Civil Aviation 2040

A Perspective by Swiss Society

Final Report by
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Scenarios
Delphi Study
Analysis
Conclusions

November 2018
– February 2020

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Executive Summary

The Swiss society in 2019 has provided a differentiated view of the civil aviation system with respect to existing infrastructure, destination offerings and the future potential and role of air mobility as a basis for growth and prosperity. As part of a scenario- and projection-based online Delphi study, a representative sample size of the Swiss population (age 16-69) underlines the economic strength and competitiveness now and in the year 2040, for which the assessments have been provided. More than 80% expect further growth of the air travel market, with a preference for direct connections on long-haul routes. At the same time, the majority of participants did not belief in the essential role of air connectivity for economic growth and prosperity of the society, causing a dissent among the opinion base and requiring further breakdowns of the answers by demographics and characteristics.

The researchers found travel frequencies (exposure to air mobility), political orientation (conservative vs. liberal) and age (Gen Z vs. Baby boomer) among the key differentiators within the assessments of projections for each traffic scenario in the year 2040. Traffic growth is in favor over decline, ticket prices seem less relevant than convenience (direct flights) and carbon offset schemes as well as a societal consciousness about the environmental footprint will become a certainty over the next 20 years. While short-haul connections are considered a real contender for alternatives such as high-speed trains or autonomous cars, the majority of innovations (unmanned systems, drones, flight taxis) are not yet reaching common acceptance levels and are not seen as a mobility game changer by the society.
According to the study participants, the existing aviation infrastructure in and offered routes from Switzerland contain the potential to grow by 2040; however, the majority of the regular travelers and non-business community do not see the need for more capacity nor increased connectivity for their personal requirements. The disconnect between expectations and requirements highlights an inherent dilemma of societal studies with respect to missing expert knowledge and know-how of underlying circumstances. The Delphi study does reveal the importance of transparent communication of facts in the air mobility sector, which are commonly understood and accepted by society and put into perspective as part of a complex aviation and economic system.

The 2019 study "Civil Aviation 2040: A Perspective by Swiss Society" cannot provide evidence for a rational behavior nor intrinsic motivation by the Swiss population to actively support the air transport industry in securing their strategic position for further growth and prosperity of the society. The aviation infrastructure and its growth parameters are taken for granted, also confirming a 2006 study by Laesser and Wittmer about the convenience and satisfaction level of travelers with respect to the existence of targeted flight offerings versus missing connectivity. The perception of civil aviation by society will be mainly affected by the degree of whether demand-oriented air mobility services are considered a hygiene factor or being a crucial contributor to growth and prosperity.


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1. Introduction

Operators in the aviation system manage local markets within a global context, requiring its stakeholders to reflect changes on macro- and micro economic as well as societal levels with both short- and long-term perspectives. Globally, the aviation market has been growing over decades and air traffic is expected to further increase while developing and adapting to markets. Despite the growth projections on a global and long-term scale, local markets are confronted with their very own circumstances, which may accelerate aviation growth (emerging economies) or limit its expansion (saturated or regulated markets). In addtion to market conditions, the stakeholders may face operational constraints and capacity issues, creating internal limitations in responding to external customer demand. In addition to trends and predictable drivers, the aviation industry has been exposed to epidemiological threats in more recent years (SARS, MERS, COVID-19), causing disruptions in demand without notice periods and affecting growth forecasts predominantly in the short-term (so far). Frequencies and severities of future events will determine, if long-term estimations need to be revised due to a systemic change in society's demand for air transport services.

The aviation industry in Europe is confronted with capacity constraints both on ground (infrastructural and/or regulated) and in the air (ATC inflicted), causing airlines to externalize operational delays, having an impact on network development and ultimately (air) connectivity of local markets. Switzerland's civil aviation system is congested but growing. It's dominated by three main national airports (Zürich, Genève, Basel) and two major carriers (SWISS / LH Group, EasyJet), currently resulting in broad coverage on ground (access) and en route (connectivity: European & Intercontinental) for the Swiss society and economy. This Swiss aviation system is a contributor to the country's international trade relations, knowledge exchange and cultural diversity with one of the world's highest air travel activities per capita.

Previous studies have shown the aviation industry's economic relevance (monetary contribution) for Switzerland and its international footprint among corporate and academic

institutions. The various assessments of tangible effects address economic and workforce-related benefits and the systemic importance for the country's GDP. The currently available research concludes and recommends addressing congested ground infrastructure, extending airport capacities and maintaining the aviation system's relevance (safeguarding the country's international competitiveness), mainly from an economic and therefore tangible point of view.

1.1 Problem Statement

Intangible catalytic and societal effects of the aviation system are not sufficiently taken into account by stakeholders and researchers, therefore limiting existing statements' validity concerning the aviation industry's overall relevance and contribution. This is especially true for statements concerning the role of civil aviation in the future. With an air traffic system in Switzerland, which can no longer grow at substantial rates or maybe facing declines in capacity or demand going forward, the stakeholders are confronted with society's needs, expectations and values concerning (air) mobility of the future, leading to the following main research question:

RQ: What is the role of aviation with respect to prosperity, wealth and well-being of the Swiss society in 2040?

1.2 Objectives

The research study about the role of the Swiss civil aviation industry (Figure 1) shall support the identification of value drivers among the population (residents of Switzerland) with a focus on:

1. Connectivity & Frequencies
2. Regulation & Limitations
3. Habits & Alternatives
4. Integration & Inter-modality
5. Ecology & Sustainability
6. Price & Competitiveness

The researchers and experts defined possible scenarios and projections about air mobility in the year 2040. Focusing on the needs for the air traffic system by the Swiss population, the characteristics and consequences were assessed in a social Delphi survey (social = Swiss residents survey panel). The representative survey determined which of these restrictions were to be accepted by Swiss society in the long term or assessed as critical for prosperity and well-being. The overall objective is to develop a basis for the national dialogue on the future of Swiss aviation and the underlying infrastructure requirements.

FIGURE 1: CONCEPTUAL VIEW OF AVIATION WITHIN THE SOCIETY


EXIT

2. Theoretical Foundation

Civil aviation is a highly relevant growth industry worldwide. In addition to the direct effects emanating from the aviation industry (income, employment etc.), which have a positive impact on the national accounts, aviation infrastructure also has indirect effects on the development and attractiveness of regions and connectivity. Globalization and, as a consequence, the international networking and expansion of companies has led to an increase in air traffic. The aviation infrastructure has thus also become a critical factor for the economic development of regions. Switzerland in particular, with its strong export orientation and as a country with a large number of corporate headquarters of international companies, has a high volume of air traffic and is dependent on a functioning aviation system, now and in the future.

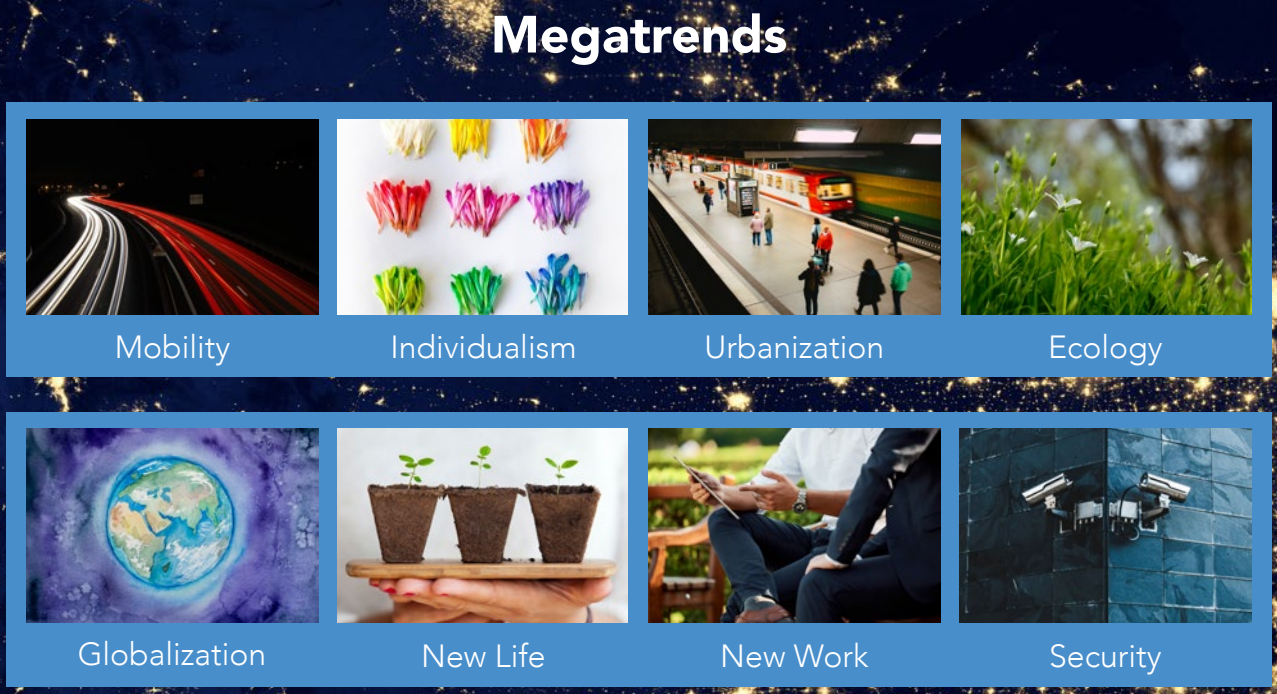
In recent years, preceding this research study, several academic assignments have been carried out, addressing the economic impact of public and private institutions within aviation. These studies generally consider the effects of services and activities triggered by infrastructures on economic variables such as production, value added, employment and income within certain spatial (regional) boundaries. Various methodological approaches are used, such as input-output analysis cost-benefit analysis, spatial incidence analysis and various financial models. As mentioned earlier, the existing studies mainly focus on the collection of tangibles effects, which is why the methodology cannot be transferred to the present study.

In order to analyze the societal impact and relevance of civil aviation, intangible and perceptional effects need to be assessed by means of quantitative and qualitative surveys. Those intangibles elements of aviation are important because they take up extended aspects of the mobility benefits that are needed as a basis for societal and political discussions. Factors are examined which are not based on a monetary foundation but can be fundamental for the future development of a region, economy and society.

2.1 Hypotheses & Research Questions

The economy and society are subject to the gigatrend of digitization and thus the megatrends of this period. In the coming decades, in addition to technological innovations and increasing urbanization of the population, mobility behavior and individualization will make a decisive contribution to the demand for broad and new services. The level of integration concerning societal and economic requirements for mobility and networking also affects the competitiveness of a country. The air traffic system plays a decisive role in the international attractiveness and as a differentiator for "glocal" organizations.

FIGURE 2: THE FUTURE OF MOBILITY: GIGATREND DIGITIZATION



Source: Wittmer & Linden (2017)

These location factors can secure the long-term growth and prosperity of a society. Switzerland is subject to the same framework conditions of those giga- and megatrends. Both the population and economy generate requirements for value-adding services of the Swiss aviation market and posing new challenges for this industry in terms of supply, capacity and sustainability. The following research questions address future scenarios related to the mentioned framework conditions and the hypotheses test if aviation is systemically relevant for Switzerland taking into account aviation infrastructures and the society's air travel behavior.

Hypotheses:

H1 Infrastructure of Swiss airports, capacity of direct flights and connectivity from and to Switzerland are the key drivers of future demand for air transport services by the Swiss society.

H2 Technological innovation, sustained demand and supply and alternative means of transport are affecting the personal air travel behavior of the Swiss society.

H3 The Swiss society believes in the systemic relevance of aviation in general and the Swiss civil aviation industry in particular.

