: Analysis FATC & M2P, Schedule data 2013

Hub-specific drivers determine the favourable number of banks – the Meta Model suggest a number plus a certain range



Fundamental (Meta) drivers

- Size (pax / fleet)
- Local pax share

Other main drivers

- **Geographic location**
- **Destination portfolio**
 - Shape of continental “catchment” area
 - Distribution / spread of distances and roundtrip times
 - Directionality of traffic flows
- **Business model and market approach**
 - Frequency patterns, time-of-day pref.
 - Intercontinental share
 - Business pax share
 - Differentiation / competitive positioning
- **Operational restrictions**
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 - Operating hours / night curfew
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Source: Analyses FATC, M2P Consulting

The destination portfolio and network structure of an airline are a crucial input for the design of the hub structure

Example



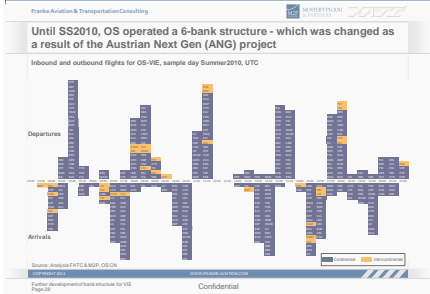
- Number and geographic position of continental destinations, frequency offered
- Number and geographic position of intercontinental destinations, frequency offered
- Deployed fleet
- Average roundtrip time per destination

Source: Analysis FATC & M2P

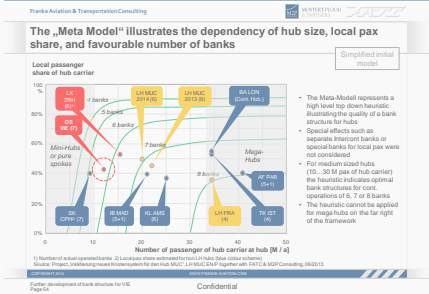
Analytical approach of FATC and M2P accounts for generic and hub-specific drivers – multiple perspectives to identify overall optimum

