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SURINAME

SUPPORT TO THE AIR TRANSPORT SECTOR IN SURINAME (SU-L1071)

BCA RESULTS

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1. Justification and objectives

1.1. Macroeconomic and national context

Suriname is a small (164.000 km2), open, commodity-based economy with a population of approximately 586,634, that is vulnerable to external shocks. Exports are concentrated in the extractive sector (mainly gold and oil), which generates approximately 86 percent of its foreign exchange earnings and 25 percent of government revenues. Private sector development is constrained by several structural factors. An underdeveloped financial sector, inadequate human capital, insufficient public infrastructure, and low adoption of technology undermine private sector performance.

The IMF (2024)[2] expects that economic growth is projected to reach 3 percent in 2024, and states that inflation is on a steady downward trend, donor support is increasing, investor confidence is returning, and international reserves are increasing. The authorities face important near-term risks, including capacity constraints and policy implementation challenges reflecting the increasingly difficult socio-political environment. Over the medium to long term, there is potential for growth to accelerate owing to the development of large new oil fields.

1.2. Problem addressed and justification

Air transport plays a crucial role in both regional and national integration, facilitating economic growth, connectivity and social cohesion. There are few international direct flights to and from Suriname. The country boosts one of the lowest connectivity indices on IATA's connectivity score. 93% of all the country's population and infrastructure assets are concentrated along the Great Paramaribo and Coastal regions, leaving isolated rural communities in the country's interior with scarce means of access to medical supplies, food, and essential services. Much of the country further from the coastline is only accessible by boat or aircraft, exacerbating the development gap between the country's interior regions and the capital. By connecting communities and enabling the movement of people and resources, air transport plays a multifaceted role in facilitating access to basic services such as healthcare, education5, employment, and essential goods.

[1] Document prepared by Juan Benavides. The views and opinions expressed in this document are those of the author and do not necessarily reflect the official policy or position of the IDB.

[2] IMF. (2024). IMF Reaches Staff-Level Agreement with Suriname on the Seventh Review of the Extended Arrangement Under the Extended Fund Facility. August 22. https://www.imf.org/en/News/Articles/2024/08/22/pr-24305-suriname-imf-reaches-agreement-on-the-7th-review-of-extended-arrangement-under-the-eff

Suriname's current civil aviation institutional framework is lacking a governance structure that secures talent retention and institutional memory for appropriate implementation of long-term plans. Additionally, its outdated aviation regulatory framework is not well adapted to the current needs of the country and its remote regions, whose aerodromes have an inefficient concentration of responsibilities for operations and management, and for the provision of air navigation services.

Suriname lacks an independent air Accident Investigation Authority (AIA). A technical assistance mission held by ICAO in April 2022 highlighted numerous critical deficiencies within Suriname's AIG framework. These deficiencies significantly impair the efficacy and independence of the accident investigation structure and stem from outdated regulations, inadequate training, financial constraints, and the absence of well-defined procedures.

The country also lacks an adequate system for the collection of charges and adequate reinvestment in the aviation sector. In terms of air transport infrastructure, the country lacks adequate expertise, financial resources and human resources to ensure efficient and sustainable operation and maintenance, as well as low levels of expenditure on operational safety at all airstrips in the country.

The Johan Adolf Pengel International Airport (PBM) is the main airport of Suriname. It serves as the main international gateway and provides air navigation services (ANS) for overflights. Except for its telecom tower that has been recently damaged the airport is in overall good standing.

The hub of the domestic air transport services is the Zorg En Hoop (SMZO) airfield. SMZO provides a basis for commercial air-cargo aviation services and to connect Paramaribo with the interior of the country. The runway is paved with asphalt with limited visual navigation aids available. The aerodrome is served by carriers that operate mostly domestic routes with small-sized aircraft (less than 19 seats each), offering scheduled and charter services.