Research Questions:

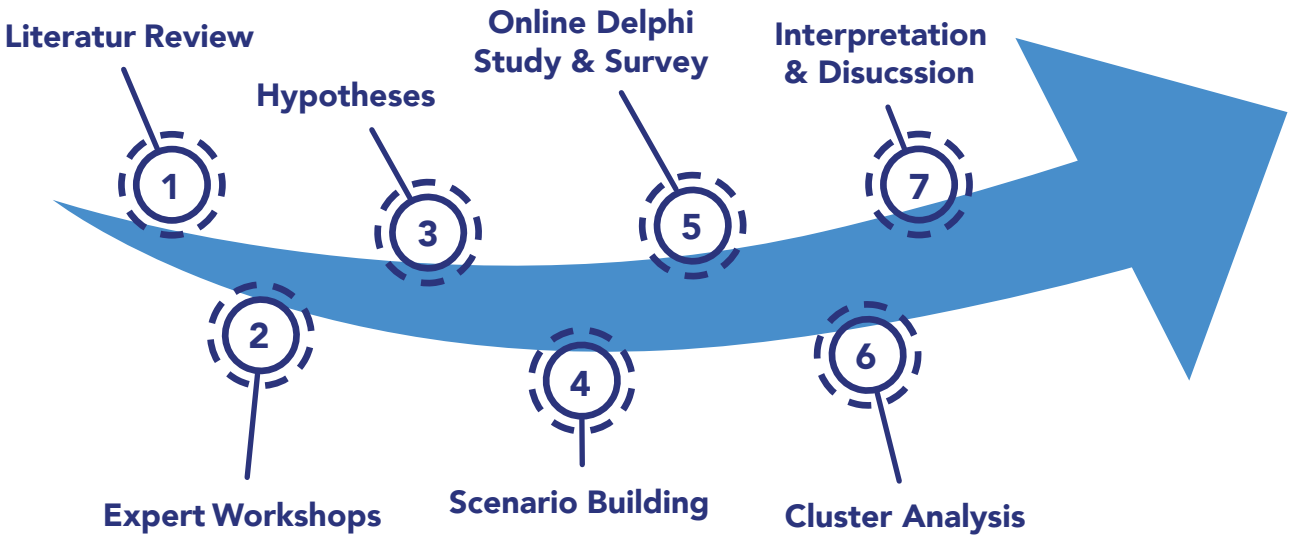
RQ1 What are the traffic scenarios for the Swiss aviation system by 2040?

RQ2 What is the expectation for the Swiss aviation system by B2C individuals and society?

RQ3 How relevant is connectivity for the Swiss society and economy of the future?

3. Research Approach

The academic assessment of hypotheses and research questions requires a systematic approach, enabling the researchers in gradually and sequentially defining a **Future World** environment, in which societal views and beliefs can be tested. Seven distinct working blocks, spreading over 14 months, allowed for a broad coverage of the study's underlying research questions.



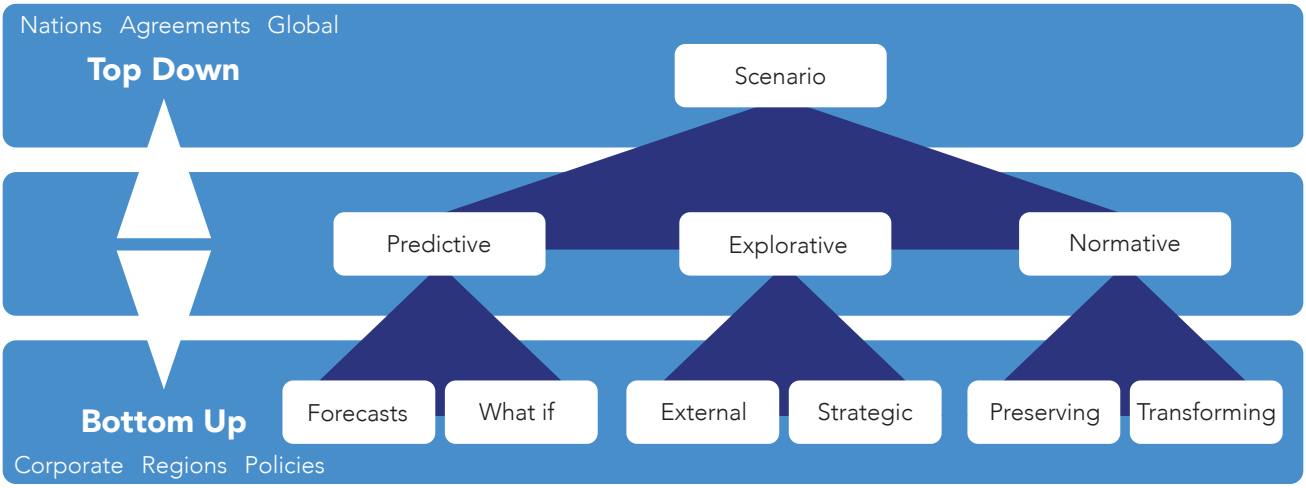
3.1 Research Design

The planning of future (demand) requirements and forecasting (supply) results in the need of concepts, which are appropriate for both the purpose and timeline of the research objectives. The following generic overview supported the selection process for this study's scientific approach and targets:

- **Economic models** with a long-term perspective to deal with **time**
- **Scenario planning** techniques to deal with **uncertainty**
- **International frameworks** to deal with global **trends**
- **National strategies** to deal with **policy making**
- **Related industries'** forecasts and capacities to deal with **demand**

There are top down and bottom up approaches to deal with the prediction of the future. The scenario approach ist a top down approach. "Scenario Planning supports anticipating the future under conditions of low predictability" (Wright & Goodwin, 2009). Figure 3 shows the linkage of different avenues of top down scenario panning.

FIGURE 3: PREDICTING THE FUTURE - TOP DOWN VS. BOTTOM UP



The researchers used a quantitative approach (**Empirical Analysis** & **Extrapolations**) to define traffic scenarios for the Swiss aviation system. Each scenario and its projections would be validated by qualitative means (**Survey**s & **Panel Consensus**), using a Swiss (resident) panel and a combination of a qualitative online survey and **Delphi** technique:

Quantitative:
- Demographic Changes
- GDP growth
- Rule & policy making (standards & trends)
- Systematic capacity (air space, accommodation,...)
- Destination marketing (tourism & business)

→
- **Empirical Analysis**
- Projections
- Simulations
- **Expectations**

Qualitative:
- Consumer behavior (mobility)
- Environmental consciousness
- Technology trust & adoption

► Impact of giga- & megatrends

→
- **Surveys**
- **Delphi**
- **Panel Consensus**
- Ethnographic

Economic **projections** and **simulations** as well as **ethnographic** approaches did not support the objectives of the research, as they require and inflict levels of details, which cannot be assessed by participants of a societal (=non expert) survey. Understanding the past and predicting the future, using extrapolations, would be a known concept and providing a basis for the scenario-planning technique. By ensuring the consistency of empirical analysis and extrapolations, multiple scenarios are developed and deployed throughout the study.

3.2 Literatur Review

The researchers specifically looked into the following areas and their coverage in academia (reference to existing studies, specifically related to society's mobility needs in the future):

- Future trends (17 sources)
- Mobility (6)
- Ecology (3)
- Economy (5)
- Society (3)
- Consumer (4)
- Behavior (4)
- "Future" in research (18)

A total of 60 sources (Appendix IV) have been identified and assessed, supporting the academic approach, including the execution of expert workshops and definition of scenarios as well as using societal surveys and the Delphi method.

3.3 Expert Workshops

In order to determine common ground and a foundation for the identification of aviation scenarios in 2040, expert workshops have proven productive in earlier research projects. For this reason the research team had decided to conduct expert workshops in a two-step approach. The intention of the workshops was to provide a moderated environment and sufficient flexibility for each participant to share knowledge, ideas, beliefs and thoughts about a Swiss society in 2040 as well as implications for mobility in general and aviation in particular.

3.3.1 Future Worlds

In a first step an overview of possible *scenarios from an aviation point of view* was aimed at. Aviation and mobility experts as well as futurists and innovation leaders provided their views and insights about (air) mobility in Switzerland by the year 2040. The workshops addressed 3 drafts of possible traffic scenarios, describing the civil aviation system in Europe and focusing on the impact on stakeholders in Switzerland.

Workshop participants:

- Raimon Christiani, IBM (Competence Center Travel & Transportation)
- Mario Eland, Basel EuroAirport

- Hauke Fehlberg, ASTRA
- Eliane Forster, BAZL
- Enrico Howe, MotionTag
- Heinz Kafader, Bern Airport
- Thomas Sauter-Servaes, ZHAW
- Max Schulthess, BAZL
- Jean-Pierre Tappy, SWISS International Airlines
- Martina Wagner, Zürich Airport
- Andreas Walker, Weiterdenken.ch

3.3.2 Society of the Future

In a second step an overview of possible *expectations by the society* from a mobility point of view was aimed at.

Mobility experts and forward thinkers discussed the societal impacts of different scenarios in the **Future World**, using storytelling techniques as well as verbal and graphical interaction to describe the requirements. With this type of workshop, the researchers were searching for disruptive elements and challenges of the (air) mobility system in 2040.

Workshop participants:

- Anas Alkhalifa, HTW Chur
- Ronald Abegglen, SWISS International Airlines
- Mario Eland, Basel EuroAirport
- Lukas Federer, EconomieSuisse
- Sabine Friedrich, KEEAS
- Felix Keller, Zürich Airport
- Frank Riklin, Atelier für Sonderaufgaben
- Patrik Riklin, Atelier für Sonderaufgaben

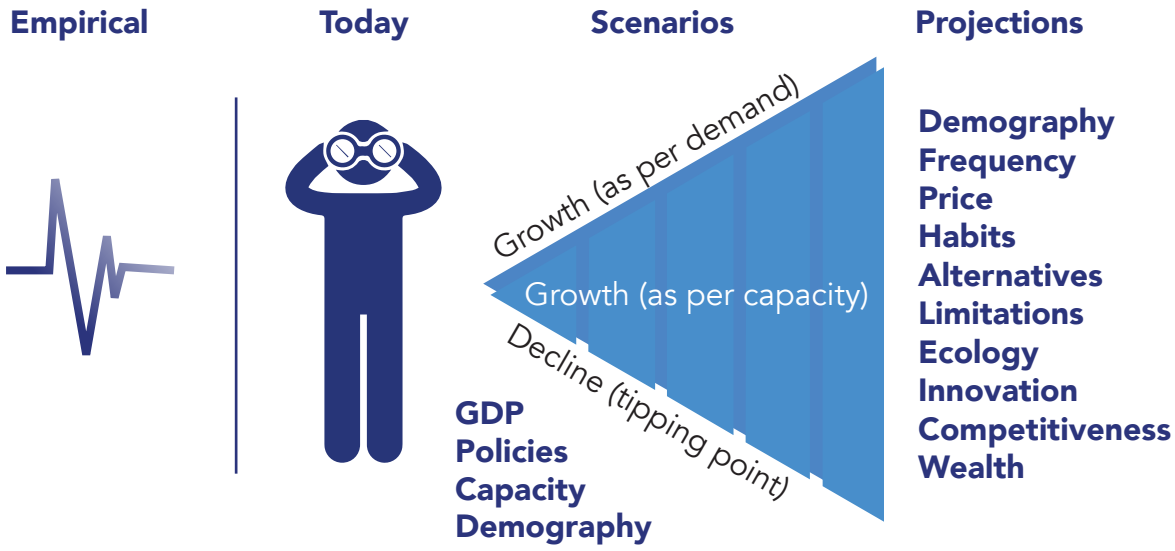
The workshop results were analyzed, compared and combined into a canvas of possible scenarios. Each scenario has been quantified (Appendix II) in order to deep dive into the development of projections (statements) for the Delphi survey.

3.4 Scenario Definition & Projections

Figure 4 shows the development of the research process. First, a reference scenario was formed using past data and data on the future of mobility (empirical). Through the literature analysis, expert workshops and deep dive sessions, two central events could be identified, resulting in additional growth (as per demand = no capacity constraints) and decline (based on a tipping point in society…comment by the authors: *Could COVID-19 represent such a tipping point?*). Two scenarios deviate from the reference

(=growth as per capacity), which could be interpreted as a dominant (most likely) scenario at the time of the discussion (2019). The projections are partially disconnected from the scenarios by the fact, that participants receive a 1-2 sentence briefing of the corresponding world, which allows for a short but unbiased overview. The idea is having answers related to an individual projection and not related to the whole scenario. The disconnection enables the researchers in assessing a single cause for each objective (connectivity, habits, price, ecology, …) rather than receiving answers in a context (complex relationships, causality).