Analytical approach

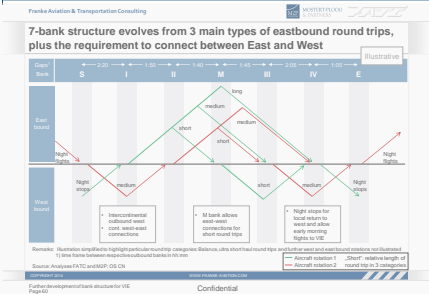
Bank Structure



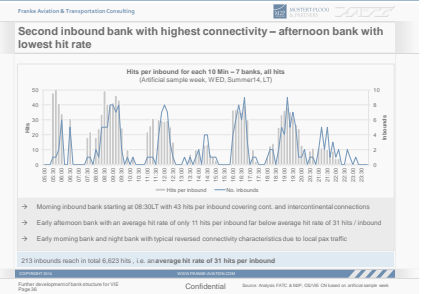
Hub Drivers



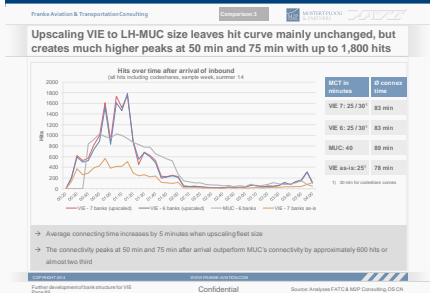
Rotational Patterns



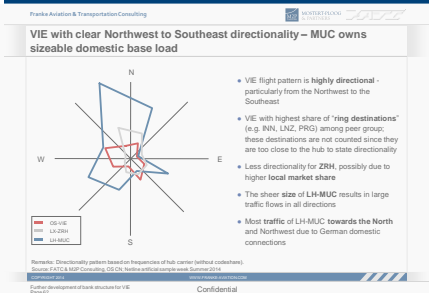
Connectivity



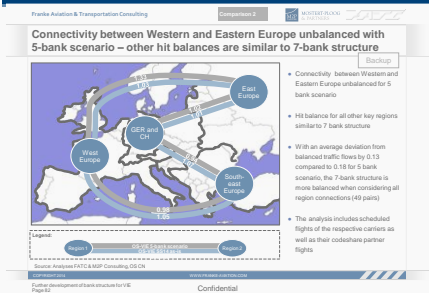
Operational Stability



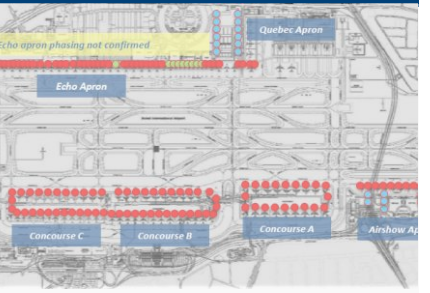
Directionality



Balance of hits



Capacity constraints



Source: Analysis FATC & M2P

The approach measures the performance of a hub along four major KPIs

KPI framework

Initial evaluation, application of benchmarks and heuristics, identification of operational framework

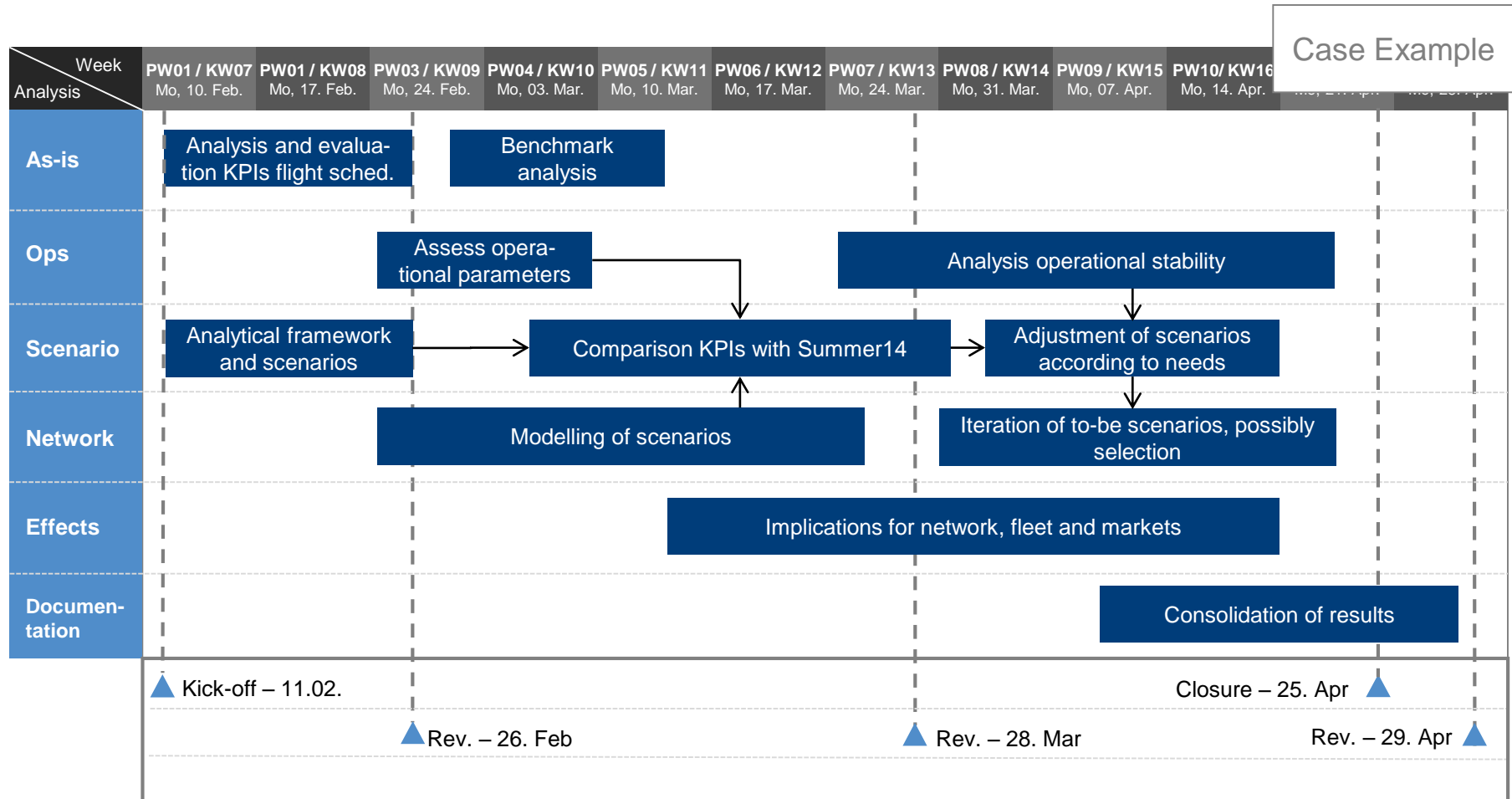
Formulation of hypotheses based on typical hub drivers: bank position, -width, -height; critical traffic of inbound / outbound, infrastructural limitations, etc.

