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**Indicator development: how could we improve existing indicators
and which new ones do we need?**

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This is an electronic version of a paper presented at the *Vista workshop*, Vienna, Austria, 23 October 2017.

Details of the workshop are available at:

<http://vista-eu.com/>

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Session 3



Indicator development:

how could we improve existing indicators and which new ones do we need?





NB1. Broadening the scope

NB2. Some thoughts from on-going work in SESAR 2020 Scientific Committee (TF3)

SESAR 2020 Scientific Committee



- Identify key challenges in performance measurement in aviation, especially regarding missing indicator development for the future system
- Characterise a set of high-level challenges, and for each one:
 - define sub-challenges
 - give an indicative timescale of likely main impact
 - identify why action needed
 - consider potential actions (initially at a high-level) ([re. also Session 5](#))

- monitor and coordinate (suggestions) with existing work 
- flag as potential new work area to be defined 
- education / dissemination 
- sub-challenge requiring particular further investigation 

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- Vertical (common, continuous)
 - indicator design, methods and supporting data
 - trade-offs (perennial topic; inter- & intra-KPA)
- Horizontal (at points in time)
 - spatial scope (least mature)
 - better stakeholder alignment
 - safety and harmonisation (most mature)
- Some inevitable, residual overlap between the categories (as will be seen)
- Needed a timeframe referenced to target-setting / SES RPs etc.


2017-19	current
2020-25	near term
2026-35	medium term
2036-50	long term
2050+	far term





Indicator design, methods and supporting data (vertical)




Define the sub-challenge	Likely outcome if no action	Potential action by SC
<p>A1. Existing indicators need to be checked for true consistency across global regions (e.g. inclusion of FUA, reactionary delay) and further explored regarding suitability for purpose (e.g. although average ATFM delay established as a leading indicator, issues pertain: see stakeholder feedback and worked example)</p>	<p>False conclusions may be drawn regarding comparisons across global regions and across time / projects</p>	<p>Monitor and coordinate with PRU and PRB (possibly also ICAO). New required.</p>
<p>A2. Lack of standardisation across datasets (e.g. scope, cleaning); limited sample sizes (e.g. top 34 airports, ≈ 2% error) – lack of metric saturation, lack of statistical testing (e.g. reliance on outlier removal)</p>		<p>SC White Paper? Education (dissemination) and coordination with KTN (from 2018) and ECTL (e.g. accessibility, awareness, manuals)</p>
<p>B1. Indicators too heavily focused at network level and on ANSPs (links with F1); many states in SES PS argue that a 'one-size fits all' system does not work</p>	<p>Lack of insight into, and appropriate targeting of, performance shortfalls (c.f. too much fragmentation in SES PS could also jeopardise performance improvement); insufficient support for evidence-based policy making; may worsen in future (links with I1)</p>	<p>Monitor and coordinate with PRU (PRRs) and PRB (SES RP3+)</p>
<p>B2. Lack of forward-scoping of new indicators re. responsiveness to emerging regulatory / business / ATM factors (e.g. paradigms such as pax speed demand, ATCO working environments); plus complementary methods affording better perf. insights</p>		<p>New work needs to be defined (could embrace big data; links with S2020 theme "Complexity, data science and information management")</p>




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Trade-offs (vertical)		
Define the sub-challenge	Likely outcome if no action	Potential action by SC
<p>C1. Quantitative relationships between KPIs usually very poorly understood (if at all).</p> <p>(Some exceptions, e.g. AEV project, ATFM worked example.)</p>	<p>Certain combinations of targets may be incompatible; situation will probably worsen as more targets are added (e.g. RP3 c.f. RP2)</p>	<p>Issue cited many times across RP3 consultation processes, for example. Previous and ongoing projects (SESAR ER1: APACHE; INTUIT; Vista) using a variety of methods (multi-criteria optimisation, Pareto frontiers; machine learning; simulated learning loop; respectively). Earlier, more influence diagrams.</p>
<p>C2. Lack of stakeholder tools to explore KPI relationships</p>	<p>Lack of understanding of impact of (investment) actions in one KPA/KPI on another (Links with F2.)</p>	<p>SC (coordinated) White Paper? A state-of-the-art review, initially amongst SJU, ECTL, PRB, EASA (recent dedicated report on interdependency analysis) and (SESAR ER1) project leaders, to explore concerted action; possible new work needs to be defined.</p> <div style="text-align: right;">  </div>

