

# Global Air Navigation Plan (GANP) Performance Framework

GANP APAC Workshop 6 March 2026



# Agenda

## Workshop Objectives

- To understand the relationship between GATMOC, Doc 9883 and GANP PF
- To navigate the GANP portal for information on performance
- To apply the performance framework for performance enhancement

## Key Takeaways

- **Know where to find the relevant information**
- **Understand how to apply the performance framework to enhance performance**

## Brief History – Performance in the ICAO Context

- **Doc 9854 Global Air Traffic Management Operational Concept (GATMOC) [2005]**
  - 11 Expectations (not Key Performance Areas)
- **Doc 9161 Manual on Air Navigation Services Economics [2006]**
  - Addresses performance in Chapter 4 Section C – Means of Measuring Performance and Productivity
- **Doc 9882 Manual on Air Traffic Management System Requirements [2007]**
  - Translation of the GATMOC into a set of requirements, cross-referenced to the GATMOC; section 2.1 defines overarching performance-related requirements, for all 11 Expectations
- **Worldwide Symposium on Performance of the Air Navigation System [2007]**
  - Significant attendance
- **Doc 9883 Manual on Global Performance of the Air Navigation System (MGPANS) [2009]**
  - Terminology, methods, processes & good practices (including the six-step ICAO performance management process); 11 KPAs derived from the 11 GATMOC Expectations; but note: the included indicators were only examples of what was in use in some Regions (some readers have erroneously assumed these were globally standardized KPIs)
- **Regional (performance framework) workshops [2009]**
  - ICAO Regions tasked by ICAO to start developing regional performance frameworks (as the time was not yet ripe to harmonize at global level)
- **AN-Conf/12: introduction of the ASBU methodology and outcome regarding performance [2012]**
  - Recommendation 1/15 – Performance monitoring and measurement of air navigation systems
  - Recommendation 1/16 – Access and equity considerations
  - Recommendation 6/11 – Regional performance framework – alignment of air navigation plans and regional supplementary procedures
- **Doc 9750 Global Air Navigation Plan (GANP) [GANP 2016]**
  - Performance chapter with 16 'Potential key performance indicators' for measuring performance outcome, and phased development approach for ICAO (until 2019, until 2022, 2022 and beyond)
  - ASBU Module benefits qualitatively (as free text) described at the level of KPAs
  - Implementation monitoring considered part of performance monitoring → has resulted in annual ASBU Implementation Monitoring Reports
- **Doc 9750 Global Air Navigation Plan (GANP) [GANP 2019]**
  - Major ASBU review; introduction of ASBU elements
  - Significant refinement and strengthening of performance based approach: 19 GANP KPIs, Performance objectives catalogue, foundation for future enhancements
  - Transition from document to on-line portal
- **Doc 9750 Global Air Navigation Plan (GANPv7) [GANP 2022]**
  - Safety performance framework
  - Call for greater coordination between all the global plans (GANP, GASP, GAsEP)
- **Doc 9750 Global Air Navigation Plan (GANPv8) [GANP 2025]**
  - Environment and Resilience performance framework
  - Guidance document

# Brief History – GANP-Performance Expert Group (GANP-PEG)

AN-Conf/13-WP/311

[https://www.icao.int/Meetings/anconf13/Documents/WP/wp\\_311\\_a4\\_en.pdf](https://www.icao.int/Meetings/anconf13/Documents/WP/wp_311_a4_en.pdf)

## Report on Agenda Item 4

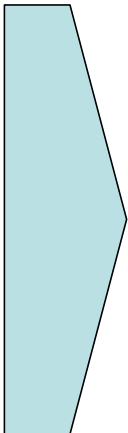
### Recommendation 4.3/1 – Improving the performance of the air navigation system

That States:

- a) adopt and adapt as needed, the **six-step performance management process** for the planning and implementation of air navigation improvements and reflect this process in their national air navigation plans;
- b) **align their national air navigation plans with regional plans to attain a globally harmonized performance management process** and support the achievement of global performance objectives;
- c) support ICAO in promoting the No Country Left Behind (NCLB) initiative and reaffirm their commitment to the development of timely and accurate national air navigation plans aligned with regional and global plans;

That ICAO:


- d) encourage the planning and implementation regional groups (PIRGs) to embrace a performance-based approach for implementation and adopt the **six-step performance management process**, as described in the *Manual on Global Performance of the Air Navigation System* (Doc 9883), by reflecting the process in Volume III of all regional air navigation plans;
- e) continue to expedite the work on **performance indicators** related to the *Global Air Navigation Plan* (Doc 9750, GANP), including review of the work by an appropriate **group of performance experts** and consider establishing such an expert group under the Global Air Navigation Plan (GANP) Study Group ; and
- f) examine possible operational incentives in the development of new air traffic management (ATM) concepts.




ICAO's six-step performance management process (shown on a slide later in this presentation) is a refined version of the classic Plan-Do-Check-Act (PDCA) cycle (<https://en.wikipedia.org/wiki/PDCA>)

Amongst others, it introduces a structured method for defining performance indicators.

The method ensures that indicators are not developed without first documenting/formalising their policy context in terms of scope, problem analysis and qualitative performance objectives



Further develop the catalogue of GANP KPIs (and associated work)



A global group of performance experts was established in April 2019 and GANP-PEG was initiated in Oct 2019.

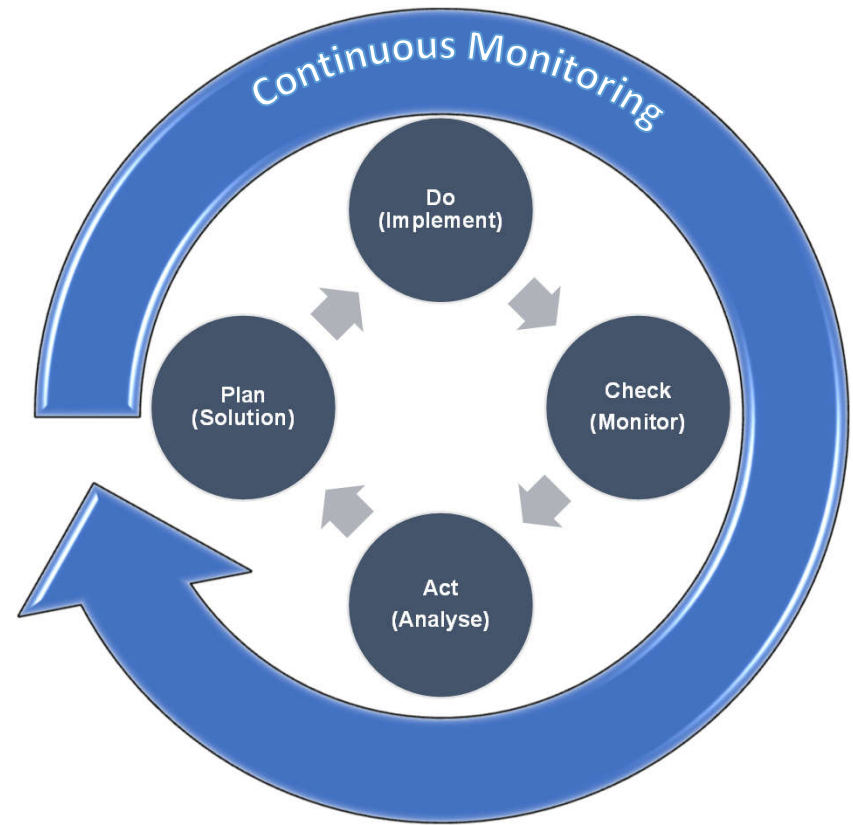
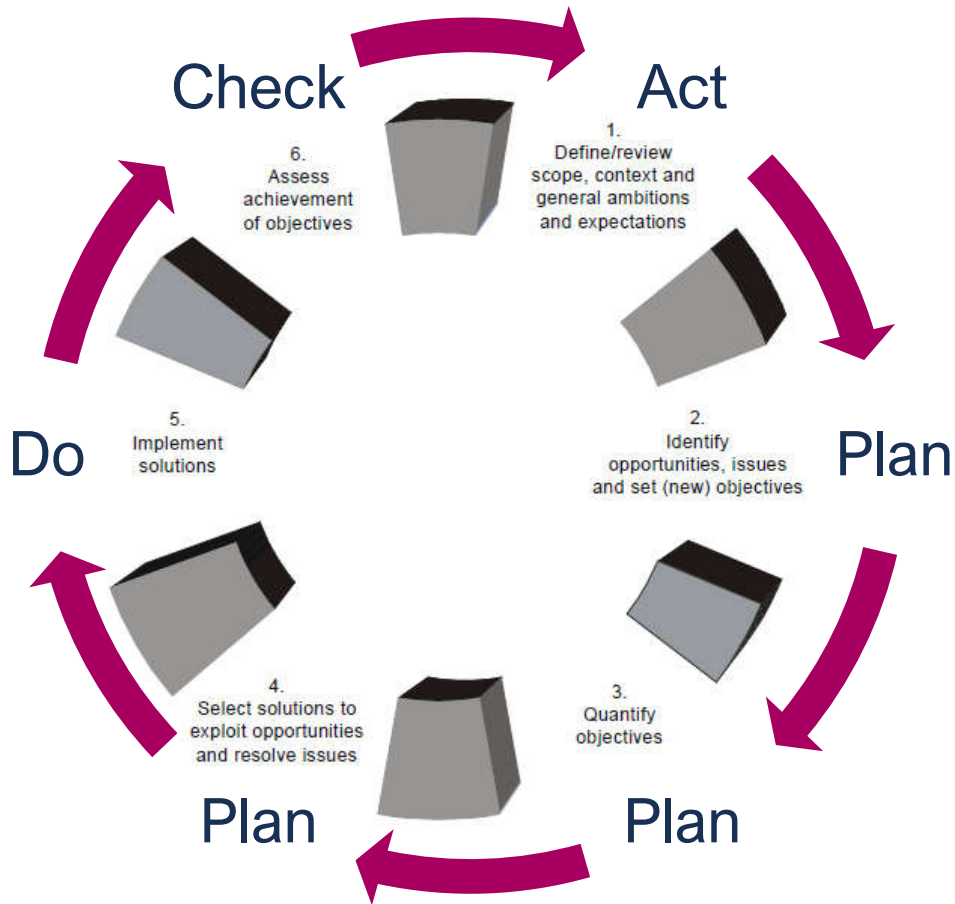
## 11 Key Performance Areas (KPAs) (1/2)

