Develop Air Connectivity in the APEC Region

PAPUA NEW GUINEA

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Glossary

The following section presents a list of commonly used expressions and abbreviations found in the report.

Connecting Potential – Common rates of passengers connecting beyond/behind when traveling through a hub to/from a particular region.

Induction/Stimulation – Initial spike in passenger demand when new non-stop service is offered due to better accessibility, shorter travel time, lower cost, etc.

List of Abbreviations

PDEW – Passenger daily each way (passenger demand in each direction between a select origin and destination).

SDEW – Seats daily each way (number of seats offered in each direction on a non-stop or one-stop flight segment).

OD – Origin and destination.

Airport Codes:

AAQ – Anapa, RUS	AYP – Ayacucho, PE	BUR – Burbank, US
ACA – Acapulco, MEX	BCD – Negros Occidental,	BWN – Bandar Seri
ADL – Adelaide, AUS	PH	Begawan, BD
AER – Sochi, RUS	BDJ – Banjarmasin, INA	BXU – Butuan, PH
AGU – Aguascalientes,	BHE – Blenheim, NZ	CAN – Guangzhou, PRC
MEX	BJX – Silao, MEX	CBO – Cotabato, PH
AKJ – Asahikawa, JPN	BKI – Kota Kinabalu, MAS	CCP – Concepción, CHL
AKL – Auckland, NZ	BKK – Bangkok, THA	CEB – Cebu, PH
ANF – Antofagasta, CHL	BLI – Bellingham, US	CEI – Chiang Rai, THA
AOR – Alor Setar, MAS	BMV – Buon Ma Thuot,	CEK – Chelyabinsk, RUS
AQP – Arequipa, CHL	VN	CEN – Ciudad Obregón,
ARH – Arkhangelsk, RUS	BNA – Nashville, US	MEX
ASF – Astrakhan, RUS	BNE – Brisbane, AUS	CGK – Jakarta, INA
ATL – Atlanta, US	BOS – Boston, US	CGO – Zhengzhou, PRC
AUS – Austin, US	BPN – Balikpapan, INA	CGQ – Changchun, PRC

