

VIETNAM'S AIR CONNECTIVITY POTENTIAL



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How can regional aviation be a major contributor in Vietnam's development?

3

What are the growth expectations and why does connectivity matter?

4

Is the current fleet profile suitable to improve regional connectivity?

5

How do we improve regional connectivity?

6

How can the industry create and sustain value through investment strategies?

8

How are regional jets poised to meet the challenges ahead?

13



HOW CAN REGIONAL AVIATION BE A MAJOR CONTRIBUTOR IN VIETNAM'S DEVELOPMENT?

As an engine of socio-economic growth, regional aviation development is indispensable to the markets and the communities it serves. Regional aviation will not only improve the connectivity from big cities to lower density destinations in Vietnam but also the international connectivity to neighbouring countries of Vietnam such as the Southeast Asia region and China. Therefore, Embraer welcomes the Transport Infrastructure Masterplan announced by the Transport Department and Strategy Institute of the Ministry of Transport on April 2021.

According to IATA, the air transport industry - including airlines and its supply chain - is estimated to support USD 2.6 billion of GDP in Vietnam. Spending by foreign tourists supports a further USD 9.9 billion, totalling USD 12.5 billion. In total, 5.2% of the country's GDP is supported by inputs to the air transport sector and foreign tourists arriving by air.

IATA reports that 2.2 million jobs are supported by air transport. Airlines, airport operators, airport on-

site enterprises (restaurants and retail), aircraft manufacturers, and air navigation service providers employ 42,000 people in Vietnam. In addition, by buying goods and services from local suppliers, the sector supported another 174,000 jobs. On top of this, the sector is estimated to support a further 182,000 jobs through the wages it pays its employees, some or all of which are subsequently spent on consumer goods and services. Foreign tourists arriving by air to Vietnam, who spend their money in the local economy, are estimated to support an additional 1.8 million jobs.

Improved air connectivity plays a large role in creating economic value, by facilitating skilled and often high-value employment opportunities which in turn contribute to national development.

As a major economic contributor, aviation's catalytic effects include (but are not limited to) trade, tourism, and social development. It also boosts productivity through its positive impact on businesses over the long run.



WHAT ARE THE GROWTH EXPECTATIONS AND WHY DOES CONNECTIVITY MATTER?

With a population of around 100 million and one of the fastest growing economies in Southeast Asia, Vietnam needs additional aviation capacity to sustain the projected air transport demand, in line with the country's projected economic growth of 6.4% between 2021 and 2030.

We forecast a projected traffic growth of 12% annually over the next 10 years to, from and within Vietnam - the highest air passenger number compound annual growth rate in Southeast Asia. Our base scenario points to a full recovery of the pre-pandemic levels by 2023.

Propensity to travel, measured by the number of trips per capita in a given year, is one of the most fundamental concepts that determine air transport development. It is affected by many interrelated forces such as personal income levels, demographic changes, and geographical features.

In fact, connectivity lies at the heart of the value provided by the aviation sector. Connectivity is not simply moving a large number of people from point A to point B. It is a composite measure of the number of destinations, the frequency of services and the quality of the connections. It is about options; it is about choices.

Accessibility and affordability of air travel are the most effective factors to immediately unlock the full potential of air traffic increase with sustainable, long-term socio-economic growth, by leapfrogging any eventual development issues with efficient air services.

The full potential of aviation to contribute to social and

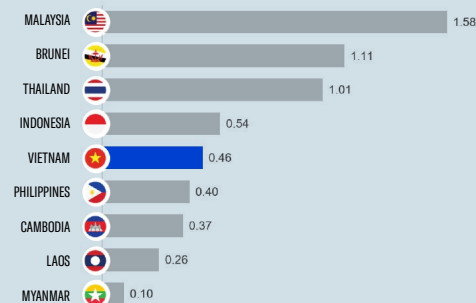
economic development depends on the industry's readiness to accommodate demand.

Air connectivity is key to unlocking economic growth potential, in part because it enables the country to attract business investment and human capital, and spurs tourism.