Productivity	Connectivity	Operational Stability	Profitability ¹
<ul style="list-style-type: none"> A/C Utilization Operational productivity Crew operations Ground operations etc. 	<ul style="list-style-type: none"> Connection number <ul style="list-style-type: none"> Hits during the day Hits per Inbound Hits per frequency Balance of traffic flows Connection quality (average connecting time, reliability) 	<ul style="list-style-type: none"> Steepness of hit curve after MCT Number of misconnexes 	<ul style="list-style-type: none"> Pax flows <ul style="list-style-type: none"> total by traffic region Revenues per RPK Costs per ASK

Remarks: 1) Profitability analysis only for most viable hub scenarios

Source: Analyses FATC & M2P Consulting

Project example: Bank structure screening and validation was conducted over 12 weeks – comprehensive scenario and KPI analysis

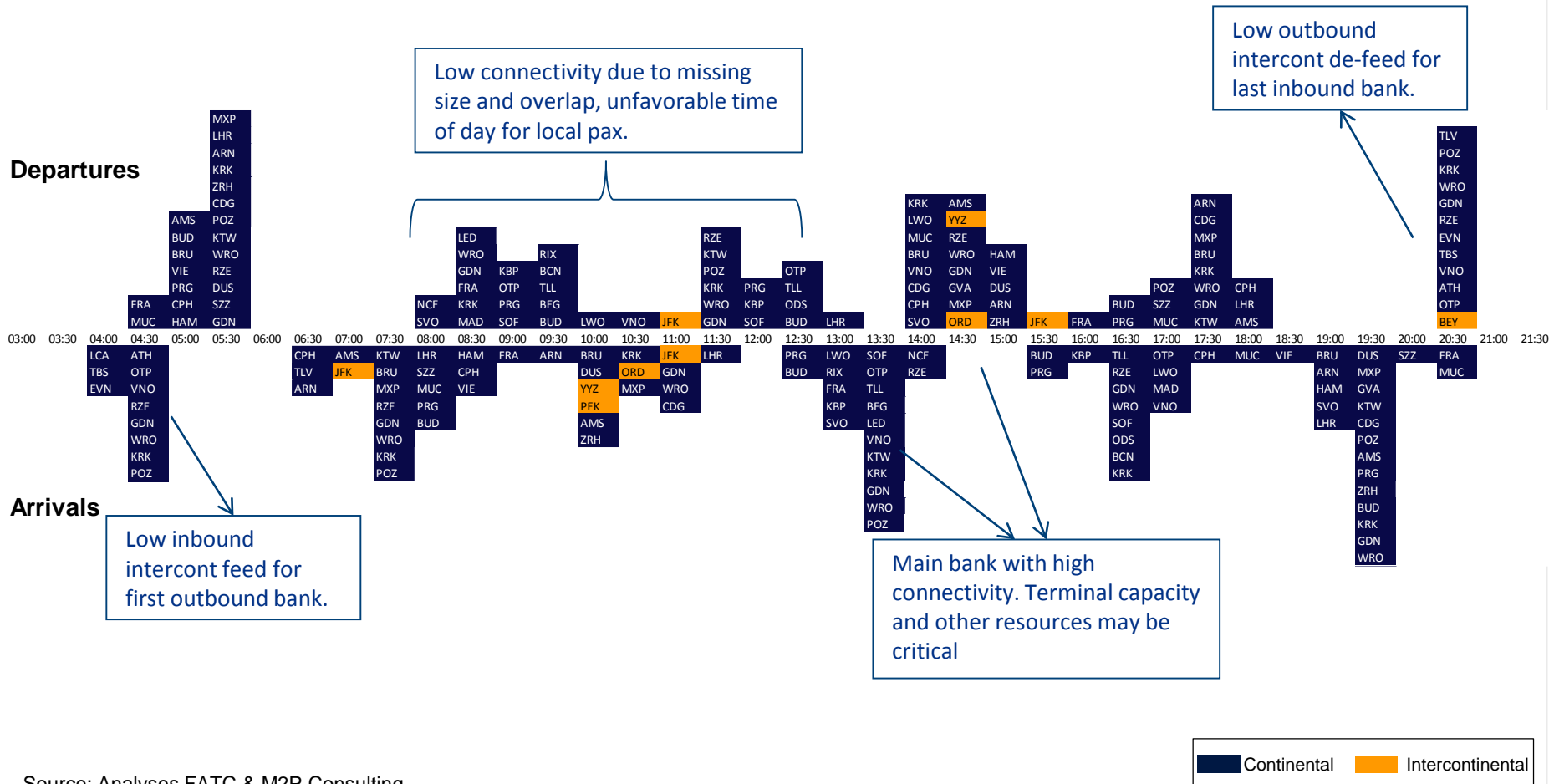


Source: Analyses FATC, M2P Consulting

Remarks: PW: Project week, KW: Calendar week

“Wave stacker” tool developed to visualize bank structure and to formulate first hypotheses on weak spots

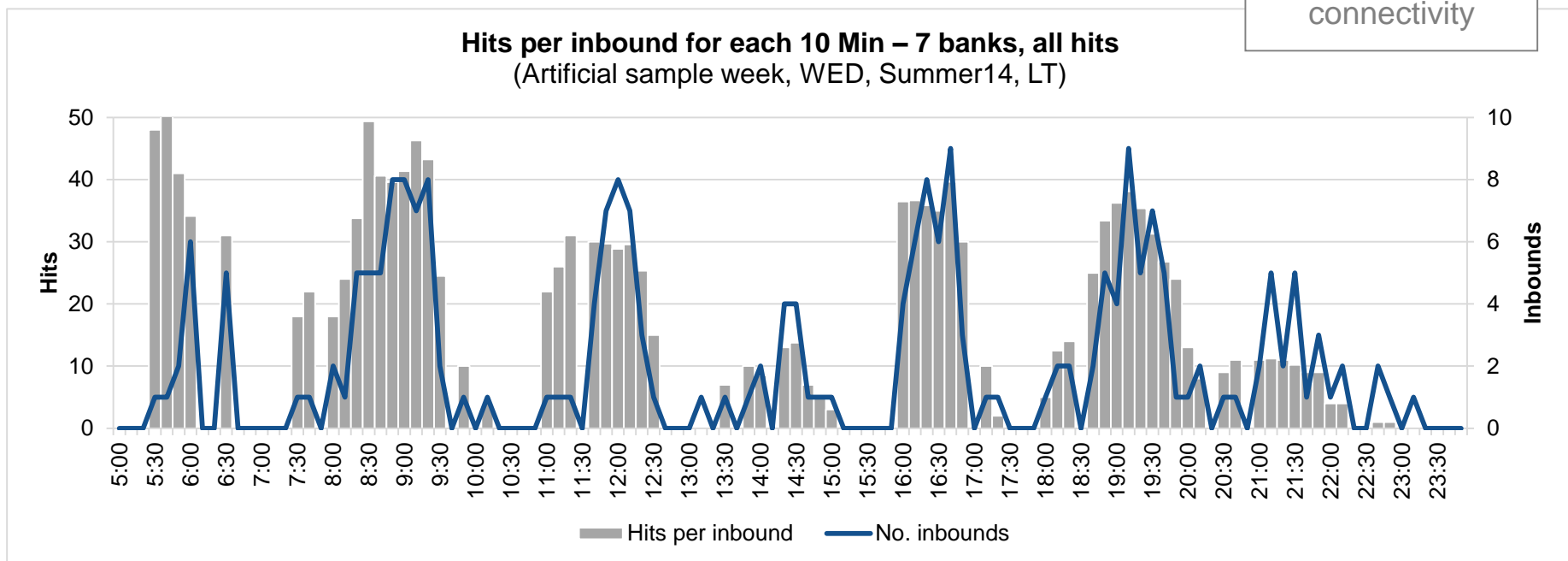
Inbound and outbound flights for sample day Summer2014, UTC