CGY – Cagayan de Oro and Iligan, PH

CHC – Christchurch, NZ

CJA – Cajamarca, PE

CJC – Calama, CHL

CJJ – Cheongwon-gu, ROK

CJU – Jeju, ROK

CKG – Chongqing, PRC

CLT – Charlotte, US

CME – Ciudad del Carmen, MEX

CNS – Cairns, AUS

CNX – Chiang Mai, THA

CSX – Changsha, PRC

CTS – Hokkaido, JPN

CTU – Chengdu, PRC

CUN – Cancun, MEX

CUZ – Cusco, PE

CVG – Cincinnati, US

CXR – Nha Trang, VN

DAD – Da Nang, VN

DAL – Dallas, US

DCA – Washington, US

DEN – Denver, US

DFW – Dallas, US

DGO – Durango, MEX

DGT – Dumaguete, PH

DJB – Jambi City, INA

DLC – Dalian, PRC

DLI – Da Lat, VN

DME – Domodedovo, RUS

DMK – Bangkok, THA

DPS – Bali, INA

DRW – Darwin, AUS

DTW – Detroit, US

DUD – Dunedin, NZ

DVO – Davao City, PH

EAT – Douglas County, US

EWR – Newark, US

EZE – Buenos Aires, ARG

FAT – Fresno, US

FLL – Fort Lauderdale, US

FOC – Fuzhou, PRC

FSZ – Shizuoka, JPN

FUK – Fukuoka, JPN

GDL – Guadalajara, MEX

GEG – Spokane, US

GMP – Seoul, ROK

GUM – Tamuning and Barrigada, GUM

GYS – Guangyuan, PRC

HAK – Haikou, PRC

HAN – Ha Noi, VN

HGH – Hangzhou, PRC

HKG – Hong Kong, China, HKC

HKT – Phuket, THA

HND – Tokyo, JPN

HNL – Honolulu, US

HRB – Harbin, PRC

HUI – Hue, VN

HUZ – Huizhou, PRC

IAD – Washington, US

IAH – Houston, US

ICN – Seoul, ROK

ILO – Ilo, PE

IQQ – Iquique, CHL

IQT – Iquitos, PE

ISG – Ishigaki, JPN

ITM – Osaka, JPN

IWK – Iwakuni, JPN

JFK – New York, US

JHB – Johor, MAS

JJN – Quanzhou, PRC

JNZ – Jinzhou, PRC

JOG – Yogyakarta, INA

JUL – Juliaca, PE

KBR – Kota Bharu, MAS

KBV – Krabi, THA

KCH – Kuching, MAS

KGD – Kaliningrad, RUS

KHH – Kaohsiung, CT

KHN – Nanchang, PRC

KIX – Osaka, JPN

KKE – Kerikeri, NZ

KLO – Kalibo, PH

KMG – Kunming, PRC

KNH – Kinmen, PRC

KNO – Kuala Namu, INA

KOJ – Kirishima, JPN

KRR – Krasnodar, RUS

KUF – Samara, RUS

KUL – Kuala Lumpur, MAS

KWL – Guilin, PRC

KZN – Tatarstan, RUS

LAS – Las Vegas, US

LAX – Los Angeles, US

LED – Saint Petersburg, RUS

SVX – Yekaterinburg, RUS

LGA – NY–La Guardia, US

LGK – Padang Matsirat, Langkawi, MAS

LHW – Lanzhou, PRC

LIM – Lima, PE

LOP – Lombok, INA

LPF – Liupanshui, PRC

LPT – Lampang, THA

MBT – Masbate City, PH

MCC – Sacramento, US

MCO – Orlando, US

MDW – Chicago, US

MDZ – Mendoza, ARG

MEL – Melbourne, AUS

MEX – Mexico City, MEX

MFM – Macau, MAC

MIA – Miami, US

MLM – Alvaro Obregon, Michoacan, MEX

MNL – Manilla, PH

MRY – Monterey, US

MSP – Minneapolis–Saint Paul, US

MTT – Cosoleacaque, MEX

MTY – Apodaca, MEX

MZG – Magong City, CT

NBC – Nizhnekamsk, RUS

NGB – Ningbo, PRC

NGO – Nagoya, JPN

NKG – Nanjing, PRC

NKM – Nagoya, JPN

NNG – Nanning, PRC

NPE – Napier, NZ

NPL – New Plymouth, NZ

NRT – Tokyo, JPN

NSN – Nelson, NZ

NTG – Nantong, PRC

OAK – Oakland, US

OAX – Oaxaca, MEX

OKA – Naha, JPN

OOL – Gold Coast, AUS

ORD – Chicago, US

OVB – Novosibirsk, RUS

OZC – Ozamiz, PH

PDG – Sumatra, INA

PEK – Beijing, PRC

PEN – Penang, MAS

PER – Perth, AUS

PHL – Philadelphia, US

PHX – Phoenix, US

PIU – Piura, PE

PLM – Palembang, INA

PLW – Palu, INA

PMC – Puerto Montt, CHL

PMR – Palmerston North City, NZ

PNK – Pontianak, INA

POM – Port Moresby, PNG

PPQ – Paraparaumu, NZ

PQC – Phu Quoc, VN

PSP – Palm Springs, US

PUS – Busan, ROK

PVG – Shanghai, PRC

PVR – Puerto Vallarta, MEX

PXU – Pleiku, VN

PYX – Pattaya, THA

RDU – Raleigh, Durham, US

REP – Siem Reap, KHM

REX – Reynosa, US

RGN – Mingaladon, MMR

RNO – Reno, US

ROC – Rochester, US

ROT – Rotokawa, NZ

ROV – Rostov-on-Don, RUS

RSU – Yeosu, ROK

RTW – Saratov City, RUS

RXS – Roxas City, PH

SAN – San Diego, US

SCL – Santiago, CHL

SEA – Seattle, US

SFO – San Francisco, US

SGN – Ho Chi Minh, VN

SHA – Shanghai, PRC

SHE – Shenyang, PRC

SIN – Singapore, SGP

SIP – Simferopol, UKR

SJC – San Jose, US

SJD – San Jose del Cabo, MEX

SLC – Salt Lake City, US

SLP – San Luis Potosi, MEX

SMF – Sacramento, US

SNA – Santa Ana, US

SOC – Solo/Surakarta, INA

SPN – Saipan, US

SRG – Semarang, INA

STL – St. Louis, US

STW – Stavropol Krai, RUS

SUB – Surabaya, INA

SVO – Moscow, RUS

SVX – Koltsovo, RUS

SWA – Jieyang Chaoshan, PRC

SYD – Sydney, AUS

SYO – Sakata, JPN

SYX – Sanya, PRC

SZX – Shenzhen, PRC

TAC – Tacloban, PH

TAM – Tampico, MEX

TAO – Qingdao, PRC

TAV – Tau, ASM

TBP – Tumbes, PE

TDX – Trat, THA

TGG – Kuala Terengganu, MSA

TGZ – Chiapa de Corzo, MEX

TIJ – Tijuana, MEX

TKG – Bandar Lampung, INA

TLC – Toluca, MEX

TNA – Jinan, PRC

TPE – Taipei, CT

TPP – Tarapoto, PE

TRC – Torreon, MEX

TRU – Trujillo, PE

TSA – Songshan, CT

TSN – Tianjin, PRC

TTJ – Tottori, JPN

TXG – Taichung, CT

TYN – Taiyuan, PRC

UFA – Ufa, RUS

UIH – Qui Nhon, VN

UKB – Kobe, JPN

UPG – Makassar, INA

URC – Urumqi, PRC

USM – Koh Samui, THA

VCL – Chu Lai, VN

VDH – Dong Hoi, VN

VER – Veracruz, MEX

VII – Vinh, VN

VKO – Moscow, RUS

VOZ – Voronezh, RUS

VSA – Villahermosa, MEX

VVO – Vladivostok, RUS

WAG – Whanganui, NZ

WEH – Weihai, PRC

WLG – Wellington, NZ

WNZ – Wenzhou, PRC

WRE – Whangarei city, NZ

WUH – Wuhan, PRC

WUX – Wuxi, PRC

XIY – Xi'an, PRC

XMN – Xiamen, PRC

YEG – Edmonton, CDA

YGJ – Yonago, PRC

YHZ – Halifax, CDA

YKA – Kamloops, CDA

YLW – Kelowna, CDA

YNJ – Yanji, PRC

YOW – Ottawa, CDA

YPR – Prince Rupert, CDA

YQM – Moncton, CDA

YQR – Regina, CDA

YSJ – Saint John, CDA

YTS – Timmins, CDA

YUL – Montreal, CDA

YVR – Vancouver, CDA

YWG – Winnipeg, CDA

YXC – Cranbrook, CDA

YXS – Prince George, CDA

YXT – Terrace-Kitimat, CDA

YYB – North Bay, CDA

YYC – Calgary, CDA

YYJ – Victoria, CDA

YYZ – Toronto, CDA

YZP – Sandspit, CDA

YZR – Sarnia, CDA

ZAL – Valdivia, CHL

ZCL – Calera de Victor Rosales, MEX

ZQN – Queenstown, NZ

ZUH – Zhuhai, PRC

1. Introduction to the project

The APEC Secretariat and Economies have observed that the flow of goods, services, capital and people in the APEC Region is constrained by air connectivity limitations and gaps that exist between the APEC economies, particularly between the Americas and Asia Pacific. Improving connectivity is a long-term target of the APEC economies. The APEC Tourism Working Group (TWG) and Transport Working Group (TPTWG) are particularly interested in pursuing this long-term target.

This Project (the "Project") was proposed in 2014 by Thailand and co-sponsored by Australia; Indonesia; Malaysia; Peru; the Philippines; and Chinese Taipei and aims to develop air connectivity in the APEC Region and in turn stimulate a more efficient flow of goods, services, capital and people. The Project has the following objectives:

- To develop market demand-based recommendations for potential new routes, improved flight schedule connection times, and hubs between APEC economies based on analysis of air passenger flow, schedules and new aircraft range capability, including analysis of the number of seats, flights and air traffic.

- To help airlines and regulators develop more accurate demand predictions so they can in turn help APEC economies by providing better air connectivity services, capacity and schedules.