Airfields across the country are key to achieve domestic integration, but the infrastructure needs to be improved. The total number of registered aerodromes in the country is 52, and the air authority maintains 33. Aerodromes located close to mining or logging areas benefit from high passenger demand and mining and logging concessionaires provide basic airstrip maintenance. Remote airfields serve as lifelines for isolated regions, providing essential connectivity for passengers, cargo, and emergency services. Unlike urban airports, these airfields face unique challenges due to their geographical isolation, harsh weather conditions, and limited resources.

2. Program strategy and Components

The main problem the program will address is the lack of a safe, connected and resilient air transport sector, due to an outdated air transport legislative framework, not well adapted to the required civil aviation international standards in institutional governance, country's development current objectives, safety and security, and fees collection and reinvestment system; and the absence of resilient, high-quality air transport infrastructure compounded by lack of investment and maintenance.

The program will finance efforts and investments seeking to: (i) improve the institutional and legal framework; (ii) improve the air transport control and operations; and (iii) establish an Independent Air Accident Investigation Authority (AIA); and (iii) ensure that the busiest airstrip in the south of the country (SMSM) is accessible year-round to bring essential services to the surrounding communities; to improve the safety and operating conditions of SMZO, to rehabilitate the communications tower and acquire new equipment for PBM international airport.

The program's *general* objective is to contribute to a safe, connected and resilient air transport sector for Suriname that delivers essential air transport services for remote communities. The *specific* objectives are to: (i) improve compliance with civil aviation safety and security standards; and (ii) enhance and maintain resilient, high-quality air transport infrastructure. It has the following components:

Component 1. Improvements in the institutional and legal framework (US$5,185,000). This Component will finance: (i) restructuration of Suriname's civil aviation system and institutional capacity strengthening and pre-investment studies for rehabilitation of civil aviation infrastructure; (ii) strengthening of CASAS' (the Civil Aviation Safety Authority of Suriname) regulatory capacity; (iii) development of a State Action Plan for Sustainable Aviation Fuel (SAF) production, distribution and use; (iv) stakeholder coordination activities at the national and regional levels on matters pertaining to air navigation and security; and (v) elaboration of a diagnosis, policy and gender action plan.

Component 2. Improvements in the air transport control and operations (US$8,155,000). This Component will finance: (i) enhancement of air navigation capacity and efficiency; (ii) establishment of an independent Air Accident Investigation Authority (AIA) complying with international standards set by ICAO; (iii) definition of a new international standard-based fee structure and collection mechanism using new digital tools and identifying new revenue sources; and, additionally (iv) it will finance investments to deploy digital technologies and equipment on key aerodromes and aviation infrastructure and increase monitoring and surveillance.

Component 3. Enhancement and maintenance of Suriname's air transport infrastructure (US$ 10,000,000). This component will finance: (i) PBM international airport interventions (energy-efficient equipment, a new communication tower, training and capacity building); (ii) SMZO domestic hub improvements (rehabilitation/upgrading of existing land-side facilities;

labor/internships of PWD; (iii) pilot for all-weather aerodrome modernization (rehabilitation SMSM) to optimize operations, installation of aeronautical equipment to ensure secure operation of the aerodrome; and (iii) training and capacity building for disaster and resilience planning, response and maintenance.

Administration and monitoring (US$1,085,000) + Contingencies (US$575,000). This component will finance management costs, including supervision and technical support for the Project Execution Unit (PEU), as well as audits and project evaluation. It will also finance a budget line for contingencies to provide some flexibility in the event of unforeseen costs variations that may arise during project implementation. These costs will be allocated among Components 1, 2 and 3 in proportion to their corresponding CAPEX.

3. Benefit characterization

3.1. Typology

Component 1

> Benefit **F1**. The monetary value of Overall-Time-Saved-at-the-Airport (OTSA) due to the introduction of international aviation standards.

The time saved due to this intervention comes from the streamlining of check-in and boarding processes. With standardized procedures, passengers can check in online, reducing the need to queue at airport counters (quicker security checks for passengers travelling with only carry-on luggage; and standardized security protocols allow passengers with carry-on luggage go directly to security. Based on various studies and industry reports (see for example IATA 2024 and Times of India 2024)[3], online check-in can save between 30-60 minutes, and streamlined procedures can save an additional 15-30 minutes for passengers travelling with only carry-on luggage. In these very optimistic estimates, the OTSA could be approximately 45-90 minutes. For Suriname, OTSA will be set as 12 minutes (conservative estimate which includes the impact of stakeholder coordination).