Source: Analyses FATC & M2P Consulting

Second inbound bank with highest connectivity – afternoon bank with lowest hit rate

Analysis example: connectivity

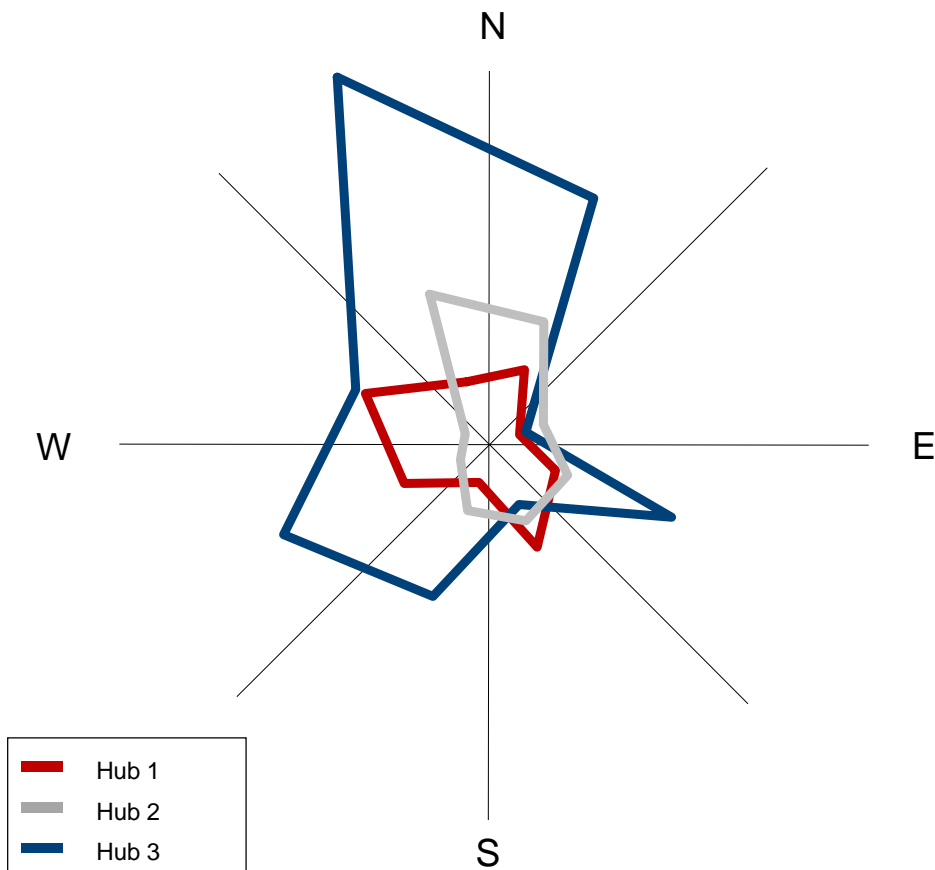


- Morning inbound bank starting at 08:30LT covering cont. and intercontinental connections
- Early afternoon bank with an average hit rate far below average hit rate
- Early morning bank and night bank with typical reversed connectivity characteristics due to local pax traffic