KPA	Description
KPA01 – Access and Equity	A global air navigation system should provide an operating environment that ensures that all airspace users have the right of access to ATM resources needed to meet their specific operational requirements; and ensures that the shared use of the airspace for different airspace users can be achieved safely. The global air navigation system should ensure equity for all airspace users that have access to a given airspace or service. Generally, the first aircraft ready to use the ATM resources will receive priority, except where significant overall safety or system operational efficiency would accrue or national defence considerations or interests dictate by providing priority on a different basis.
KPA02 – Capacity	The global air navigation system should exploit the inherent capacity to meet airspace user demand at peak times and locations while minimizing restrictions on traffic flow. To respond to future growth, capacity must increase, along with corresponding increases in efficiency, flexibility, and predictability while ensuring that there are no adverse impacts to safety giving due consideration to the environment. The air navigation system must be resilient to service disruption and the resulting temporary loss of capacity.
KPA03 – Cost Effectiveness	The air navigation system should be cost effective, while balancing the varied interests of the ATM community. The cost of service to airspace users should always be considered when evaluating any proposal to improve ATM service quality or performance. ICAO guidelines regarding user charge policies and principles should be followed.
KPA04 – Efficiency	Efficiency addresses the operational and economic cost effectiveness of gate-to-gate flight operations from a single-flight perspective. Airspace users want to depart and arrive at the times they select and fly the trajectory they determine to be optimum in all phases of flight.
KPA05 – Environment	The air navigation system should contribute to the protection of the environment by considering noise, gaseous emissions, and other environmental issues in the implementation and operation of the global air navigation system.
KPA06 – Flexibility	Flexibility addresses the ability of all airspace users to modify flight trajectories dynamically and adjust departure and arrival times thereby permitting them to exploit operational opportunities as they occur.

## 11 Key Performance Areas (KPAs) (2/2)

KPA	Description
KPA07 – Global Interoperability	The air navigation system should be based on global standards and uniform principles to ensure the technical and operational interoperability of air navigation systems and facilitate homogeneous and non-discriminatory global and regional traffic flows.
KPA08 – Participation by the ATM Community	The ATM community should continuously be involved in the planning, implementation, and operation of the system to ensure that the evolution of the global air navigation system meets the expectations of the community.
KPA09 – Predictability	Predictability refers to the ability of the airspace users and air navigation service providers to provide consistent and dependable levels of performance. Predictability is essential to airspace users as they develop and operate their schedules.
KPA10 – Safety	Safety is the highest priority in aviation, and ATM plays an important part in ensuring overall aviation safety. Uniform safety standards and risk and safety management practices should be applied systematically to the air navigation system. In implementing elements of the global aviation system, safety needs to be assessed against appropriate criteria, and in accordance with appropriate and globally standardized safety management processes and practices.
KPA11 – Security	Security refers to the protection against threats, which stem from intentional (e.g. terrorism) or unintentional (e.g. human error, natural disaster) acts affecting aircraft, people or installations on the ground. Adequate security is a major expectation of the ATM community and of citizens. The air navigation system should therefore contribute to security and should be protected against security threats. Security risk management should balance the needs of the members of the ATM community who require access to the system with the need to protect the air navigation system. In the event of threats to aircraft or threats using aircraft, ATM shall provide responsible authorities with appropriate assistance and information.

# ICAO performance management process



# ICAO performance management process

## PLAN

### Strategic Planning

- Establishing the leadership team for performance management.
- Leadership team establishes the project team.
- Engaging with relevant stakeholders.
- Establishing performance ambitions.
  
- Based on data and information gathered, define:
  - Performance objectives or system deficiencies
  - Size and scope (e.g. airspace regions, aerodromes, stakeholders)
  - Timeframes: short, medium, long

### Technical Planning

- Define performance objectives within scope.
- Define performance indicators and performance targets.
- Assess current ATM performance.
- Identify and understand issues and performance gaps.
- Identify solutions to achieve performance objectives.

# ICAO performance management process

## DO

- The execution step of the performance management process.
- Develop detailed and actionable plans:
  - Small-scale implementations (short-term or daily duties)
  - Major implementations
    - Identify stakeholders, define a roadmap and timeline.
    - Multiple solutions and deployment plans.

# ICAO performance management process

## CHECK

- To assess whether performance objectives are being achieved as planned after deploying solutions.
- Calculate the KPIs defined during PLAN step and compare them against targets.
- Measure the effectiveness of deployed solutions.

# ICAO performance management process

## ACT

- Measure actual achieved performance.
- Close the performance management process cycle if performance targets are reached.
- If targets not reached, conduct a review to feedback into the PLAN step of the next iteration cycle.
  - Were performance targets too ambitious?
  - Did the solutions address the performance needs?
  - If not, why?
- Document all four steps for lessons learnt for future applications.

