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1 INTRODUCTION

1.1 Context: Vision of Small Air Transport System

Mobility studies showed that for the last 40-45 years, each percent of Gross Domestic Product (GPD) growth resulted in approximately 1-2 percent of motorized traffic growth[1]. If the past trend were to continue in the future, then the coming decades a significantly increase in the amount of the present European transportation system will be seen, and more particularly in the surface and air transportation. Beside economical and socio-economical circumstances, many other factors are also influencing the demand of the transportation system in general. Some of the most important include for example the social needs, the availability of fossil oil, the environmental concerns, the coming regulations, or the political stability. The European transport system should therefore, be based on an environmentally sustainable, cost efficient, safe, seamless and co-modal passenger friendly system aiming to ensure mobility and cohesion for the European citizens while enabling economic growth.

In the present context, most of the transportation systems are already facing with their limits of capacity, causing congestion in the road as well as in the air. In addition, it is predicted, that for example the volume of air transportation will almost double in the next decades[2]. Within these circumstances, a potential solution to ensure future mobility includes capacity balancing with **advanced transportation using small aircraft at underutilized infrastructures, such as small / regional airports**. This is also reasonable from the point that the alternative transportation modes (especially high speed trains) are usually operated along established highly populated corridors, and that new EU member states are still facing with limited transportation infrastructures[3].

This transport mode will therefore enable fast travel in areas of Europe where high speed trains or traditional airline connections are unavailable and will alleviate road congestion problems in a customer - and environmentally friendly way. This vision is also in line with the related

(i) reports of the Commission: “general and business aviation complements regular air transport performed by commercial airlines and thus provides specific social and economic benefits such as increasing the mobility of citizens, the productivity of businesses and regional cohesion“[3], and

(ii) the past or on-going national and EU projects such as EPATS, CESAR, PPlane, or ESPOSA.

The idea of small aircraft transport (SAT) focuses on a new more affordable, accessible, and energy effective component of the air transportation system in general. In the future, SAT is envisioned to provide a wide choice of transportation modes - and the wider use of small aircraft, served by small airports, to create access to more communities in less time. The major objective of the SAT-Rdmp project is to **demonstrate and understand the role that small-size aircraft operating on scheduled or non-scheduled flights can play as a component of the Air Transport System to satisfy the needs of transportation in regions where transport networks are underdeveloped** and to satisfy:

- the need for low-intensity intercity air transport routes, which have been dependent so far on road transport;
- regions out of the central European “economic banana” with less developed infrastructures to stimulate the economic development;

- the needs of business people to travel door to door. Current business aviation is expensive and only for the happy few.

In this context, the project will

(i) define a common vision of the European small aircraft transportation system,

(ii) (define relevant business cases being compliant with the user and SAT requirements,

(iii) assess the current European capabilities,

(iv) define a roadmap for SAT, (v) list the risks and benefits related to the concept of small aircraft transportation.

1.2 Delivery objective

In compliance with Description of Work (DoW) of the SAT-Rdmp Project (grant agreement number 265603), after the development of the common vision and more particularly based on the results of the demand model (as given in D1.2: "Demand of small air transport aircraft analyses") WP2 should:

- define the most profitable business case,
- define the economic, environmental and safety impact of different business models,
- define the major influential variables of the impact parameters of each business model.

In order to find the most profitable business case, one should:

- analyze potential business cases in general,
- define relevant business cases for the European small air transportation system,
- define method to analyze/simulate the potential impact of selected business cases on the economy, environmental and safety level related to small air transportation,
- extend the demand model of SAT-Rdmp to enable the analysis mentioned above,
- find the most suitable business case.

This delivery (D2.1. "Business case subscriptions with operational characteristics") focuses on the first two tasks, and therefore aims at

(i) analyzing the potential business cases in general, and

(ii) defining those being relevant for the European small air transportation system.

The work introduced here under this deliverable is fully compliant with Task 2.1: "Identification and definition of the business cases".

To reach the objective of this delivery, this document is structured as follows. After a short summary and introduction, the second chapter gives a summary of the refined demand model in order to give an insight to the predicted amount of demand, and therefore to get the first impression on the potential business models.

Chapter 3 gives a summary of first thoughts and envisioned problems of a business case generation. Later, it also introduces the method for business case generation.

Using the findings of the preliminary assessment, chapter 4 lists some of the most suitable business cases for the European small air. This would be used as input in "Task 2.2. simulation of business model", which aims at identifying the most suitable business case. Chapter 5 provides the conclusions of the work.

2 ENVISIONED EUROPEAN DEMAND OF SMALL AIR TRANSPORT

This chapter presents the results of the demand forecasting model developed in the SAT-Rdmp project subpart 1.2. **The results given are based on the demand model elaborated in the context of the SAT-Rdmp project (grant agreement number 265603), and introduced in "D1.2 Demand of small air transport aircraft analysis".**

The objective of this chapter is to summarize and briefly analyze the absolute demand for various small aircraft operations between the member states of the European Union. As numerous critical input records for the demand model are unfortunately publicly not available in certain cases, this model considers the following countries: Belgium, Czech Republic, Finland, Sweden, France, Germany, Greece, Hungary, Luxemburg, Italy, Netherlands, Poland, Portugal, Spain, United Kingdom. While this is not considering all Member States of the European Union, still it reflects countries with various socio-economic records from the "old" and the "new" Member States.

According to the agreement in the consortium, the results of the demand model should reflect various potential Small Air Transport (SAT) operational scenarios, ranging from scheduled and non-scheduled commercial to personal movements, with different amount of annual flight hours. In the view of this, and to cover various realistic small aircraft operations being also in line with the related projects such as the EU funded PPlane, a total of four different scenarios were defined by the consortium (see Table 2.1.). It should be however noted that ***the objective is to assess the European passenger demand***, and therefore these results are not focusing on the number of flights neither on the number of aircraft that should be needed to achieve the envisioned passenger demand. Therefore, at this stage, the travel party size – a highly influencing factor on the number of flights and on the number of aircraft which is required to perform the estimated amount of passenger demand – is taken to be constant.
In addition, the model is not taking into account whether

(v) the European resources would be available (e.g. aircraft, pilots, airports, avionics to guarantee all weather utilization), or

(vi) other negative effects influence the demand, such as fear of flying.