The upshot of our analysis shows that each Vietnamese flies only 0.46 times in a year on average (or once every two years). This travel pattern presents a huge potential for air transport demand. And when passenger demand increases, so does the need for an efficient air network.

Propensity to Travel

Trips per Capita (2019)



However, the strong growth prospect in the country requires an understanding of the opportunities and challenges that can potentially affect the market outlook.

IS THE CURRENT FLEET PROFILE SUITABLE TO IMPROVE REGIONAL CONNECTIVITY?

Given Vietnam's reliance on large capacity aircraft, the aircraft capacity and market demand unbalance limits airlines' ability to efficiently serve regional markets. As a knock-on effect, air services are heavily concentrated on major trunk routes.

An efficient air network that connects major financial centres and small communities is key to long term inclusive and sustainable growth. The extension of its benefits depends on its depth and breadth.

Vietnam is composed mainly of low and mid-density market profiles. Even before COVID, around 50% of all domestic and intra-regional city-pairs had up to 150 passengers daily each way. In contrast, the average aircraft size in the same period was 190 seats. Large narrow-body aircraft are the backbone of the current fleet profile, accounting for over 90% of the fleet profile.

As an example, Noi Bai - Tan Son Nhat route accounted for a whopping 23% of Vietnam's domestic air ticket sales in 2019. The top 5 city-pairs, which also include connections to Da Nang, Phú Quốc and Nha Trang, accounted for over 50% of total passengers transported.

Between 2014 and 2019, Vietnamese airlines expand capacity at a strong pace - 18% annually on average, measured in ASK (available-seat kilometre).

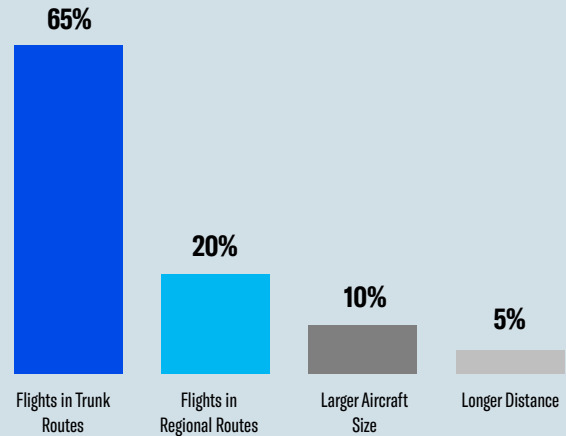
Simply put, ASK is the fundamental unit of supply produced by an airline and is equal to the number of seats available

multiplied by the number of kilometres flown. In summary, airlines expand capacity by flying larger aircraft and/or longer sector distance, or even adding flights.

During the 5-year period that preceded COVID, additional flights on trunk routes were the main pillars of the airline industry, accounting for 65% of total capacity increase.

Contribution to Capacity Growth

ASK Breakdown (2014-2019)



HOW DO WE IMPROVE REGIONAL CONNECTIVITY?

A multi-fleet strategy provides the desired flexibility to adjust aircraft capacity to regional market demand.

In this context, infrastructure investment strategies can provide the resources needed to cope with growth prospects, as the industry shifts from survival to expansion mode.

A wide range of opportunities for investment in infrastructure is available in Vietnam. Airports Corporation of Vietnam (ACV) reports that VND 25 trillion (USD 1 billion) has been invested in expanding airport infrastructure over the past five years to support passenger and cargo growth, but that it will need approximately VND120 trillion (USD 5.2 billion) by 2025 to complete infrastructure projects. Vietnam's five-year airport infrastructure requirement expands fivefold by the year 2025.

Tourism grew by an average 23% per annum until 2019. China, Japan, South Korea, and Taiwan accounted for around 80% of Vietnam's foreign tourism spending. Whereas Australia, Singapore, Malaysia, and Thailand can provide inbound expenditure growth over the coming years.

