ONWARD & UPWARD:

Navigating the Future of Sustainability in Aviation

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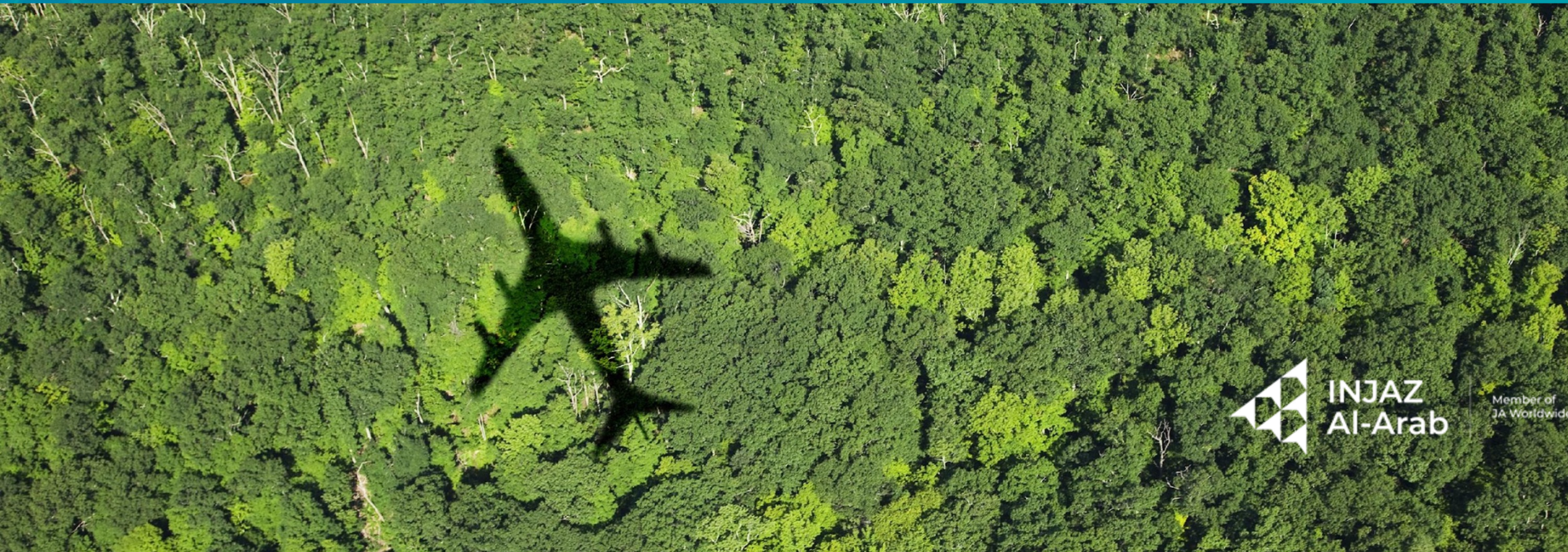
Module 4:
Economic Sustainability in Aviation



Look out for:

General Knowledge & Insightful Facts

Key Things to Note

Self- paced Learning Activity

Required Tasks

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Module 4: Objectives & Learning Outcomes

Objectives

4.1: Examining economic aspects of sustainable aviation

4.2: Exploring cost benefit analysis tools in aviation sustainability

4.3: Defining criteria for sustainable business models

Learning Outcomes

4.a: Recognize the importance of economic sustainability for long-term industry resilience

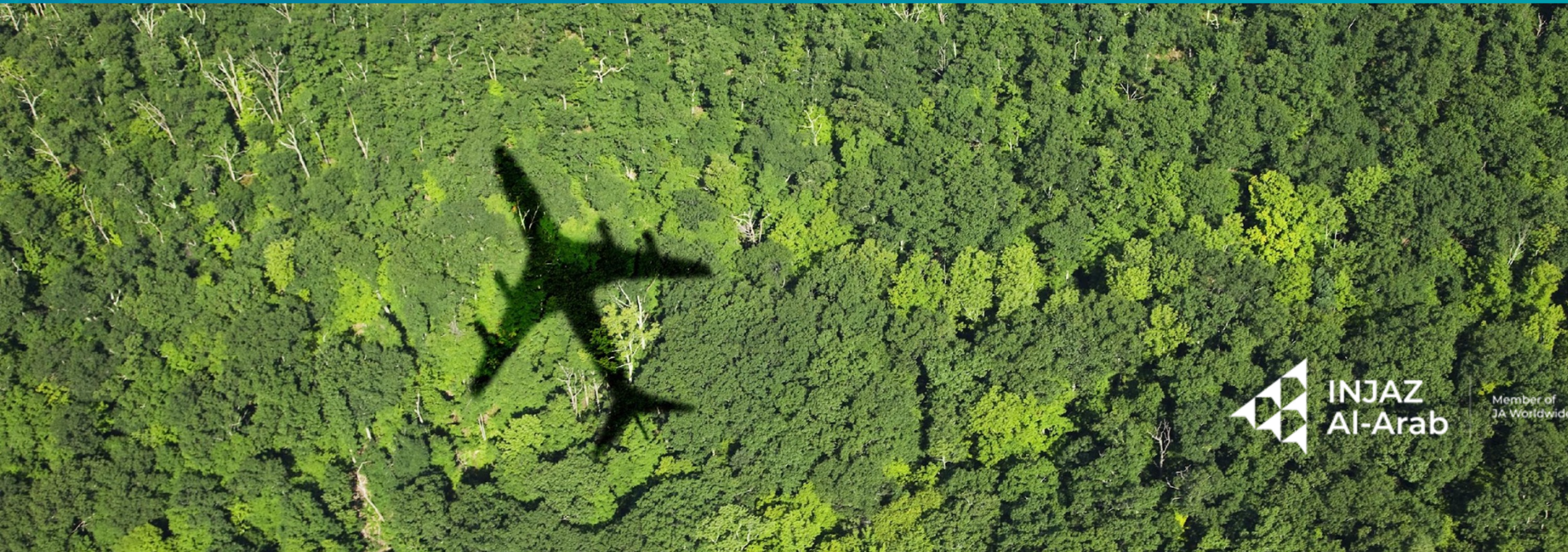
4.b: Utilize tools to evaluate efficacy of sustainability initiatives