Component 2

> Benefit **F2**. The monetary value of reduction in take-off time due to operational optimization.

[3] IATA. (2021). Why Standardization is Good for your Air Cargo and Ground Operations Business? https://www.iata.org/en/publications/newsletters/iata-knowledge-hub/why-standardization-is-good-for-your-air-cargo-and-ground-operations-business/
Times of India. (2024). Web Check-in for Flights: What is it, benefits, how to do web check-in, and other information. March 2022.
https://timesofindia.indiatimes.com/technology/tech-tips/web-check-in-for-flights-what-is-it-benefits-how-to-do-web-check-in-and-other-information/articleshow/108716262.cms

The time saved due to the enhancement of air transport control and navigation arise from technologies such as the Advanced ATC Tower concept (a very small sub-set of A-CDM[4]) and advanced surface movement guidance systems (A-SMGCS[5]), which optimize taxi times and improve predictability. Eurocontrol (2016) evaluations indicate that A-CDM implementations have shown taxi-out time reductions by 7 to 9 minutes for narrowbody aircraft due to less congestion on taxiways and improved management of gate assignments. Additionally, A-CDM implementations may result in average taxi-out time savings of 0.25 to 3 minutes per flight. Finally, enhanced systems have improved take-off time predictability by as much as 85%, especially during adverse weather conditions. This leads to better adherence to scheduled departure times and minimizes delays. The cumulative effect of these improvements can lead to a time saving of 25 minutes (conservative estimate which includes the increase in GOS ability to define better arrangements for overflight fees and to monitor key airstrips, airfields and aviation infrastructure)[6].

Benefit **F3**. The monetary value of reduction in departure fatality risk.

The introduction of training programs for airline personnel and airport staff will improve compliance with ICAO's Safety Management Systems (SMS) and IATA´s Security Management Systems (SeMS) will lower accident rates. The shift towards a Dynamic Risk Management (DRM) approach to aviation security will allow for more effective responses to emerging threats[7]. Partnerships with IATA, ICAO, and more active participation in the Caribbean Aviation Safety and Security Oversight System (CASSOS) will facilitate improve safety protocols. According to the ICAO Safety Report 2023, the global accident rate was 2.05 accidents per million departures in 2022[8]. On the other hand, the introduction and adherence to international safety standards have led to a 50% reduction in total fatalities, from 160 in 2022 to 72 in 2023 across scheduled commercial air transport operations globally[9]. For Suriname, a conservative estimate of 20% reduction of the world average for departures will be used in the analysis (0,4 avoided fatalities per million departures).

[4] Eurocontrol. (2024). Airport collaborative decision-making.
https://www.eurocontrol.int/concept/airport-collaborative-decision-making
[5] Skybrary. (2024). Advanced Surface Movement Guidance and Control System (A-SMGCS).
https://skybrary.aero/articles/advanced-surface-movement-guidance-and-control-system-smgcs
[6] Eurocontrol. (2026). A-CDM Impact Assessment. Final Report.
https://www.eurocontrol.int/sites/default/files/2019-04/a-cdm-impact-assessment-2016.pdf
[7] IATA. (2023). IATA Annual Security Report 2023 Edition.
https://www.iata.org/contentassets/b7736d5f28f34255ba1b366283f8f0d1/iasr-final-30jan24-v2.pdf
[8] ICAO. (2023). Safety Report 2023.
https://www.icao.int/safety/Documents/ICAO_SR_2023_20230823.pdf
[9] ICAO. (2024). Safety Report 2024.
https://www.icao.int/safety/Documents/ICAO_SR_2024.pdf

Component 3

Benefit **F4**. Monetary value of reduction in taxi-in and taxi-out time due to instrumentation and physical interventions in SMZO (domestic hub), SMJP (international airport) and the SMSM pilot (includes delay multiplier of 1,5).