# Global Air Navigation Plan



Doc 9883 by ICAO ATMRPP

GANP Performance Framework by the GANP-Performance Expert Group

Regional ATM Performance Framework endorsed at APANPIRG/30

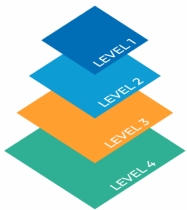
APAC ATM Performance Reports by Data Analytic Group

# The big picture – 3 performance loops in the GANP context

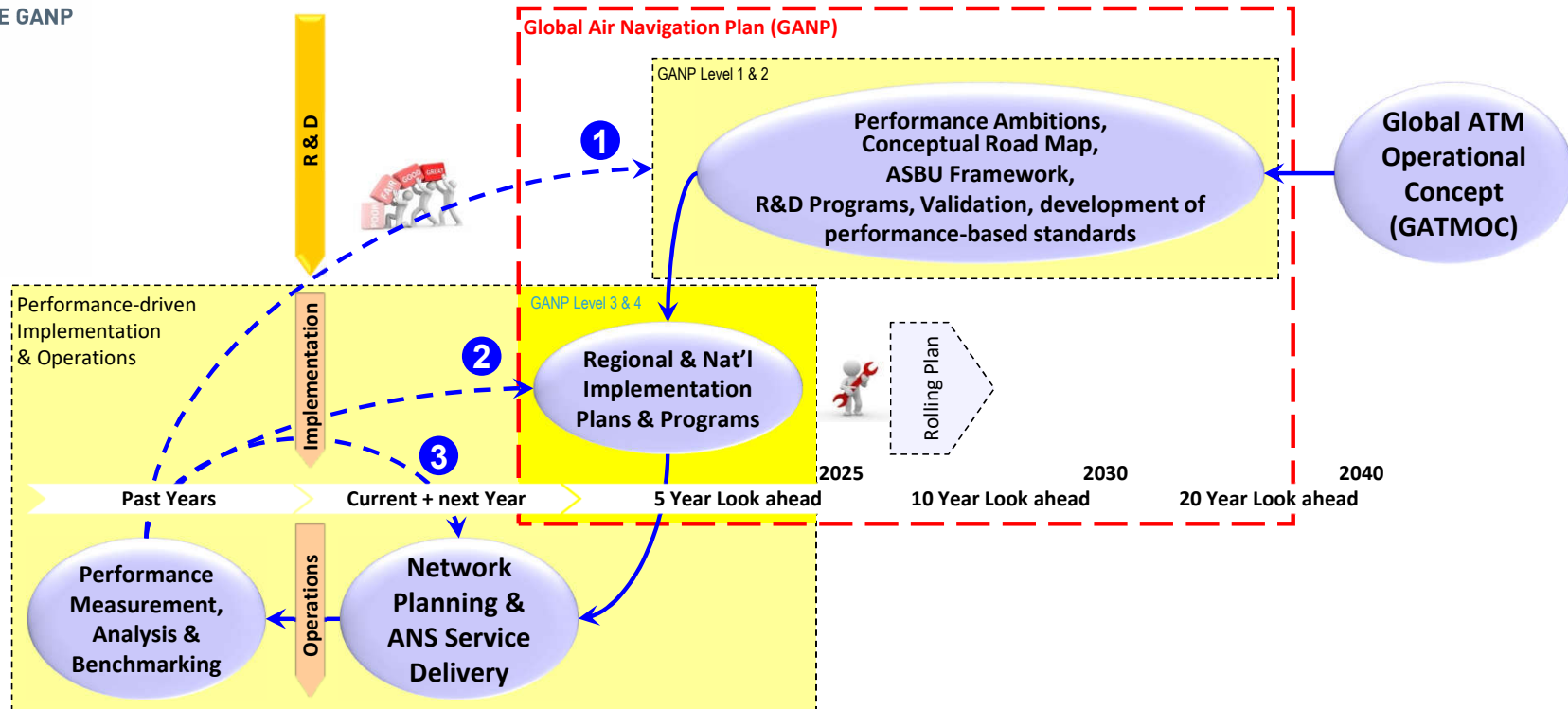
## MULTILAYER STRUCTURE OF THE GANP

Click a level to navigate

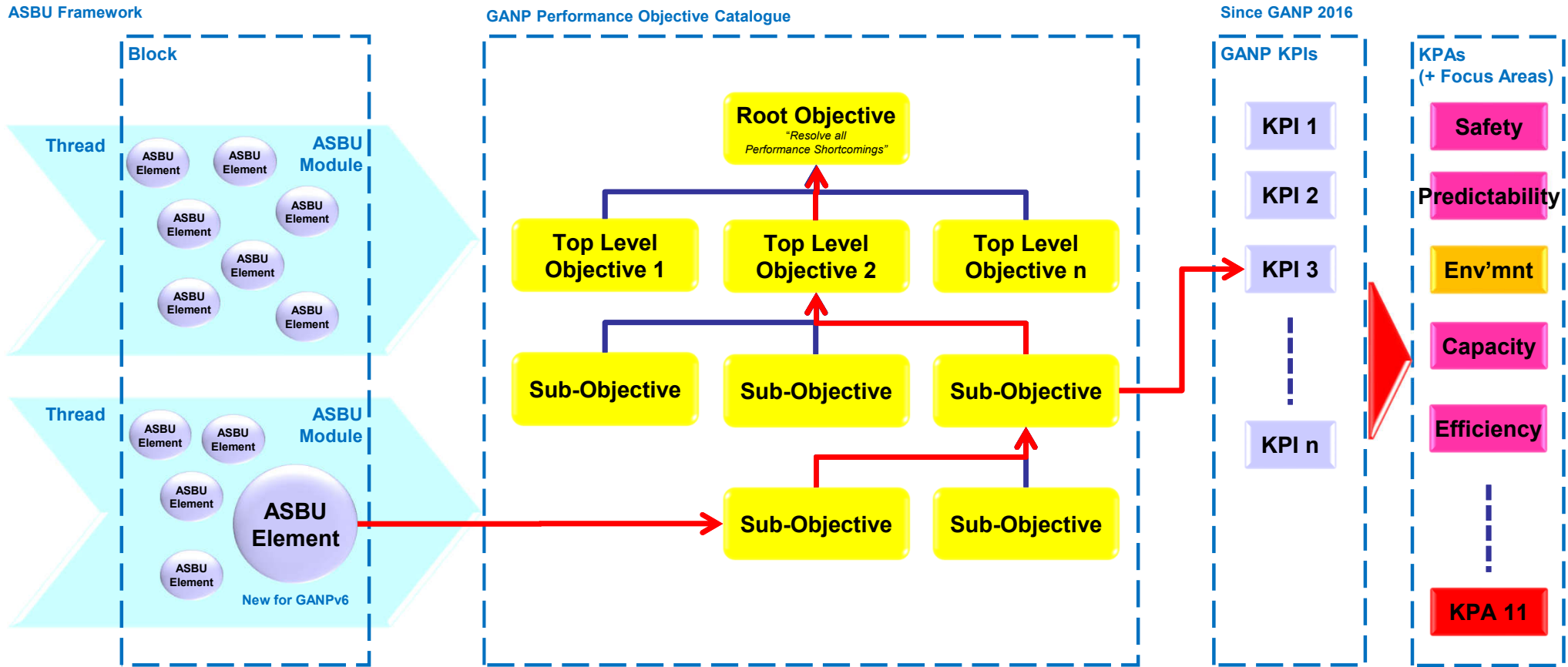
- GLOBAL STRATEGIC
- GLOBAL TECHNICAL
- REGIONAL
- NATIONAL



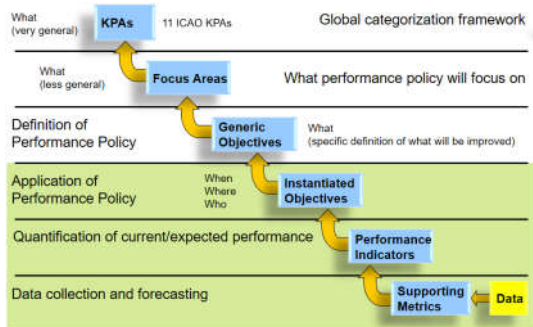
*A holistic approach from research and development to deployment and operations based on stakeholders operational needs and a global network approach to ensure harmonized and synchronized implementation delivering performance benefits*