4.c: Strategize sustainable policies and approaches for businesses

Write down and set your learning intentions for this module. Ask yourself what do you want to learn and why? **DO**

Skills: Structured problem solving, win-win negotiations, organisational awareness, drive change and innovation

Objective 4.1:
Economic Aspects of Sustainable Aviation



Aviation Economics:
Principles

Source: Altrurki

Aviation Economics: *Principles*

Cost Structure	Description
Revenue Management	Techniques to maximize revenue by managing inventory and pricing.
Yield	Measure of revenue per unit, critical for profitability analysis.
Carrier Type	Differentiation between low-cost, regional, and full-service carriers.
Taxation	Impact of taxes on profitability and cost management.
Capital	Financial resources required for operations and expansion.
Fuel	Significant cost component, influenced by market volatility.
Volatility	Economic factors affecting stability and financial planning.

DO

Considering the various cost components in aviation, such as fuel, revenue management, and capital, how can airlines balance the need for profitability with the adoption of sustainable practices? Reflect on the potential challenges and think about potential solutions to achieve this balance.

Aviation Finance:
Industry Statistics

Airlines have spent
$1 trillion
on new aircraft in the last decade

Airlines have spent
$4.3 trillion
on fuel in the last 30 years

Global airline operating expenses over the last 30 years (1990-2019):
$19.3 trillion
(or an average of $670 billion per year)

Annual spend on efficiency research and development by aerospace:
$15 billion
(up to $450 billion over 30 years)

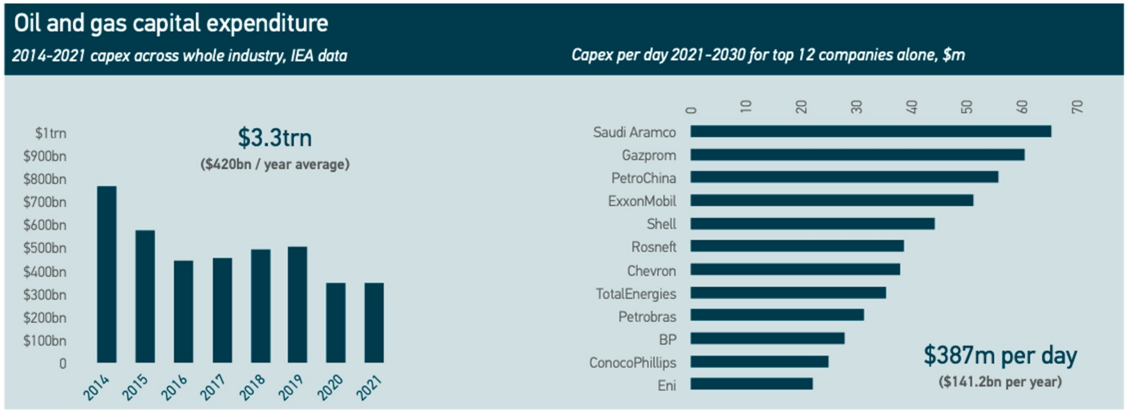
ACI estimates that global airports will need over
$2.4 trillion
in capital expenditure over the next 20 years: for capacity and routine upgrades[14]

Airport capital expenditure needs
2021-2040 total needed capex by region

The next 20 years will require **$2.4 trillion** in airport capex worldwide.

Source: ICAO

Aviation Finance:
Industry Statistics



Source: The Economist

Aviation Finance:
Industry Statistics

87.7 million

Jobs supported by aviation worldwide

- » 11.3 million direct jobs in the industry:
  - 648,000 at airport operators
  - 5.5 million in other on-airport jobs
  - 3.6 million at airlines
  - 1.3 million in civil aerospace
  - 237,000 at air navigation service providers
- » 18.1 million jobs supported through the aviation industry supply chain
- » 13.5 million jobs through induced benefits of industry and employee spending
- » 44.8 million jobs supported in the tourism industry

$3.5 trillion

Global contribution to GDP, 2018 (4.1% of world economic activity)

4.3x

Aviation jobs are, on average, 4.3 times more productive than other jobs

35%

Worldwide trade by value carried by air transport, 2018 ($6.5 trillion). By volume: 0.5%

17th

If aviation were a country, it would rank 17th in size by GDP

Regional statistics

Region	Jobs supported	GDP supported	Passengers (2019)	% of global passengers	Annual growth 2018-2038	Flights (2019)
AFRICA	7.7 m	$63 bn	115 m	2.5%	3.4%	1.3 m
ASIA-PACIFIC	46.7 m	$944 bn	1.7 bn	37%	4.2%	12.8 m
EUROPE	13.5 m	$991 bn	1.2 bn	26%	2.1%	9.1 m
LATIN AMERICA AND THE CARIBBEAN	7.6 m	$187 bn	356 m	7.7%	3.2%	3.2 m
MIDDLE EAST	3.3 m	$213 bn	192 m	4.2%	4.1%	1.3 m
NORTH AMERICA	8.8 m*	$1.1 trn*	1 bn	22.7%	2.1%	10.6 m

**In the USA, the FAA also collects employment and economic impact data, but includes domestic tourism and general aviation in its figures (not included in this conservative analysis). With these wider catalytic impacts, civil aviation jobs in the USA alone amount to 10.9 million, with $1.1 trillion contribution to GDP.*