The cumulative impact of reductions in taxi-in and taxi-out times, coupled with improvements from enhanced communication and control tower investments, result in the following international time savings: (i) the use of solutions such as ApronAI, (Assaia´s Turnaround Control solution) may lead to average reduction of 49 seconds in taxi-in per flight at active gates[10]; (ii) real-time data sharing among airlines, ground services, and air traffic control with enhanced communication leads to quicker decision-making and better coordination, reducing delays by an estimated 3 to 5 minutes per flight during peak hours; (iii) control towers equipped with advanced monitoring systems enable better traffic management both on the ground and in the airspace which can lead to an additional reduction in taxi times by approximately 2 to 4 minutes[11]. Due to technological backwardness of the control and communications technologies in place in the two airports hubs, it is safe to assume a cumulative 20 minute of time savings in all airfields. And due to the hub nature of the two intervened airports, a Delay Propagation Multiplier (DPM; which is a measure of the change in system-wide delay as a result of a change in delay at a particular airport) of 1,5 (the lower bound of US airports) will be used. The final result is a quite important reduction of 30 minutes for all the air traffic of Suriname.

Table 1 summarizes the benefit categories by Component.

Table 1. Benefit categories

Component	Benefit category	Beneficiaries	Comment
C1. Institutional capacity	**F1**: Monetary value of reduction in airport check in and check out times due to the introduction of international aviation standards	All international and domestic passengers	12 minute/pax reduction
C2. Technical capacity and increased safety and security	**F2**: Monetary value of reduction in take-off due to operational optimization	All international and domestic departures (half of total passengers)	25 minute/taxi-out pax reduction

[10] ASSAIA. (2024). Taxi Time Reduction. https://www.assaia.com/resources/taxi-time-reduction

[11] Justaviation. (2024). Airport Collaborative Decision Making (A-CDM) & Its Impact on Turnaround Time. https://justaviation.aero/airport-collaborative-decision-making/?amp=1
IATA. (2018). Airport – Collaborative Decision Making (A-CDM) – IATA Recommendations. https://www.iata.org/contentassets/5c1a116a6120415f87f3dadfa38859d2/iata-acdm-recommendations-v1.pdf

	F3: Monetary value of reduction in departure fatality risk	All departing passengers (half of total passengers)	0,4 avoided fatalities per million departures
C3. Physical infrastructure and communications	**F4**: Monetary value of reduction in taxi-in and taxi-out time due to instrumentation and physical interventions in SMZO (domestic hub), SMJP (international airport) and the SMSM pilot (includes delay multiplier of 1,5)	All international and domestic passengers	30 minutes/pax reduction

Source: own elaboration.

3.2. Additional input data

To calculate the monetary value of both time saved and reduction in fatalities, it is necessary to provide air traffic forecasts, and estimate the average per hour valuation of time for inbound passengers by country in both international and domestic flights, and the average cost of 1 departure fatality for inbound by country in both international and domestic flights.

The IMF (2024) forecasts a GDP growth of 3% for 2024 in Suriname[12], and Bourguignon and Darpeix (2016) find that a 1% increment in GDP may increase air traffic in 1,8% for developing countries[13]. Combining these two figures, domestic traffic in Suriname can increase 5,4% a year, with an initial value of 64,400 pax/y in 2024. The World Travel & Tourism Council argues a 4.6% annual growth in international passengers traveling to Suriname (BAU)[14]. Due to the systemic interventions of this program, it is assumed that both domestic and international air traffic will grow at the same rate (5,4%).

The International traffic is assumed to reach in 2025 the pre-pandemic level of 2019 (259,087 international pax/y)[15]. Suriname citizens may constitute around 25-35% of international flight passengers. This order-of-magnitude combines the Surinamese diaspora (300.000 Surinamese citizens live in the Netherlands) share in international flights, the above-mentioned current tourism inflow, and comparable statistics from other small Caribbean nations. The lower bound (25%) is taken. A conservative share of 10% of international travelers are taken for domestic flights, using the Guyana figures for the Rest of the world. The shares of inbound international travelers in 2019 and 2022 are shown in Figure 1.