The Project was approved in December 2014, with IATA Consulting selected as the consultant in May 2015. IATA was mandated to complete the following tasks:

1. Develop market demand-based recommendations for potential new routes.

2. Provide recommendations to improve connections between flights at the main hubs linking the APEC economies.

3. Determine which APEC market-pairs could benefit from the introduction of new aircraft with extended range.

2. Approach followed and data used

This section explains the methodology applied by IATA and presents the data used to feed the various underlying analysis. To conduct the analysis, IATA took systematic steps identified in Figure 1.
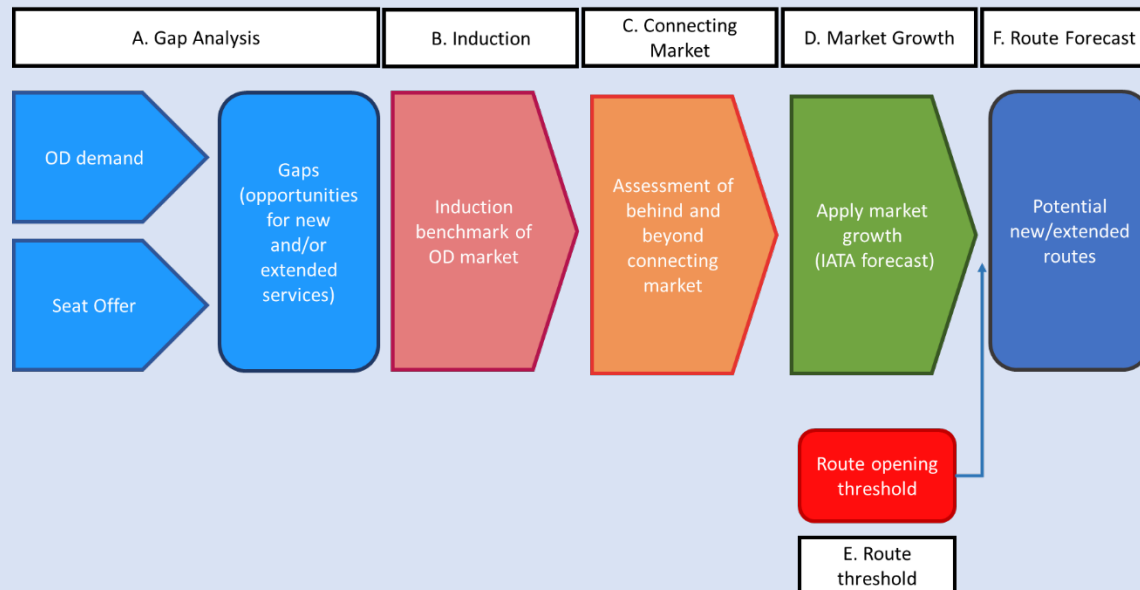
Figure 1: Process used to complete analytical work

The first step involved a demand-supply gap analysis aimed at identifying the unserved routes, presenting potential demand for future development. The size that this potential demand could actually represent if turned into direct service in the future was subsequently forecast, using realistic assumptions related to induction, connecting potential and demand growth.

2.1 Data fueling the model

Principal data for the model originates from Airport IS. IATA's Airport IS system uses IATA billing and settlement plan data to provide detailed demand and supply information on total air traffic. This data has been available for over a 10-year historical period (since 2005).

> *Approximately 18,500 international APEC routes were analyzed in the execution of this study. Airport IS data was particularly relevant in the gap analysis and assumption development.*

Academic articles and published ratios were also used to justify some of the assumptions, including induction and origin destination traffic captured through direct service.

For some of the other variables used in the final traffic determination, economic forecasts were extracted from IHS Global Insight, one of the world's largest commercially available economic databases.

Tourism data was extracted from the World Travel and Tourism Council.

2.2 Gap analysis

IATA applied a funnel approach in conducting the analysis. It first considered the market at the economy pair level, followed by city pairs leading to a market potential assessment (see figure below). Both seat supply and seat demand were considered in the analysis to identify gaps in air service.

Economy pairs
gap analysis

Unserved
airport pairs
identification

Market
potential
assessment

Route selection
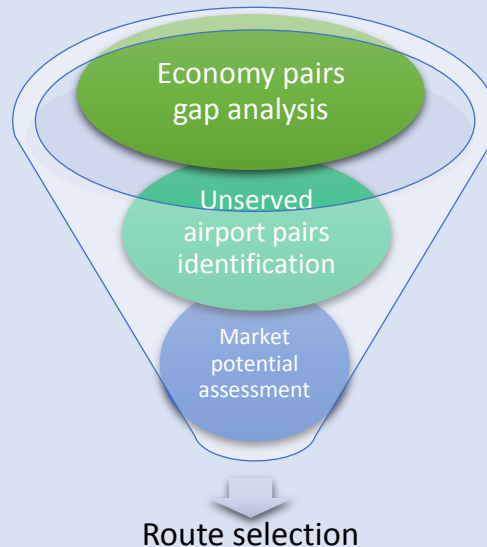
Figure 2: Funnel approach used to conduct analysis

The economy-pair analysis allowed IATA to identify unserved markets.

As an illustration, the analysis showed that there is a daily demand of 134 Passengers Daily Each Way (PDEW) via existing connecting routings between PNG and Australia, while 780 non-stop services are presently available.

When extending the analysis down to the city pairs it was possible to identify the largest unserved routes between the two economies: 39 Passengers Daily Each Way (PDEW) travelled between POM and MEL in 2015.

The top 20 unserved routes for PNG within APEC region are presented in the table below.

Origin Airport	Origin Economy	Destination Airport	Destination Economy	2015 OD Demand (PDEW)	non-stop seats in 2015 (SDEW)	1-stop seats in 2015 (SDEW)
POM	Papua New Guinea	MEL	Australia	39	0	0
POM	Papua New Guinea	AKL	New Zealand	18	0	0
LAE	Papua New Guinea	BNE	Australia	12	0	7
MAG	Papua New Guinea	HKG	Hong Kong, China	11	0	0
POM	Papua New Guinea	PER	Australia	9	0	0
POM	Papua New Guinea	TSV	Australia	8	0	0
POM	Papua New Guinea	ADL	Australia	6	0	0
POM	Papua New Guinea	CBR	Australia	6	0	0
LAE	Papua New Guinea	CNS	Australia	6	0	0
LAE	Papua New Guinea	MNL	The Philippines	6	0	0
LAE	Papua New Guinea	SIN	Singapore	5	0	0
POM	Papua New Guinea	KUL	Malaysia	4	0	0
POM	Papua New Guinea	WLG	New Zealand	3	0	0
HGU	Papua New Guinea	BNE	Australia	3	0	0
MAG	Papua New Guinea	BNE	Australia	3	0	0
LAE	Papua New Guinea	HKG	Hong Kong, China	3	0	0
RAB	Papua New Guinea	BNE	Australia	2	0	0
HGU	Papua New Guinea	SIN	Singapore	2	0	0
POM	Papua New Guinea	CHC	New Zealand	2	0	0
POM	Papua New Guinea	BKK	Thailand	2	0	0

Table 1: Top 20 unserved routes within APEC, 2015 data

2.3 Induction

To determine realistic estimates of the success of new air service, various assumptions were considered and applied to current passenger demand.