Source: Aviation Benefits

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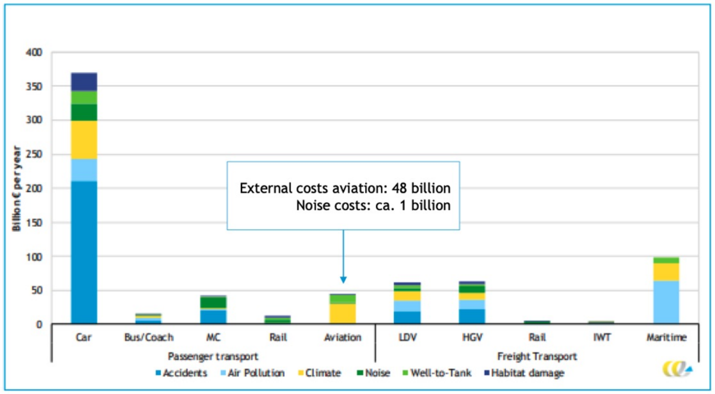
Aviation Economics:
Environmental Impact

Source: Interrog

Total external costs of transport in EU28 in 2016



Targets

World-first targets for CO_2 reductions for a global sector, set by the industry in 2008:

1. **Improve 1.5% per annum average fleet fuel efficiency between 2009 and 2020** (currently at 2.1% rolling average improvement)
2. **Stablise net CO_2 emissions from 2020 through carbon-neutral growth** (will be made possible through the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) at ICAO)
3. **Reduce net CO_2 emission from aviation to half of 2005 levels, by 2050** (through new technologies and sustainable aviation fuels)

$188 billion

Spent by airlines on fuel, 2019

CORSIA

The world's first global offsetting scheme for any single sector: www.enviro.aero/CORSIA

914 million

Tonnes of CO_2 emitted by airlines in 2019, 2% of the global man-made total of 43 gigatonnes

80%

of aviation CO_2 emissions are from flights over 1,500 km in length

-54.3%

CO_2 emissions per passenger kilometre since 1990 through technology and operations

270,000

Flights on sustainable aviation fuel (SAF) since 2011: see www.enviro.aero/SAF for updates

11 billion tonnes

CO_2 avoided since 1990 via new technology, better operations, improved infrastructure

$15 billion

Spent each year by aerospace companies on research for aircraft technology efficiency

Source: Springer

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Sustainable Aviation:
Economic Implications

BBC

Home News Sport Business Innovation Culture Travel Earth Video Live

Greener flights will cost more, says industry

17 April 2023

Share

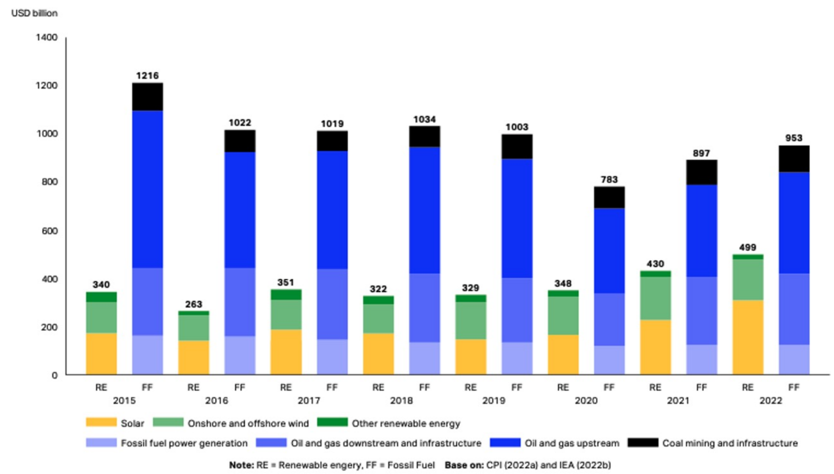
The cost of decarbonising air travel is likely to push up ticket prices and put some off flying, a group representing the UK aviation industry says.

Measures such as moving to higher-cost sustainable aviation fuel will "inevitably reduce passenger demand", according to Sustainable Aviation.

But it found people will "still want to fly" despite "slightly higher costs".

Source: BBC

Chart 3: Annual investment in renewable energy versus fossil fuels, 2015 – 2022



Sources: IRENA and CPI. Global landscape of renewable energy finance, 2023, International Renewable Energy Agency, Abu Dhabi

Source: SAP

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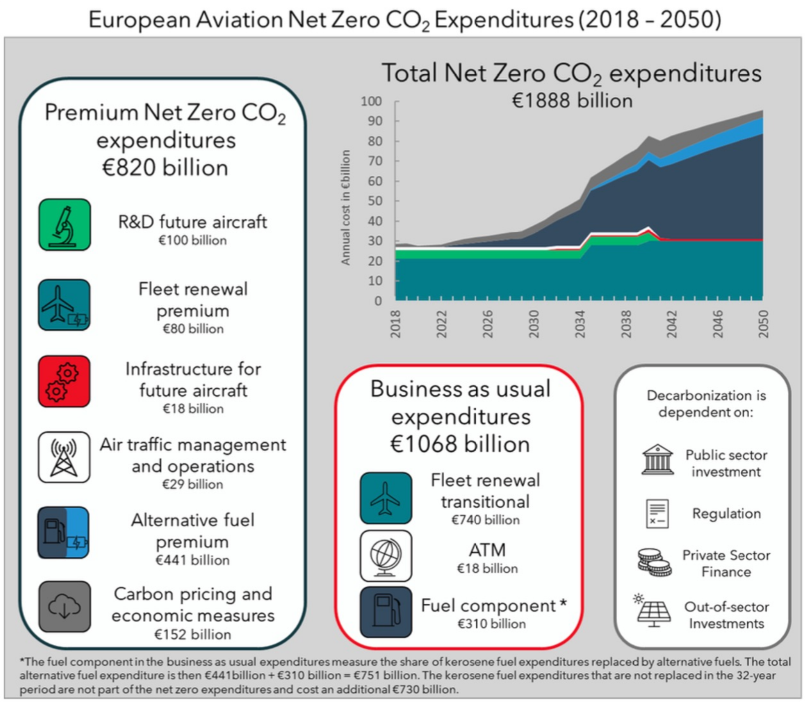
Sustainable Aviation: *Economic Implications*



Source: SEO

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Sustainable Aviation: *Financial Viability*

DfT Aviation MACC study: Technical Report: Final

Table (ii) Estimated emission savings over the period 2010 to 2050 from "UK aviation" by policy lever ($MtCO_2$).