Source: Analyses FATC & M2P Consulting

Hub 1 and 2 with clear directionality – Hub 3 owns sizeable domestic base load

Analysis example: directionality



- Flight pattern of **Hub 1** is **highly directional** - particularly from the Northwest to the Southeast
- **Hub 1** with highest share of short-haul destinations; these destinations are not counted since they are too close to the hub to state directionality
- Less directionality for **Hub 2**, possibly due to higher **local market share**
- The sheer **size** of **Hub 3** results in large traffic flows in all directions
- Most **traffic** of **Hub 3** **towards the North** and Northwest due to domestic connections

Remarks: Directionality pattern based on frequencies of hub carrier (without codeshare).
 Source: FATC & M2P Consulting, artificial sample week Summer 2014

Benchmark: size proves to be main connectivity driver - specific hub conditions also impact performance

Analysis example: benchmarking

Hub (Fleet ¹)	Bank structure ²	Connectivity [hits / inbound]	Productivity ³ [avg. BLHs per day]	Finding
Airline / Hub 1 (11/59)		28	13.2 / 8.7	<ul style="list-style-type: none"> • 2 local pax banks, 4 connex banks, 1 sub bank • Bank structure customised to asymmetric block hours to destinations • Night stops to feed intercontinental outbound
Airline / Hub 2 (26/91)		40	13.6 / 8.4	<ul style="list-style-type: none"> • 6 banks, large overlap • Priority on optimisation of commercially important connections, all other aspects follow • Domestic shuttle flights
Airline / Hub 3 (28/51)		27	15.5 / 8.6	<ul style="list-style-type: none"> • 6 banks, medium overlap • Focus on intercontinental feed / defeed • Small continental destination portfolio
Airline / Hub 4 (11/128)		19	n/a	<ul style="list-style-type: none"> • 6 banks, large overlap • Night stops due to small local market • High number of short haul shuttle flights
Airline / Hub 5 (5/31)		13	n/a	<ul style="list-style-type: none"> • Not a full-size hub • Half the size of critical mass (estimate) • Domestic feed / de-feed drives complexity

Remarks: 1) Fleet size for SS2014, Wide- and Narrowbody; 2) 30 minutes clustering; 3) 2013 numbers: widebody / narrowbody
 Source: Analysis FATC & M2P

Hub screening and bank structure analysis leads to four major results

Product	Content	Result / Benefit
Performance analysis	<ul style="list-style-type: none"> Analyze and compare 'effectiveness' of an airline's number of banks 	<ul style="list-style-type: none"> Transparency and visibility of improvement opportunities
Hub driver analysis	<ul style="list-style-type: none"> Assess hub drivers and influence on hub structure Compare current hub structure with driver characteristics 	<ul style="list-style-type: none"> Alignment of hub structure with business model, fleet development and external influences
Scenario comparison	<ul style="list-style-type: none"> Validate or provide alternative bank structures including route candidates for addition to / removal from network 	<ul style="list-style-type: none"> Increased connectivity Quantified comparison
Benchmark study	<ul style="list-style-type: none"> Conduct performance analysis within agreed parameter framework Derive lessons-learned and differences 	<ul style="list-style-type: none"> Alignment of hub structure with business model, fleet development and external influences