Spatial scope (horizontal)		
Define the sub-challenge	Likely outcome if no action	Potential action by SC
<p>D1. ATM is not integrated into the D2D, intermodal context</p> <p>Medium-term</p>	<p>Potentially disruptive changes (e.g. new stakeholder behaviour w.r.t. A-CDM, UDPP) could significantly impact flight planning (and other ops); ATM could become unpredictably coupled with processes beyond the airport</p>	<p>New work needs to be defined; impact assessment required, including, but not limited to, performance assessment. Links with S2020 theme "ATM's role in intermodal transport".</p> 
<p>D2. Lack of D2D indicators</p> <p>Medium-/long-term</p>	<p>We cannot measure or manage D2D performance</p>	<p>New work needs to be defined; design the required D2D metrics (build on projects such as DATASET2050, see example); decide on their likely prioritisation and evolution; determine what data will be required & how could be obtained. (Links with E1.)</p> 

Better stakeholder alignment (horizontal)

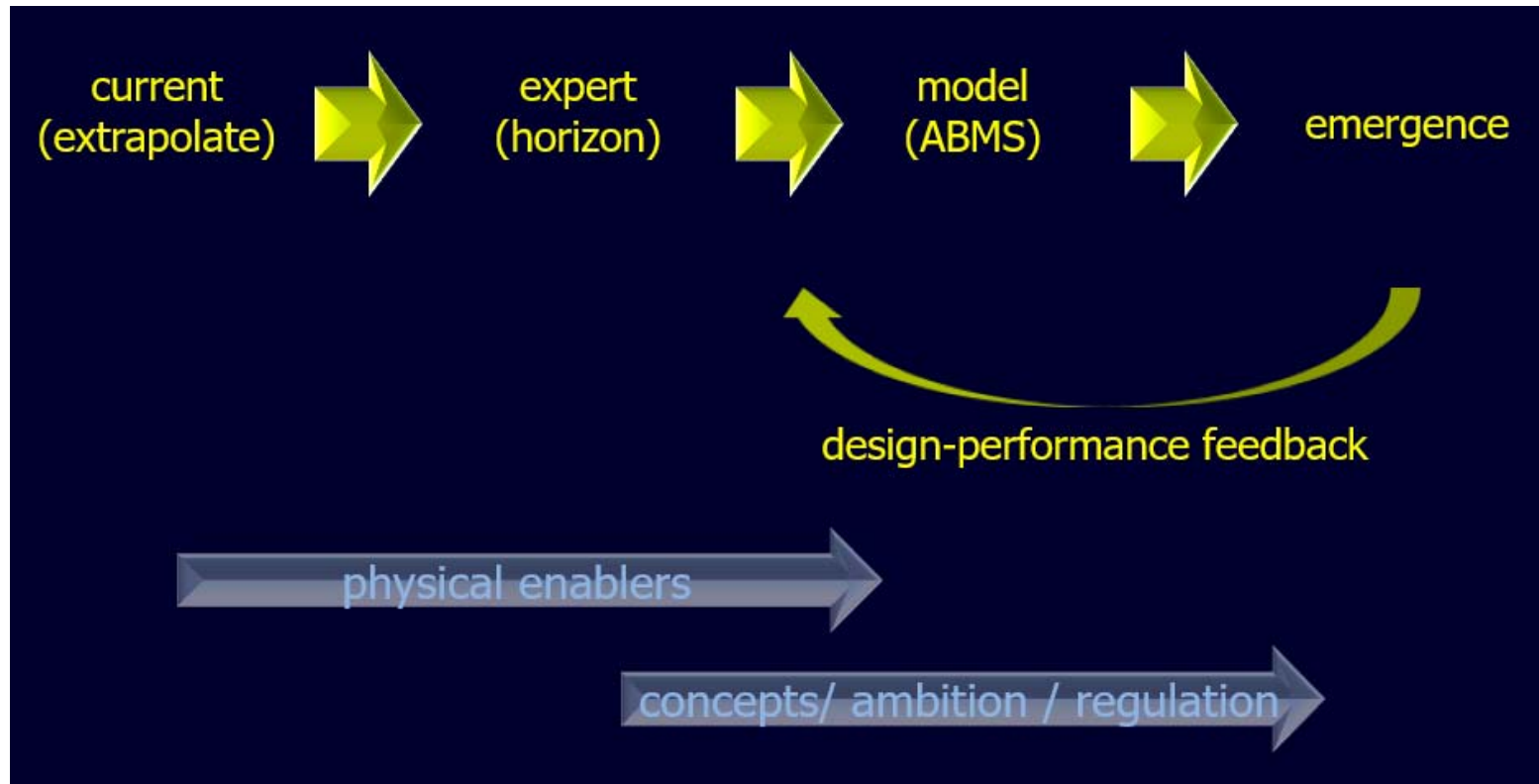
Define the sub-challenge	Likely outcome if no action	Potential action by SC
<p>E1. Scope of indicators too restricted in terms of metrics used (e.g. cost instead of delay; flight performance only, not delivery to the passenger)</p> <p>Near-term</p>	<p>Can't measure ('see') performance delivery to pax; can't measure ('see') certain other changes in performance (e.g. cost per flight)</p>	<p>New work needs to be defined. Coordinate with PRB. (Links with D2.) NB. Cost of cancellation, cost of predictability, (cost of) resilience – all relatively immature.</p> 
<p>F1. Scope of indicators too restricted in terms of stakeholder inclusion; SES PS slow to extend to other stakeholders and impact areas; often have contrasting indicator perspectives (e.g. AUs (flight OTP), airports (pax dwell time / congestion), ENV (NO_x))</p> <p>Medium-term</p>	<p>Can't measure performance roles played by other stakeholders / impacts on ENV</p>	<p>New work needs to be defined. Coordinate with PRB. (Links with B1.)</p> 
<p>F2. Further mapping required between ATM deployment beyond PCP in particular (New Essential Operational Changes) and impacts on (SES) indicators</p> <p>Medium-/long-term</p>	<p>Insufficient understanding of relationships between investment and indicator impact</p>	<p>Further work to be defined. Substantial progress in MP edition 2015 (Chapter 6, Business View). Coordinate with SJU / PRB. (Links with C2.)</p> 