Induction is a well proven concept that explains how new direct air service has a significant impact on increasing the total number of O&D passengers on a city-pair market. This is due to product improvement: shorter travel time, greater convenience and more affordable ticket prices. The extent to which the market will be stimulated varies based on current levels of service (price and flight frequency) offered on a particular route. As stated in the Successful Air Service Development presentation (ICF International, 2014) a market's first non-stop flight can stimulate demand by 100% to 300%.

IATA quantified this induction value to show a relationship between two primary factors: region pair and the size of the market before a new route is initiated.

The table below shows the stimulation rates considered for this analysis of Papua New Guinea. For some instances where inadequate data (less than 4 routes) to conduct a region pair analysis was available, other variables were considered, including the average of all routes, the average of long-haul routes or the average of short-haul routes, depending on the specific market.

Overall, potential routes to Papua New Guinea have high rates of market stimulation due to the small existing market sizes.

Market	Base of 10,000 Annual Pax	Base of 25,000 Annual Pax	Base of 50,000 Annual Pax
All APEC Economies	130%	42%	18%
Long Haul	101%	36%	16%
Short Haul	150%	50%	21%
Australasia - Asia	124%	39%	17%
Australasia - South East Asia	159%	75%	44%
Australasia - China	65%	15%	5%

Table 2: Stimulation rates applied to the analysis

2.4 Connecting potential

Increasing the quality of connections through alliance agreements, codeshares, shorter journey times or fewer stops increases overall travel demand in connecting markets. It is a normal phenomenon for new routes to not only increase demand for the city pairs served but also for beyond and behind destinations that are now more easily accessible (Swan, 2008). On long-haul routes, typically two-thirds of the passengers will make a connection.

IATA's analysis found that connecting markets would stimulate at various rates depending on the region of origin and the hub airport being flown through. These ratios are applied in determining the impact of a new route on connecting flows. For Papua New Guinea it is the hubs at the destinations flown to which will have an impact on this value

	NRT	MNL	SIN	BNE	SYD	MEL
Papua New Guinea	12.3%	19.6%	54.1%	15.8%	15.5%	11.7%

Table 3: Connecting potential rates used when flying to/from Papua New Guinea the following hubs

2.5 Demand growth

This refers to the consideration of the natural growth observed on a market segment. IATA Economics publishes a detailed inter- and intra-regional global traffic forecast. These demand growth forecasts were used to provide a regionally specific rate of growth to and from PNG between 2016 and 2018. Growth was typically seen to be around 5%. Demand growth also refers to the fact that approximately 80% of a market will choose a non-stop flight option if it is available (Belobaba, 2015).

2.6 Other

Other factors, including distance and available traffic rights, were used to refine the assessment of potential new service to be offered. Distance considers the feasibility of offering a nonstop flight with existing technology, using 15,000 km as a maximum distance. Available traffic rights consider the bilateral agreements between economies and the current use of those bilateral rights.

2.7 Final route forecast

After conducting the gap analysis and applying the established rates from the various assumptions, the future market potential was estimated, as illustrated in Figure 3 below for the POM-MEL route.

| | | | | | 1 | 2 | 4 | |
Origin Airport	Destination Airport	Destination Airport	Destination Economy	2015 OD Non-direct Demand	OD Captured Though Deorect Service	OD Stimulation	Behind/Beyond Connecting Potential	Caculations
POM	PNG	MEL	Australia	(A) 39	(B) 80%	(C) 80%	(D) 12%	
					(1) 31			(1) = AxB
					(2)	25		(2) = 1xC
				Subtotal (3)		59		(3) = 1+2
			POM - MELTotal Market Potential (2015 Base)				(4) 63	(4) = 3/(1-D)

Figure 3: Example of the various assumptions being applied to determine the potential for a new air service.

3. Papua New Guinea

A summary of Papua New Guinea (PNG)'s economy and demographics, aviation demand, and airport-specific information is presented in this section.

3.1 Economy and demographics

Papua New Guinea (PNG) is a developing economy that occupies the eastern half of the island of New Guinea and its offshore islands in Melanesia, a region of the south-western Pacific Ocean (see Figure 5 above). Australia (to the south), Indonesia (to the west), and the Solomon Islands (to the east) are the closest neighbouring nations to PNG.

3.1.1 Demographics

Papua New Guinea has a population of approximately 7.1 million, with only 13% living in urban centres (The World Bank, 2016). With its remote population, the PNG is very culturally diverse with approximately 852 listed languages. Approximately 40% of the economy's population lives a self-sustainable lifestyle with no access to global capital (The World Bank, 2016). The dispersed population and mountainous terrain necessitates air travel as the sole means of transportation to many of the remote communities in PNG. Air travel is vital in terms of economic and social development for the economy:

City	Population (million)
1. Port Moresby	364
2. Lae	148
3. Wewak	38
4. Madang	36
5. Mount Hagen	29
6. Kimbe	23

Table 4: Largest cities in Papua New Guinea 2011 Source: (City Population, 2015)

3.1.2 Economy

Papua New Guinea has a relatively small economy with the International Monetary Fund listing PNG as a 'developing economy' (IMF, 2015). The economy has seen strong economic growth in recent years with a boom in the mining and resource sector and an average GDP growth of 7.4% between 2006 and 2013. PNG is a resource exporting economy and is subject to commodity price cycles (Flanagan, 2016). Future growth in Papua New Guinea is slowing due to international and domestic factors (Voigt-Graf, 2015). Low prices for commodity exports and unfavourable weather have dimmed the outlook for agricultural output and exports in 2016 (Asian Development Bank, 2016).