# Performance in the ASBU Framework – Principles

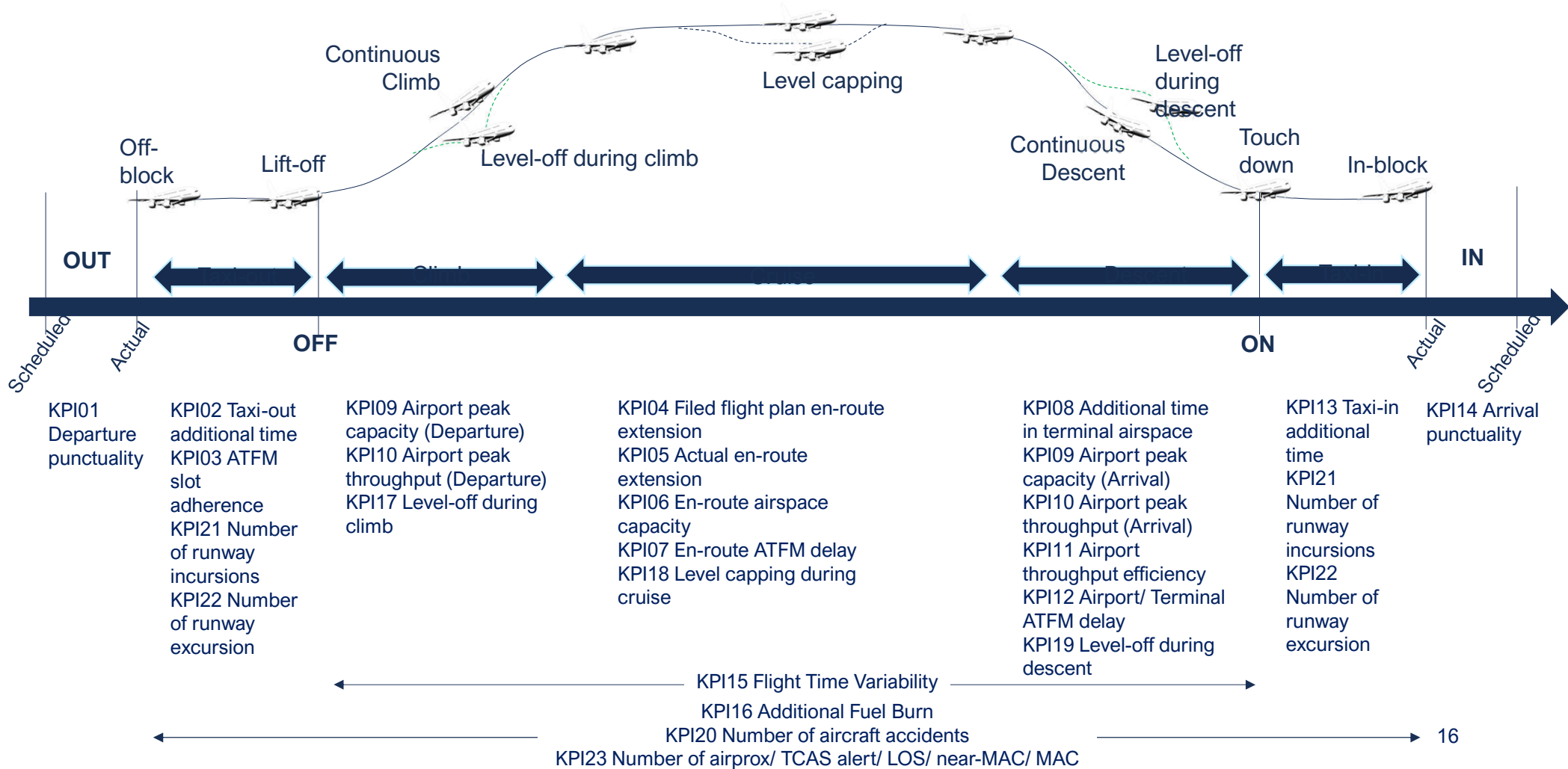


# 23+1 operational performance KPIs defined for the GANP ed.8



KPA	Efficiency	Capacity	Predictability	Safety	
<b>Focus Area(s)</b>	Additional flight time & distance	Capacity, throughput & utilization	Capacity shortfall & associated delay	Operational safety outcomes	
<b>KPI(s)</b>	KPI02 Taxi-out additional time  KPI13 Taxi-in additional time  KPI04 Filed flight plan en-route extension  KPI05 Actual en-route extension  KPI08 Additional time in terminal airspace	KPI17 Level-off during climb  KPI18 Level capping during cruise  KPI19 Level-off during descent	KPI16 Additional fuel burn  KPI09 Airport peak capacity  KPI10 Airport peak throughput  KPI06 En-route airspace capacity  KPI11 Airport throughput efficiency	KPI07 En-route ATFM delay  KPI12 Airport/Terminal ATFM delay  KPI01 Departure punctuality  KPI14 Arrival punctuality  KPI03 ATFM slot adherence	KPI15 Flight time variability  KPI20 Number of aircraft accidents  KPI21 Number of runway incursions  KPI22 Number of runway excursions  KPI23 Number of airprox/ TCAS alert/ loss of separation/ near midair collisions/ midair collisions (MAC)

# ICAO GANP KPIs (in Graphical Format)



## ICAO GANP 8ed.

KPI 24 – People/ Area Impacted by Significant Noise

# GANP Portal

<https://ganpportal.icao.int/>



**ICAO GANP PORTAL**

Global Strategic ▾ Global Technical ▾ Regional ▾ National ▾

Tutorial  
BBBs  
BBBs & USOAP – PQs  
ASBUs & PF  
AN-SPA

## WELCOME TO THE GLOBAL AIR NAVIGATION PLAN PORTAL

The GANP Portal is a web portal where all aviation stakeholders will be able to find the most relevant information related to the Seventh edition of the GANP

ganpportal/ANSPA/Reports

THE GLOBAL AIR NAVIGATION PLAN

## Regional: Data Analytics Group (DAG)

- Formed under the ambit of the ATM/SG under the APANPIRG
- **Aim**  
Establish a framework for evaluation of ATM performance that enables consistent reporting across APAC States/Administrations.
- **Scope**  
Develop a phased approach and information exchange between the States/Administrations, identify data and analytical capabilities across the APAC region, and KPIs suitable for assessment of ATM performance in the region. Develop a reporting framework consisting of common ATM KPIs, data requirements and evaluation methodologies for their assessment.

KPIs for the Region

KPA	APAC ATM KPI	GANP Reference
Capacity	Airport peak arrival capacity	KPI09-A
Capacity	Airport peak departure capacity	KPI09-D
Capacity	Airport peak arrival throughput	KPI10-A
Capacity	Airport peak departure throughput	KPI10-D
Efficiency	Additional taxi-in time	KPI13
Efficiency	Additional taxi-out time	KPI02
Predictability	Arrival punctuality	KPI14
Predictability	Departure punctuality	KPI01

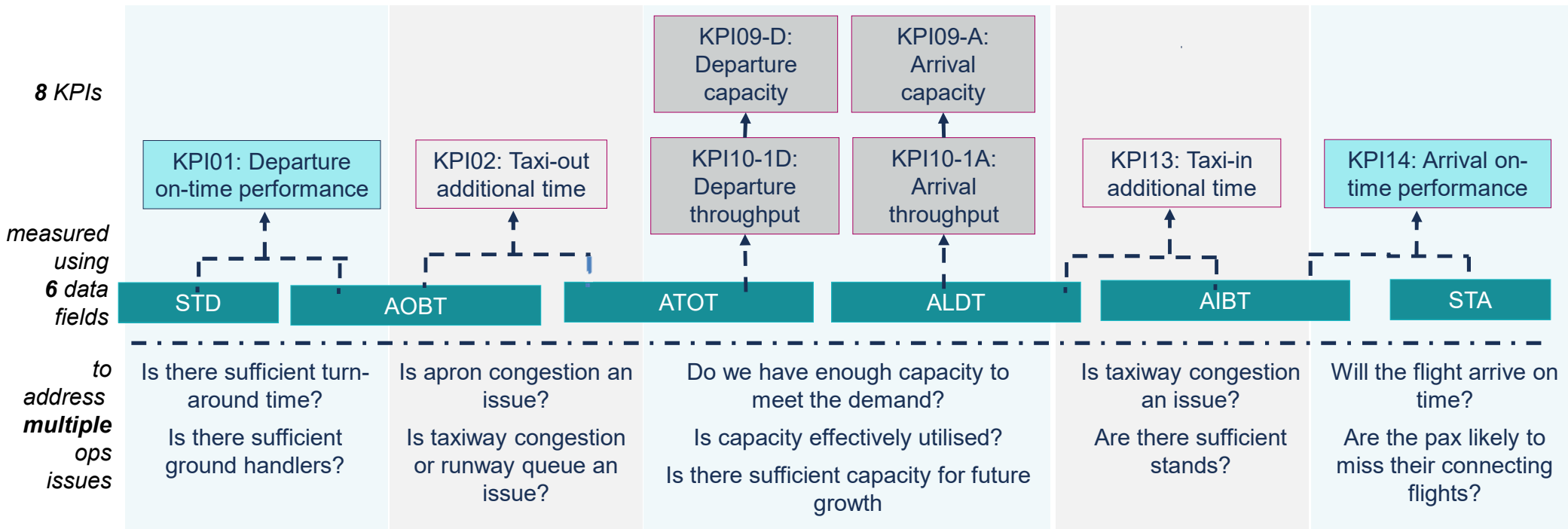
## **14 Member States in DAG, including 5 ASEAN Member States**