Infrastructure improvement projects in bigger airports such as additional runways, new terminals, taxiway, and apron improvements to accommodate projected traffic growth in major international airports can potentially improve Vietnam's competitive positioning in Southeast Asia versus Singapore or Bangkok among others.

For regional airports, on the other hand, a detailed cost-benefit analysis is needed to clearly demonstrate the monetary return on investment (and the risks associated with these investments in the long-term) vis-à-vis other alternatives.

While competitiveness will be increasingly higher on trunk routes, there is still plenty of room for profitable operations on regional routes, connecting small communities to Ho Chi Minh City's Tan Son Nhat International Airport, Hanoi's Noi Bai International Airport as well as those in the cities of Da Nang and Nha Trang.

Lower-density markets are poised to flourish post-pandemic if driven by an efficient air network and increased regional connectivity. It is imperative, though, to balance aircraft capacity and market demand.

The downside of high dependence on large narrow-body aircraft might soon become apparent when it proves to be inefficient in improving connectivity at regional airports.

In addition, there are several restricted airports in Vietnam that cannot handle large narrow-body aircraft. Exclusive destinations like Côn Đảo, Cà Mau, Điện Biên Phủ and Rạch Giá are currently served by turboprops.





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NEW STRATEGIES



HOW CAN THE INDUSTRY CREATE AND SUSTAIN VALUE THROUGH INVESTMENT STRATEGIES?

Regional jets can provide both affordable and profitable operations simultaneously. Profits and returns should evolve as the primary focus and key deciding factor over the next few years.

Rather than costly infrastructure projects, regional jets are the most viable alternative to improve air services with no limitation and higher payload compared to turboprops. In addition, it provides distinct operational advantages, such as optimized seating capacity, cost efficiency, operating range, improved service quality, and flexibility of route development.

Given its capabilities, regional jets are the 'go to' aircraft for airlines looking to expand their domestic regional operations beyond the current ATR network. One interesting example is the Hanoi – Côn Đảo route. Before the introduction of regional jets, the city-pair was served with a stopover in Ho Chi Minh given the limitations to handle large narrow-body aircraft in Côn Đảo, and the distance between the two cities falling outside the operational range of a turboprop.

Local demand can be revitalized by focusing on emerging destinations with new non-stop flights. Before the introduction of regional jets in 2020, Côn Đảo was directly connected to Ho Chi Minh and Cần Thơ only. In 2021, despite rising COVID cases, ten daily flights depart to six destinations - Da Nang, Hai Phong, Thanh Hóa, and Vinh City in addition to the aforementioned Hanoi, Ho Chi Minh and Cần Tho.

Regional Expansion

Air Service Network Out of Côn Đảo (VCS)



An aerial photograph of a bay, likely Ha Long Bay in Vietnam, featuring numerous limestone karsts rising from the water. Several small boats are visible on the water's surface. The scene is bathed in a warm, golden light, suggesting sunrise or sunset.

Case Study: Côn Đảo Airport Upgrade Plan versus Regional Jet Operation

Côn Đảo, famous for its beautiful beaches and wartime prison, is a tourist destination whose popularity has risen in recent years. In the 2010-2016 period, Côn Đảo airport achieved an average annual growth rate of 23%.

In 2019, the island had welcomed 400,000 tourists, up 37% year-on-year. In 2020, despite the impact of the COVID-19 pandemic, the number of passengers handled by the airport was 447,750, an increase of 4% over 2019.

Before the introduction of regional jets, turboprops were the only aircraft operating in Côn Đảo airport. The Embraer E190 allowed Bamboo Airways to offer jet services to the island.