In the longer term, however it is likely that PNG will see strong growth again with projects such as increased liquefied natural gas production and other commodity exports. Overall PNG is a resource rich economy and agriculture potential is high in many regions. As national transport improves along with service delivery it will increase the ability to extract resources and for rural workers to participate in the economy (Asian Development Bank, 2016).
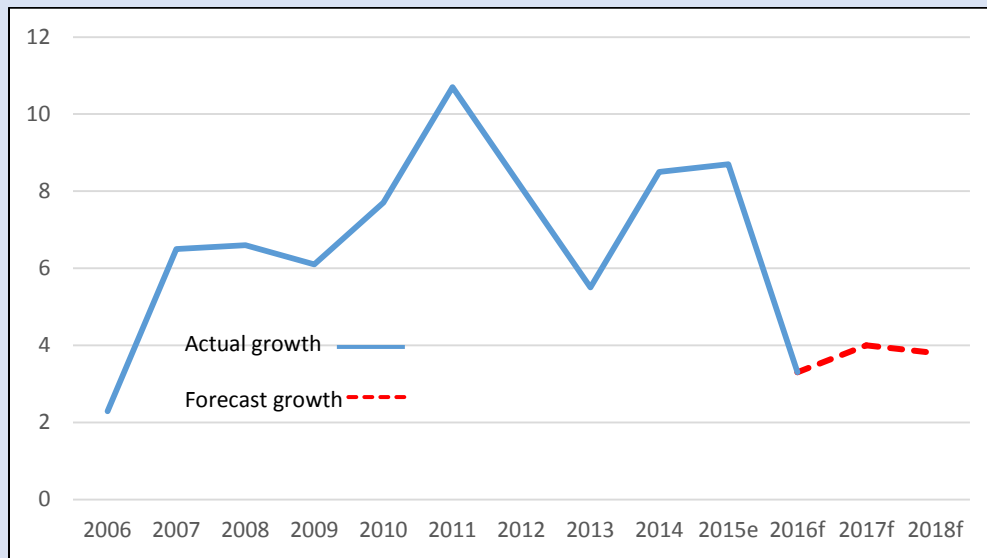
Figure 4: Annual GDP growth PNG (Source: World Bank, 2016).

3.1.3 Tourism

Tourism is a small but growing industry in Papua New Guinea, in 2013 the economy received 174,000 international visitors (The World Bank, 2016). There are various attractions including the culture and festivals, the landscape including beaches and mountains with unique flora and fauna, and outdoor activities such as diving, surfing, hiking, and fishing. Tourism represents 1% of total GDP, generating 24,000 jobs. The sector is forecast to grow by 4.3% p.a. between 2014 and 2024 (World Travel & Tourism Council, 2014). International tourism is very small relative to domestic tourism in PNG representing only a fraction of total spending.

In March 2016 current travel advisories by other APEC members such as Australia and Canada advised to exercise a high degree of caution when visiting Papua New Guinea due to the potential for serious crime (Australian Government, 2016). This level of caution is higher than in other Pacific island nations, yet the same as neighbouring Indonesia and other Southeast Asian nations. Visas are required to visit Papua New Guinea and must be obtained prior to arrival for most foreign nations.

In 2015, PNG hosted the Pacific games, a multi-sport event with participation exclusively from nations around the South Pacific. This event brought approximately 3,700 participating athletes to the Papua New Guinea along with thousands of visitors and significant media attention (Pacific Games Limited, 2015).

3.2 Aviation demand

3.2.1 Recent demand growth

Air travel demand to and within PNG has increased significantly over the past decade as a result of the increased economic activity. The number of visitors tripled in the last decade, which has been closely linked to the expanding economy (Voigt-Graf, 2015). Data on reasons for international visitor arrivals found that business and employment are the main drivers of increased passenger travel to PNG since 2009, with the number of passengers on holiday remaining relatively the same at 25,000 per year (Voigt-Graf, 2015). In 2010, the total air passenger traffic in the Papua New Guinea was approximately 2.5 million passengers and traffic is forecast to grow to more than 6 million in 2020 (Oxford Business Group, 2014).

3.2.2 Current air services to Papua New Guinea

Internationally, all of the air services to PNG are focused at POM. The flag carrier Air Niugini is the principal provider of international air services to POM linking five APEC economies with regular non-stop services. QantasLink, Philippine Airlines, and Virgin Australia provide international services to CNS, MNL, and BNE respectively.

Figure 5: Non-stop international service from PNG within the APEC region 2016 (Source: Airport IS)

3.2.3   Aviation and the economy

Air travel is particularly important for domestic travel in Papua New Guinea due to the mountainous terrain and limited road access. Port Moresby, the economic centre of the economy, is not linked to any other major city by road, necessitating air travel for passenger and freight transportation (CAPA, 2016). For its size and population, PNG has a relatively well-developed system of air services (Asian Development Bank, 2011).

3.2.4   Government position on aviation

The sustainability of air services was threatened by many of the 22 national airports failing to meet ICAO safety and security standards. The Civil Aviation Development Investment Programme (CADIP) was established as a means to bring operational safety and efficiency up to international standards and improve capabilities and capacity of the existing airports.

The outcome is safer, and more secure, and provides more efficient all-weather access to air transport services in the project areas (ADB, 2013). Each year the PNG government has invested in this program and it has been supported by the Asian Development bank and the Government of Australia.

In 2008, seven of Papua New Guinea's airports were certified to meet ICAO standards, and according to the PNG Medium Term Development Plan, as of 2015, all of the 22 airports are supposed to be certified (Oxford Business Group, 2014). These improvements have led to more robust runways and supporting infrastructure, permitting the deployment of larger aircraft to certain destinations. Funding for improvements have been approved through to 2017.

International Air Services

The government has a number of priorities, specifically focussed on attracting and increasing international air services.

As part of the airport improvement plan, the government aims to provide international flight facilities and international access to select secondary airports. This would provide an effective alternative if POM closes due to inclement weather and would facilitate international tourism to other regions of the economy (Department of Transport, 2013).

Overall, the government policy encourages competition in air services. The government is not however prepared to commence an open skies regime, instead, take a phased approach towards full liberalization, with the aim of achieving fair and equitable competition for each economy's carriers (Department of Transport, 2013). The government hopes to provide improved and reasonably priced international services to establish PNG as a gateway between continents.

Unfortunately, a number of the international destinations served by Air Niugini have low demand giving the flag carrier an effective monopoly on some important routes (Asian Development Bank, 2011). Internationally owned carriers will not be permitted to enter the domestic PNG market.

3.3 Airport-specific information

3.3.1   Busiest airports in Papua New Guinea

Port Moresby's Jacksons International Airport (POM)

POM is the main international gateway to Papua New Guinea and serves almost half of the economy's total air traffic (Oxford Business Group, 2014). The airport is situated 8km from the centre of Port Moresby (Papua New Guinea Tourism Authority, 2015). As the busiest airport in PNG and the hub for Air Niugini and PNG Air, it operates a domestic and international terminal which are adjacently connected. The airport has one runway of 2,750m.

Recently the airport underwent a major terminal upgrade in preparation for the 2015 Pacific games. This upgrade saw a doubling of check-in facilities, a new international screening area, immigration, customs and quarantine processing areas, and a new lounge area. The upgrade also improved the retail and restaurant offerings within the terminal.