Safety and harmonisation (horizontal)		
Define the sub-challenge	Likely outcome if no action	Potential action by SC
<p>G1. Accidents / incidents are typically at end of chain of events. PRB believes that accidents are avoided, in some cases, by the activation of final safety interventions e.g. TCAS defence, in a number of very serious incidents</p> <p>Near-term</p>	<p>Continuing reliance of final safety interventions is probable</p>	<p>Activation of final interventions suggests need to develop missing higher-level indicators, especially those giving warnings of degradation (including strategically). More focus on GA, where most incidents occur. New work needs to be defined. Monitor progress in RP3.</p> 
<p>H1. PRC raised concern: definition & guidance on development of Acceptable Level of Safety Performance (ALoSP) currently not available in Europe. ICAO requirements for ALoSP leave room for interpretation regarding best way to implement</p> <p>Near-term</p>	<p>Initiative is required to fill this gap by developing a harmonised approach, to ensure a harmonised implementation of State Safety Programmes and to facilitate the exchange of safety information in the future.</p>	<p>An ALoSP survey will achieve more comprehensive understanding of ALoSP implementation in EUROCONTROL member states, in terms of concept definition, scope, and implementation challenges. Coordinate with PRC.</p> 
<p>I1. Limited assessment potential for new operational concepts and future market changes (e.g. drones), partly as we cannot rely on historical data (links with B2)</p> <p>Medium-term</p>	<p>Limits the development of safety cases for new operational concepts (especially in the context of increasing traffic and improved safety targets).</p>	<p>Better modelling (& new indicators?) required, especially for capturing emergent behaviours of exceptional safety critical events & safety risks of novel designs (approaches include agent-based safety risk analysis & (big) data-driven models). Coordinate with EASA. New work needs to be defined.</p> 