FIGURE 4: OVERVIEW OF SCENARIOS



3.4.1 Maximum (Growth as per demand)

In a maximum growth scenario, demand for air transport will continue to increase until 2040. The existing infrastructure of Swiss airports will be expanded accordingly. More short- and long-haul destinations are offered. The following projections define the growth scenario:

- Projection 1: In 2040, there will be more connections from Swiss airports to European destinations than today.
- Projection 2: In 2040, there will be more intercontinental direct flights from Swiss airports than today.
- Projection 3: In the year 2040, I have several daily flights from Switzerland to major European cities (e.g. 10 times daily to Amsterdam).
- Projection 4: In 2040, private short trips (up to 3 days) by plane will be much more common than today.
- Projection 5: In 2040, no ticket surcharge will be levied to compensate for CO2 emissions.

- Projection 6: In the year 2040, I take the train instead of the plane for journeys of up to 700 km (e.g. Zurich to Barcelona, Amsterdam, Vienna, Prague, Rome).
- Projection 7: In 2040, flights up to 400 km distance (e.g. Zurich to Munich, Frankfurt, Nice, Paris, Bologna) are prohibited.
- Projection 8: In 2040, I travel to the airport by air taxi (with pilot).
- Projection 9: In the year 2040, I live in a Switzerland that is competitive with other European locations.
- Projection 10: In the year 2040, Switzerland's good international air connections will make a decisive contribution to my prosperity.

3.4.2 Reference (Growth as per capacity)

The reference scenario assumes that demand for air transport will continue to increase until 2040. However, the existing infrastructure of Swiss airports will not be significantly expanded. The additional demand is no longer met in Switzerland, but via airports in neighboring countries. The following projections define the reference scenario:

- Projection 1: In 2040, there will be as many connections from Swiss airports to European destinations as there are today.
- Projection 2: In 2040, I will be able to fly to certain long-haul destinations only via airports in the Gulf States, China and Southeast Asia (fewer direct flights from Swiss airports than today).
- Projection 3: In 2040, the range of destinations will not be further expanded compared to today.
- Projection 4: In the year 2040, flying will be a matter of course, just like today.
- Projection 5: In 2040, ticket prices will rise by 40% to compensate for CO2 emissions.
- Projection 6: In the year 2040, for journeys of up to 700 km (e.g. Zurich to Barcelona, Amsterdam, Vienna, Prague, Rome), I use an autonomous electric car instead of an airplane.
- Projection 7: In 2040, flights of up to 700 km distance (e.g. Zurich to Barcelna, Amsterdam, Vienna, Prague, Rome) are prohibited.
- Projection 8: In the year 2040, my airliner will be unmanned.

- Projection 9: In the year 2040, I live in a Switzerland that has a locational disadvantage in international competition.
- Projection 10: In 2040, the international networking competencies of the Swiss population will decline.

3.4.3 Minimum (Decline from tipping point)

The minimum scenario assumes that by 2040, demand for air transport in Europe will fall significantly, while demand in Asia will continue to grow. The number of flights departing from Swiss airports is decreasing. Numerous destinations can only be reached from airports in neighboring countries or via hubs in the Near & Middle East (e.g. Turkey, Gulf region). This scenario can be explained by the following projections for the future:

- Projection 1: In 2040, there will be fewer connections from Swiss airports to European destinations than today.
- Projection 2: In 2040, I can reach many long-haul destinations only via major European airports or with non-European airlines (just a few direct flights from Swiss airports).
- Projection 3: In 2040, the supply of flights will have declined sharply.
- Projection 4: In 2040, Swiss society will only accept short flights for important reasons.
- Projection 5: In 2040, European air transport will be climate-neutral, and air ticket prices will double.
- Projection 6: In 2040, I will give up travelling by plane up to 700 km (e.g. Zurich to Barcelona, Amsterdam, Vienna, Prague, Rome).
- Projection 7: In 2040, flights of up to 1,000 km distance (e.g. Zurich to London, Copenhagen, Berlin, Budapest, Naples) are prohibited.
- Projection 8: In the year 2040, I will cover distances of up to 50 km also with autonomous drones (without pilot).
- Projection 9: In 2040, international companies will cut jobs in Switzerland.
- Projection 10: In 2040, my quality of life in Switzerland will improve.


SWISS
Komisch, dass ein Flugzeug beides auslösen kann.
Made of Switzerland.
Zurich Airport
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4. Data Collection

The data collection for this research study is based on certain principles. Strategic assessments with a long-term perspective require scientific concepts, based on relevant and likely information. For this purpose the scenario technique was used. Scenarios need serious bottom-up planning to validate the robustness of the **Future World**. Projections can help creating the robustness and simplifying the complexity of possible futures to assess opinions & preferences. Online Delphi is a possible research method to address large samples, trying to get answers with a higher potential for consensus than from simple surveys. They result in clear preferences and for this reason provide answers, combining an individual qualitative thought process with a quantitative assessment over lager samples.

4.1 Population & Screening

The research population (recruited from an "online access panel" by Intervista – ISO-certified market research) consists of 3'000 people (1'000 per scenario) between the age of 16 and 69 years (representing 70% of CH population in 2019 and a projected 60% for 2040), residing in Switzerland and having traveled by plane at least once between August 2016 and August 2019 (36 months). The age distribution has been selected to reflect demographic changes until 2040 and to focus on participants that are able and willing to take decisions concerning aviation and mobility services in the next 20 years. The following distributions have been coded (proposed) per scenario:

Age	Proposed Share	Proposed Sample
16 - 26	19%	190
27 - 35	20%	200
36 - 43	20%	200
44 - 52	17%	170
53 - 59	15%	150
60 - 69	9%	90
	100%	1000

CH population in 2019:

Age-groups	Mill.	Pct.
70+	**1.2**	**14%**
16-69	**6.1**	**70%**
<16	**1.4**	**16%**
Total	**8.7**	**100%**

Old-age dependency ratio 19.6
Median age 42.9

CH population in 2040 (reference age 2019):

Age-groups	Mill.	Pct.
70+	**2.0**	**20%**
16-69	**6.5**	**65%**
<16	**1.5**	**15%**
Total	**10.0**	**100%**

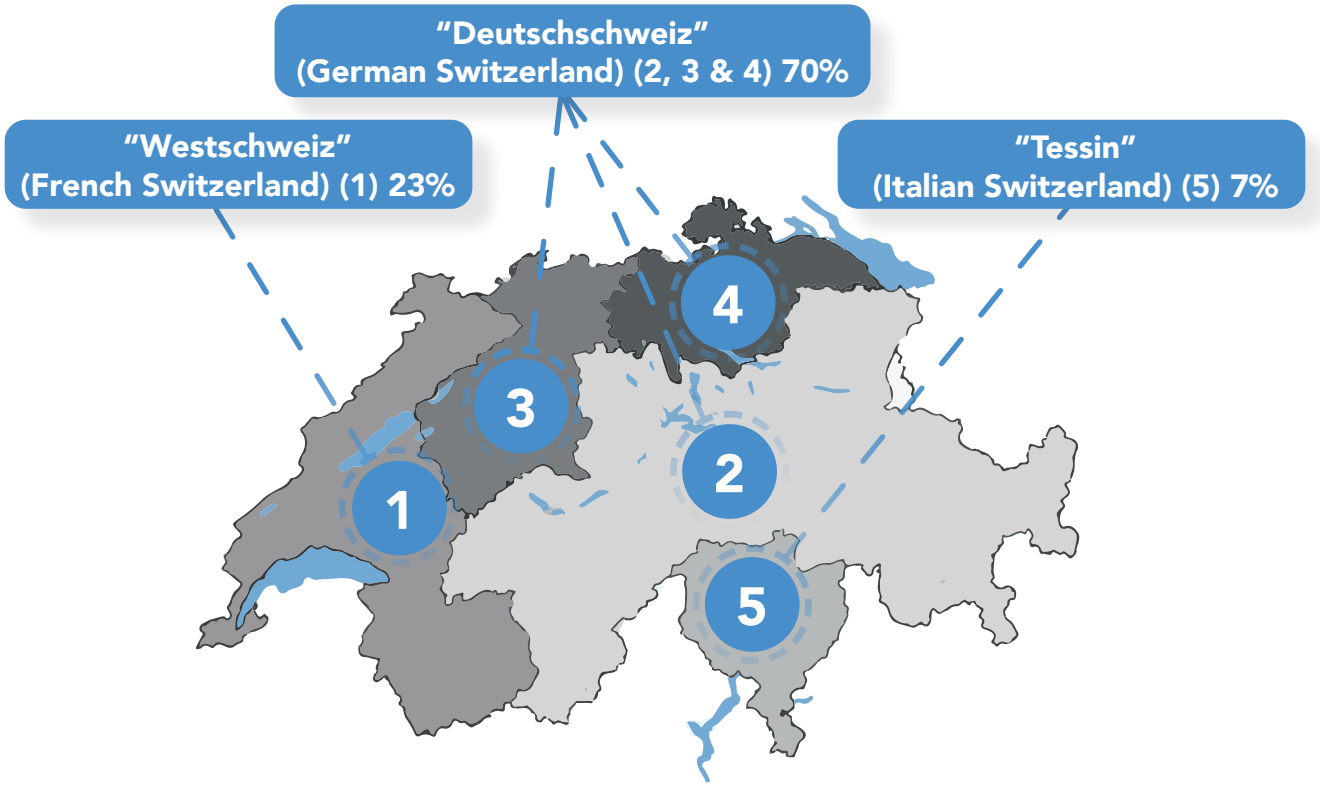
Old-age dependency ratio 30.6
Median age 46.6

CH population in 2040 (sample from 2019):

Age-groups	Mill.	Pct.
91+	**0.2**	**2%**
37-90	**6.1**	**60%**
<37	**3.8**	**38%**
Total	**10.0**	**100%**

Old-age dependency ratio 30.6
Median age 46.6

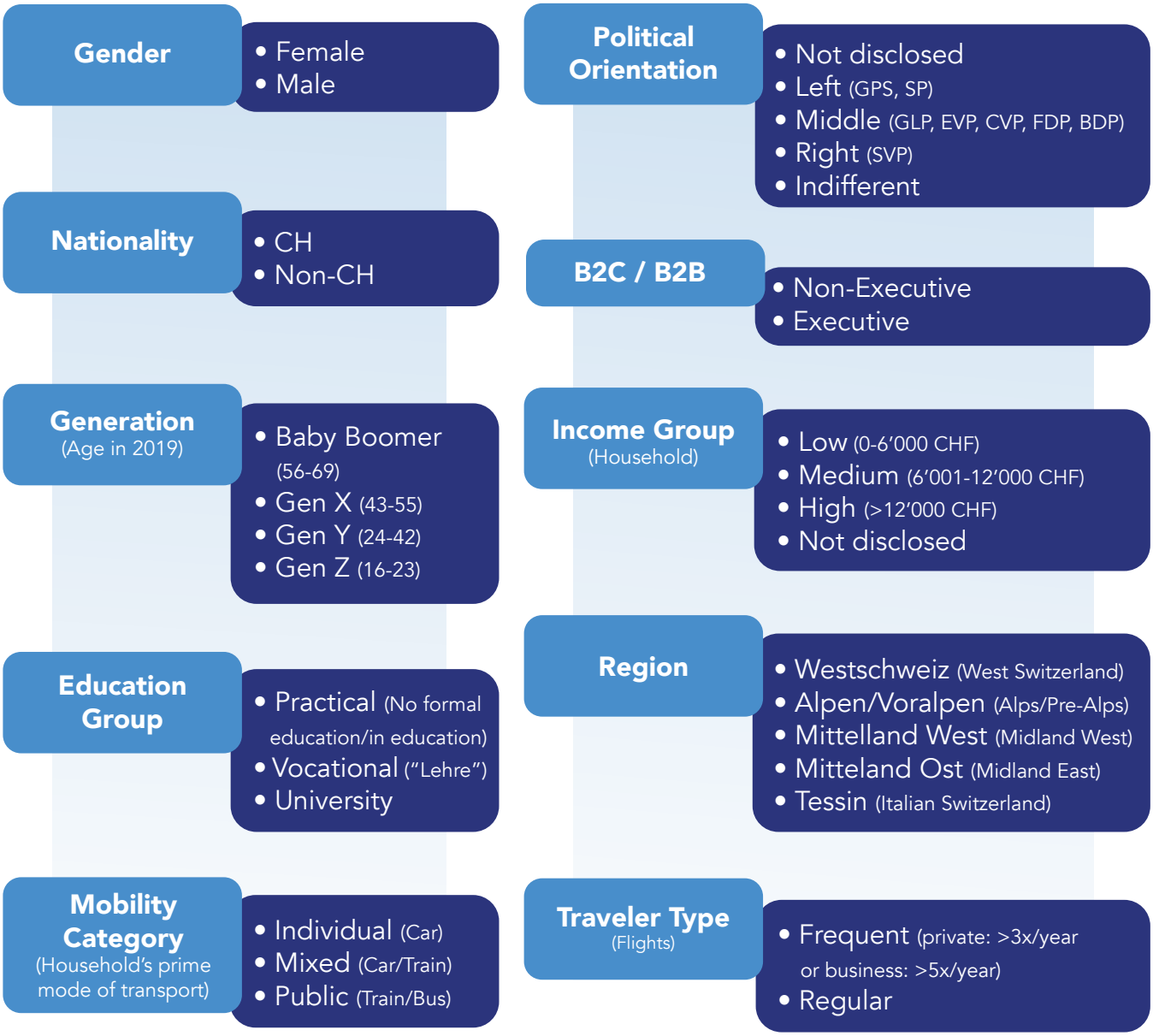
The geographical distribution is following a real split (of Switzerland in 2019), providing a slightly higher focus on the population of Ticino (limited access to major CH airports) to serve as a control group. The split has been coded as follows:



1. Westschweiz (West Switzerland)
2. Alpen/Voralpen (Alps/Pre-Alps)
3. Mittelland West (Midland West)
4. Mitteland Ost (Midland East)
5. Tessin (Italian Switzerland)

The gender split "female/male" has been selected to reflect a balanced view, using a 50/50 allocation. The sample of 3'000 panelists from a Swiss resident pool can be considered representative for the Swiss population (society), using a confidence level of 95% and an error margin of 3%.

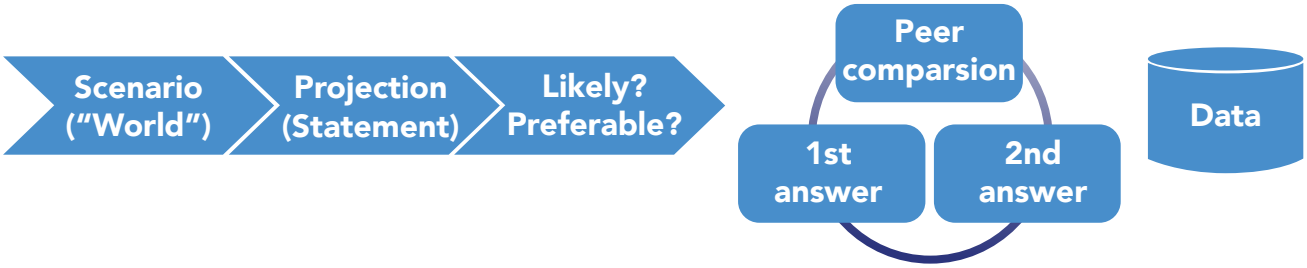
The following characteristics have been used for the Online Delphi analysis:



4.2 Online-Delphi B2C

The research team decided to innovate the data collection process, combining an established online B2C panel with consensus-facilitating Delphi techniques (Figure 5). The introduction of Online-Delphi enabled the analysis of probabilities, preferences and behavior, using scenario projections and a two-stage assessment process:

FIGURE 5: SURVEY SEQUENCE



The research approach supported the simplification of complex scenarios, introducing the **Future World** through brief and clear descriptions, followed by short projections without causality (no cause-and-effect relationships). Each panelist provided an initial assessment concerning the likelihood of the projection and their preference or level of impact. Each initial assessment was followed by presenting the average score (mean) of their peer group, allowing the participants to re-consider their first assessment and providing a second score or keeping the initial one.

This concept is derived from traditional Delphi studies, in which experts are consulted as part of a consensus process. However, consensus may not be achieved, if opinions and beliefs deviate and remain strong with individuals. Throughout the data collection phase (sampling), the means of each projection/assessment may move toward a common score (range) among the panelists. On the contrary, it contains a risk of streamlining and therefore increasing the level of bias. Therefore, the survey has been developed to keep records of every score (1st, mean, 2nd) for every participant throughout the sampling, allowing for further analysis of the consensus process and score variations (not part of this research study).

The assessment data for each projection contains a score between 1 and 10 (Likert scale, with a theoretical middle point at 5.5 = expected mean of a normally distributed sample). The Likert scale relates to different assessments (likelihood, preference, habit, relation), depending on the projections of each scenario (full list in Appendix III). In addition to the mean, data for the 25, 50 and 75 percentiles have been analyzed. Both Likert scale and Delphi consensus contain a risk of balanced answers (around the middle point), resulting in potentially less meaningful information to address the research questions (careful consideration required to draw relevant conclusions). The data consolidation for this research study uses the arithmetic mean of the 1st answer by panelists, in order to discuss results based on unbiased responses.

5. Analysis

5.1 Descriptive Statistics

Table 1 shows the distribution across all scenarios concerning **Travel type, Education group** and **Generation**.

TABLE 1: SAMPLE DISTRIBUTION OF ALL PANELISTS

Type	Education	Gen Z	Gen Y	Gen X	Baby Boomer	Total
Regular traveler	None/Practical	159	19	15	22	**215**
	Vocational	60	243	229	198	**730**
	University	136	872	436	281	**1'725**
	Total	**355**	**1'134**	**680**	**501**	**2'670**
Frequent traveler	None/Practical	13	2	2	1	**18**
	Vocational	5	36	26	13	**80**
	University	23	146	64	29	**262**
	Total	**41**	**184**	**92**	**43**	**360**
Total	None/Practical	172	21	17	23	**233**
	Vocational	65	279	255	211	**810**
	University	159	1'018	500	310	**1'987**
	Total	**396**	**1'318**	**772**	**544**	**3'030**

5.2 Correlations

The data set shows strong correlations for multiple variables (characteristics of participants), indicating how relevant cluster analysis can be for further interpretations of responses concerning scenarios and projections. For example, gender correlates strongly to income and executive profiles, or: male participants disclosed a higher income and more leading positions than females, as well as travelling more frequently.

TABLE 2: CORRELATION DATA FROM SAMPLE

Variable	Gender	Nationality	Generation	Education	Mobility	Inc. group	Exec. mgt.	Polit.	Reg.	Fqt. Trav.
Gender	1.000	0.026	0.010	-0.018	0.009	.088**	-.071**	-0.025	-0.023	-.055**
Nationality	0.026	1.000	-.053**	.069**	.052**	0.023	-0.004	0.008	-0.002	.105**
Generation	0.010	-.053**	1.000	.125**	-.045**	-.083**	.060**	-.087**	-0.005	-.040*
Education group	-0.018	.069**	.125**	1.000	.134**	-.134**	0.031	-.069**	0.007	.058**
Mobility category	0.009	.052*	-.045*	.134**	1.000	-.072**	-.049**	-.072**	.051**	.043*
Income group	.088**	0.023	-.083**	.134**	-.072**	1.000	-.051**	-0.024	0.018	-0.014
Executive mgt.	-.071**	-0.004	.060**	0.031	-.049**	-.051**	1.000	.038**	0.010	.061**
Political poles	-0.025	0.008	-.087**	-.069**	-.072**	-0.024	.038*	1.000	0.031	.036*
Region	-0.023	-0.002	-0.005	0.007	.051**	0.018	0.010	0.031	1.000	-.057**
Fqt. traveller	-.055**	.105**	-.040*	.058**	.043*	-0.014	.061**	.036*	-.057**	1.000

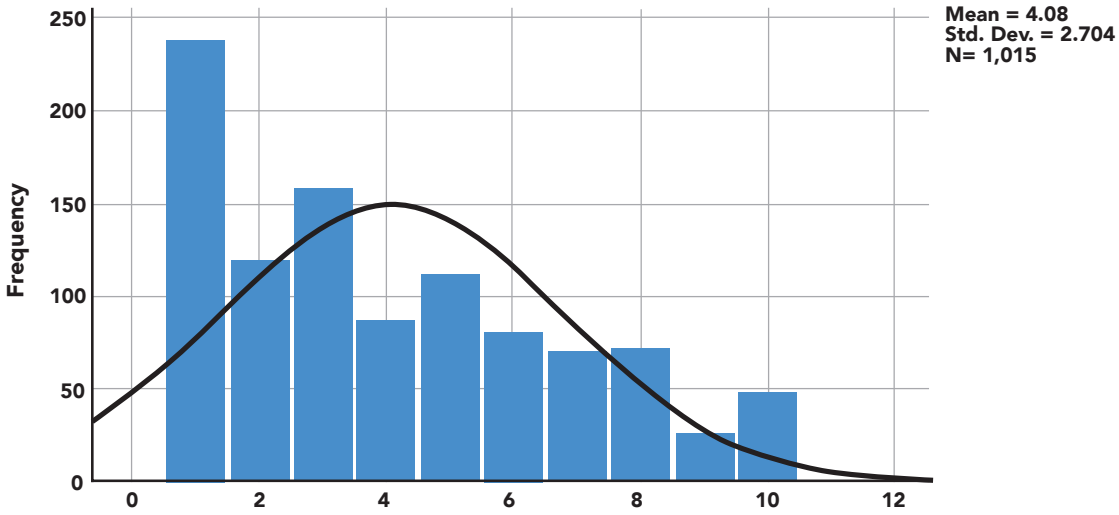
Table 2: Pearson Correlation between variables (** significant at 0.01 level, 2-tailed)

6. Discussion

The descriptive analytics of the dataset allowed the researchers to identify various clusters (different characteristics of panelists) among the participant pool, with an interpretation focus on trends, consensus, debates and mixed.

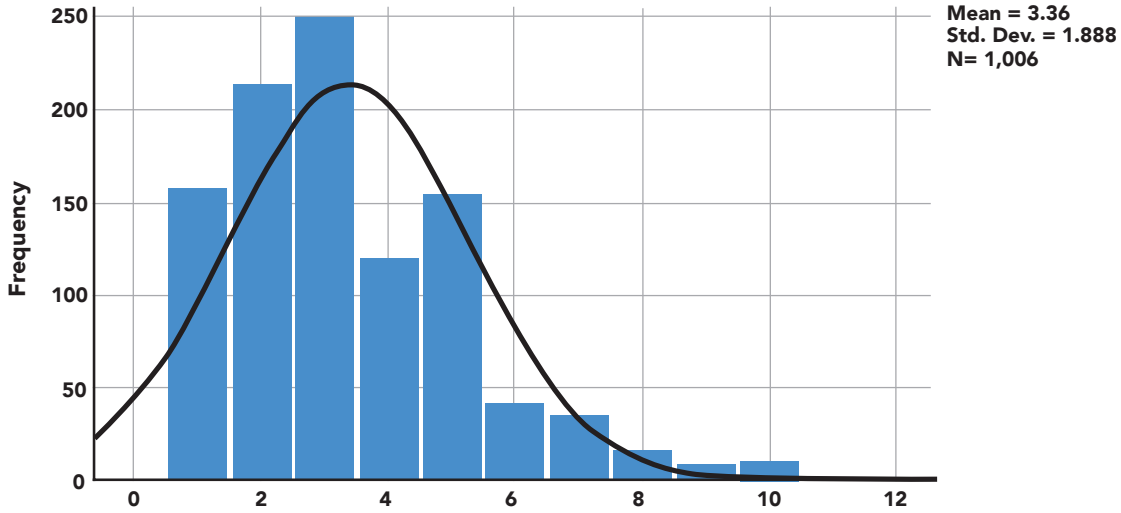
Trends refer to consolidated answers for values at distinct 25 or 75 percentiles and normal standard deviation. Figure 6 shows a sample distribution for answers in the lower range of the 1-10 Likert scale (Mean: 4.1; Std. Dev.: 2.7)