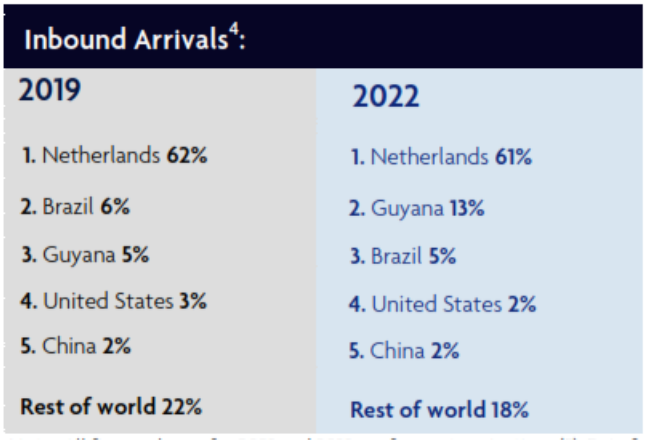
[12] IMF. (2024). Suriname and the IMF. https://www.imf.org/en/Countries/SUR

[13] Bourguignon, F. and P. E. Darpeix. (2016). Air traffic and economic growth: the case of developing countries. *PSE Working Papers* halshs-01332085, HAL. https://ideas.repec.org/p/hal/psewpa/halshs-01332085.html

[14] The World Travel & Tourism Council. (2023). Travel and tourism economic impact 2023 – SURINAME. https://assets-global.website-files.com/6329bc97af73223b575983ac/647df24b7c4bf56088056of9_EIR2023-APEC.pdf

[15] Airport Management Ltd. (2021). Airport Statistics. https://www.japi-airport.com/wp-content/uploads/2021/02/Website-Stats-Sheets_02-2021.pdf

Figure 1. Inbound arrivals 2022 by country



Source: The World Travel & Tourism Council. (2023).

The 2022 shares are used to compute the average Value of Time (aVOT), which is the weighted average of the VOT of the passengers by country in both international and domestic flights (approximated as half the hourly wage)[16]. The same shares are used to estimate the average Value of a Statistical Life (aVSL) as the weighted average of VSLs in both international and domestic flights (the individual values by country are taken from Viscusi and Masterman (2017))[17].

The estimations yield an aVOT of USD 10,42/h for international flights and USD 2,60/h for domestic flights, and an AVSL of USD M 4,77/pax for international flights and USD M 2,03/pax for domestic flights. The occupancies are taken as 30 pax/international flight and 10 pax/domestic flights (conservative estimate).

The social discount rate used in this analysis is 12% a year. The CAPEX for Components 1, 2 and 3 includes US$1,085 M of administrative costs + US$ 0,575 M of funded contingencies.

[16] US DOT. (1997). Memorandum: Departmental Guidance for the Valuation of Travel Time in Economic Analysis. https://www.transportation.gov/sites/dot.gov/files/docs/1997%20Value%20of%20Travel%20Time%20Guidance.pdf

[17] Viscusi, W. K., and C. J. Mastermann. (2017). Income Elasticities and Global Values of a Statistical Life. *Journal of Benefit-Cost Analysis* 226. https://web.archive.org/web/20180729081739id_/https://www.cambridge.org/core/services/aop-cambridge-core/content/view/5AE299883F668DCC265C41A377E1E063/S2194588817000124a.pdf/div-class-title-income-elasticities-and-global-values-of-a-statistical-life-div.pdf

4. Economic evaluation

4.1. General model

For each project Component and the whole program, the CBA calculations use the logic and data presented in section 3 as follows:

$$0 = -I + \sum_{t=1}^{N} \frac{\big(B(t) - C(t)\big)}{(1 + IRR)^t}$$

$$B = \sum_{t=1}^{N} \frac{B(t)}{(1 + IRR)^t}$$

$$C = \sum_{t=1}^{N} \frac{C(t)}{(1 + IRR)^t}$$

$$NPV = -I + \sum_{t=1}^{N} \frac{\big(B(t) - C(t)\big)}{(1 + r)^t} + \frac{SRV_N}{(1 + r)^N}$$

Where:

I is the CAPEX (Capital Expenditure).
$B(t)$ is the benefit in year.
$C(t)$ is the cost in year t.
r is the social discount rate (12%).
IRR is the internal rate of return.
B is the present value of benefits.
C is the present value of costs (less US$ 25 million due to discounting of half CAPEX investment in year 2 for Component 3).
NPV is the Social Net Present Value.