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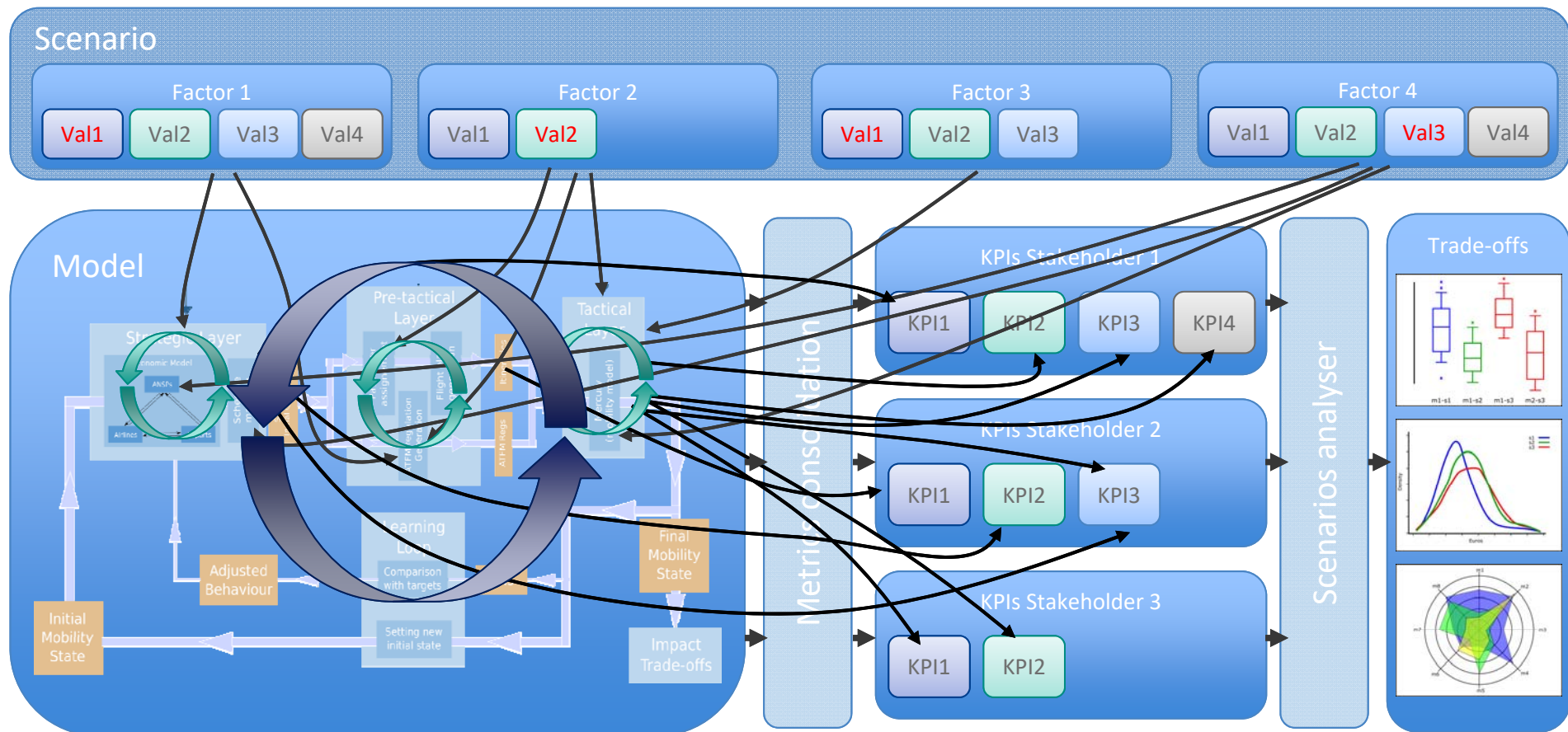
Towards a full performance assessment framework: future indicator requirements



(Session 5 ...)