	Scenario n.1	Scenario n.2	Scenario n.3	Scenario n.4
operation	conservative scheduled and non-scheduled business	moderate (scheduled and non-scheduled) business	advanced (scheduled and non-scheduled) business	advanced (scheduled / non-scheduled) business and personal
propulsion	piston, turboprop, jet	piston, turboprop, jet	piston, turboprop, jet	piston, turboprop, jet
size	1-5 PAX	4-19 PAX	4-19 PAX	4-19 PAX
TOC	based on real (air taxi) fares	based on estimated fares	based on estimated fares	based on estimated fares
annual Flight Hours / aircraft	500-1000	500	1000	1500

Table 2.1: The scenarios, and major input parameters of the demand model

2.1 Scenario 1: conservative commercial operations

Scenario nr.1 defines small aircraft operations as conservative commercial air taxi operations with single and multi-engine pistons, turboprops and jets, up to 5 passengers. *The total operational cost (TOC) of 2030 is therefore primarily based on the future evolution of the present real airfares of various air taxi companies.* To determine a fare function based on trip distance which can be inserted into a generalized cost method, trips of various distances where inserted into the flight request modules of various air taxi websites. From the data extracted, the cost/h and the cost per km were determined. The distance used to calculate the cost/km was the distance between the two airports measured in Google Earth (2010).

The basic total operating costs of 2010 in function of different flight distances are found to be the following:

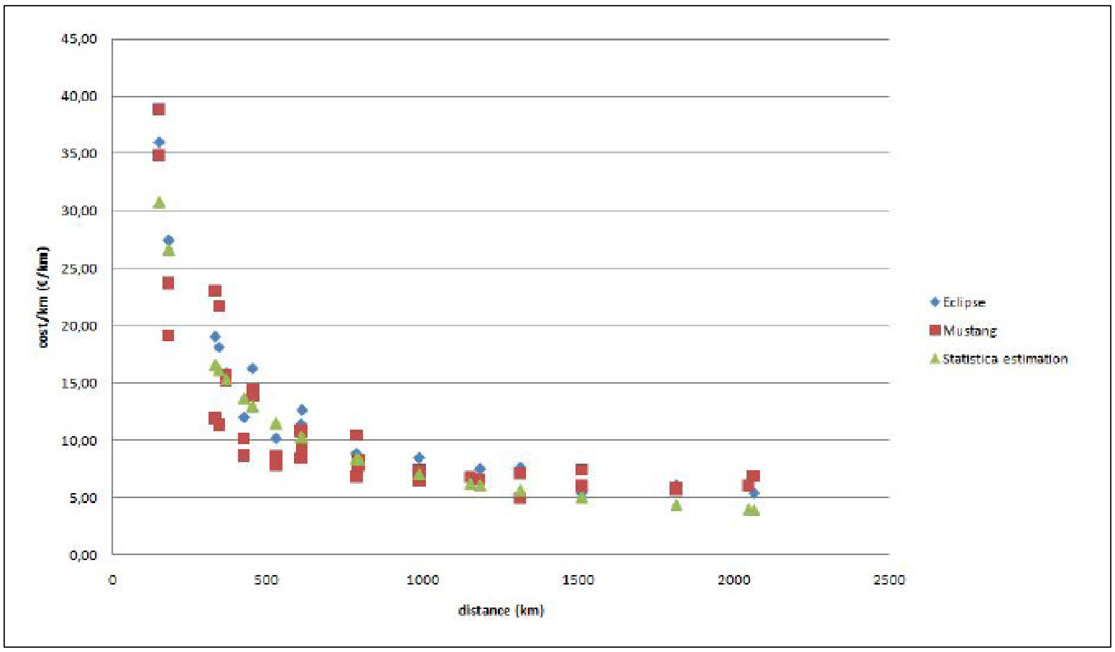

Figure 2.1: Fare cost/km (in EUR/km) of the VLJ

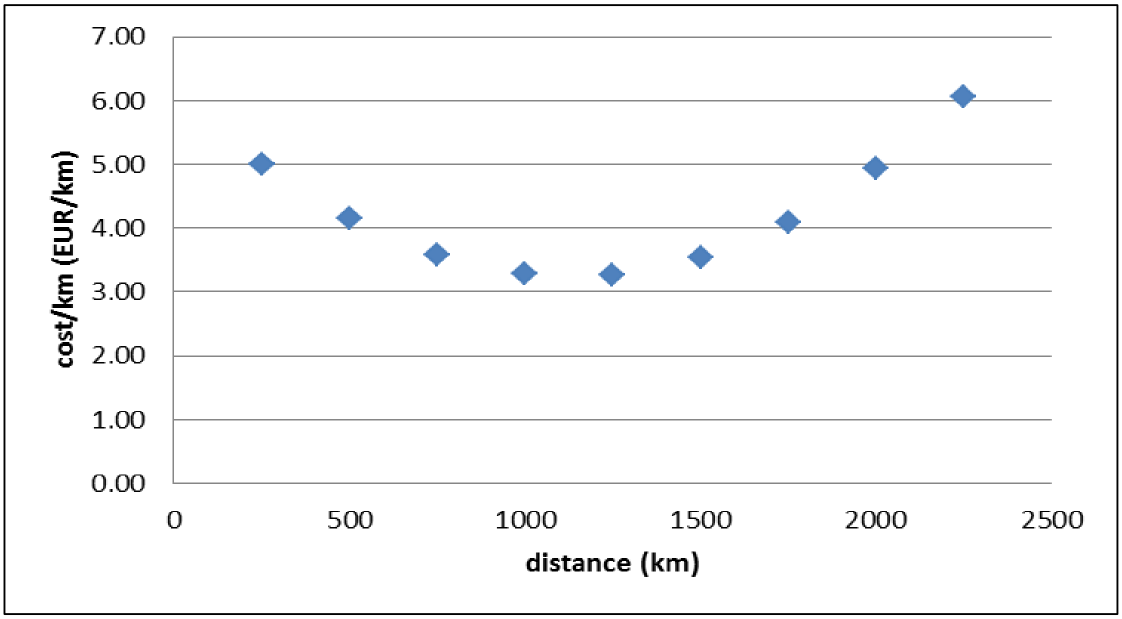

Figure 2.2: Fare cost/km (in EUR/km) of the turboprop aircraft

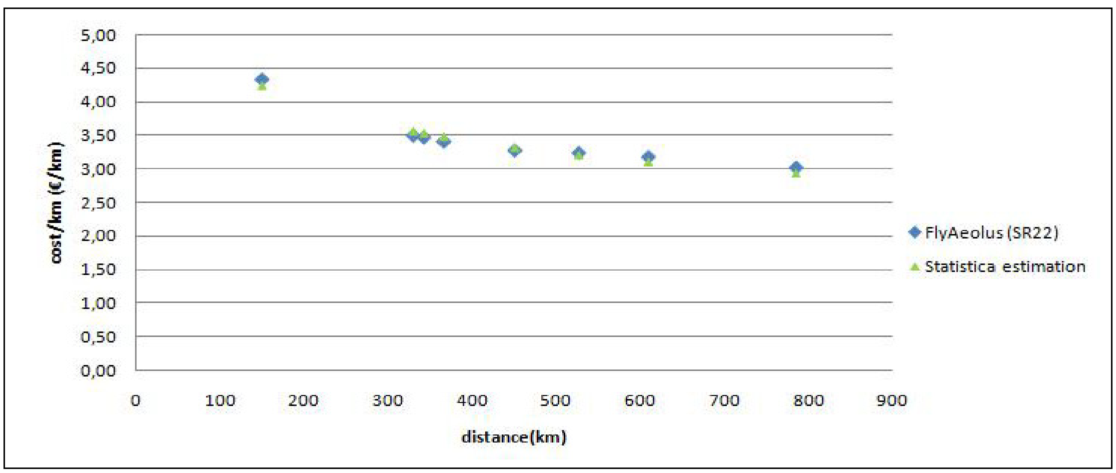

Figure 2.3: Fare cost/km (in EUR/km) of the single engine piston aircraft

The small aircraft operating costs for 2030 were based on the assumption that due the coming technological achievements (e.g. application of lighter advanced materials, modern small aircraft engines, advanced aerodynamic design) and a more frequent aircraft operation, the operational cost of 2030, will decrease by 20%[5] relative to the 2010 values.

In addition, for the evolution of the other transportation modes considered in the model, the following was assumed:

- based on the fuel price report December 2010 of the AA[6] and taking account of the modern diesel engines, the hybrid configuration and the technological achievements, it is assumed that the fuel consumption could decrease by 0.4% annually[7]. On the other hand, the fuel price seems to increase 4,1% per year. Therefore, the overall fuel cost increases +3,7% per year and the car costs are also increasing with a total factor of 1.39 over 20 years,
- the prices for commercial airlines increase with 1%[8],
- comparable with commercial airlines, the ticket prices of the HSR are also increasing with 1%[9],
- a growth factor of 2,12% per year is taken into account[10] for the SAT market.

Under the assumptions defined above, the simulated passenger demand is given in Table 2.2

2.2 Scenario 2: moderate business operations

According to table 2.1, Scenario nr.2 defines small aircraft movements as moderate (scheduled and non-scheduled) business flights performed by single and multi-engine pistons, turboprops and jets up to 19 passengers. The annual flight hours per aircraft are assumed to be 500, while the total operating cost comes from the SAT-Rdmp report, titled “Small Air Transport Aircraft characteristics” (for more information, see Dziugiel, B. 2011[11]).

Under the assumptions defined above, the simulated passenger demand is given in Table 2.2

2.3 Scenario 3: advanced business operations

According to the table 2.1, Scenario nr.3 defines small aircraft movements as advance (scheduled and non-scheduled) business operations performed by single and multi-engine pistons, turboprops and jets up to 19 passengers. The annual flight hours per aircraft are assumed to be 1000, while the total operating cost comes from the SAT-Rdmp report, titled “Small Air Transport Aircraft characteristics” (for more information, see Dziugiel, B. 2011[11]).

Under these assumptions defined above, the simulated passenger demand is given in Table 2.2

2.4 Scenario 4: advanced business and personal operations

According to the table 2.1, Scenario nr.4 defines small aircraft movements as advanced (scheduled and non-scheduled) business and personal operations performed by single and multi-engine pistons, turboprops and jets up to 19 passengers. The annual flight hours per aircraft are assumed to be 1500, while the total operating cost comes from the SAT-Rdmp report, titled “Small Air Transport Aircraft characteristics” (for more information, see Dziugiel, B. 2011[11]).

Under the assumptions defined above, the simulated passenger demand is given in Table 2.2

2.5 Results

By simulating the four different scenarios described above, the model predicts the following passenger demand numbers.
As mentioned already, please note that results show total passenger demand generated on various aircraft with different propulsion systems defined under the scenarios considered in table 2.1. In addition, the model is not taking into account whether (i) the European resources would be available (e.g. aircraft, pilots, airports, avionics to cope guarantee all weather utilization), or (ii) other negative effects occur, such as fear of flying.

	Scenario n.1	Scenario n.2	Scenario n.3	Scenario n.4
total passenger demand	955.385	50.201.540	61.933.090	66.205.120

Table 2.2: Demand results per scenario

At this stage, results seem to be reasonable, as scenarios with lower operating costs result in higher passenger demand. However, to gain confidence in the model, results and the model itself should be validated (see chapter 2.6.).

2.6 Validation

The results are validated in two ways. First the model is validated with the demand model developed by Laplace I., 2009[10] in the EU 7th Framework program EPATS, by using the same fare data available within the SAT-Rdmp demand model. In addition, the model was also simulated to project the demand for 2010, which was checked with the real data from Eurocontrol, 2009[12].

2.6.1 Validation with EPATS

In using the cost and average speed inputs of EPATS into the SAT-Rdmp model (table 2.4) we get the demand results in table 2.5. The choice in varying those two variables to check the validity of the model is conform the sensitivity analysis (see also figure 2.4. and 2.5.), which projects that the major factors influencing demand are personal commercial aviation costs and the travel time. Next sensitive parameters are the Travel Party Size (TPS) and passenger Value Of Time (VOT). The TPS and the VOT are distributed in the SAT-Rdmp model by using Monte Carlo analysis, therefore these are not changed according to the EPATS input data.