FIGURE 6: TREND DISTRIBUTION



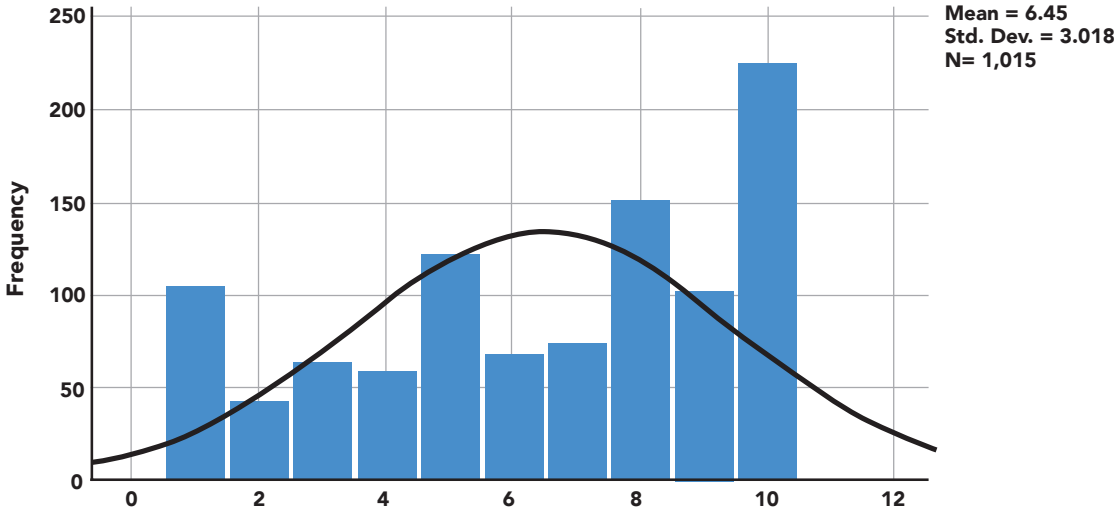
Consensus refers to consolidated answers for values at very distinct 25 or 75 percentiles and a narrow standard deviation. Figure 7 shows a sample distribution for answers in the very low range of the 1-10 Likert scale (Mean: 3.4; Std. Dev.: 1.9)

FIGURE 7: CONSENSUS DISTRIBUTION



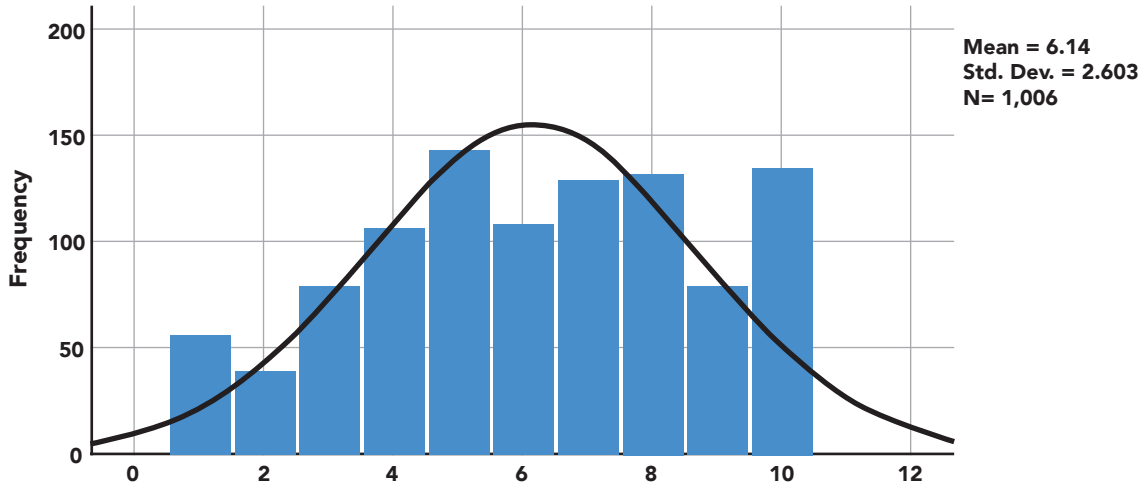
Debates refer to consolidated answers for values at distinc 25 and 75 percentiles and a wide standard deviation. Figure 8 shows a sample distribution for answers across the 1-10 Likert scale with polarizing opinions at both ends (Mean: 6.5; Std. Dev.: 3.0)

FIGURE 8: DEBATES DISTRIBUTION



Mixed patterns refer to consolidated answers for values with a balanced median (50 percentile) and a normal standard deviation. Figure 9 shows a samples distribution for "expected" answers around the mean of 5.5 (Mean: 6.1; Std. Dev.: 2.6)

FIGURE 9: MIXED DISTRIBUTION



The **overall** scores for likelihood, preference or other attributes of projections (=Total Mean of the total sample) are showing a rather balanced view/opinion among the Online-Delphi participants in general. Therefore, a cluster analysis (characteristics of participants) has been applied to identify differentiated scores and providing a basis for further interpretations and conclusions. The following discussion provides a more detailed view on the four opinion clusters and provides an understanding of the general opinions derived from the Delphi analysis.

6.1 Trends

6.1.1 Habits

Participants are expecting an increase of short trips by plane (Mean: 6.1; 75-Perc: 8.0), with Generation Z (Mean: 6.7), practitioners (Mean: 6.7) and inhabitants of canton Ticino (Mean: 6.6) leading this opinion. However, individuals are less convinced to be / become a consumer of such short trips (Mean: 4.1, 75-Perc: 6.00). The responses show a gap between societal expectations on the macro-level versus personal habits on the micro-level, with a spread between left parties (Mean: 3.2) and right parties (Mean: 5.2) as well as deviations in Ticino (5.4) and by frequent travelers (5.3). In general, Swiss society strongly believes in the acceptance level of civil aviation and flights being a matter of course (Mean: 6.6; 75-Perc: 9.0), especially by Ticinesi (Mean: 7.5).

The personal beliefs, opinions and habits among individual members of the society do not reflect the expectation for the society as a whole with respect to mobility needs. The development of transportation offerings (and infrastructure) in accordance with societal requirements could be misinterpreting artificial for intrinsic needs. The researchers found evidence for "attitude-behavior gaps" in various cases of the sample data, showing the importance of societal elements in the assessment of the aviation industry.

6.1.2 Competitiveness

Participants consider Switzerland being competitive within Europe (Mean: 6.8; 75-Perc: 8.0) and not having (low likelihood) a strategic disadvantage from an international point of view, with strong emphasis by the "Midland East" region (Zürich, Aarau, Schaffhausen, St. Gallen) (Mean: 7.4). Participants from Ticino are less optimistic concerning Switzerland's international competitiveness. The Swiss society perceives Aviation being less contributing to the country's competitiveness (Mean: 5.6; 75-Perc: 7.0), economic attractiveness (Mean: 5.7; 75-Perc: 7.0) and networking capabilities (Mean: 5.7; 75-Perc: 7.0), with shifting opinions by frequent travelers and the population of Ticino.

The competitiveness of Switzerland is not seen to be at risk by 2040. The Swiss society believes in the country's economic strength and capability to innovate. However, the Aviation industry seem to be less relevant or connected to this competitiveness, according to the majority of the panelists. The air mobility system and its stakeholders would need to execute more proactive communication of the tangible and intangible impact of Aviation, if the current views and perceptions by the Swiss society are not reflecting this impact sufficiently.

6.1.3 Innovation

At the time of the online survey, participants showed very low acceptance levels for air taxis (Mean: 2.9; 75-Perc: 4.0), unmanned commercial aircrafts (Mean: 3.9; 75-Perc: 3.0) and autonomous passenger drones (Mean: 3.8; 75-Perc: 5.0), with clear distinctions between gender, generations, education groups and executive levels. The likelihood and the preference of each projection is not showing gaps between belief in technology and potential demand for such services. The Swiss society is not optimistic about potential advancements in urban air mobility or pilot-less concepts.

The technical footprint of air mobility in 2040 is neither clear nor in favor of autonomous solutions by the panelists in 2019. The maturity of unmanned vehicles has not progressed enough for today's consumers being visible as viable alternatives. Whether the low acceptance rate is for safety reasons or lack of demand is not obvious from the data collected. Therefore, the Swiss society in 2019 may not be considered ready or savvy for air mobility innovations (the results of the B2B control group were not conclusive enough to identify innovation drivers by the Swiss economy either).

6.2 Consensus & Debates

6.2.1 Infrastructure

On one side, participants (no matter which cluster/characteristic) don't believe that there will be less destinations offered from Swiss airports than in 2019 (Mean: 4.6; 75-Perc: 6.0), therefore expecting increasing supply by airlines. However, the same respondents indicated that they would not be affected by much, if airlines will cut destinations in their portfolio for Switzerland (Mean: 5.2; 75-Perc: 6.0). This statement is also true for the majority of frequent travelers (Mean: 5.1), but not so much for executives (Mean: 6.0).

The Swiss society expects more connections to and from Switzerland by 2040, however leaving it open whether this growth should happen with the current infrastructure or requiring additional capacity (on ground). According to personal needs by participants, the Swiss market could be saturated for outbound travel, as the panelists are less concerned about a decline in destination offerings. Hence, the growth would be covering needs of inbound travelers, transit passengers and the business community (confirmed by the B2B control group). Overall, any statement made by leisure travelers with respect to current offerings and needs would require more research (e.g. conjoint analysis), as the B2C participants might not have all necessary information available for a final assessment.

6.2.2 Limitations

When confronted with restrictions such as flight bans up to 700km or 1'000 km, the Swiss society doesn't believe that those limitations would be reality by 2040 (Mean: 3.1; 75-Perc: 4.0), regardless of the scenario, generation, mobility type or region. In this projection, respondents with lower education levels indicated a higher likelihood for flight bans up to 700km (Mean: 3.9).

The projections related to flight bans and imposed limitations caused a unanimous response pattern for routes, which are typically served by air (>700km), indicating that the Swiss society is objecting flight bans as a regulatory action. The opposition for such measures seems to be less related to the ecological footprint or sustainability concerns, but to the restrictive character of the projections and the underlying interdiction.

6.2.3 Alternatives

The projections concerning flight alternatives up to 700km in each scenario caused a debate among the participants. A majority is in favor of train trips (instead of flights) (Mean: 6.5; 75-Perc: 9.0), with very strong support by "public" mobility profiles (Mean: 7.6) and a large gap between left parties (Mean: 7.6) and right parties (Mean: 4.8), who opposed the idea of using railway options. Similar outcome and debate with respect to usage of autonomous electric cars instead of planes (Mean: 5.7, 75-Perc: 8.0). The Swiss society indicated flexibility with respect to self-regulation (here: not taking flights up to 700km of personal and business nature), with frequent travelers showing a lower preference (Mean: 4.5). Alternatives are seen controversial between frequent travelers of trains (Mean >6.5) and flights (Mean <4).

Inter-modality and modal switching seem to polarize the societal landscape, from a political perspective and based on current travel patterns. Participants, who are not exposed to already existing mobility alternatives (e.g. train, night train, car sharing, long-distance bus) are less likely to accept these projections, therefore opening opportunities to affect behavior by increasing today's exposure to alternative modes of transport. On the contrary, this missing exposure could be also based on less attractive train and bus connections between metropoles.

6.3 Mixed

6.3.1 Pricing

Participants are clearly expecting higher ticket prices to compensate for CO2 emissions (Mean: 6.4; 75-Perc: 8.0), however being less clear about whether or not a 40% increase would affect their willingness to reduce air travel (Mean: 5.8). There is no obvious panel characteristic being determined, but also no indication for price sensitivity at a 40% increase. Even for the clip level of 100% increase, the Swiss population does not respond with a considerable willingness to reduce the current flying behavior, nevertheless showing some trend to adjust (Mean: 6.1; 75-Perc: 8.0), with Executives being less willing to cut air travel (Mean: 5.1).