1. Australia
2. China
3. Hong Kong, China
4. India
5. Indonesia
6. Japan
7. Papua New Guinea
8. Philippines
9. Republic of Korea
10. Singapore
11. Sri Lanka
12. Thailand
13. United States
14. Vietnam

*Supported by ICAO Secretariat*

# Data-driven approach to diagnose operational issues

- 8 KPIs were identified for one-year exercise; consistent with the KPIs outlined in the ASEAN ANS Master Plan
- These KPIs can be derived from just 6 data fields and they provide answers to help diagnose operational issues



STD: Scheduled time of departure AOBT: Actual off-block time ATOT: Actual take-off time ALDT: Actual landing time AIBT: Actual in-block time STA: Scheduled time of arrival

## Data-driven approach to diagnose operational issues

- KPIs are calculated at flight-level, then aggregated for reporting.

KPI02: Taxi-out additional time

KPI01: Departure on-time performance

Callsign	AOBT	ATOT	ATOT - AOBT	SOBT	AOBT - SOBT	KPI01 Bucket
SIA537	2024-10-25 12:53:09	2024-10-25 13:14:00	20.85	2024-10-25 12:50:00	3.15	[-15,15]
AXB688	2024-10-25 14:24:37	2024-10-25 14:37:00	12.38	2024-10-25 14:00:00	24.62	(15,INF)
THY208	2024-10-25 14:56:59	2024-10-25 15:13:00	16.02	2024-10-25 15:00:00	-3.02	[-15,15]
JSA817	2024-10-25 05:47:40	2024-10-25 06:03:00	15.33	2024-10-25 05:55:00	-7.33	[-15,15]
SIA922	2024-10-25 17:27:00	2024-10-25 17:53:00	26	2024-10-25 17:45:00	-18	(-INF,15)

*Working example*

# KPI01 Departure Punctuality

- Definition: Percentage of flights departing from the gate on-time (compared to schedule).
- Utility of KPI: This KPI gives an indication of the service quality experienced by passengers, and the ability of the airlines to execute their schedule at a given departure location.
- Data required:
  - Scheduled time of departure (STD) or Scheduled off-block time (SOBT)
  - Actual off-block time (AOBT)
- Methodology:
  1. Exclude non-scheduled flights and cancelled flights.
  2. Calculate the time difference  $AOBT - STD$ .
  3. Categorize each flight into the 3 buckets of  $(-INF, -15)$ ,  $[-15, 15]$ ,  $(15, INF)$ .
  4. Sum up the number of flights in each bucket for every month.

## KPI02 Taxi-out Additional Time

- Definition: Actual taxi-out time compared to an unimpeded/reference taxi-out time.
- Utility of KPI: This KPI gives an indication of the efficiency of the departure phase operations on the surface of an aerodrome.
- Data required:
  - Actual off-block time (AOBT)
  - Actual take-off time (ATOT)
  - Departure gate ID and Take-off runway ID
- Methodology:
  1. Only include IFR flights.
  2. Calculate actual taxi-out for each flight:  $ATOT - AOBT$
  3. Group flights by runway and gate / gate clusters
  4. For each group, subtract the reference time from the actual times to obtain the additional taxi-out time, using a different reference time for each runway and gate / gate cluster combination.
  5. Obtain the average additional taxi-out times for the month across all flights.

# KPI09 Airport Peak Capacity

- Definition: Highest number of operations an airport can accept in an one-hour window. Also called declared capacity.
- Utility of KPI: This KPI gives an indication of the highest number of operations an airport will accept, under optimum operational conditions. This KPI is typically used for scheduling and ATFM purposes.
- Data required:
  - Scheduling parameters for slot controlled airports
  - Airport Acceptance Rates (AAR) and Airport Departure Rates (ADR)
- Methodology:
  1. Select highest value from set of declared capacities at the level of individual airports.
  2. Convert the value to an hourly rate, if the declaration is at smaller time intervals.
  3. Can be computed for arrivals, departures, or arrivals + departures.

# KPI10 Airport Peak Throughput

- Definition: The 95<sup>th</sup> percentile of the hourly number of operations recorded at an airport, in rolling hours sorted from least busy to busiest hour.
- Utility of KPI: This KPI gives an indication of “busy-hour” actual movement rates. For congested airports, this throughput is an indication of effectively realised capacity. For uncongested airports, it is a measure of demand.
- Data required:
  - Actual landing time (ALDT)
  - Actual take-off time (ATOT)
- Methodology:
  1. Restrict the hours considered to 0600 – 2259 local time for all airports.
  2. Calculate the number of flights per rolling hour, set at 15 minutes time interval.
  3. Arrange these rolling hours from the least number of flights to the greatest number of flights.
  4. The 95th percentile rolling hour will be taken as the peak throughput.
  5. Can be computed for arrivals, departures, or arrivals + departures.

## KPI13 Taxi-in Additional Time

- Definition: Actual taxi-in time compared to an unimpeded/reference taxi-in time.
- Utility of KPI: This KPI gives an indication of the efficiency of taxi-in after landing.
- Data required:
  - Actual landing time (ALDT)
  - Actual in-block time (AIBT)
  - Arrival gate ID and Landing runway ID
- Methodology:
  1. Only include IFR flights.
  2. Calculate actual taxi-out for each flight:  $AIBT - ALDT$
  3. Group flights by runway and gate / gate clusters
  4. For each group, subtract the reference time from the actual times to obtain the additional taxi-in time, using a different reference time for each runway and gate / gate cluster combination.
  5. Obtain the average additional taxi-in times for the month across all flights.

# KPI14 Arrival Punctuality

- Definition: Percentage of flights arriving at the gate on-time (compared to schedule).
- Utility of KPI: This KPI gives an indication of the service quality experienced by passengers, and the ability of the airlines to execute their schedule at a given destination.
- Data required:
  - Scheduled time of arrival (STA) or Scheduled in-block time (SIBT)
  - Actual in-block time (AIBT)
- Methodology:
  1. Exclude non-scheduled flights and cancelled flights.
  2. Calculate the time difference  $AIBT - STA$ .
  3. Categorize each flight into the 3 buckets of  $(-INF, -15)$ ,  $[-15, 15]$ ,  $(15, INF)$ .
  4. Sum up the number of flights in each bucket for every month.

# KPI08 Additional Time in Terminal Airspace

- Definition: Actual terminal airspace transit time compared to an unimpeded time.
- Utility of KPI: This KPI gives an indication of the average queuing taking place in terminal airspace as a result of sequencing or metering. It captures the extent arriving flights are subjected to speed restrictions, path extensions and holding patterns.
- Data required:
  - Terminal airspace entry time, computed from surveillance data (e.g. radar, ADS-B)
  - Actual landing time (ALDT)
  - Terminal airspace entry segment, computed from surveillance data (e.g. radar, ADS-B)
  - Landing runway ID
- Methodology:
  1. Only include IFR flights.
  2. Calculate actual terminal airspace transit times for each flight: ALDT – terminal airspace entry time, terminal airspace time = time over 40NM/100NM boundary
  3. Group flights by runway direction and terminal airspace entry segment.
  4. For each group, subtract the reference time from the actual times to obtain the additional terminal airspace transit time, using a different reference time for each runway direction and terminal airspace entry segment combination.
  5. Obtain the average additional terminal airspace transit times for the month across all flights.