4.2. Benefit calculations

Component 1 $[BF1(t)]$

$$BF1(t) = [IT(t) \cdot aVOTI + DT(t) \cdot aVOTD] \cdot OTSA$$

Where:

$IT(t)$ is the international air traffic in Suriname in year t.
$DT(t)$ is the the domestic air traffic in Suriname in year t.
$aVOTI$ is the average VOT for international flights.
$aVOTD$ is the average VOT for domestic flights.
$OTSA$ is the overall-time-saved-at-the-airport.

Component 2 $[BF2(t) + BF3(t)]$

$$BF2(t) = [IT(t) \cdot 0{,}5 \cdot aVOTI + DT(t) \cdot 0{,}5 \cdot aVOTD] \cdot TSOO$$

$$BF3(t) = [IT(t) \cdot 0{,}5 \cdot aVSLI + DT(t) \cdot 0{,}5 \cdot aVSLD] \cdot AFMD$$

Where:

$TSOO$ is the time saved due to operational optimization.
$aVOTI$ is the average VSL for international flights.
$aVOTD$ is the average VSL for domestic flights.
$AFMD$ are the avoided fatalities per million departures.

Component 3 $[BF4(t)]$

$$BF4(t) = [IT(t) \cdot aVOTI + DT(t) \cdot aVOTD] \cdot TSTC$$

Where:

$TSTC$ is the time saved in taxi-in and taxi-out due to improvements and technology in the two airport hubs.

4.3. Results and sensitivity analysis

The IRR of the whole Program in its Basic Scenario is 13,92%, its B/C ratio is 1,14, and its NPV is US$ 3,14 M. As shown in Table 2, the major net value addition (NPV) and the biggest contribution to the whole Program's IRR come from Component 3, because of the deep and transformative impact (´network effect´) of direct infrastructure and communication interventions in the two key Surinam airports.

Table 2. Project summary of results. Basic Scenario. Figures in US$ M (2024)

	C1	C2	C3	Whole Program
IRR %	13,70%	8,53%	18,09%	13,92%
B	6,27	6,70	14,99	27,95
C	5,55	8,74	10,14	24,43
B/C	1,13	0,77	1,48	1,14
NPV	0,64	-1,83	4,34	3,14

Source: own elaboration.

Table 3 compares the indicators for the whole project in the Basic Scenario and four pessimistic scenarios: (i) a reduction of 10% of air traffic; (ii) a reduction of 20% of benefits; (iii) and increase of 10% in costs; and (iv) an increase of 20% in costs. The traffic level change is the key impact parameter to model once time savings and fatality reduction are fixed at their lower bounds.

Table 3. Sensitivity analysis. Figures in US$ M (2024)

	Basic Scenario	0,1 reduction in air traffic	0,2 reduction in air traffic	0,1 increase in costs	0,2 increase in costs
IRR %	13,92%	12,45%	11,22%	12,55%	11,35%
B	27,95	25,15	22,36	27,95	27,95
C	24,43	24,43	24,43	26,87	29,31
B/C	1,14	1,03	0,92	1,04	0,95
NPV	3,14	0,72	-1,26	0,96	-1,22

Source: own elaboration.

The pairs {0,1 reduction in air traffic, 0,1 increase in costs} and {0,2 reduction in air traffic, 0,2 increase in costs} have similar impacts on all the indicators. The Program is highly sensitive to the worst-case scenarios both in reduction of air traffic and increase in costs.

The complete calculations of the previous analysis results can be found in the following link.