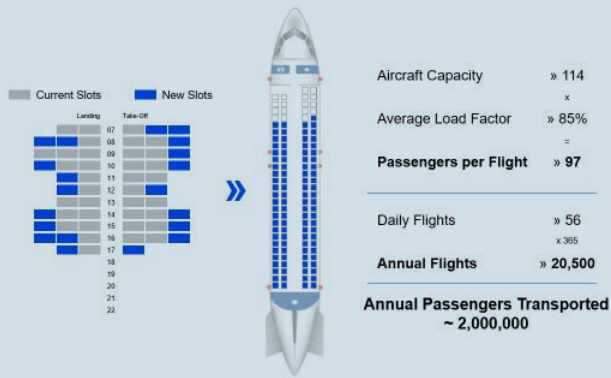
There are currently 36 aircraft movements to/from Côn Đảo every day - 16 performed by ATRs and 20, by E190s.

Recently, the national aviation authority has proposed widening a runway and building more taxiways and aprons to further tap its tourism potential, with 1.6 million additional passengers annually. The investment project is estimated at over USD 235 million and is expected to be completed by 2030.

Only 20 additional daily take-off and landing (totalling 56) would be enough to serve 2,000,000 passengers a year, as targeted by the aviation authority. One important element is that the incremental capacity does not necessarily require night operation and can be allocated during the day.

Slot Allocation

Bank Structure in Côn Đảo (VCS) | Regional Jet Operational Profile



There are ongoing discussions on the installation of a runway lighting system at the airport. The aim is to allow the increasingly popular tourist destination to receive and see off visitors at night, which would allow additional slots in the airport and, consequently, open up more opportunities to expand operations.

Even in cases where infrastructure projects are necessary to accommodate future passenger demand, regional jets require between 25-50% lower upgrade cost compared to large narrow-body aircraft, including runway extension and load-carrying capacity.

Infrastructure projects underpins economic activity and catalyses growth and development. The McKinsey Global Institute estimates that infrastructure has a socioeconomic rate of return around 20 percent. In other words, USD 100 of infrastructure investment can raise GDP by USD 20 in the long run.

Benefits from infrastructure projects are fully realized, however, only when projects generate tangible public payback. An efficient and cost-effective infrastructure project must consider the option that best meets Vietnam's needs. The priority listing of projects must be ranked by the benefit-cost ratio.

The assessment of options is crucial since it takes years to materialize. Infrastructure projects frequently require multiyear planning and construction timelines, and uptake and full use of the assets can ramp up slowly.

Although transport infrastructure is a critical asset in every country, it is expensive to build. Finance expenditures of this magnitude must consider both the direct impact of the infrastructure and the indirect effects on the rest of the economy and society.

Alternatively, next-generation regional jet is an immediate option to operate in shortened and lighter runways with the highest and fastest returns. While its capabilities provide a long-term solution to fly in and out of Côn Đảo with no payload limitation, it also frees more investment to be allocated to other strategic areas.

The effect of regional jet operation in Côn Đảo can shed light on the capability of regional jets to efficiently develop an extensive network.

Just like in Côn Đảo, regional jets can benefit other regional airports like Cà Mau, Điện Biên Phủ and Rach Giá by giving them access to a wider network as well as more frequent and better-connected services.

Case Study: How Regional Jets Can Support the Biggest Leisure Development Site in Southeast Asia