The pricing aspect of air mobility services is not a key differentiator for the travel decisions made by Swiss society. Participants seem to be less concerned about cost or whether higher prices are caused by (emission) compensation charges. This behavior has an impact on the effectiveness of regulatory measures and monetary incentives, which could be less effective, if flying shows a lower price sensitivity among the consumers. Executives are part of the B2B control group, hence air travel is even less driven by ticket prices for the business community.

6.3.2 Connectivity

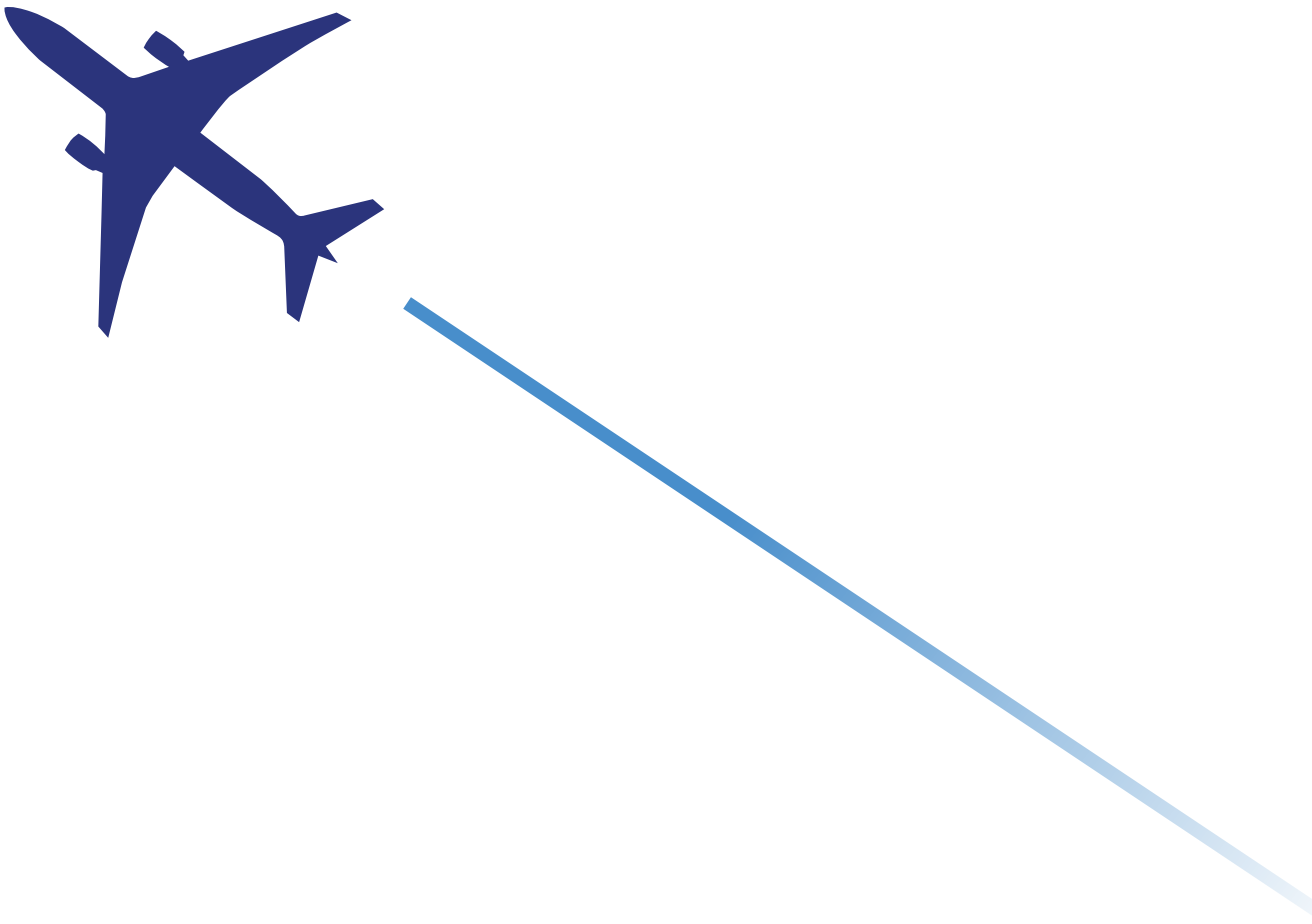
Projections concerning connectivity to/from Switzerland caused a mixed assessment across all projections of the "growth" scenarios (Means between 5.0 and 5.7; 75-Perc: 7.0/8.0), with high expectations for intercontinental destinations by frequent travelers (Mean: 6.7) and low expectations for European routes by train users (Mean: 5.0), who would also be less likely to use airports in neighboring countries (Mean: 4.5). Travelers from Ticino, however, are very much inclined to travel from abroad (Mean: 6.9). In general, frequent travelers and Ticinesi showed a clearer trend toward using non-CH airports if direct flights would not be available from Switzerland.

The projections concerning how Switzerland will be connected to other countries in 2040 created a very differentiated picture of requirements by the Swiss society, indicating that "it depends" on the circumstances of individuals. Whether or not airports and airlines need to increase offerings by adding capacity and direct flights cannot be answered by this very one measure.

6.3.3 Ecology

A potential gap exists between the likelihood of more expensive carbon-neutral travel (Mean: 6.9), the personal impact on each individual (Mean: 5.8) and the society's willingness to condemn short trips in 2040 (Mean: 4.5). Swiss inhabitants are expecting more consciousness about the footprint of travelling, especially when considering flights as a mode of transport (Mean: 6.5; 75-Perc: 9.0), with disputes between left parties (Mean: 7.7) and right parties (Mean: 5.1). Despite the expectations for the Swiss society, statements for personal sustainable behavior are less obvious and clear. Depending on the distance, participants would still travel similar to current levels (Mean: 6.5 up to 400km, Mean: 6.1 up to 700km and Mean: 5.4 for trips up to 1'000km).

Expectations for environmentally conscious behavior by 2040 are not necessarily based on ecological behavior in 2019. The carbon footprint of air travel seems to be obvious to most panelists, showing willingness to compensate in the future. However, the footprint by other means of transport is less obvious to the Swiss society in 2019, creating a less differentiated perception of the ecological impact by mobility today and in the future.



6.4 Control Group (B2B)

The B2B panelists have been derived from the group of Executives, who represent owners, board members and executive managers within the sample. A total of 120 participants quali-fied to serve as a control group. The share of B2B panelists of the total sample was the same for each scenario (4%).
The assessment behavior by the B2B panelists does not significantly differ from the one by the B2C group. **Among the main differences are the following statements:**

- B2B panelists indicate a higher likelihood (Mean) for flight bans up to 400km (B2B: 4.8; B2C: 3.6). They expect more regulatory intervention by 2040.
- B2B panelists are less willing to reduce flight activities up to 700km (B2B: 4.5; B2C: 5.7). Sacrificing short trips by plane is less appealing to them.
- B2B panelists show a lower price sensitivity, even in case of 100% cost increases (B2B: 5.1; B2C: 6.2). Executives value travel time over cost savings.
- B2B panelists would not necessarily benefit from more destinations compared to today's European connections (B2B: 4.3; B2C: 5.1).
  They consider existing offerings being sufficient. However, Executives are expecting more intercontinental connections via hubs outside of Switzerland by 2040.
- B2B panelists are more optimistic concerning autonomous mobility in 2040 (B2B: 4.5; B2C: 3.8) and would appreciate innovation more than Non-executives (B2B: 4.7; B2C: 4.2). How- ever, even among Executives unmanned air vehicles and piloted air taxi services are not a key driver for mobility of the future.

Overall, the control group confirms that the assessment of the projections is based on personal opinions and expectations rather than an industry or economic view. However, characteristics of the B2B panelists are correlating with attributes such as gender, income, generation and travel frequencies, which are having a similar or even greater impact on the assessment scores. This covariation is an important input for drawing conclusions in future research with respect to whether or not economic variables affect the degree of mobility behavior more than societal variables would do.

The data analysis shows how much variation can exist among participants when breaking down into individual characteristics of each panelist. Early deep dives into single cases (records) by the researchers revealed the complexity of personal preferences based on individual situations. On the contrary, a lot of the key statements and findings are supported by majority of the participants, allowing to draw conclusions for air mobility in Switzerland (and Europe) by 2040 or somewhere on the timeline between now and then. The aggregation of individual assessments by representatives of the Swiss society enables stakeholders filtering out bias, outliers and less relevant assessments, ensuring a focus on the key drivers and influencers of mobility behavior in Switzerland.


MACH
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CHRONO
SIDE STICK PRIORITY
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NORTH REF
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CRUISE
LDG GEAR
AUTO/BRK
A/SKID & N/W STRG
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7. Interpretation

The Delphi study enabled a differentiated consideration of the societal demands for the aviation system in Switzerland in the year 2040, an evaluation of criteria for satisfying the travel needs of today and tomorrow with aspects that go beyond the economic and business management components, especially taking civil aviation and the Swiss society into account. The research questions are answered based on the findings of all research activities, especially the Delphi study.

• RQ1: What are the traffic scenarios for the Swiss aviation system by 2040?

The traffic scenarios are reflecting growth (Scenario Maximum: +2.3%, Scenario Reference: +1.4%) of the aviation industry with and without adjustments to existing capacity and infrastructure at Swiss airports as well as route offerings by airlines. Environmental consciousness and sustainable travel behavior by 2040 are included in projections of declining traffic (Scenario Minimum: -1.0%), demand and acceptance of air mobility. In general, the scenarios have been developed using high level estimations for global, European and Swiss air traffic as well as bottom-up assumptions for outbound and inbound travel.

• RQ2: What is the expectation for the Swiss aviation system by the Swiss B2C society?

The Swiss society (B2C sample) does not reflect on aviation and air travel without reflecting on mobility in general. While overall expectations for air traffic and the Swiss society as a whole are in favor of increased capacity and additional offerings (with a focus on direct intercontinental routes), individual panelists are less demanding and not so much in need of more flight options than today. Regulation and financial incentives to address environmental concerns are not a clear requirement and the mobility behavior, using alternative means of transport, is very differentiated by individuals. Results of the control group (B2B requirements) are not sufficient to draw representative conclusions, however did not deviate significantly from the B2C sample.

• RQ3: How relevant is connectivity for the Swiss society and economy of the future?

Being internationally connected and international travel are important to individuals of the Swiss society, today and tomorrow. However, the role of aviation and its contribution to connectivity and Switzerland's competitiveness has not been materialized in the responses by the Delphi panelists. The economy seems to benefit from the country's air connectivity and air transport industry in general, while wealth and well-being of citizens are not necessarily associated with service offerings by airports and airlines. It seems that the society does not make a link between the export/import related GDP of Switzerland and air transport.

The posed hypotheses have the goal to clearly generate specific answers and a basis for recommendations for practice. They link the results related to the posed research questions with the aviation infrastructure, connectivity of the swiss society, alternative means of transport and the systemic relevance of aviation for Switzerland.

• H1: Infrastructure of Swiss airports, capacity of direct flights and connectivity from and to Switzerland are the key drivers of future demand for air transport services by the Swiss society.

For the time being, the Swiss society is less concerned about infrastructure and destination offerings as being a key driver for connectivity in the next 20 years. Demand is perceived as being high in 2019 and not necessarily growing from an individual point of view. Direct flights, however, are more important to the Swiss society, today and in the future. H1 can be partially accepted.

• H2: Technological innovation, sustained demand and supply and alternative means of transport are affecting the personal travel behavior of the Swiss society.

The Swiss society does not consider air mobility innovations being a critical development of the aviation industry. Sustainability and carbon footprints of air travel are a commodity aspect rather than a real decision-making condition. Alternative means of transport do not attract all individuals in Switzerland in 2019. Overall, H2 cannot be accepted, with some exceptions from the sample data.

• H3: The Swiss society believes in the systemic relevance of air connectivity, aviation in general and the Swiss civil aviation industry in particular.

The systemic relevance could not be confirmed from the assessments of the projections in this study. Still, the Swiss society believes in growth and the importance of intercontinental connectivity and air travel being a common mode of transport in 2040. However, both individual opinions and consolidated views are not supporting a societal belief in civil aviation being a strong contributor to the system. H3 needs to be rejected.