# KPI11 Airport Throughput Efficiency

- Definition: The percentage of airport throughput compared to the lower of either capacity or demand.
- Utility of KPI: This KPI gives an indication of how effectively capacity is managed by the ANSP. It is a measure of accommodated demand, compared to the available capacity at the airport.
- Data required:
  - Actual landing time (ALDT) and Actual take-off time (ATOT)
  - Estimated landing time (ELDT) and Estimated take-off time (ETOT)
  - Declared total, landing, and arrival capacities for each airport.
- Methodology:

For each time interval of 15 minutes,

  1. Compute the throughput—count of number of actual landings based on ALDT
  2. Compute the demand—count of number of estimated landings based on ELDT
  - 3a. If demand  $\geq$  capacity, efficiency = throughput / capacity
  - 3b. If demand < capacity, efficiency = throughput / demand
  4. Compute the KPI =  $\text{sum}(\text{efficiency} * \text{demand}) / \text{sum}(\text{demand})$

## KPI03 ATFM Slot adherence

- Definition: Percentage of flights taking off within their assigned ATFM slot (CTOT compliance)
- Utility of KPI: This KPI gives an indication of the capability of an airport to contribute to ATFM effectiveness by delivering outbound traffic in a predictable manner to the departure runway, in compliance with ATFM slots
- Data required:
  - Calculated Take-Off Time (CTOT) for departures that were subject to ATFM
  - Actual Take-Off Time (ATOT) for departures that were subject to ATFM
- Methodology:
  1. Exclude flights not subject to an ATFM regulation
  2. Categorize each departing flight as compliant with its ATFM slot window or not (ATOT – CTOT)
  3. Number of compliant departures divided by total number of departing flights subject to an ATFM regulation

## KPI12 Airport/Terminal ATFM Delay

- Definition: ATFM delay attributed to arrival flow restrictions at a given airport and/or associated terminal airspace volume
- Utility of KPI: This KPI is a time aggregation of the ATFM delay generated by flow restrictions which are established to protect the destination airport or terminal area against demand/capacity imbalances
- Data required:
  - Calculated Take-Off Time (CTOT) at upstation airport, for arrivals that were subject to ATFM
  - Estimated Take-Off Time (ETOT) at upstation airport, calculated from the last filed flight plan
- Methodology:
  - Select the subset of arrival flights which are affected by the flow restrictions at this airport/ terminal airspace
  - Calculate ATFM delay:  $CTOT - ETOT$
  - At aggregated level:
    - Compute the KPI: sum of ATFM delays divided by total number of arrivals at the airport

# Establishing a Common Methodology

- KPI calculation methodologies are collated into a document guide and shared to members.
- Enables standardisation through agreement on a common methodology for collection and sharing.

## 5.2 DATA COLLECTION

The Basic Efficiency KPIs will be collected with the following data collection template.

Airport	Date	KPI02-1	KPI02-2	KPI13-1	KPI13-2
ZZZZ	2025-01	10.03	4.85	2.07	1.75
ZZZZ	2025-02	11.71	5.27	2.34	1.83
ZZZZ	2025-03	11.89	5.32	2.40	1.90

**Table 6 – Data collection template for efficiency (basic) with dummy data**

## 5.3 CALCULATION METHODOLOGY

### Reference Time

1. Only include IFR flights.
2. Calculate actual taxi-out or taxi-in times for each flight: ATOT – AOBT or AIBT – ALDT respectively.
3. Group flights by runway and gate / gate clusters (e.g. 20L\_G).
4. For each group, obtain the 20<sup>th</sup> percentile taxi-out or taxi-in time as the runway and gate / gate cluster combination's reference time.

### Additional Taxi Time

1. Only include IFR flights.
2. Calculate actual taxi-out or taxi-in times for each flight: ATOT – AOBT or AIBT – ALDT respectively.
3. Group flights by runway and gate / gate clusters (e.g. 20L\_G).
4. For each group, subtract the reference time from the actual times to obtain the additional taxi-out or taxi-in time, using a different reference time for each runway and gate / gate cluster combination.
5. Obtain the average additional taxi-out or taxi-in times for the month across all flights.

*Sample section from DAG Data Collection Guide*

## KPI09 Airport Peak Capacity

	2024			2025		
Airport	KPI09-AD	KPI09-A	KPI09-D	KPI09-AD	KPI09-A	KPI09-D
RPLL	40	20	20	40	20	20
VHHH	69	35	32	73	37	39
VTBS	71	35	36	85	42	43
VVNB	51	24	24	52	26	26
VVTS	52	26	26	52	26	26
WSSS	73	38	40	73	38	40

## KPI10 Airport Peak Throughput

	2024			2025		
Airport	KPI10-AD	KPI10-A	KPI10-D	KPI10-AD	KPI10-A	KPI10-D
RPLL	47.8	23.4	27.8	46.2	24.2	26.8
VHHH	53.8	29.3	31.6	60.9	32.8	38
VTBS	57.3	31.4	30.8	-	-	-
VVNB	34.3	18.5	17.4	34.7	19.6	18.3
VVTS	42.4	22.3	22.2	42.4	23.1	22.4
WSSS	47.1	31.1	22.4	48.1	31.4	21.5

## KPI02 Taxi-out Additional Time (Mins) and KPI13 Taxi-in Additional Time (Mins)

Airport	2024		2025	
	KPI02	KPI13	KPI02	KPI13
VHHH	4.1	1.7	4.1	3.4
VTBS	3.7	2.4	3.8	2.5
VVNB	3.1	3.3	3.9	2.5
VVTS	4.1	11.3	5.0	10.3
WSSS	3.2	2.3	3.4	2.3

## KPI11 Airport Throughput Efficiency (%)

Airport	2024			2025		
	KPI11-AD	KPI11-A	KPI11-D	KPI11-AD	KPI11-A	KPI11-D
VHHH	98%	100%	98%	98%	100%	99%
VTBS	100%	100%	100%	-	-	-
VVNB	101%	100%	101%	101%	101%	102%
VVTS	104%	101%	103%	105%	104%	107%
WSSS	91%	97%	88%	90.2%	96%	89%

## KPI08 Additional Time in Terminal Airspace (Mins)

	2024				2025			
Airport	KPI-08A40	KPI-08A100	KPI08-B40	KPI08-B100	KPI-08A40	KPI-08A100	KPI08-B40	KPI08-B100
VHHH	-	3.0	-	5.0	-	3.5	-	5.3
VTBS	-	-	-	-	4.5	-	-	-
VVNB	2.8	-	2.9	-	3.1	-	3.3	-
VVTS	-	-	3.7	-	-	-	3.7	-
WSSS	2.7	4.3	4.6	5.4	2.9	4.3	4.9	5.6

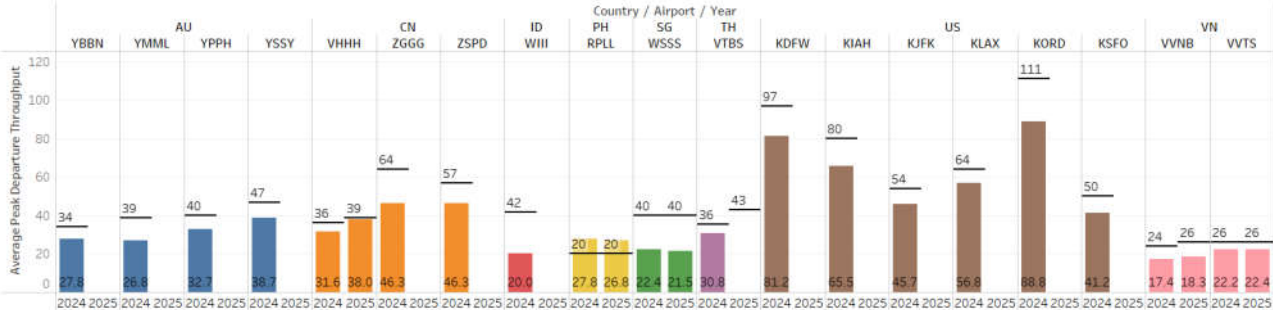
## KPI01 Departure Punctuality (%) and KPI14 Arrival Punctuality (%)