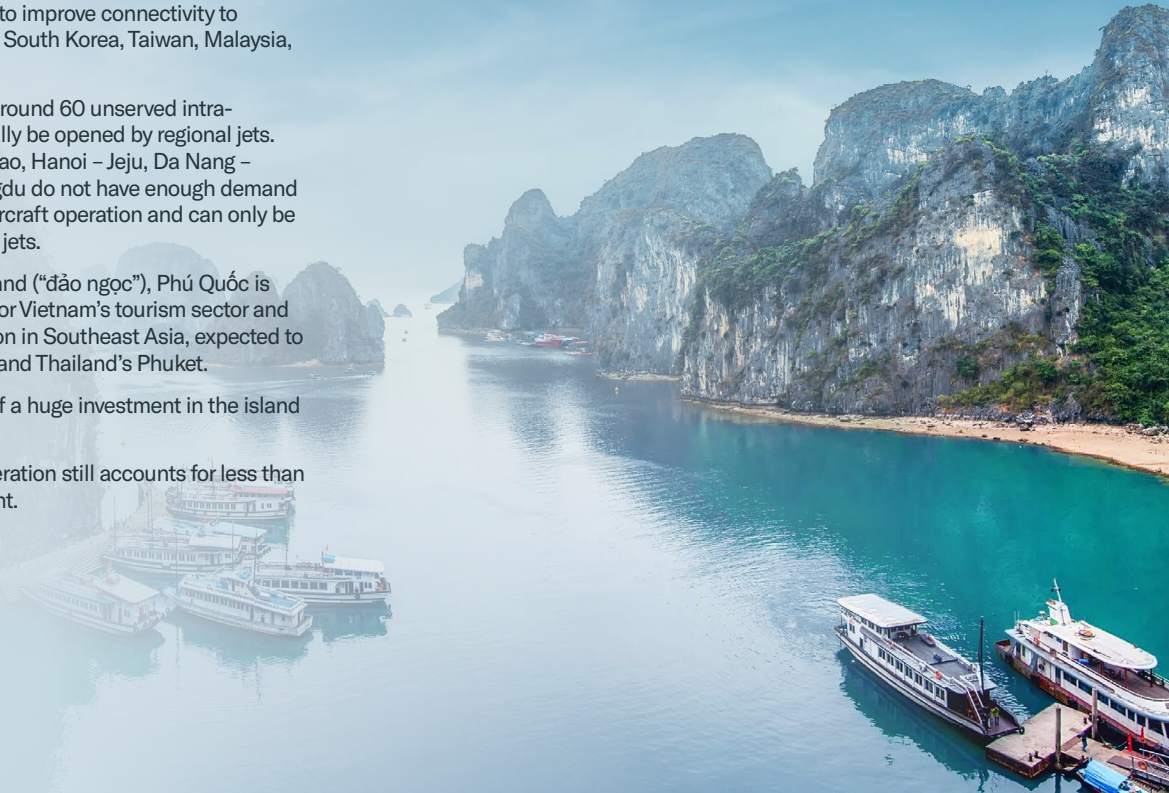
As regional jets can expand the limits of regional aviation, it presents a unique opportunity to improve connectivity to secondary cities in China, Japan, South Korea, Taiwan, Malaysia, Thailand, India, and Indonesia.

Based on 2019 passenger data, around 60 unserved intra-regional city-pairs could potentially be opened by regional jets. Routes like Ho Chi Minh – Qingdao, Hanoi – Jeju, Da Nang – Fukuoka, and Phú Quốc – Chengdu do not have enough demand to sustain a large narrow-body aircraft operation and can only be efficiently connected by regional jets.

Known as The Pearl Paradise Island (“đảo ngọc”), Phú Quốc is underway to become an engine for Vietnam’s tourism sector and a leading luxury tourist destination in Southeast Asia, expected to rival the likes of Indonesia’s Bali and Thailand’s Phuket.

The expectations are the result of a huge investment in the island over the last few years.

Yet, Phú Quốc’s international operation still accounts for less than 10% of the total aircraft movement.

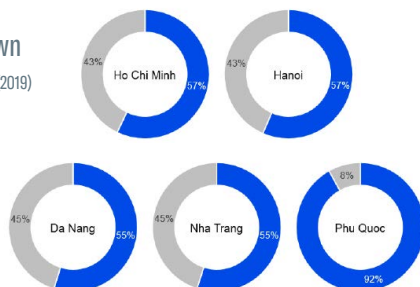


Capacity Breakdown

Domestic versus International (2019)

■ Domestic

■ International



The relatively underserved operation has prompted the government to further upgrade the airport, including a second runway, to increase capacity to 10 million passengers annually by 2030 –up from current capacity of 4 million passengers.

Over the last years, the imbalance between aircraft capacity and passenger demand have limited airlines' ability to expand international services to/from Phú Quốc. The deployment of large narrow-body aircraft has led airlines to open markets with one to three weekly frequencies, which did not make the route viable, and so, as quickly as it was added, it got dropped.