Demand baseline	Low			Central			High		
Policy	**Low**	**Mid**	**High**	**Low**	**Mid**	**High**	**Low**	**Mid**	**High**
Regulatory CO_2 Standards	0	9	10	-ve	9	11	-ve	11	13
Early fleet retirement	0	1	33	1	19	59	20	41	84
Achieve CAEP goals	4	25	44	7	40	66	8	53	84
Retrofitting	1	2	4	1	3	4	1	3	5
Airport capacity	13	14	18	37	37	13	159	77	88
ATM efficiency	12	23	33	15	27	38	16	30	41
Operational incentives	59	92	139	69	108	162	77	120	180
Biofuel demonstration plant	11	20	44	13	23	51	14	26	58
Mandatory biofuels	39	66	108	34	68	118	23	64	125
Behavioural change	0*	11	19	0*	37	43	0*	12	27
Videoconferencing	0*	0	5	0*	-ve	7	0*	17	1
Total savings	**139**	**263**	**457**	**177**	**371**	**572**	**318**	**454**	**706**

Key: * lever defined as having no impact for the demand/policy case. –ve: model reports increase in emissions for the lever in question over the period. For explanation of shading, see text.

DfT Aviation MACC study: Technical Report: Final

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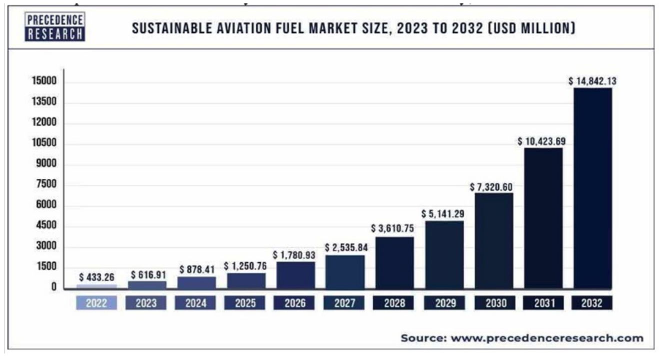
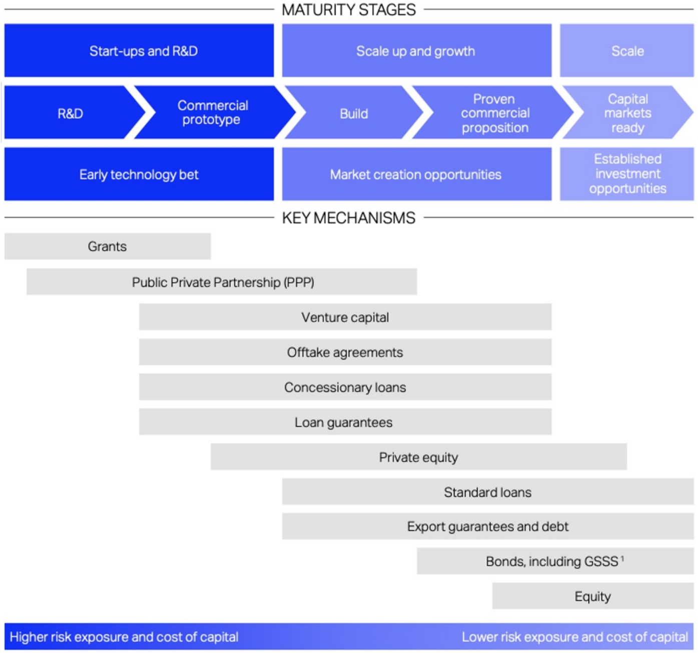
Source: BMC

Sustainable Aviation: *Economic Drivers*



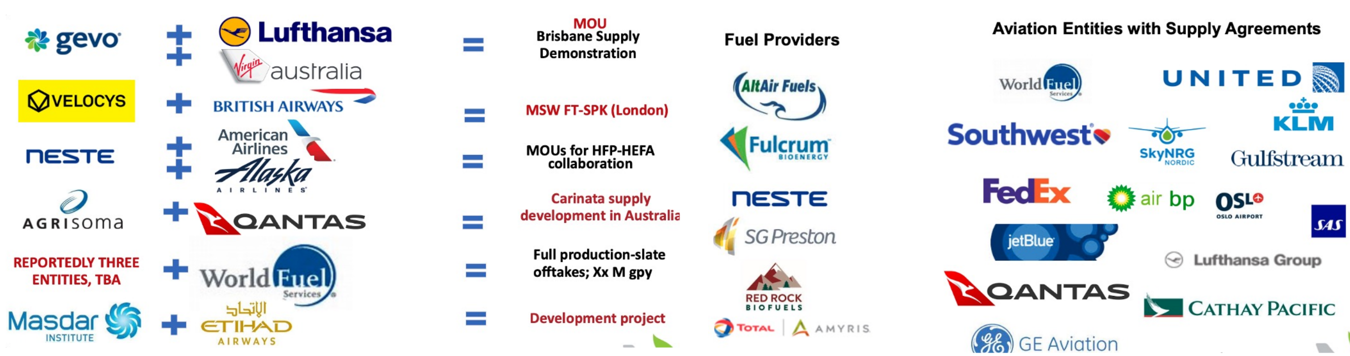
Source: Precede



Source: Cordeiro

Sustainable Aviation:
Industry Collaborations

Industry Collaborations:



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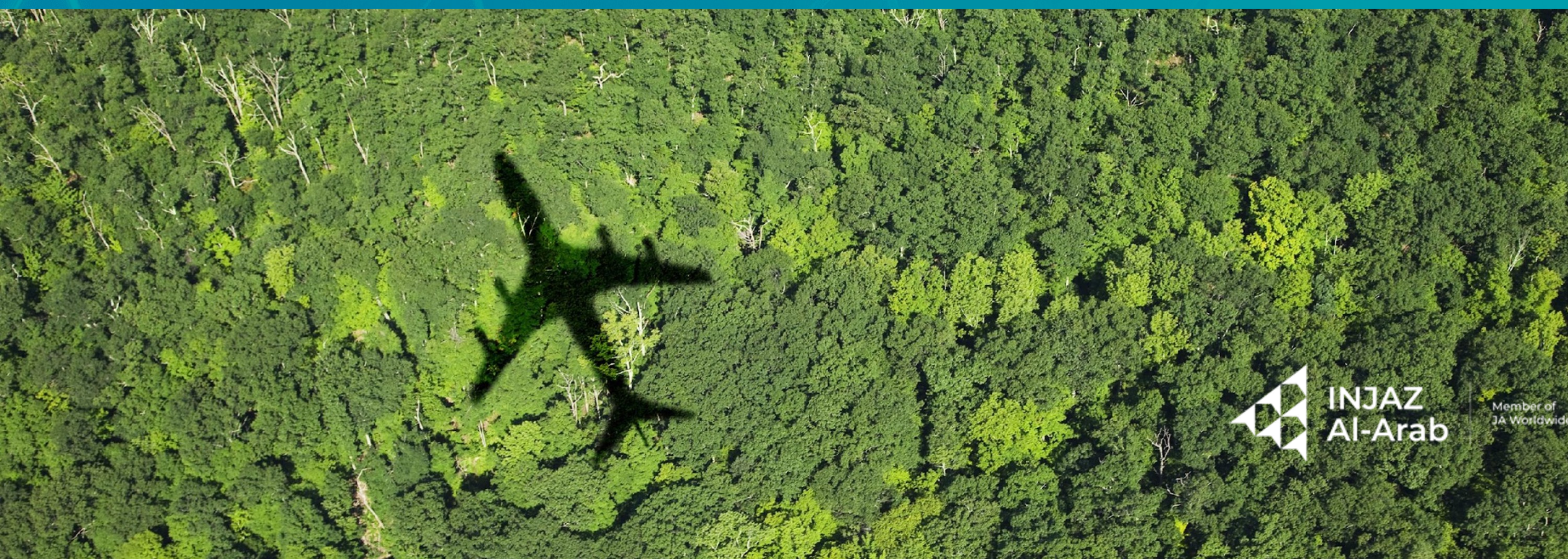
Objective 4.2:

Cost- Benefit Analysis of Sustainable Aviation Practices & Technologies



Sustainable Aviation: *Cost- Benefit Analysis*

Costs

- Direct costs
- Indirect costs
- Intangible costs
- Opportunity costs
- Costs of potential risks

Benefits

- Direct
- Indirect
- Total benefits
- Net benefits

Cost-Benefit Analysis

Pros

- Requires data-driven analysis
- Limits analysis to only the purpose determined in the initial step of the process
- Results in deeper, potentially more reliable findings
- Delivers insights to financial and non-financial outcomes

Cons

- May be unnecessary for smaller projects
- Requires capital and resources to gather data and make analysis
- Relies heavily on forecasted figures; if any single critical forecast is off, estimated findings will likely be wrong.

Source: EVA Community

Sustainable Aviation:
Cost- Benefit Analysis

Table 4.5 Source, type and taxonomy overview

Components	Public vs. private	Investment vs. cost	Finance taxonomy
a. Future aircraft R&D	Private and public Private: new aircraft Public: high risk R&D	Investment	Transitional and green Transitional: efficient kerosene air-craft Green: zero-carbon aircraft
b. Fleet renewal	Mostly private	Investment	Transitional and green Transitional: efficient kerosene air-craft Green: zero-carbon aircraft
c. Airport infrastructure	Private and public Private: Revenue generating pro-jects Public: Subsidies replacement	Investment	Transitional and green Transitional: more efficient ground ops. Green: SAF infrastructure
d. ATM & operations	Private and public	Investment	Transitional and green Transitional: more efficient ATM Green: electric taxing
e. Alternative fuels	Private and public Public funding possible to re-duce price gap (examples) to prevent negative connectivity ef-fect	Cost	Out of sector investment
f. Economic measures and negative emissions	Private	Cost	Out of sector investment

Table 4.3 Total expenditures per pillar, associated CO_2 savings, and average efficiency

Pillar	Cost components	Total expenditures (B€)	CO_2 reduction (Mt)	Average efficiency (€/tCO_2)
Improvements in technology	• Future aircraft R&D • Fleet renewal • Infrastructure for future aircraft	938	1410	665
Improvements in ATM and operations	• Airline operations • Airspace and ATM • Ground operations at airports	47	555	85
Alternative fuels	• Drop-in SAF • Hydrogen • Renewable electricity	751	1609	467
Carbon pricing / negative emissions		152	1148	132
Total		1888	4820	392

Source: Slide Team

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Cost Benefit Analysis:
Methodology

Basic Cost Benefit Analysis Chart Template

PROJECT TITLE					
AUTHOR		DATE		VERSION	0.0.0

BASIC COST BENEFIT ANALYSIS CHART						
PROPOSED ACTION / ALTERNATIVE	BENEFITS	BENEFIT IMPACT HIGH=3 MEDIUM=2 LOW=1	COSTS	COSTS IMPACT HIGH=3 MEDIUM=2 LOW=1	RATIO BENEFITS / COSTS	RANKING

Source: Smart Sheet

Cost Benefit Analysis:
Case Study

Example 1:
Example 1 is a base case scenario. This is an example where purchasing land, equipment and constructing a SAF refining plant cost $260 million. Both operating costs and revenues ramp up, then remain consistent from year 3. In a real world scenario these are not likely to be linear but this does not impact the example. A discount rate of 9% is used. This is the rate that must be achieved to deliver a NPV of $0. This example delivers a forecast NPV of -$83.28 million or an internal rate of return on the funds employed of 3.82%. This does not meet the hurdle rate (of 9%) hence a rational firm would not undertake this project.