For the limited traffic statistics available, the total traffic at POM increased from 1.5 million passengers in 2012 to 1.7 million in 2014.

3.3.2   Principal airline operators

There are three airlines with scheduled service are based in Papua New Guinea: Air Niugini, PNG Air, and Travel Air.

Air Niugini

Air Niugini is the national state-owned airline of PNG which commenced operations in 1973. Currently the carrier has restrictions on foreign ownership. Air Niugini operates both a domestic and international network of routes. The airline has a hub in POM and currently serves 32 destinations (21 domestic and 11 international) with scheduled services.

From POM, the airline serves a number of international destinations in APEC, including NRT, HKG, SIN, DPS, and CNS, BNE, and SYD. The airline operates a mixed fleet of 26 aircrafts including: Bombardier Dash 8, Boeing 737 and 767, and Fokker 70 and 100 aircraft.

PNG Air

The second most prominent airline of Papua New Guinea is PNG Air, founded in 1987. With its hub in POM, the airline offers domestic service to 22 destinations. The carrier operates 20 turboprop aircrafts, composing of ATR-72 and Bombardier Dash 8 aircraft.

Travel Air

Travel Air is a relatively new entrant in PNG, which commenced services in 2011. The carrier offers domestic services to 11 destinations on Fokker 50 aircraft.

4. Medium-term new route opportunities

This section of the report is dedicated to explaining the potential future air service developments to and from Papua New Guinea within the APEC region over the next three years. Service gaps, route traffic forecasts, and high-level feasibility analysis will be conducted.

4.1 Service gaps

As part of the process, air services to Papua New Guinea were considered at an economic-pair and city-pair basis.

4.2 Economic-pair analysis

The following chart outlines the demand for air travel between Papua New Guinea and other APEC economies and the related supply. Essentially, the data shows the economy pairs where non-stop service is sufficiently supplied (in green), where air service could be improved (in yellow) and where air service is at a large shortfall (in red). Typical ratios found in highly liberalized domestic markets with adequate capacity for demand ranges from 60% to 80%. This ratio is attributed to the fact that aircrafts usually fly at under 80% load factors, and there is a natural phenomenon for approximately 20% of passengers to take connecting options.

In some cases, the demand-to-supply ratio is under 60%. In such instances, supply is adequate and the low percentage figure may be representative of high rates of connecting passengers flying between nations (i.e. Domestic service in PNG is 50%, as many passengers flying in the economy take connecting options). Where demand-to-supply ratios are higher than 80%, seat offer could be increased between economy pairs.

Origin Economy	Demand (PDEW)	Non-Stop Seat Offer (SDEW)	One-Stop Seat Offer (SDEW)	Ratio of Demand to Supply
Australia (AUS)	610	779	0	78%
Brunei Darussalam (BD)	0	0	0	*
Canada (CDA)	0	0	0	*
Chile (CHL)	0	0	0	*
People's Republic of China (PRC)	4	0	0	*
Hong Kong, China (HKC)	64	74	0	86%
Indonesia (INA)	16	18	0	87%
Japan (JPN)	18	19	0	92%
Republic of Korea (ROK)	1	0	0	*
Malaysia (MAS)	5	0	0	*
Mexico (MEX)	0	0	0	*
New Zealand (NZ)	24	0	0	**
Papua New Guinea (PNG)	4,895	7,465	2,285	50%
Peru (PE)	0	0	0	*
The Republic of the Philippines (PH)	76	87	0	87%
Russia (RUS)	0	0	0	*
Singapore (SGP)	107	134	0	80%
Chinese Taipei (CT)	0	0	0	*
Thailand (THA)	3	0	0	*
United States (US)	2	0	0	*
Viet Nam (VN)	0	0	0	*

Table 5: Total daily demand (PDEW), non-stop seat offer (SDEW),one-stop seat offer (SDEW) and demand-to-supply ratio (Source: IATA analysis of Airport IS Data)

* Delineates an economy pair with no air services that has inadequate demand to consider air services in the long term

** Delineates an economy pair with no air services that may have adequate demand for service in the long term (next 10 years)

Based on the analysis at the economy level, Papua New Guinea will likely need to improve service to three economies in the long term (highlighted in yellow) and could take actions to increase service frequencies with four economies in the medium term if traffic levels grow (highlighted in red). The remaining 14 destination economies are adequately served or have inadequate demand for non-stop

services. The following section will look into greater detail at these shortfalls in supply at a city-pair level.

4.2.1 City pair analysis by APEC economy

Origin City	Origin Economy	Destination City	Destination Economy	Demand PDEW
POM	Papua New Guinea	MEL	Australia	39
LAE	Papua New Guinea	BNE	Australia	12
POM	Papua New Guinea	PER	Australia	9
POM	Papua New Guinea	TSV	Australia	8
POM	Papua New Guinea	ADL	Australia	6
POM	Papua New Guinea	CBR	Australia	6
LAE	Papua New Guinea	CNS	Australia	6
HGU	Papua New Guinea	BNE	Australia	3
MAG	Papua New Guinea	BNE	Australia	3
MAG	Papua New Guinea	HKG	Hong Kong, China	11
LAE	Papua New Guinea	HKG	Hong Kong, China	3
POM	Papua New Guinea	KUL	Malaysia	4
POM	Papua New Guinea	AKL	New Zealand	18
POM	Papua New Guinea	WLG	New Zealand	3
LAE	Papua New Guinea	MNL	The Philippines	6
LAE	Papua New Guinea	SIN	Singapore	5

Table 6: APEC routes to PNG over 3 PDEW with no non-stop service (Source: IATA analysis of Airport IS data.)

When considering the shortfall in service to city pairs in Papua New Guinea, 16 routes were examined which have a demand of over 3 PDEW with no non-stop service.

Australia

Australia is the largest international market for Papua New Guinea with approximately 610 PDEW and a supply of 779 SDEW. The greatest air service development opportunities for Papua New Guinea are currently in Australia. According to the Australian Airports Association, Air service agreements between the two economies are a factor that could be constraining market growth (Australian Airports Association, 2015). Overall, the supply and demand is relatively aligned with one new route opportunity from POM to MEL identified in section 4.3.2 below.

Hong Kong, China

Hong Kong, China is adequately served from PNG with an average 74 SDEW. Due to the high demand-to-supply ratio, additional frequencies between the two economies could become viable in the

medium term. Due to demand from HKG to other destinations outside of POM in Papua New Guinea, and if other international routes are established in PNG in the long term, HKG could be a viable destination.