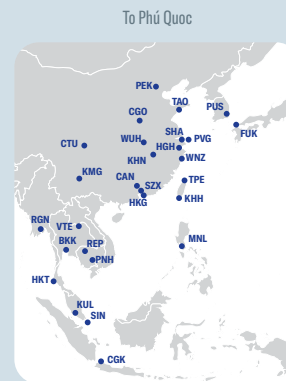
Singapore was connected to Phú Quốc in 2015 by two weekly flights, with 90 passengers onboard on an average. Similarly, three weekly flights departed from Shanghai to Phú Quốc in 2018, with 75 passengers onboard on average. Both city-pairs were served by a 184-seat aircraft, which resulted in less than 50% load factor.

Singapore and Shanghai are no longer served by a non-stop flight to Phú Quốc (that has been the case even before the pandemic). In a “what if” scenario, they would have been best served by regional jets, better suited to carry fewer expected passengers.

To capitalize on Phú Quốc's emergence as the new hot destination for tourism in the region, regional jets can, not only sustain a long-term capacity expansion, but also widen the city's potential by providing the connectivity needed to increase tourism flows.

On top of that, Asia is home of many unexploited opportunities to connect low and mid-density cities to Phú Quốc, as well as major cities currently underserved, or not served at all.

New International Market Opportunities



Regional jets provide airlines the flexibility to place the aircraft on strategically important routes where demand is currently thin. Regional jets can provide not only additional flight from Phú Quốc to Guangzhou in China, but also unlock a new air service to Singapore, with as close a match in aircraft capacity as there is in organic demand.

HOW ARE REGIONAL JETS POISED TO MEET THE CHALLENGES AHEAD?

New generation regional jet designs achieved what airlines and passengers want: low operating costs and a seamless experience.

To further tap into the domestic and international opportunities, operators will have to focus on affordability while striving to maintain high-quality products and experience.

In this context, how can regional jets play a vital role in the Vietnamese regional aviation development?

In a high-volume, low-margin environment, a competitive cost structure remains strategically important for business sustainability. Compared to a large narrow-body aircraft, regional jets deliver roughly 20% lower cost per trip and similar seat cost economics. While the previous generation regional jets focused on trip cost advantage, the latest programs have challenged the paradigm of higher cost per seat on a small capacity aircraft.

Aircraft design has evolved over time, from propellers to turboprops to jets and to turbofans. With all the engine technology taking front stage, an important element, sometimes forgotten - the design of the interior - evolved even more during the last 40 years especially for smaller airplanes, from the first generation of regional aircraft of the 70s, to the current modern and emission friendly aircraft of the environmental driven world we live in, like the E-Jets E2.

In general, a good interior design offers passengers better personal space and better use of the surrounding volume for cabin storage. Modern regional aircraft, once thought small and uncomfortable, have evolved over time, and now boast seats, bins, amenities, and baggage space that matches - or even exceeds - those of traditional narrow-body aircraft. Aisle width, for example, has increased to allow faster passenger boarding and deplaning. Baggage space went from nil (no overhead bins) to bins able to accommodate all passengers with one full sized carry-on bag, loaded wheels first into the bin, and with room to spare. Cabin vibration and noise levels have also reduced significantly, windows are larger and brighter, and power sockets are available in each seat.

Furthermore, not having a middle seat provides a more comfortable onboard experience, with passengers assigned either a window or aisle seat.

To summarize, regional jets play a fundamental role in achieving long-term prosperity, as a highly efficient user of resources and infrastructure.

A careful and responsibly planned approach to airport infrastructure development is needed for Vietnam, and regional aviation is the most economically viable enabler to facilitate tourism and trade, as it generates economic growth, provides jobs, improves living standards, alleviates poverty, and increases revenues from taxes. On top of several spill-over benefits, the relatively low investment vis-à-vis major airport upgrades makes it the best strategic fit to underpin a sustainable long-term growth plan.



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