Back to Vista context ...

Vista metrics and assessment

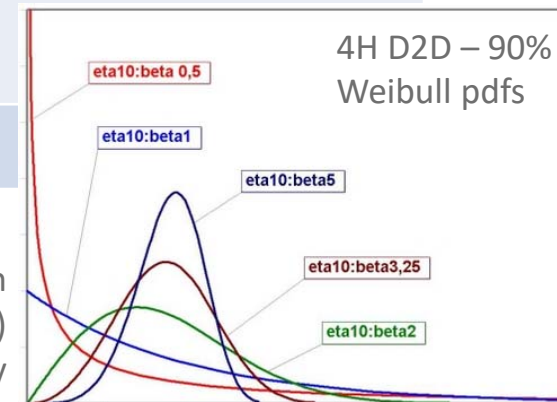


Vista metrics and assessment



Stakeholder	Metrics	
Passengers	<ul style="list-style-type: none"> Number / volume Delay (departure, arrival; reactionary) Gate-to-gate time Door-to-door time 	<ul style="list-style-type: none"> Missed connections Hard / soft costs Value of time (utility)
Airlines	<ul style="list-style-type: none"> Number / volume (flights, pax) Delay (departure, arrival; reactionary) Revenue and costs (incl. delay) 	<ul style="list-style-type: none"> Gate-to-gate time (OTP) Missed connections Gate-to-gate time
ANSPs	<ul style="list-style-type: none"> Number / volume (flights) Delay (generated, mitigated) 	<ul style="list-style-type: none"> Flight-km controlled Revenue and costs (incl. delay)
Airports	<ul style="list-style-type: none"> Number / volume (flights, pax) Delay (departure, arrival; reactionary) Revenue and costs (incl. delay) 	<ul style="list-style-type: none"> Missed connections
Environment	<ul style="list-style-type: none"> CO₂ 	<ul style="list-style-type: none"> NO_x

policy / regulation
 technology (incl. UDPP etc.)
 intermodality



Vista metrics and assessment



Stakeholder	Current	2050 (additional) - ??
Passengers	<ul style="list-style-type: none"> • Cost of ticket • Frequency of flights • Punctuality (G2G) • Travel time (D2D) 	<ul style="list-style-type: none"> • Intermodality (D2D resilience) • ENV footprint (speed paradigm) • In-mode connectivity (utility)
Airlines	<ul style="list-style-type: none"> • Punctuality (G2G) (OTP) • Resilience (e.g. cost of delay) • Profitability (yields, load factors) • Market share 	<ul style="list-style-type: none"> • Intermodality (G2G resilience) • ENV footprint (marketing)
ANSPs	<ul style="list-style-type: none"> • Delay (ATFM – generated, mitigated) • Cost efficiency • Flight efficiency 	<ul style="list-style-type: none"> • Market share (trajectories?) • Profitability (freer market?) • Capacity (better) & QSM • Drone accessibility / density
Airports	<ul style="list-style-type: none"> • Connectivity (DG MOVE Aviation Strategy for Europe) • Delay (departure, arrival; reactionary) • Profitability • QSM (wide range PIs; penalties applied) • ENV footprint (marketing) 	<ul style="list-style-type: none"> • Intermodality (catchments; access) • Resilience packages (volumes) • New retail paradigms (NER %)
Environment	<ul style="list-style-type: none"> • CO₂ • Local NO_x • Noise 	<ul style="list-style-type: none"> • En-route NO_x • Particulates • Recycling % / rare earth content
+ ??		

Discussion points



- Q1.** Are some current indicators not best-suited to their intended purpose and how could they be improved and/or complemented?

- Q2.** What is the best method to identify and prioritise indicator development for the 2035/2050 timeframe, across stakeholder types? Is the ICAO KPA framework sufficient?

- Q3.** What areas of future indicator development work should be prioritised?

- Q4.** What form (e.g. building a full performance assessment framework, modelling future aviation development?) and funding mechanism are best suited to support such future work?