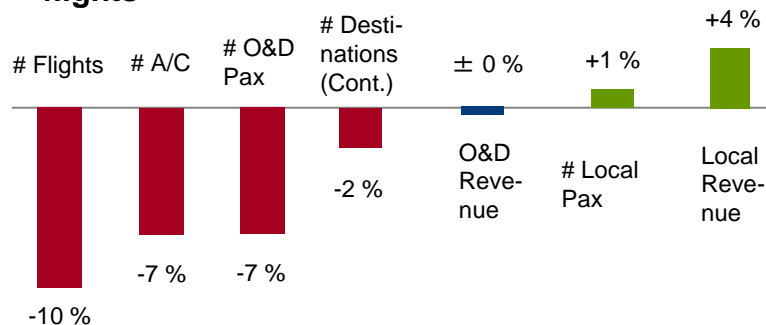
Source: Analyses FATC & M2P Consulting

The approach of FATC and M2P has proven to generate both quantitative and qualitative benefits

Simplified case studies

Quantitative benefits

- Due to reduced growth prospect, client decided to adjust hub size and reduce fleet
- Client felt that actual number of banks was too high for reduced growth path – banks were not properly filled and thus inefficient connection-wise
- Validation of hub performance under new bank structure was conducted by FATC and M2P and led to an **improved connection pattern** – thus, new model delivered **more revenue** despite a 10% **drop in flights**



Source: Analyses FATC & M2P Consulting

Qualitative benefits

- Client was concerned about the number of banks in his hub since that was higher than expected for a carrier of that size
- FATC and M2P performed the validation, proving that the relatively high number of banks was the optimum scenario in terms of connectivity, productivity, and revenues – due to the specific geographic location of the hub, and the specific portfolio of continental destinations
- Besides some **network optimisation hints**, the validation project also provided qualitative benefits:
 - **better transparency** about the interaction between multiple hub drivers, and their impact on a favourable bank structure in a given hub setting
 - **clearer definition** of hub performance KPIs, standardised calculation, better understanding of sensitivity of KPIs against changes of the bank structure (based on analytical tools and benchmark)

FATC and M2P focus on transportation clients and have teamed up to deliver strategic views with strong analytical foundation



Franke Aviation & Transportation Consulting

- **Franke Aviation & Transportation Consulting** offers classic strategy consultancy. Proven success is built on:
 - Leading expert knowledge across all industry sectors
 - Long-standing, international project experience
 - Analytical rigor and methodological excellence
 - Social competence
- Founder **Dr. Markus Franke** as one of the leading European airline experts with **19 years experience**
- Extensive track record of international projects on **strategy, business models, organisation, network & hub planning, operational efficiency**



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- **M2P Consulting** is specialized on aviation consulting with a track record of **16 years of international projects**
- Frankfurt-based, decent growth has led to opening four international offices:
 - New York City
 - London
 - Dubai
 - Hong Kong
- M2P has profound experience with **analytical airline models** (hub & network optimisation, crew planning, etc.), as well as with **process redesign** and **IT specification**

Source: FATC & M2P

FATC and M2P serve renowned clients across all transportation modes with focus on airlines and airports

Selected clients

Aviation	Airlines	Lufthansa germanwings brussels airlines الخطوط الجوية العربية السعودية SAUDI ARABIAN AIRLINES SAS
	Airports & ANSPs	Emirates S7 AIRLINES Eurowings bmi Austrian We fly for your smile. POLISH AIRLINES LOT AIR INDIA ETIHAD AIRWAYS
	Suppliers, investors, public authorities	Fraport DFS Deutsche Flugsicherung Berliner Flughäfen PPL Aena BER FLUGHAFEN BERLIN BRANDENBURG Dubai Airports
	Air Cargo	Ministerstwo Infrastruktury Ministry of Infrastructure MUBADALA DEVELOPMENT IATA GSA Lufthansa Cargo VOLGA-DNEPR GROUP AirBridgeCargo American Airlines Cargo
Postal, Forwarding & Logistics		DHL Deutsche Post World Net PANALPINA on 6 continents KUEHNE+NAGEL
		DB SCHENKER hellmann Worldwide Logistics LUG aircargo handling Thiel Logistik AG
Others (e.g., service providers)		Lufthansa Technik T-Systems vodafone IKEA

Source: FATC & M2P

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