8. Conclusion

8.1 Scientific Relevance

The Delphi study provided valuable data to address the problem statement, answering the research questions and collecting evidence to assess the hypotheses. The panelists have been asked to comment on projections mainly from a subjective point of view, applying individual estimations and preferences. Even with the Delphi method of using peer answers to reconsider the initial assessment, participants have not been changing their opinions on a large scale, hence the researchers are confronted with predominantly unbiased data and/or a mature panel basis.
The participants have been showing an interesting switching behavior during the final selection of the most likely scenario at the end of the survey. While the initial scenario assignment was done randomly (automatic selection), panelists were given all 3 scenarios to choose from (short descriptions of each **Future World** were provided) after completion of the assessments. Regardless of the scenario, more than half of the panelists have chosen a different scenario as being the most likely one. In total, 63% of the population switched. The final selections were in favor of the growth scenarios (82% believe in air traffic growing until 2040).

		FINAL SELECTION			
		Max (+2.3%)	Ref (+1.4%)	Min (-1.0%)	Switched
PRE-SELECTION	Max (+2.3%)	488	383	144	52%
	Ref (+1.4%)	395	413	198	59%
	Min (-1.0%)	288	495	226	78%
	Total	1'171	1'291	568	63%

The survey data contains much more insight of societal, behavioral and economic relevance concerning mobility in general, but also aviation in particular. However, due to the number of data points and records being generated, not every information has been analyzed for relevance to this study. The researchers kept a focus on societal elements, that were connected to behavioral aspects of the panelists and being able in answering the research questions.

8.2 Societal Relevance

The opinion base from the sample was a balanced representation of the Swiss society. The researchers assume a representative sample for various characteristics among the population (in addition to age, gender and region). Cluster analysis has shown a broad variety of characteristics, which caused differentiated opinions and expectations by the panelists.

Top 10 differentiating factors among participants (Polarized):

1. Travel frequency **(Frequent traveler)**
2. Political orientation **(Right parties)**
3. Geographic location **(Ticino)**
4. Political orientation **(Left parties)**
5. Transport profile **(Public)**
6. Nationality **(Non-CH citizens)**
7. Generation **(Baby boomer)**
8. Corporate status **(Executives)**
9. Education level **(Lower level)**
10. Generation **Z**

Top 10 non-differentiating factors (Balanced):

1. Corporate status **(Non executives)**
2. Nationality **(Swiss)**
3. Travel frequency **(Regular travelers)**
4. Education level **(University degree)**
5. Income **(Average salaries)**
6. Transport profile **(Mixed)**
7. Gender **(Male)**
8. Gender **(Female)**
9. Political orientation **(Middle parties)**
10. Generation **X**

The Swiss society shows clear signs of personal beliefs that are based on intrinsic needs, experiences but also political influence and public opinion (social media). Gender, geography, income or corporate status seem to be less influential among the panelists. However, age, education and the current mobility behavior are making a difference in assessing the likelihood and preference for projections in the year 2040.

8.3 Outlook

Research in (air) mobility for the next decade will have to focus on societal and individual consumer aspects, and being less concerned about the economic or environmental impact when identifying intrinsic travel needs and habits. Travelers will materialize their carbon footprint by selecting/non-selecting mobility options according to both impact and convenience created by each mean of transport. Academic assignments should include intangible aspects of air transport, as the aviation sector could move from an industry that has become more and more influenced by supply driven pricing concepts to demand oriented services and value driven industry, for which regulatory decisions might be a key stimulator.

For individuals of the Swiss society, and therefore customers of the outbound travel portfolio, the current infrastructure and offerings seem to satisfy their needs, at least for now and some part of the foreseeable future. However, researchers should monitor the opinion base frequently, as expectations and circumstances can shift and evolve, especially among customer groups that are representing the "polarizing" characteristics, as found by this research study (refer to 8.2). The impact of technological advancements in autonomous air transport and the economic role of aviation, as perceived by the society, should be additional areas of future research, in order to reduce bias in the data, analysis and conclusions.

9. Summary

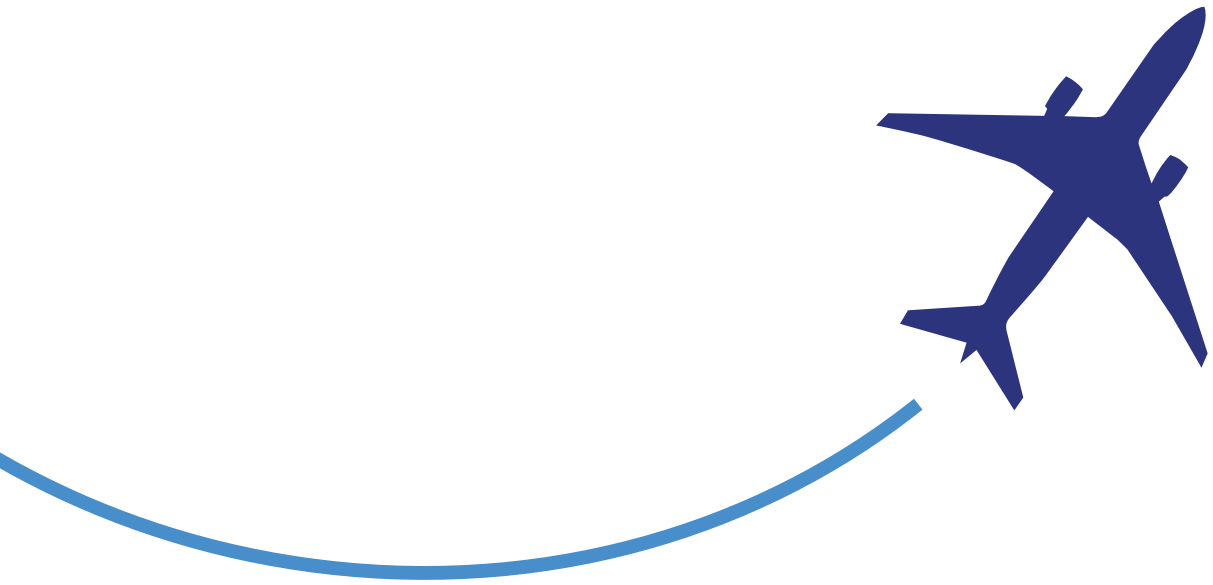
The research study about the role of aviation with respect to prosperity, wealth and well-being of the Swiss society in 2040 revealed some unexpected statements and opinions by a representative Swiss sample and a mobility consumer base in the year 2019. With 2019 having been subject to "Fridays for Future" initiatives and Swiss federal elections, both also focusing on the role of aviation as a contributor to global warming, the social Delphi study did not show a significant nor explicit bias toward assessments predominantly associated with sustainability concerns by the panelists. Nevertheless, the researchers used the opportunity to assess the influence of a potentially more radical consciousness about the impact of air transport as part of the projections in the traffic scenario "Minimum", which has been chosen by nearly 19% of all participants as the most likely scenario (majority believes in the growth of the Aviation system).

The data of the study show how individual mobility needs are presented and evaluated by the Delphi participants, which then provide a consolidated view of a representative Swiss sample. In addition to the trends such as the expected increase in intercontinental connections and more connections via hubs outside Switzerland, the panelists also made it clear that their own travel demands are already sufficiently covered today and that, even in 2040, personal air transport requirements could be met with the existing infrastructure and destination portfolio. The Swiss society of 2019 does not believe in the need and success of autonomous air mobility solutions; however, there is a certain trust shown into the electrification of ground vehicles, including autonomous cars. Overall, the panelists consider Switzerland being and remaining both innovative and economically successful, with aviation not being considered as one of the key drivers for this level of competitiveness. This result is especially interesting, as about 65% of all Swiss production is exported and about 35% of the exported value shipped by air. Most likely, respondents did not make the link to these facts, when evaluating the Delphi projections.

The B2C sample assessed possible flight bans and a limitation of mobility choices as unlikely and not acceptable. The Swiss society, however, evaluates alternative means of transport from different perspectives depending on their current mobility profile; the willingness for modal switching is connected to already existing experiences with air travel alternatives on ground. Despite the differentiated opinions about air connectivity based on age, region, education or political beliefs, the panelists consider compensation measures for the carbon footprint of Aviation as likely and useful in the future, and theoretically accepting significant price increases for tickets with mixed responses whether this would affect their travel behavior. It is interesting to recognize that additional travelling costs implemented by additional air transport charges may not influence travel behavior. Hence, there is indication that the price elasticity of demand is over-evaluated by airlines and by governments, who aim at reducing air mobility by increasing existing or imposing new passenger charges. This consumer behavior is confirmed also by passenger charges in Germany, which were implemented a few years prior to this study and did not have a real impact on air travel demand.

The B2B sample was considered a control group of this study and confirmed that the

individual travel behavior and requirements are not significantly different from B2C panelists. Personal needs and preferences as well as the consciousness for air mobility are dominated by other characteristics than assessing the role of Aviation from a pure business point of view. Individual members of the society (regardless of B2C or B2B panelists) do not necessarily associate wealth, international jobs or quality of life with air connectivity. It seems like sufficient air transport as well as other modes of transport are taken for granted and being a hygiene factor. But if it is reduced or regulated, there are negative indications of the sample, meaning that in such cases the social reaction would switch to a free growth scenario of air mobility. The indifference in the assessment of participants with respect to the intangible contribution of Aviation (wealth, well-being, connectivity) in Switzerland now and by 2040, as opposed to differentiated statements about tangible and measurable elements (pricing, routes, distances), requires researchers and practitioners of the industry to deep dive into this opinion base and decision-making process of Aviation customers.



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Design and layout by Raffael Gava.

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11. Appendix

11.1 Appendix I: Participants

Panel data for the Online Delphi Survey: ***Frequencies & Distribution***

Geschlecht

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Männlich	1516	50.0	50.0	50.0
	Weiblich	1514	50.0	50.0	100.0
	Total	3030	100.0	100.0	

Nationalität

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Schweiz	2708	89.4	89.4	89.4
	Andere	322	10.6	10.6	100.0
	Total	3030	100.0	100.0	

Generation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Gen Z	396	13.1	13.1	13.1
	Gen Y	1318	43.5	43.5	56.6
	Gen X	772	25.5	25.5	82.0
	Baby Boomer	544	18.0	18.0	100.0
	Total	3030	100.0	100.0	

Bildungsgruppe

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Praxis	233	7.7	7.7	7.7
	Lehre	810	26.7	26.7	34.4
	Hochschule	1987	65.6	65.6	100.0
	Total	3030	100.0	100.0	

Mobilitätskategorie

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Individuell	1090	36.0	36.0	36.0
	Gemischt	1738	57.4	57.4	93.3
	Öffentlich	202	6.7	6.7	100.0
	Total	3030	100.0	100.0	

Einkommensgruppe

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Gering	622	20.5	20.5	20.5
	Durchschnitt	1286	42.4	42.4	63.0
	Hoch	481	15.9	15.9	78.8
	Keine Angabe	641	21.2	21.2	100.0
	Total	3030	100.0	100.0	

Executive Management

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Non Executive	2910	96.0	96.0	96.0
	Executive	120	4.0	4.0	100.0
	Total	3030	100.0	100.0	

Politische Pole

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Unbekannt	490	16.2	16.2	16.2
	Links	717	23.7	23.7	39.8
	Mitte	973	32.1	32.1	71.9
	Rechts	310	10.2	10.2	82.2
	Unbestimmt	540	17.8	17.8	100.0
	Total	3030	100.0	100.0	

WEMF-Region

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Westschweiz	699	23.1	23.1	23.1
	Alpen Voralpen	574	18.9	18.9	42.0
	Mittelland West	686	22.6	22.6	64.7
	Mittelland Ost	866	28.6	28.6	93.2
	Tessin	205	6.8	6.8	100.0
	Total	3030	100.0	100.0	

Vielflieger

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Reisender	2670	88.1	88.1	88.1
	Vielflieger	360	11.9	11.9	100.0
	Total	3030	100.0	100.0	

11.2 Appendix II: Traffic Scenarios

The Future World scenarios have been developed in a 2-step approach:

1. Top-down (including input from expert workshops) to understand possible trends in traffic projections for the future
2. Bottom-up (including a baseline = 2019, extrapolations from historical traffic, capacity at airports, data from tourism behavior/overnight stays, demographics of population in CH and travelers CH/international) to understand the opportunities & limitations from intrinsic demand and market potential

From the baseline numbers for 2019 (as known by mid 2019), the research team calculated traffic figures for passengers and movements, using CAGR (compounded annual growth rates) to represent growth, stagnation (moderate growth) and decline. Category splits and values are indicative, as they do not have to serve as a traffic forecast for the industry, but to allow the researchers to define projections to be answered by non-aviation experts.