Modality	Fare [EUR/FH]	Avg. Speed [km/hr]
ACP	250,00	335
ACT	1150,00	550
ACJ	1650,00	725

Table 2.4: EPATS input data for SAT-Rdmp validation

Model	SAT-Rdmp	MS	EPATS	MS	Difference
PAX demand	77.894.009,00	100.00%	69.000.000,00	100,00%	11,42%

Table 2.5: EPATS vs.SAT-Rdmp passenger demand comparison for 2030 (adapted for aircraft categories)

Table 2.5 gives the SAT-Rdmp demand results by using EPATS input data. The EPATS demand results were retrieved from the amount of flights anticipated and a 70% load factor SAT-Rdmp goal[11] and consider the same aircraft categories as those in SAT-Rdmp.
It can be concluded that the total personal commercial aviation demand figures are in the same range, taking into account the high amount of demand. Though high differences can be spotted in between the market share of the modalities because of the increasing detailed modeling of the separate modalities in the SAT-Rdmp model.

Using the input parameters of the EPATS Project, the trend of the flight occurrences over range is given in figure 2.4. The graph projects a peak demand for flights around 400 km and has a mean square deviation on 275 km to the left of the mean (450km) and 575 km to the right of the mean. The graph shows the same trend as the current business aviation does[12].

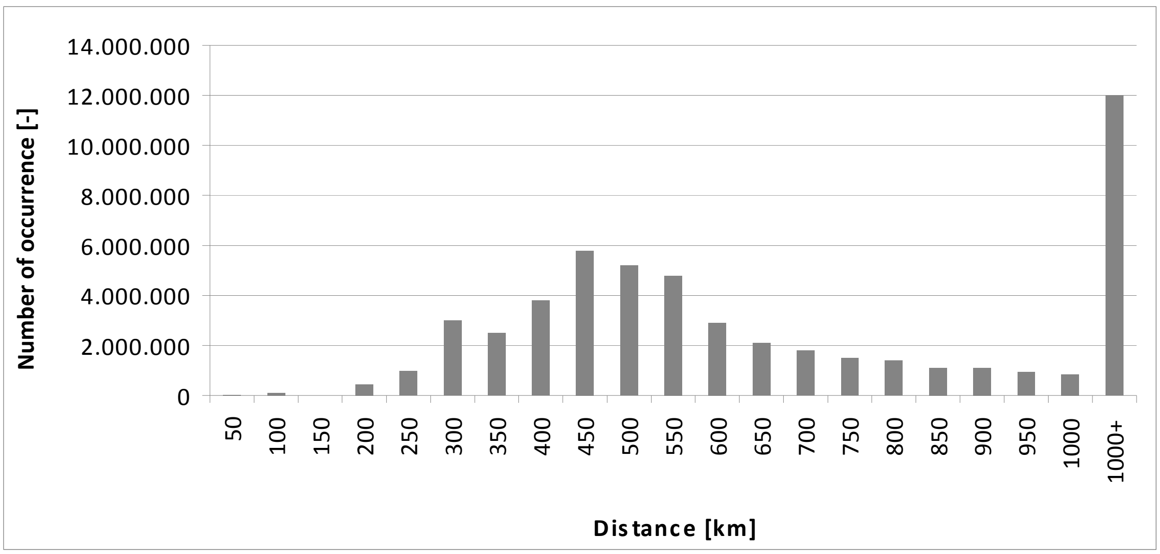

Figure 2.4: Number of personal commercial aviation flights forecast per range flown

2.6.2 Validation with Eurocontrol data

The comparison can be found in table 2.6.

Modality	2010	MS	2030	MS	Growth	EC (2009)	MS
Piston	105000	50.24%	600535	62.86%	572%	66757	23.19%
Turboprop	92000	44.02%	313617	32.83%	341%	206077	71.59%
VLJ	12000	5.74%	41233	4.32%	343%	15337	5.22%
Total	209000	100.00%	955385	100.00%	457%	287858	100.00%

Table 2.6: 2010 Model passenger demand versus Eurocontrol data (MS: market share).

Anticipating on the demand in 2010 a model based on a fully economic rational passenger and a non-developed air taxi or commercial personal aviation market by means of piston aircraft and turbo prop aircraft, on can only really compare the passenger demand for VLJs. The comparison of the SAT-Rdmp model with Eurocontrol data, projects that passenger demand for VLJs is of the same magnitude. Looking at the total market, a 23% difference can be found. Comparing the results from a VLJ market share point of view, the difference is 10%.

Additionally looking at the European Commission´s "An Agenda for Sustainable Future in General and Business Aviation" (2007), it mentions: "It is estimated that in 2005 approximately 15 million General and Business aviation flights took place in Europe. Less than 1 million of them were operated under the supervision of air traffic control."[3] This number encompasses commercial and non-commercial personal; aviation. Compared to the last EPATS research[11], forecasting 43 million flights in 2020 this indicates an extrapolated growth of 3,7 over 20 years. Comparing the latter growth with the growth factor from 2010-2030 of the SAT-Rdmp model, a growth factor of 4,57. A difference of 19% can be spotted.

Based on the market share and growth evaluation, including the Laplace comparison one can conclude that the model results project a reliable conservative forecast.

2.7 Sensitivity

Figure 2.5 concludes that the demand for commercial personal aviation is most sensitive for changes in operational costs of SAT system modalities. The picture states the normalized change of a parameter reflected in the legend, on the X-axis; the Y-axis on the other hand projects the change in demand of the respective modality. For all 3 SAT modalities the sensitivity towards the various parameters influencing the demand are in the same range, although the demand sensitivity for piston aircraft is larger per unit cost change.

The demand for the piston SAT modality is less sensitive to an increase in car cost then an increase in average car travel time. The demand for HSR services and commercial aviation on the other hand are sensitive towards a car cost change. The sensitivity in demand for turboprop aircraft and VLJs by means of a car travel time change is in the same order of magnitude, whereas it is the highest for the demand of the piston SAT modality. The change in the average car speed has a logarithmic growth effect on the demand for piston aircraft.

Looking at the sensitivity of SAT system demand towards the costs or fares for other modalities (commercial aviation, HSR and car costs), it can be concluded that for all three personal aviation modalities the highest sensitivity can be remarked with commercial aviation costs, followed up by operational car costs. The demand for SAT modalities is almost insensitive to the high-speed railway costs changes.

Figure 2.6 projects a sensitivity analysis of the variables influencing the SAT cost, and thus the SAT demand. The fare or cost the cost of service is still the most sensitive parameter – although negatively oriented, followed up by the Value of Time and the Travel party size. The time variables seem to have a very low influence on the demand.