EXAMPLE: 1	*Simplified cost-benefit example - base case project CBA*										
Project analysis (Million USD)											
Year	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Capital costs											
Project construction	-250										187.5
Improvements						-25					17.5
Equiptment	-10					-10					5
Total	-260	0	0	0	0	-35	0	0	0	0	210
Operating costs											
Aggregate annual costs		-5	-15	-20	-20	-20	-20	-20	-20	-20	-20
Revenues											
Annual aggragate revenues		15	25	40	40	40	40	40	40	40	40
Net Cash Flow	-260	10	10	20	20	-15	20	20	20	20	230
Discount rate	9%										
NPV	**-$83.28**										
IRR	**3.82%**										

Source: ICAO Fuel Guidance

Sustainable Business Models:
Guiding Concepts

ESG: Three Pillars of Long- Term Sustainable Business

Environment:
Preserving nature and ensuring resource efficiency

Social:
Building safe, inclusive and empowered communities

Governance:
Responsible corporate practices and policies

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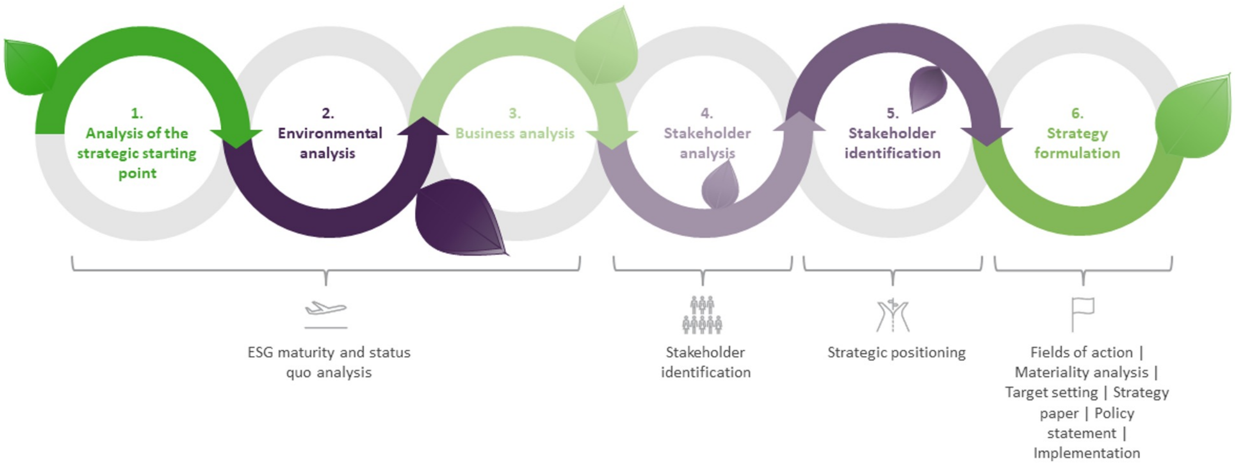
Aviation Sustainability: *Strategy*



Source: ESG Strategy

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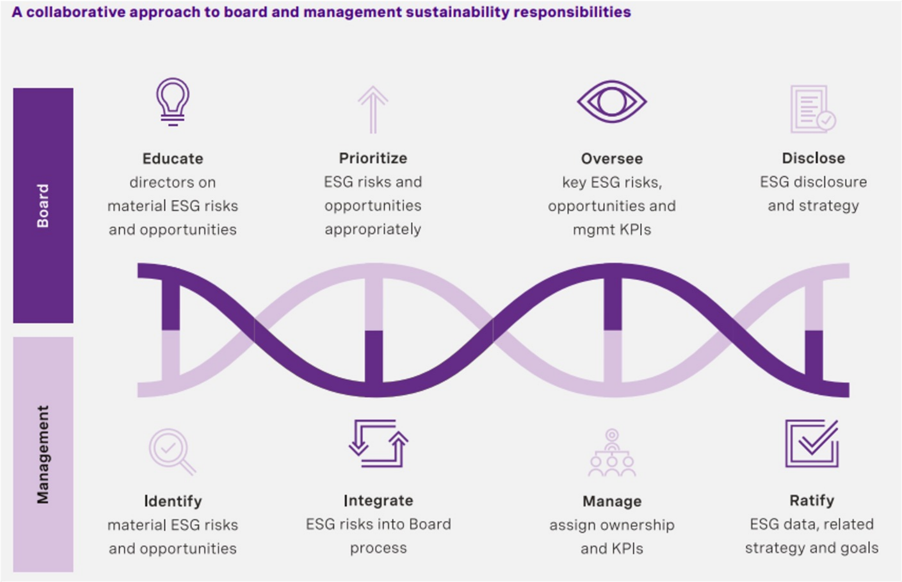
Aviation Sustainability:
Oversight & Reporting

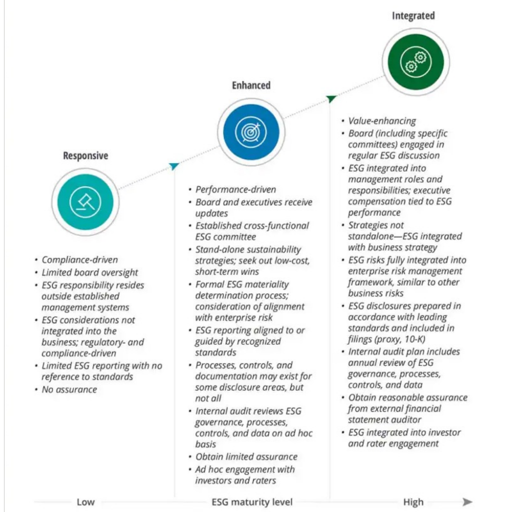


Source: Activating Sustainability

FIGURE 5

Deloitte's ESG maturity model

A progression to fully integrated ESG



Source: Kristen Sullivan, Maureen Bujno, and Kimia Clemente, *Navigating the ESG journey in 2022 and beyond*, Deloitte, 2022.