The Future Worlds have been discussed with international aviation researchers and civil aviation experts in Switzerland to provide realistic scenarios as a foundation for the Delphi projections.

	2019		2040					
	Baseline		*Growth (Demand)*		*Growth (Supply)*		*Decline (Demand & Supply)*	
Scenario			***Maximum***		***Reference***		***Minimum***	
PAX Growth (CAGR), 2019-2040 (21 y.)			**2.3%**		**1.4%**		**-1.0%**	
O-D Leisure	**61%**	**34'412'000**	**66%**	**59'625'000**	**64%**	**47'812'500**	**63%**	**28'125'000**
O-D Business	**22%**	**12'068'000**	**19%**	**16'875'000**	**21%**	**15'937'500**	**33%**	**14'625'000**
Transfer	**17%**	**9'520'000**	**15%**	**13'500'000**	**15%**	**11'250'000**	**5%**	**2'250'000**
Passengers		**56'000'000**		**90'000'000**		**75'000'000**		**45'000'000**
Outbound (CH Residents)	**50%**	**28'000'000**	**50%**	**45'000'000**	**45%**	**33'750'000**	**40%**	**18'000'000**
Leisure	80%	22'400'000	80%	36'000'000	75%	25'312'500	60%	10'800'000
Business	20%	5'600'000	20%	9'000'000	25%	8'437'500	40%	7'200'000
Inbound (Visitors)	**33%**	**18'480'000**	**35%**	**31'500'000**	**40%**	**30'000'000**	**55%**	**24'750'000**
Leisure	65%	12'012'000	75%	23'625'000	75%	22'500'000	70%	17'325'000
Business	35%	6'468'000	25%	7'875'000	25%	7'500'000	30%	7'425'000
Transfer	**17%**	**9'520'000**	**15%**	**13'500'000**	**15%**	**11'250'000**	**5%**	**2'250'000**
Movements		**470'000**		**700'000**		**550'000**		**300'000**
Short-haul	83%	387'750	80%	560'000	75%	412'500	65%	195'000
Long-haul	18%	82'250	20%	140'000	25%	137'500	35%	105'000
∅ **PAX/Flight**		**119**		**129**		**136**		**150**
∅ PAX/Short-haul Flight		94		98		105		108
∅ PAX/Long-haul Flight		238		249		229		227
Population CH (Age: 10-75)		**6'200'000**		**7'200'000**		**7'100'000**		**7'000'000**
Annual Outbound Trips / Capita (CH)		**2.3**		**3.1**		**2.4**		**1.3**
Destinations from CH		**200**		**220**		**200**		**120**
Countries from CH		**60**		**70**		**65**		**35**
Zürich Airport		**Intercontinental Hub**		**Intercontinental Hub**		**Intercontinental Hub**		**Intercontinental P2P**
Geneva Airport		**European P2P**		**Regional Hub**		**Regional Hub**		**European P2P**
Basel Airport		**European P2P**		**Low-cost Hub**		**European P2P**		**European P2P**
Regional Airports		**Niche P2P**		**European P2P & Hub Feeder**		**Niche P2P**		**General Aviation only**
National Carrier		**Hub Carrier (established)**		**Hub Carrier (expansion)**		**Hub Carrier (stagnation)**		**Not existing**
Regulator		**EASA Regulation (adoption)**		**Passive Regulation**		**Proactive Regulation**		**CORSIA Compliance**

11.3 Appendix III: Projections & Assessment Questions

Maximum (Growth as per demand)

"Demand for air transport will continue to increase until 2040. The existing infrastructure of Swiss airports will be expanded accordingly. More short- and long-haul destinations are offered."

Projection 1: In 2040, there will be more connections from Swiss airports to European destinations than today.

- o How likely is this projection for Switzerland? very unlikely - very likely
- o How desirable is this projection for you (personally)? not desirable - very desirable

Projection 2: In 2040, there will be more intercontinental direct flights from Swiss airports than today.

- o How likely is this projection for Switzerland? very unlikely - very likely
- o How desirable is the projection for you (personally)? not desirable - very desirable

Projection 3: In the year 2040, I have several daily flights from Switzerland to major European cities (e.g. 10 times daily to Amsterdam).

- o How likely is this projection for Switzerland? very unlikely - very likely
- o How desirable is the projection for you (personally)? not desirable - very desirable

Projection 4: In 2040, private short trips (up to 3 days) by plane will be much more common than today.

- o How likely is this projection for Switzerland? very unlikely - very likely
- o How likely is it that you will take more short trips by plane in this projection? very unlikely - very likely

Projection 5: In 2040, no ticket surcharge will be levied to compensate for CO2 emissions.

- o How likely is this projection for Switzerland? very unlikely - very likely
- o How desirable is this projection for you (personally)? not desirable - very desirable

Projection 6: In the year 2040, I take the train instead of the plane for journeys of up to 700 km (e.g. Zurich to Barcelona, Amsterdam, Vienna, Prague, Rome).

- o How likely is this projection? very unlikely - very likely
- o How desirable is this projection for you (personally)? not desirable - very desirable

Projection 7: In 2040, flights up to 400 km distance (e.g. Zurich to Munich, Frankfurt, Nice, Paris, Bologna) are prohibited.

o How likely is this projection for Switzerland? very unlikely - very likely
o How likely is it that you will continue to travel up to 400km as often as to day and use other means of transport for this purpose? very unlikely - very likely

Projection 8: In 2040, I travel to the airport by air taxi (with pilot).

o How likely is this projection for Switzerland? very unlikely - very likely
o How desirable is this projection for you (personally)? not desirable - very desirable

Projection 9: In the year 2040, I live in a Switzerland that is competitive with other European locations.

o How likely is this projection for Switzerland? very unlikely - very likely
o How relevant do you estimate the contribution of aviation to Switzerland's competitiveness? no contribution - very big contribution

Projection 10: In the year 2040, Switzerland's good international air connections will make a decisive contribution to my prosperity.

o How likely is this projection for Switzerland? very unlikely - very likely
o How relevant do you estimate the contribution of aviation to social prosperity? no contribution - very big contribution

Reference (Growth as per capacity)

"Demand for air transport will continue to increase until 2040. However, the existing infrastructure of Swiss airports will not be significantly expanded. The additional demand is no longer met in Switzerland, but via airports in neighboring countries."

Projection 1: In 2040, there will be fewer connections from Swiss airports to European destinations than today.

o How likely is this projection for Switzerland? very unlikely - very likely
o How desirable is this projection for you (personally)? not desirable - very desirable

Projection 2: In 2040, I will be able to fly to certain long-haul destinations only via airports in the Gulf States, China and Southeast Asia (fewer direct flights from Swiss airports than today).

o How likely is this projection for Switzerland? very unlikely - very likely
o How likely is it that you will increasingly use airports in neighboring countries in order not to have to give up direct flights? very unlikely - very likely

Projection 3: In 2040, the range of destinations will not be further expanded compared to today.

o How likely is this projection for Switzerland? very unlikely - very likely
o How strongly would you (personally) be affected by this projection? negative impact - positive impact

Projection 4: In the year 2040, flying will be a matter of course, just like today.

o How likely is this projection for Switzerland? very unlikely - very likely
o How likely is it that you will weigh up the benefits of each individual flight against the environmental footprint? very unlikely - very likely

Projection 5: In 2040, ticket prices will rise by 40% to compensate for CO2 emissions.

o How likely is this projection for Switzerland? very unlikely - very likely
o Would you reduce your air travel compared to today? no reduction in air travel - no air travel at all

Projection 6: In the year 2040, for journeys of up to 700 km (e.g. Zurich to Barcelona, Amsterdam, Vienna, Prague, Rome), I use an autonomous electric car instead of an airplane.

o How likely is this projection? very unlikely - very likely
o How desirable is this projection for you (personally)? not desirable - very desirable

Projection 7: In 2040, flights of up to 700 km distance (e.g. Zurich to Barcelona, Amsterdam, Vienna,Prague, Rome) are prohibited.

o How likely is this projection for Switzerland? very unlikely - very likely
o How likely is it that you will continue to travel up to 700 km as often as today and use other means of transport for this? very unlikely - very likely

Projection 8: In the year 2040, my airliner will be unmanned.

o How likely is this projection for Switzerland? very unlikely - very likely
o How desirable is this projection for you (personally)? not desirable - very desirable

Projection 9: In the year 2040, I live in a Switzerland that has a locational disadvantage in international competition.

o How likely is this projection for Switzerland? very unlikely - very likely
o How big do you estimate the contribution of aviation to Switzerland's competitiveness? no contribution - very big contribution

Projection 10: In 2040, the international networking competencies of the Swiss population will decline.

o How likely is this projection? very unlikely - very likely
o How relevant do you estimate the contribution of aviation to social networking? no contribution - very big contribution

Minimum (Decline from tipping point)

"By 2040, demand for air transport in Europe will fall significantly, while demand in Asia will continue to grow. The range of flights departing from Swiss airports is decreasing. Numerous destinations can only be reached via airports in neighboring countries or via hubs in the Near & Middle East (e.g. Turkey, Gulf region)."

Projection 1: In 2040, there will be fewer connections from Swiss airports to European destinations than today.

o How likely is this projection for Switzerland? very unlikely - very likely
o How desirable is this projection for you (personally)? not desirable - very desirable

Projection 2: In 2040, I can reach many long-haul destinations only via major European airports or with non-European airlines (just a few direct flights from Swiss airports).

o How likely is this projection for Switzerland? very unlikely - very likely
o Would this change your travel habits for long-haul flights? no influence (choice of transfer connections) - strong influence (choice of airports with direct flights)

Projection 3: In 2040, the supply of flights will have declined sharply.

o How likely is this projection for Switzerland? very unlikely - very likely
o How strongly would you (personally) be affected by this projection? negative effect - positive effect

Projection 4: In 2040, Swiss society will only accept short flights for important reasons.

o How likely is this projection for Switzerland? very unlikely - very likely
o How likely is it that you will therefore completely renounce short flights? very unlikely - very likely

Projection 5: In 2040, European air transport will be climate-neutral, and air ticket prices will double.

o How likely is this projection for Switzerland? very unlikely - very likely
o Would you reduce your air travel compared to today? no reduction of air travel - no air travel

Projection 6: In 2040, I will give up travelling by plane up to 700 km (e.g. Zurich to Barcelona, Amsterdam, Vienna, Prague, Rome).

o How desirable is this projection for you (personally) with regard to business trips? not desirable - very desirable
o How desirable is this projection for you (personally) with regard to private travel? not desirable - very desirable

Projection 7: In 2040, flights of up to 1,000 km distance (e.g. Zurich to London, Copenhagen, Berlin, Budapest, Naples) are prohibited.

o How likely is this projection for Switzerland? very unlikely - very likely
o How likely is it that you will continue to travel up to 1000 km equally often as today and use other means of transport for this purpose? very unlikely - very likely

Projection 8: In the year 2040, I will cover distances of up to 50 km also with autonomous drones (without pilot).

o How likely is this projection for Switzerland? very unlikely - very likely
o How desirable is this projection for you (personally)? not desirable - very desirable

Projection 9: In 2040, international companies will cut jobs in Switzerland.

o How likely is this projection for Switzerland? very unlikely - very likely
o How large do you estimate the contribution of aviation to international jobs in Switzerland? no contribution - very large contribution

Projection 10: In 2040, my quality of life in Switzerland will improve.

o How likely is this projection? very unlikely - very likely
o How big do you estimate the contribution of aviation to the quality of life? negative contribution - positive contribution

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