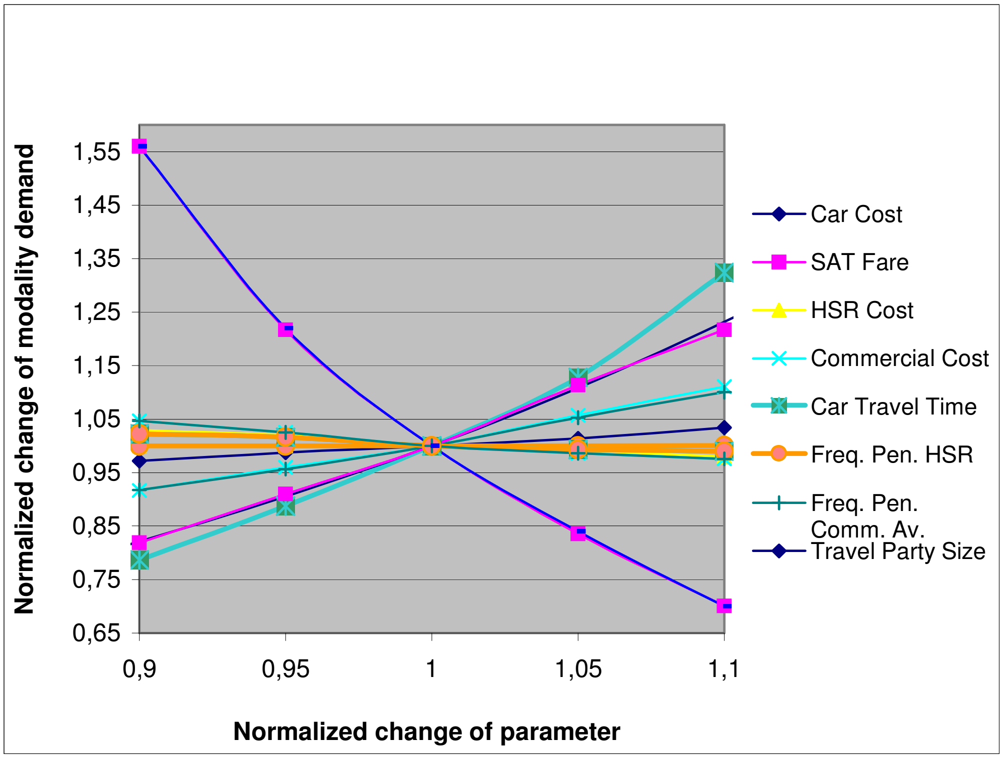

Figure 2.4: SAT demand sensitivity according to transport modality costs, car travel time and HSR and commercial aviation connections

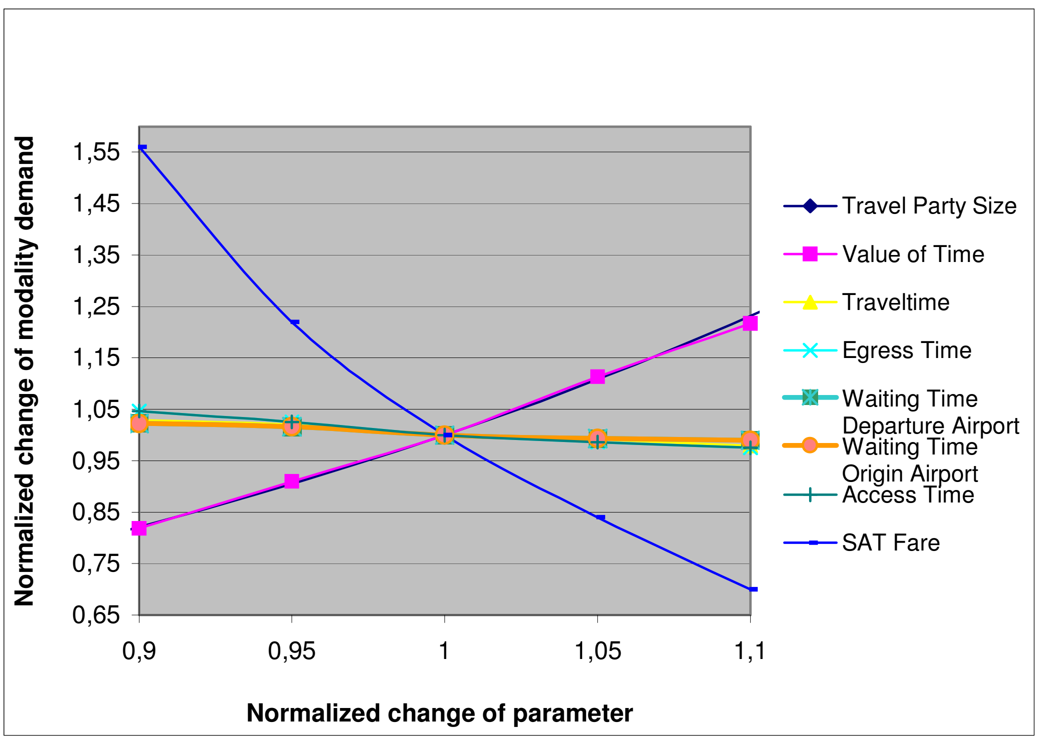

Figure 2.5: SAT demand sensitivity according to the fare, travel, egress and regress travel time, value of time and travel party size

3 METHOD OF BUSINESS CASE GENERATION

Finding the most profitable business case is one of the key elements in this project as defined in the SAT-Rdmp project requirements. The economic impact, sustainable impact and safety are also important to reflect upon when a business case is designed, yet the focus in this chapter will only go to what a business case is, what the important parameters for a business case are and how profitability can be optimized (cost versus revenue approach). By facing the parameters to the SAT industry and using the opinion of industry experts, a complete set of parameters will be the input for the scenarios to come to the business models for the business cases in Chapter 4 and implement these business cases in the model in WP2.2.

The impact on an economical, ecological and safety level will be investigated once the most profitable business cases are designed. But before the research can start, it is important to question what `a profitable business case' means.
Therefore, this chapter will be split up in two parts. On the one hand Section 3.1 will investigate the important aspects of a business case in the SAT industry, on the other hand section 3.2 will go deeper into the concept and design of a business model.