Deloitte Insights | deloitte.com/insights

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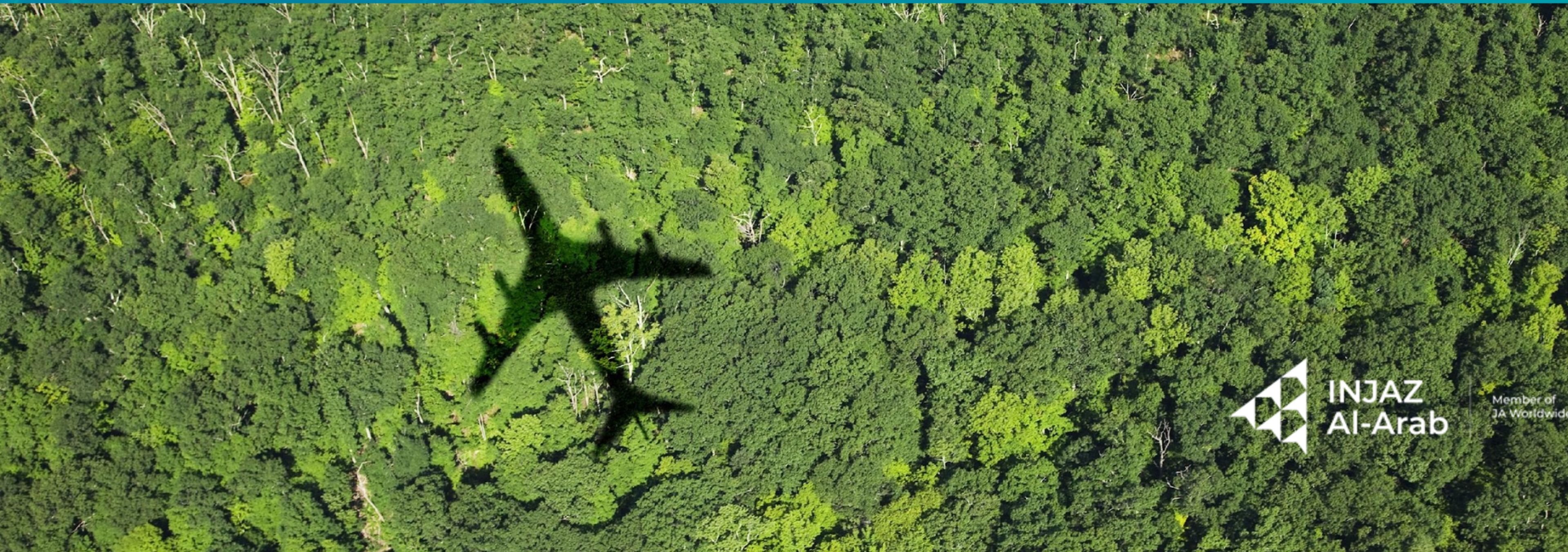
Objective 4.3:
Defining criteria for sustainable business models



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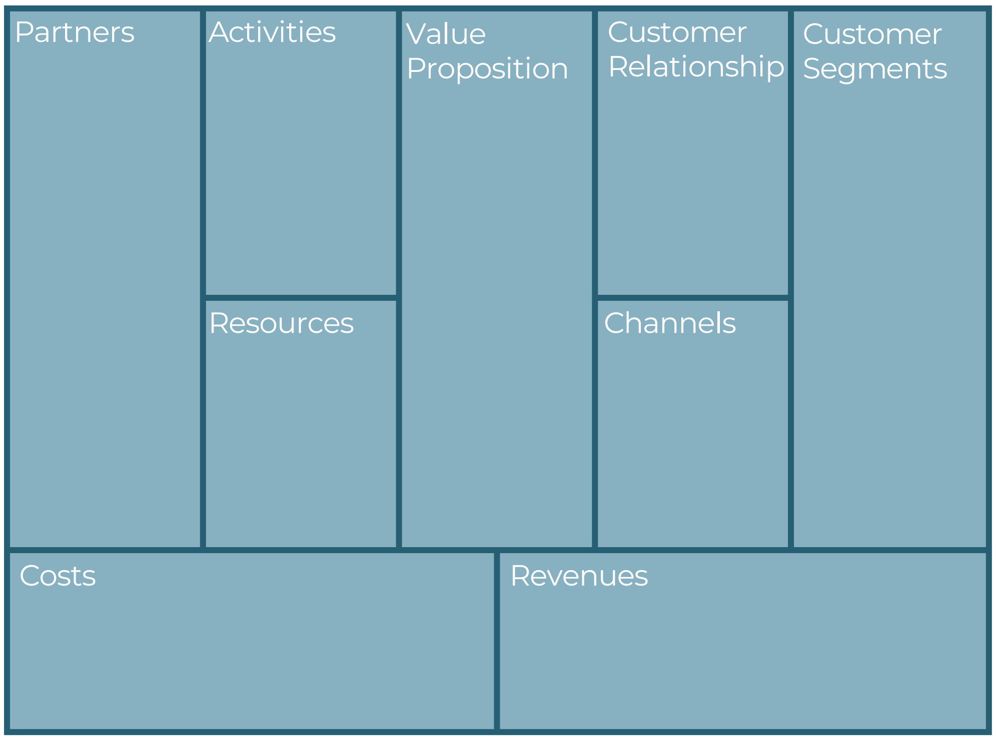
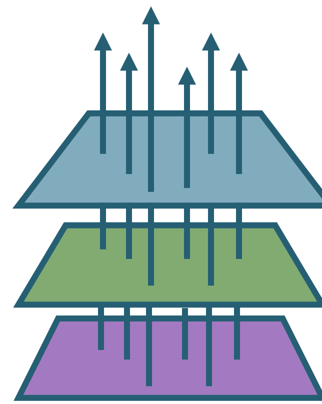
Aviation Sustainability:
Strategy