		2024			2025		
Airport	Phase	(-INF,-15)	[-15,15]	(15,INF)	(-INF,-15)	[-15,15]	(15,INF)
VHHH	ARR	20.3%	50.2%	29.5%	22.3%	50.1%	27.6%
VHHH	DEP	1.5%	63.3%	35.2%	1.5%	66.6%	32.0%
VTBS	ARR	26.9%	57.1%	16.0%	25.5%	55.5%	18.9%
VTBS	DEP	0.8%	70.3%	28.9%	1.0%	71.7%	27.3%
VVNB	ARR	-	61.8%	-	-	55.6%	-
VVNB	DEP	-	75.5%	-	-	71.8%	-
VVTS	ARR	-	54.1%	-	-	71.8%	-
VVTS	DEP	-	64.6%	-	-	61.6%	-
WSSS	ARR	19.5%	55.0%	25.5%	17.9%	56.4%	25.7%
WSSS	DEP	0.3%	73.9%	25.9%	0.5%	74.3%	25.2%

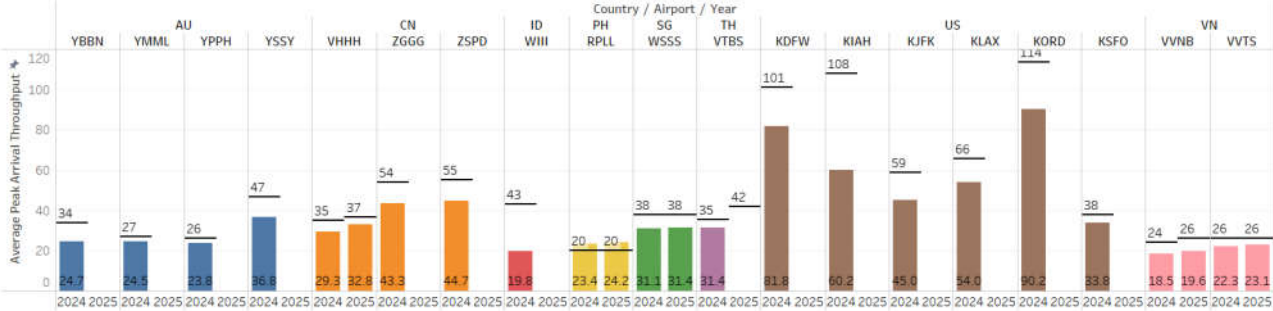
# PEAK CAPACITY AND THROUGHPUT

KPI09, KPI10

Capacity and Throughput - Departure



Capacity and Throughput - Arrival

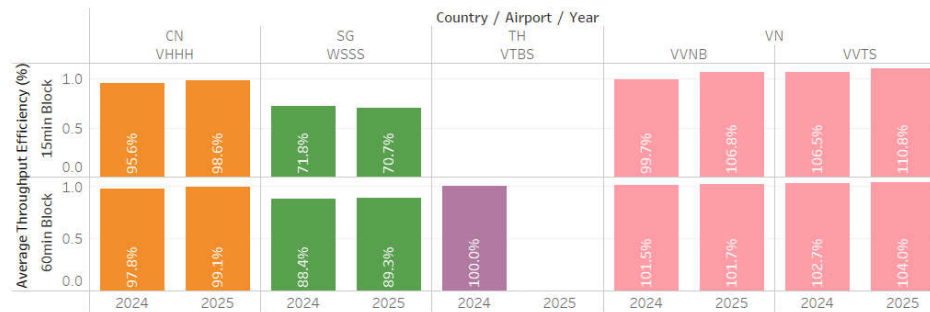


- Comparing 2024 to 2025, all airports saw slight increase in peak throughput while declared capacity has mostly remained unchanged.
- Airports operating near their peak capacity in 2024 continue to do so in 2025.

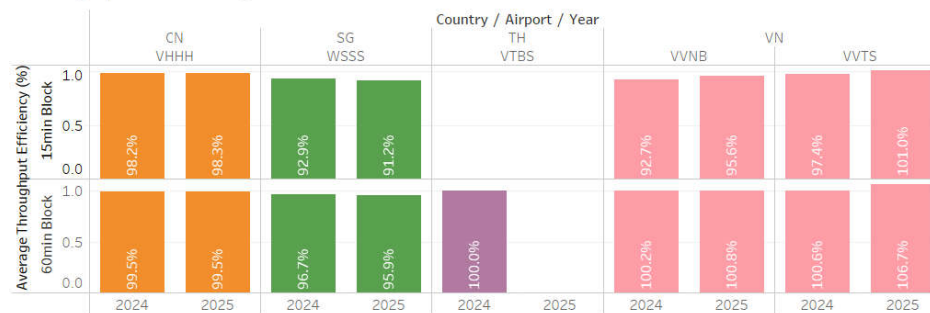
# THROUGHPUT EFFICIENCY

KPI11 (NEW)

Throughput Efficiency - Departure



Throughput Efficiency - Arrival



- All airports were observed to be operating at high throughput efficiency.
- The basic variant, with a 60 minute interval, is more stable and exhibits less variance.

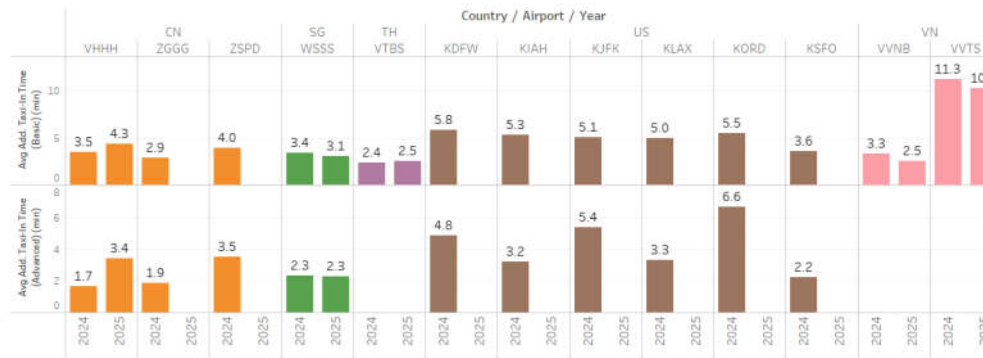
# ADDITIONAL TAXI TIME

KPI02, KPI13

Additional Taxi-Out Time



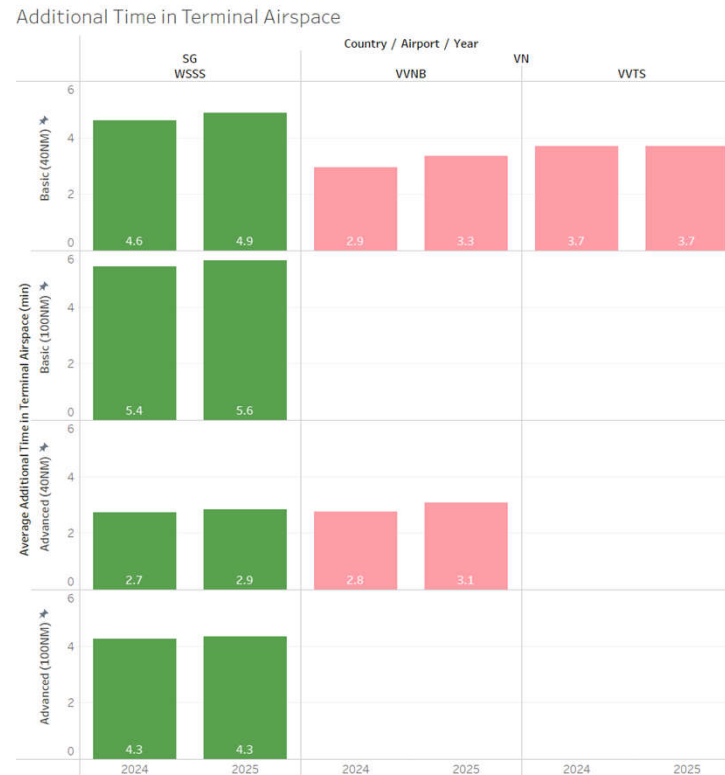
Additional Taxi-In Time



- Comparing 2024 to 2025, a slight increase across airports is observed in additional taxi-out time.