New Zealand

At an economy level, New Zealand is the largest unserved market from Papua New Guinea. Although demand is not sufficient at any city pairs to commence service in the medium term, there is a potential that as market growth continues, service could become viable in the long term between AKL and POM.

4.3 Route traffic forecast

Selected routes which have strong development potential are further examined. A traffic forecast based on historical market trends, induction, connecting potential and expected economic and tourism development is presented in this section.

4.3.1   Preliminary feasibility/viability considerations

City pairs with over 10 PDEW (3,650 annual passengers each way) were considered as the minimum threshold for analysis. There are four routes to and from Papua New Guinea that met this criterion.

As a way to further define a viable route selection, IATA used two metrics: distance and market size. Due to aircraft range restrictions, city pairs with distance over 15,000km apart from one another are eliminated. The second criterion used the application of induction and connection potential rates (unique to each region and route type) to determine if the route would garner demand of a minimum 130 PDEW for long-haul routes (longer than 4,000km), or 75 PDEW for short-haul routes.

The selection process is seen below in table 7.

Origin Airport	Origin Economy	Destination Airport	Destination Economy	2015 OD Demand	2015 Estimated Market Potential	Distance viable for non-stop flight with current technology	Market size adequate for non-stop service in medium term	Proposed Route
POM	Papua New Guinea	MEL	Australia	39	70	✔	✔	Yes
POM	Papua New Guinea	AKL	New Zealand	18	35	✔	✘	No
LAE	Papua New Guinea	BNE	Australia	12	22	✔	✘	No
MAG	Papua New Guinea	HKG	Hong Kong, China	11	36	✔	✘	No
POM	Papua New Guinea	PER	Australia	9	15	✔	✘	No
POM	Papua New Guinea	TSV	Australia	8	13	✔	✘	No

Table 7: Viable distance is used as any route under 15,000km, and viable demand is calculated as any route serving a minimum of 75 PDEW within the coming three years. Calculations are shown in market potential analysis below.

The selection eventually yielded one route to be considered for further analysis (POM-MEL).

4.4 Proposed route analysis

Based on the filtering process applied above, IATA eventually identified one route that could potentially be connected through a direct service in the medium term. This section decomposes the route potential and presents a forecast of the current demand in the medium term.

4.4.1   Route MEL-POM

2015 MEL-POM total route potential definition:

Origin Airport	Destination Airport	Destination Airport	Destination Economy	2015 OD Non-direct Demand	OD Captured Though Deorect Service	OD Stimulation	Behind/Beyond Connecting Potential	Caculations
POM	PNG	MEL	Australia	(A) 39	(B) 80%	(C) 80%	(D) 12%	
					(1) 31			(1) = AxB
					(2)	25		(2) = 1xC
				Subtotal (3)		59		(3) = 1+2
			POM - MELTotal Market Potential (2015 Base)				(4) 63	(4) = 3/(1-D)

IATA estimates that the POM-MEL route could present a market potential of 67 PDEW in 2016 if a direct service were to be introduced.

This potential would grow to 74 by 2018, as displayed below. This forecast uses the 2015 estimated demand and applies to it the IATA inter- and intra-regional global traffic forecast published by our Economics Division.

Economy Pair	City Pair	Served in 2015	2015 OD Base	2016	2017	2018
Australia-Papua New Guinea	POM-MEL	No	63	67	70	74

4.5 High-level feasibility analysis

This section considers the above route through three main feasibility criteria:

- air service agreements
- airline network strategies and fleets
- route economics

Additionally, proposed operational aspects of the route are presented, including an indicative start date based on market maturity, a proposed airline to serve the route, type of aircraft to be used, flight frequency, and estimated load factors.

4.5.1   Route MEL-POM

MEL-POM is a short-haul route (about 3,100 KM) that could potentially be served with a regional aircraft such as the Fokker 70 for instance that has a range of 3,450km (fully loaded).

This kind of aircraft typically offers between 72 and 85 seats depending on the cabin configuration. It will therefore require a smaller base level of passenger demand to operate a profitable air service. It is indeed estimated that a load factor of 65% would allow to break even operations with this kind of aircraft – namely 47 to 55 passengers per flight.

From that point of view, the POM-MEL route such as estimated by IATA could become a viable service from 2016 onwards, as it displays a market potential of 67 PDEW in 2016.

In terms of airlines, Air Niugini, the local PNG airline, would be a natural candidate to operate the route, due to their strong establishment on the local market and their fleet that counts nine Fokker 70 aircraft. Their 80-seat cabin configuration would set the minimum demand level at 52 passengers per flight.

Considering the 2016 estimated demand, a daily service could be operated as from inception, making the route particularly attractive.The proposed service would therefore allow for an 84% average load factor, as illustrated below:

Route (non-directional)	Minimum Opening Date	Airline	Aircraft	#of Seats	Flight Frequency per week	Number of Pax per Flight	Load Factor
MEL-POM	16-Oct	Air Niugini	Fokker 70	80	7	67	84%

Finally, in terms of air service agreements, IATA does not foresee any road blocker for this route to be operated. This point should however be further validated based on the official bilateral agreements in place (not available for the consultation to IATA).

5. Other opportunities

In addition to the development of new air services in the medium term, other opportunities for air service development such as connectivity improvement, route frequency increases, and long-term developments are also presented.

5.1 Connectivity improvement

This section identifies poorly connected markets that could be better served by improved connecting times, hence granting additional access to already existing yet less accessible connecting markets.

IATA examined international flights from POM to CNS, SYD, NRT, HKG, MNL, and BNE, and identified the largest beyond and behind connecting markets at these connecting points. Based on an optimal 45-minute to 120minute connecting window, IATA developed a series of suggested improvements pertaining to certain flight schedules between POM-BNE and POM-CNS.

BNE

BNE is the main international destination from PNG.

The analysis carried out highlighted that connecting flows on the main connecting markets are currently optimized.