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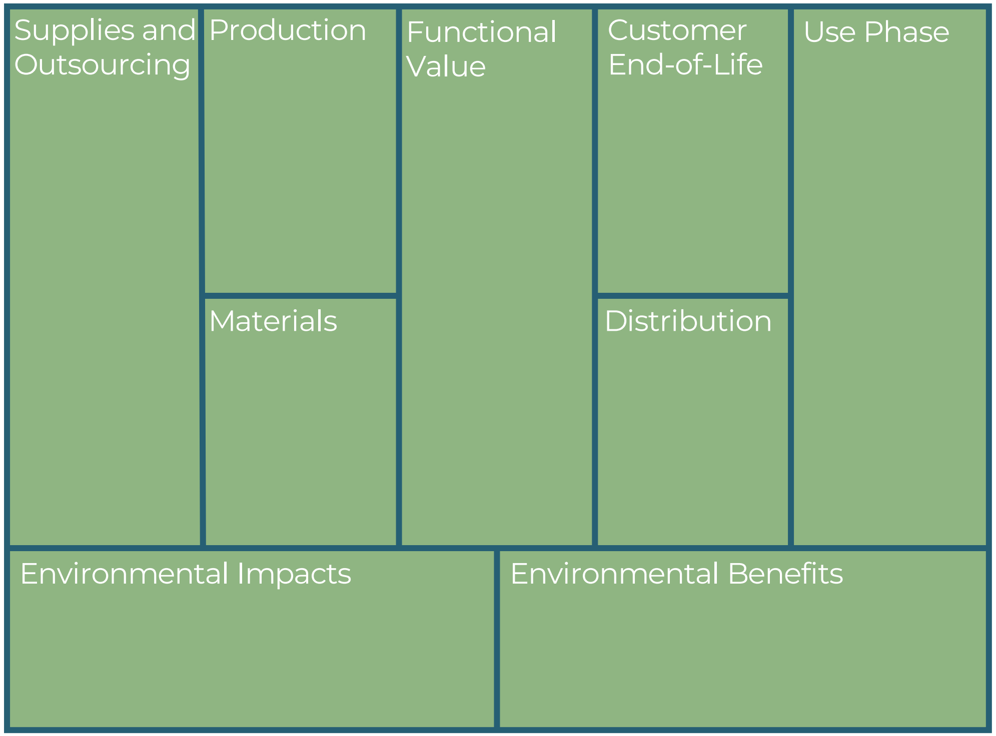
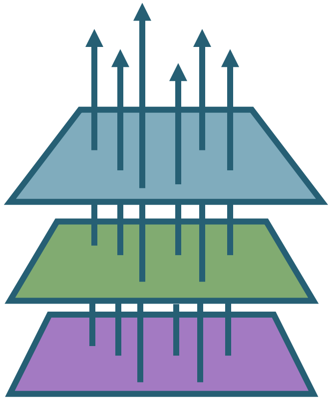
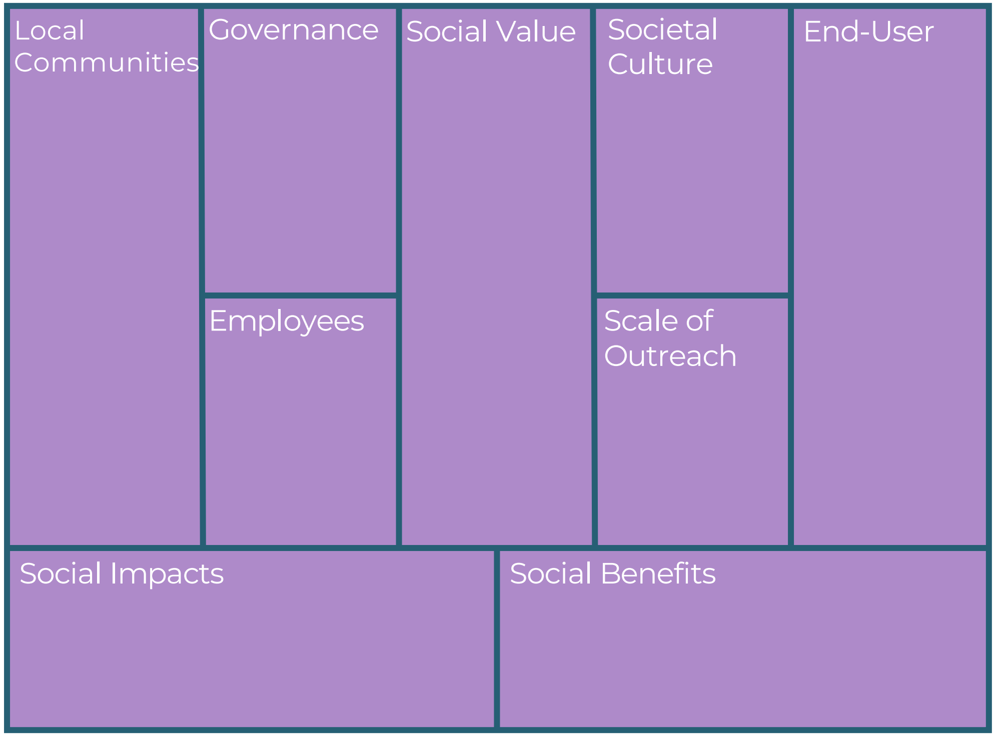
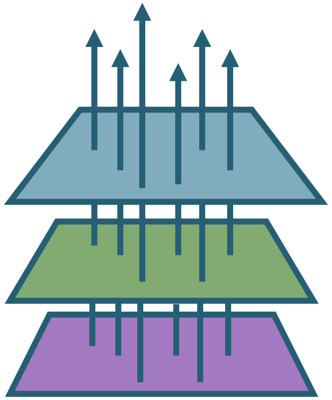
Aviation Sustainability:
Strategy





Aviation Sustainability:
Strategy





Aviation Sustainability:
Assessment and Measurement Criteria in Aviation

- Integration of ESG Metrics
- Stakeholder Engagement
- Cost-Benefit Analysis
- Reporting and Disclosure
- Technology and Innovation Tracking

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