3.1 A Business Case

An interesting way to look at the concept of a business case as defined by the Australian Government[13] is: *The task of defining why it's worth doing your project. Making the business case involves in-depth research on the target market, considering how you will reach them and with what business model.*

The SAT-Rdmp project is a European project where the future of the SAT industry is investigated and can be influenced by. The first part of this SAT-Rdmp project was to investigate the demand, which will be used as one of the building blocks in this part of the project. In order to investigate this demand, an investigation of the target market was already required. Summarized, one can say that this target market is 15% of the transportation market, namely travel conducted for business purposes[14]. The most important step is left, selecting a business model to answer the demand and reach the target market (which will only be done once the most profitable business case is found) and thus create revenue.

By selecting the most profitable business model for the business case, a business model of most value to the SAT company in Europe is created. Not only will the business case be profitable, it will be the most profitable, after a broad market investigation and design of the most interesting designed business models. In addition, the safety, ecological and economical impact is studied as well. The following section will go into more detail on the business model concept.

3.2 A Business Model

Simply put, the business model for a product, content or service is the manner in which the service will earn its keep. It is the answer to the questions `Who pays for what, to whom, why and how?' Business models are the methods and form by which revenue will be earned[13]. A business model thus reflects on how money is created by offering a certain service, which in this case is the SAT concept. In order to generate money, the business model needs to be set up and looked in to on how money can be generated with this business model.

The first subsection that will follow will look at how a business model can be set up. Research will go deeper into the first step of setting up a business model, which is mapping the current situation of the SAT market. First, the current market will be analyzed, namely what the demand is (as given in D1.2: "Demand of small air transport aircraft analyses") and what current players in the SAT industry realized up to this day. Then, Eurocontrol[12, 15, 16] reports are discussed, followed by the airline business model according to Doganis[17] and finally what Lovelock & Wright[18] have to say about service marketing and management.

3.3 Developing a Business Model

The business model that will be used should take into account the financial aspect to reflect upon the e.g. the profitability. The service aspect, which includes the operational parameters, should also be incorporated. Finally, a technological perspective within the business model is demanded too, to reflect upon what is feasible by 2030. For an extensive analysis on the business model problem and new business model design, one is referred to van der Star[19]. A figurative description of the business model that will be used is provided in Figure 3.1.

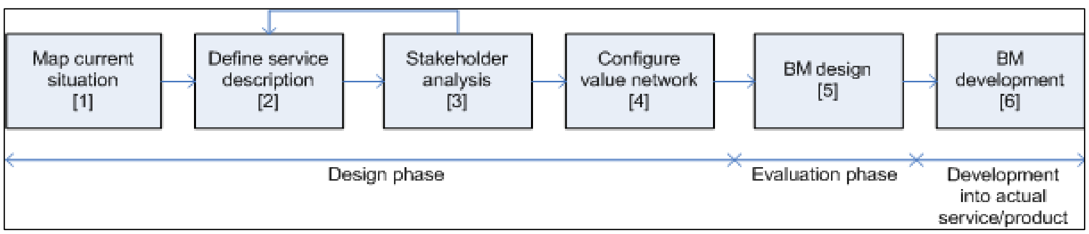

Figure 3.1: Development of a Business Model[19]

Step one can be compared to performing a literature study on the subject to get familiar with the situation and recognize the important parameters for a further development of the business model in detail. A market research, reports of organizations involved in the Industry such as Eurocontrol, existing airline model theories etc. play a role in finding how to set up such a business case in the SAT industry. The first part of the SAT-Rdmp project investigates the demand. It is logical to use the demand as an input too when designing the business model. However, this is only one of the building blocks in trying to get a complete image of the SAT industry. The opinion of industry experts will be used to define whether the research and resulting set of parameters is complete.

In the second step, a service description is required, starting from the characteristics found in the initial research that could lead the business model to be the most profitable one. The service description will go through the actual service (target group, context of use, primary value proposition, previous experiences, rates, effort, service description) as well as the technology design and the finance design. The requirements, opinion and ideas of the stakeholder and industry experts (step 3 in Figure 3.1) will be used repetitively back and forth to come to a final set of business cases. The final business models, dependent on the scenario that was created, are depicted in Chapter 5. The design phase of the business model will thus be finished once step 2 and 3 are complete, since step 4 will not be executed in this research (explained in the next paragraph). As a side note, step 2 contains an extra fourth item besides the service, technology and financial design. An organizational design was also included. Yet, going in to detail on this aspect would go beyond the scope of this research.

Step 4 will not be executed in this research. This step would be the phase where roles and capabilities of the stakeholders are configured in a value network. However, the goal of this part of the research does not contain such a value network. The evaluation (step 5) and development (step 6) of the business model into an actual service will be performed in the final chapters of this research.

4 IDENTIFIED BUSINESS MODELS

Chapter 3 resulted in characteristics of the SAT industry and came to a set of parameters, which influence the design of a business model. The design of a set of business models based on the afore mentioned parameters and the business model design method by van der Start\[19] will lead the reader to the next step in coming to the most favorable business case, being (most) profitable and comparing its ecological and safety input. Every section will discuss a different business model by addressing the chosen strategy and its important parameters.

The first thing that was known at the start of this project was the result of Geudens[14], the previous part of the SAT-Rdmp project, which mentioned demand is influenced positively by lower costs of flying SAT modalities or faster travel time of SAT systems. Based on literature, a set of important parameters to set up a business model was found, in which target market/demand and ticket price are two of the three most important parameters.
In addition profitability, equaling to revenue minus costs, is closely linked to the following resulting important parameters:

- the ticket price
- target market and demand,
- alliances,
- region served,
- fleet magnitude,
- dynamic pricing and
- cancellation & flexible tickets

which are parameters more related to the revenue maximization. On the other hand the resulting parameters:

- fleet composition,
- aircraft routing system,
- fleet magnitude and
- flight hours per year

have an influence on the costs. This will be used in the actual business model design, once the scenario has been determined. Last service (brand image) should always be remembered, since this eventually will have a bad influence on demand and thus profit[17].

Concluding the five parameters: faster travel time, ticket price, revenues, costs and service are the criteria on which a set of business models will be designed, based on the earlier performed literature study up to this point and their relative importance to all the parameters. General strategically information will be provided per business model, yet the level of detail is limited and not provided on every parameter, since a lot of factors will be varied, dependent on the business model design and what is estimated to be profitable. The variation of the parameters is not a part of the main strategy of the business model and will therefore only be discussed when the business model needs to be implemented into the simulation model, where the variability of the parameters is important to find out what is most profitable (e.g. is it more profitable to lease or to rent within this business model?). This will all be discussed in WP 2.3.