However, on smaller connecting markets, some schedule adjustments could be made to optimize accessibility to beyond destinations:

- For Virgin Australia flight 188 from POM arriving at 17:10, postponing the flight arrival time by two hours in BNE would not only offer a shorter connecting time for beyond travel to PER, it would also make it possible to catch connections to WLG and CHC. These improvements would make the PER product more attractive and make it possible to enhance connectivity to WLG and CHC.
- For Air Niugini flight 5 arriving in BNE at 16:40, postponing the current arrival time by 60 minutes would shorten the connecting time for beyond travel to PER (currently three hours connecting).
- For Air Niugini flight 3 arriving at 09:25, beyond connections to CBR could be made more attractive by postponing the arrival time of the incoming flight by two hours, in order to shorten the connecting time to approximately two hours (instead of four hours wait time)

CNS

CNS serves as a connecting point for several domestic destinations in Australia. Based on the current schedule of flights to TSV, passengers must typically wait over three hours to have a connecting option. Shifting the arrival time of the Qantas flight 192 and the Air Niugini flight 90 by close to an hour would make this connecting option more interesting.

5.2 Route frequency increase

IATA considered all of the international non-stop routes from PNG to determine whether the current supply adequately matches the demand. IATA identified a route on which the current demand exceeds supply by close to 30%:

Origin Airport	Origin Economy	Destination Airport	Destination Economy	2015 OD Demand	Direct Seats in 2015	Demand Excess over supply	Ratio of Demand to non-stop Supply
POM	Papua New Guinea	SYD	Australia	53	41	11	127%

Table 8: Description of the route for frequency increase

Currently, Air Niugini serves SYD with a Boeing 737 on a biweekly basis. Increasing supply to a three-weekly service should allow to capture this exceeding demand and maybe even attract additional passengers currently constrained by the lack of offer.

Another option which consists in down-gauging the current 737 aircraft to a smaller regional one, such as a Fokker 70, should also be studied. This could potentially turn this service into a more regular weekly offer (4 or more/week), enhancing connectivity on the SYD route.

5.3 Long-term new route opportunities

On the longer term, routes that do not provide a sufficient market base for viable operations could potentially become interesting for airlines. IATA would recommend to re-verify in five years from now the market potential of those routes previously identified that did not meet the current requirements:

- POM – AKL (18 PDEW in 2015)
- LAE – BNE (12 PDEW in 2015)

5.4 Development of aircraft technology

The latest aircraft available on the market, Airbus' A350-900 and Boeing's B787-9, are capable of flying ultra-long-haul routes. The technical capabilities of these aircraft will allow new direct routes to be operated between APEC economies across the Pacific. The following map illustrates the range limit[1] of the A350-900 and B787-9.

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[1] For illustration only. Based on published range for the base model of each aircraft type. Specific operating conditions may affect the range of the aircraft.

Figure 6: Range limit for the latest generation of aircraft from Port Moresby (Source: GCMap)

6. Recommendations to improve air connectivity

6.1 Generic recommendations

This chapter provides recommendations applicable to all economies such as greater liberalization of air routes by allowing more access and the elimination of curfews and operational restrictions.

- Continue to liberalize the air services market to other APEC economies, allowing the fullest access to PNG airports.

6.2 Specific recommendations

- Keep investing in operational safety and efficiency to maintain international standards.
- Ensure capabilities and capacity of the existing airports remain adequate to cater future demand.

6.3 How the APEC economy's regulator can help

- Work closely with different stakeholders, such as Papua New Guinea Tourism Promotion Authority (PNGTPA), the Chamber of Commerce, etc., to gain a deeper understanding of the development of the aviation demand.
- Explore the possibility of relaxing visa requirements for tourists.
- Reduce Passenger Movement Charge on international air passengers.

7. Appendix

7.1 Overview of IATA and IATA Consulting

7.1.1 IATA

IATA – The International Air Transport Association was founded in 1945 as the prime vehicle for inter-airline cooperation in promoting safe, reliable, secure and economical air service for the benefit of the world's consumers. IATA is fully committed to supporting the commercial aviation industry's stakeholders and governments in their efforts to achieve profitability and long-term viability.

IATA's mission:

- To represent, lead and serve the airline industry.

IATA's vision:

- To be the force for value creation and innovation, driving a safe, secure and profitable air transport industry that sustainably connects and enriches our world.

IATA in numbers:

- 250+ member airlines
- 83% of total air traffic
- $387B processed by IATA financial systems
- 1,400+ employees
- 54 offices in 53 countries

7.1.2 IATA Consulting

IATA Consulting overview

IATA Consulting has comprehensive experience in the full array of business challenges facing the aviation sector. Serving the airline industry for 70 years, IATA has developed unrivalled practical experience, which we bring forth to provide the best solutions to our clients.

With our depth and breadth of aviation industry experience, we assist clients to maximize the value of their operating model, realize growth ambitions and gain insights that translate into sustainable competitive advantages.

IATA Consulting has expertise in the following areas:

SAFETY & FLIGHT OPERATIONS

Solutions for aviation organizations and airlines to improve safety, efficiency and air transport management.

ENVIRONMENT & ECONOMICS

Solutions for fulfilling the vision of a safer, more competitive and sustainable aviation industry.

AIRLINES

Solutions to achieve real and lasting results in every aspect of airline commercial and operational management.

AIRPORTS, PASSENGERS & SECURITY

Solutions to plan your airport efficiently to avoid costly mistakes and profit from untapped opportunities.

GROUND HANDLING & CARGO

Solutions to optimize your operations and improve your safety and security while reducing costs.

Our clients

IATA Consulting has successfully demonstrated its capabilities by providing airlines, airports, tourism offices and other organizations with accurate, unbiased and reliable high quality information and analysis to help them define and understand their markets, while ensuring their long-term facility development and financial success.

IATA is trusted by multiple clients all over the world including airlines, airports, governments and aviation institutions.

Why IATA Consulting was chosen for this project

IATA has, over time, recruited and retained some of the most highly experienced and capable aviation consulting resources within the aviation industry. Due to its position at the heart of the industry, IATA has access to exceptionally skilled and informed subject matter experts and specialists. IATA Consulting's objective is to make a positive difference in its clients' performance, while delivering quality services to all industry stakeholders.

IATA Consulting provides its customers with vast knowledge and expertise in all sectors of the industry worldwide. Our approach has been finely tuned to leverage IATA's global presence and industry thought leadership position in the development of tailored solutions that fit with local cultural considerations and embody international best practices. Our consultants rely on international state-of-the-art standards, unmatched access to data, and products and expert resources to provide cost-efficient and highly informed solutions.

IATA is backed by a robust set of decision support tools, Airport IS and Pax IS have been essential to undertake this study.

AirportIS and **PaxIS** are the most comprehensive aviation databases available in the marketplace, capturing 100% of traffic around the world and bringing together total market supply and demand under a single platform. The data provided is accurate and reliable as it is captured through IATA's Billing and Settlement Plan (BSP).

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