# ADDITIONAL TIME IN TERMINAL AIRSPACE

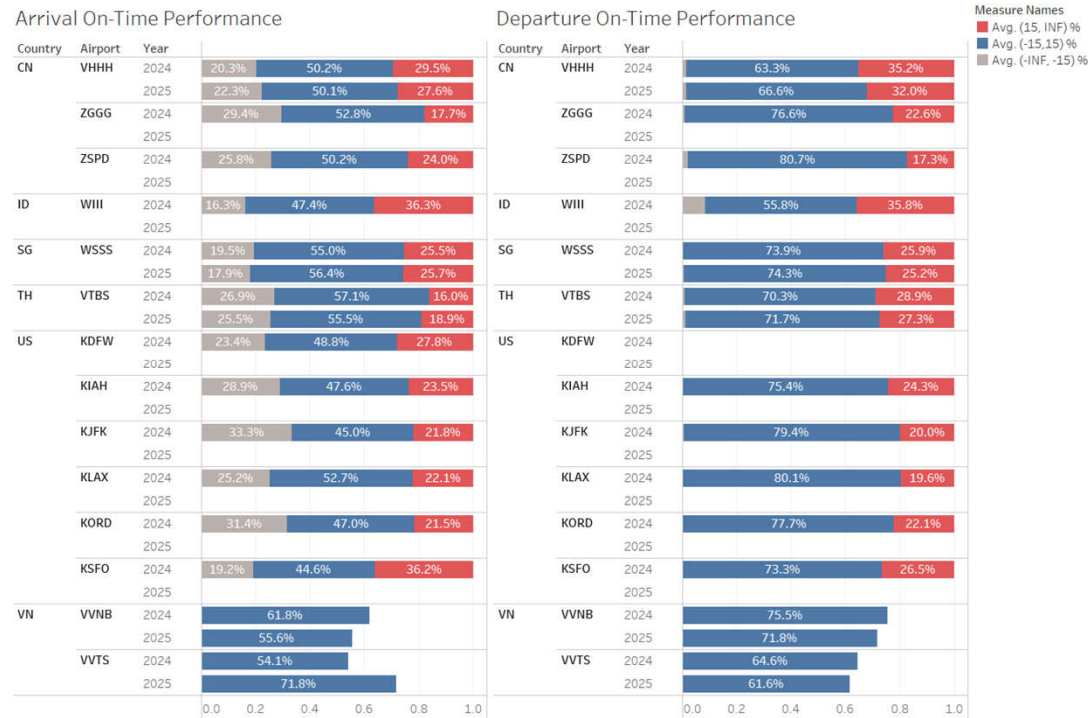
KPI08



- Slight increase in additional time in terminal airspace is observed across airports.
- The advanced variant produces lower values than the basic variant in WSSS, due to accounting for differences in aircraft categories.

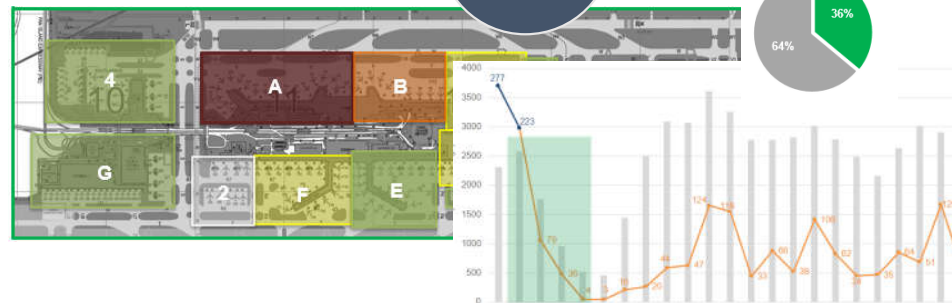
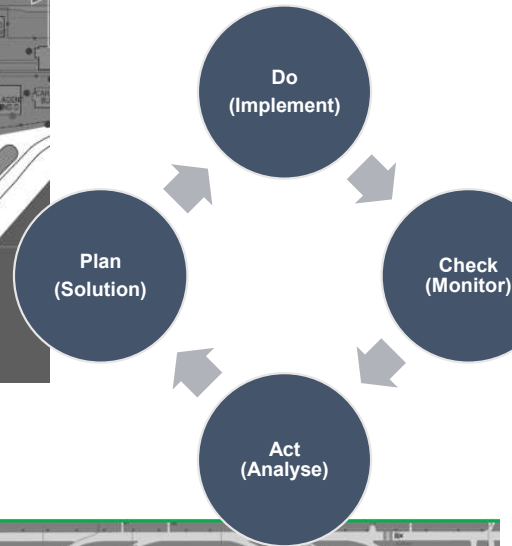
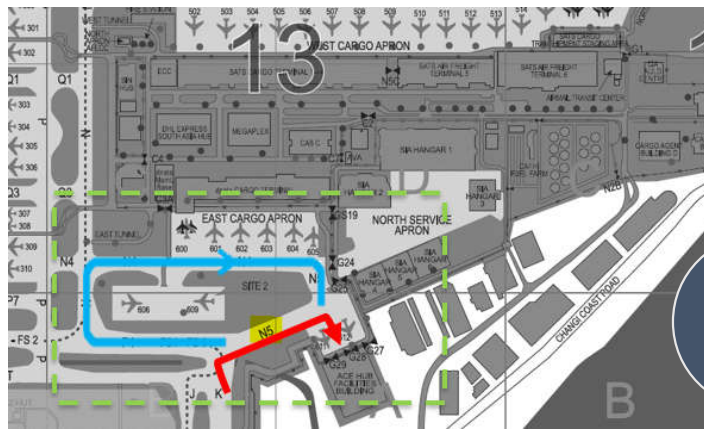
# PUNCTUALITY

KPI01, KPI14



- Arrival on-time performance remains poorer compared to departure on-time performance across all airports.
- Most airports saw improvements in departure on-time performance from 2024 to 2025, while improvements in arrival on-time performance were mixed.

# Applying the ICAO 4-step performance management process to improve Changi's taxi-out performance



# Performance Measurement needs NOT be...

Complex complicated nor too precise

Handwritten mathematical notes on grid paper, including:

- Equations:  $\frac{3}{\sqrt{5+\sqrt{2}}} + \frac{5}{\sqrt{8+6x^2}} + \frac{x^2}{18} \frac{2\sin^3 52^\circ - 1}{\cos 58^\circ - \cos 31^\circ} = \sqrt{2} \sin 2x$ ;  $\int \int \int f(x,y,z) dT = \int_a^b dx \int_c^d dy \int_e^f f(x,y,z)$ ;  $\lim_{x \rightarrow 0} \frac{\Delta f}{\Delta x} = \frac{f(x) - f(x_0)}{x - x_0}$ ;  $\frac{2a-b}{(a+b)^2}$ ;  $\frac{3\pi}{5} (-A \sin x - B \cos x) + \frac{2}{5} A \sin x + B \cos x - \sin x \cos x^3$
- Diagrams: A 3D pyramid with height  $h$  and base side  $c$ ; A hyperboloid of one sheet; A circular sector with radius  $r$  and angle  $\theta$ .
- Other notes:  $A=0$ ;  $B=-1/2$ ;  $\frac{bc \cdot \sin \alpha}{a}$ ;  $\frac{1}{2} \delta f = 0$ ;  $\frac{1}{18}$ ;  $\frac{1}{13x}$ ;  $\frac{dz}{dx} = \varphi\left(\frac{y}{x}\right) - \frac{y}{x} \cdot \varphi'\left(\frac{y}{x}\right) - \frac{y^2}{x} \cdot \varphi''\left(\frac{y}{x}\right)$