Five business models are identified based on minimizing the ticket price and/or the travel time balanced out with a decreasing service offered to maintain profitability. As an increase in service can influence demand, the influence of an increase is also checked towards the latter business case in a separate scenario. In the last scenario a model is set-up in response to the entire market demand.

4.1 Business model 1

The first business model to obtain a maximum profitability is by minimizing the costs (to the air taxi company and the passenger, thus minimizing the ticket price too), in order to enlarge the market demand. This model will further be referred to as Business Model 1. A strategic presentation of the parameters and their level of importance is given in Figure 4.1.

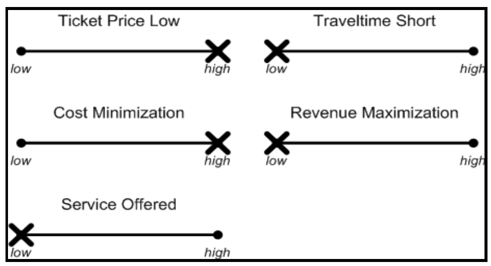

Figure 4.1: Scenario Business Model 1

4.1.1 Scenario effects

Figure 4.1 clearly demonstrates two of the five scenario creation parameters have a high effect to the business model. Therefore, an elaboration on these two parameters will be given here before the other business model parameters are discussed.

The ticket price has an effect on both financial as the service level. The ticket price is also dependent on the aircraft type(s) flown, so in this way it is also related to a technical aspect. Keeping the costs as low as possible, the rule in which a minimum of 10% of the profit on costs is obtained is applied[17]. By minimizing costs (obtained from (SAT-Rdmp Characteristics[20])) on all levels and keeping the profit on a minimal 10% level, the ticket price will be kept low (which is the primary value of this business model) and the market demand will be increased, which again is estimated to increase the profit. Yet, the question is whether this increase in demand compensates enough for the minimum, which is left as a profit and whether the profit percentage of 10% on operating costs could be increased.

Summarized:

- Ticket price: As low as possible, 10% profit on costs

The most important one to save costs on and how are given here:

- Fuel strategies
- Maintenance: Single fleet type (of 15 or more aircraft)
- Landing & Parking fees: Avoid large, more expensive airports
- Crew: Single pilot operations
- Leasing vs. buying: Discussed below

- Flight hours per year: Discussed below

4.1.2 Priority parameters

The first and most important parameter is the ticket price and has already been discussed above. The aircraft type, which is most suitable for minimum costs, is a piston aircraft. Costs of a piston aircraft are considerably lower than flying a turboprop or VLJ aircraft (on average, costs are at least 5 times lower[20]. A result of this could be seen in the demand model results developed by WP 1.2, where majority of the European SAT demand goes to piston aircraft. Since single aircraft type fleet compositions experience lower costs (especially maintenance and crew training), only one piston aircraft type will be used in this model.

The target market is the business traveler, as defined by WP 1.2. The target market can further be increased by attracting passengers from outside the initially stated target group and by selling empty leg flights for a discount (% not yet determined), thus increasing the load factor.

The brand image and associated level of service of the air taxi company is kept to a minimum in order to reduce costs. The product should also be marketed so people get a correct image of the convenience and affordable way of traveling. In order to reduce costs even further, a semi on demand service is implemented: e.g. selling of tickets per seat or per aircraft. Assuming a certain amount of passengers per flight and selling the tickets per seat, will make prices per ticket drop, but in that case passengers must accept services are not fully on demand.

The effect of alliances is not clear on an economical level, yet alliances do have a good influence on the market that is reached (larger region, more aircraft available, less empty legs flights). They can be beneficial to reduce empty leg flights or broaden the region served. SAT companies can also form an alliance with commercial airlines by feeding the first and business class passenger from their home or work to the airport for longer flights.

Summarized, the priority parameters are:

- Ticket price: Low
- Aircraft type: Piston aircraft (lowest cost option)
- Target market/ demand: The business passenger (and more, by selling empty leg seats)
- Brand image: Low service; tickets per seat initially (variable in model to see the effect on profitability); semi on demand
- Alliances: Variable in model to see the effect on profitability

4.2 Business model 2

A low cost model was already worked out in business model 1. This model will focus on decreasing the travel time, at a higher price. The second business model to obtain a maximum profitability undertakes a strategy to minimize the travel time and at the same time offers a good service to the customers. This model will further be referred to as the Business Model 2. A strategic presentation of the parameters and their level of importance are given in Figure 4.2.

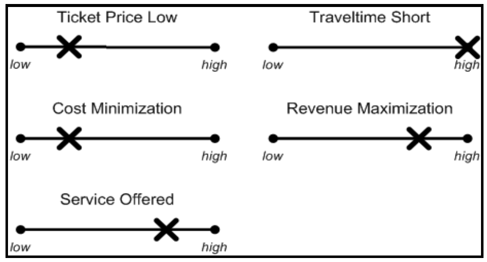

Figure 4.2: Scenario Business Model 2

4.2.1 Scenario effects

Figure 4.2 demonstrates that three of the five scenario parameters will have a higher effect, in which the short travel time parameter is the most important.

The fleet directly influences the travel time, since a specific aircraft (type) has a specific speed. A VLJ aircraft is faster than a piston aircraft, yet external parameters such as the influence of delays to business models cannot be neglected.

Revenue maximization can be done in a straightforward way such as raising the ticket price or increasing the demand. Yet, forming alliances could also cause revenue generation. By means of dynamic pricing and cancellation and flexible tickets, additional revenue is obtained.

In order to improve the level of service, a positive brand image by an attractive frequent flyer program or the fitted ownership model is suggested.

The way to accomplish the specific business model aspects are:

- Fleet: Fastest way of flying within piston, turboprop and VLJ market (VLJ fleet)
- Delays: Implemented and studied what if... (e.g. due to bad weather)
- Ticket price: Less important parameter
- Target market/ demand: The business passenger
- Alliances: Variable
- Dynamic pricing: Variable
- Cancellation and flexible tickets: Variable
- Frequent flyer program: Variable
- Ownership model: Variable

4.2.2 Priority parameters

Since the VLJ market was found to be less price sensitive, the focus will go to pleasing the passenger with the service offered while maximizing the revenues and profit, within this demand, rather than to minimize costs to a maximum. A minimum value of 10% profit on the operating cost again applies, yet the sensitivity analysis will demonstrate the demand elasticity to the ticket price, which in itself can generate a higher profit value towards the costs. An optimum of the final ticket price will result. The ticket price can thus be decided from the beginning, yet the profit ability will only be known at the end (because the cost reduction/adding factors are not known from the start of the simulation).

Since it is well known that the VLJ aircraft are remarkably faster (average block speed of 654km/h, compared to 244km/h for piston aircraft of 463km/h for turboprop aircraft[20] and the price sensitivity is lower with VLJ aircraft, a high service VLJ model will be worked out. The fleet choice is obvious from the start, thanks to the higher average speed of VLJ aircraft (which comes at higher costs).

The targeted market is the business passenger. However, compared to Business Model 1 the travel time factor is now the most important. Thus, the level of service is set prior to the ticket price. The target market in this business model is defined more in the direction of the affluent business passenger willing to pay higher prices.

The brand image and accompanied service is highly related to the target market. Since the target market is the business passenger that cares more about service than price, the goal is to create a first class experience. Adjustable seats, elaborate in flight entertainment with audio and video on demand available, satellite telephone, magazines, catering. A link with ground transportation offered on demand should be possible and is easy to include by means of an agreement with local taxi services.

As explained in the previous section about business model 1, the alliance possibilities will be varied in the model.

Summarized, the priority parameters are:

- Ticket price: Variable
- Aircraft type: VLJ
- Target market/ demand: The affluent business passenger
- Brand image: Luxury
- Alliances: Variable in model to see the effect on profit ability

4.3 Business Model 3

The third business model is a combination of the first and the second business model. Both the cost and ticket price minimization business model parameters and the travel time are important to increase demand (as a parameter to increase revenues) and decrease the costs. If the service business model parameter is set as a less important, a lower ticket price and cost minimization can be effectuated. A variation of this business Model, where service is more important, will be studied in Business Model 4. A strategic presentation of the parameters and their level of importance is given in Figure 4.3.

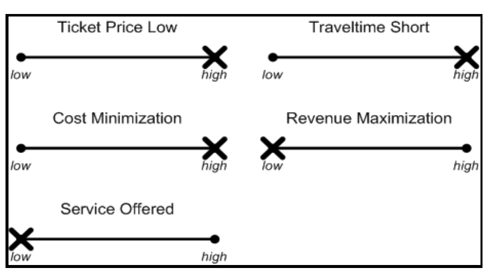

Figure 4.3: Scenario Business Model 3

Figure 4.3 demonstrates that three of the five scenario creation parameters will be more important, namely a low ticket price, a short travel time and cost minimization. The travel time is directly influenced by the fleet choice, since a specific aircraft (type) has a specific (average)

speed. Additionally external parameters, such as the influence of delays to the business model, are important too.

The ticket price, once again, can be defined with a minimum of 10% profit on top of the total costs.

The way to accomplish the aspects in this business model is as follow:
- Fleet: VLJ fleet
- Delays: Implemented and studied what if... (e.g. due to bad weather)
- Ticket price: As low as possible, 10% profit on costs
- Fuel cost minimization strategy
- Maintenance: Single fleet type (of 15 or more aircraft)
- Landing & Parking fees: Avoid large, more expensive airports
- Crew: Single pilot operations
- Leasing vs. buying evaluation
- Flight hours per year evaluation

4.3.1 Priority parameters

The brand image is includes both fast travel and an increased luxurious flying experience by using (very light) jet aircraft by achieving at the same time a low and transparent cost base, hence minimizing the travel costs and fare price for both airline and passenger.

In order to minimize costs even further, the choice has been made to make a plane sharing product (and semi on demand services) available; if the customer decides to adapt its itinerary accordingly (the latter in the light of travel time being one of the most important parameters influencing demand and profitability).

Summarized, the priority parameters are:
- Ticket price: Low
- Aircraft type: VLJ
- Target market/ demand: The business passenger (and more, by selling empty leg seats)
- Brand image: Low service; tickets per seat initially (variable in model to see the effect on profitability); semi on demand
- Alliances: Variable in model to see the effect on profitability

4.4 Business Model 4

The fourth business model is a combination of the first and the second business model. It includes a cost minimization and travel time decrease strategy to increase the demand and revenues on the one hand, and decrease the cost on the other hand. If service is set as a more important parameter (in contradiction with Business Model 3), a low ticket price and cost minimization strategy can still be realized. This is what is done in this model, Business Model 4. A strategic presentation of the parameters and their level of importance is given in Figure 4.4.

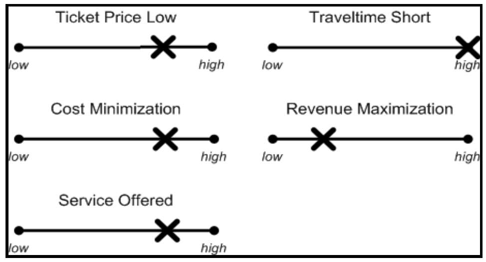

Figure 4.4: Scenario Business Model 4

4.4.1 Scenario effects

Except for revenue maximization figure 4.4 demonstrates that all scenario creation parameters will have a high importance in the business model strategy. The short travel time is the most important one. A summarized overview on these four parameters will be given here before the other business model parameters are discussed.

The way to accomplish the scenario of Business Model 4 is:

- Fleet: Piston & VLJ fleet (see paragraph 4.4.2)
- Delay evaluation (e.g. due to bad weather)
- Ticket price: As low as possible per aircraft choice, minimum 10% profit on costs-
- Fuel cost saving strategies
- Maintenance: Dual fleet type (of 15 or more aircraft per fleet type)
- Landing & Parking fees: Avoid large, more expensive airports
- Crew: Single pilot operations
- Leasing vs. buying: Variable
- Flight hours per year: As high as possible (see paragraph 4.4.2)
- Frequent flyer program: Variable
- Ownership model: Variable

4.4.2 Priority parameters

As the ticket price is the sensitive parameter both on the demand as the other parameters to set up the business model, the costs will again be kept as low as possible. A 10% profit on the costs again applies to maximize the demand. While costs are kept to a minimum, the passenger can still choose whether he wants to save time in the air and go for the fastest option (at the lowest price possible) or increase travel time for the sake of flying for the cheapest price.

Since both travel time as costs can be chosen as a priority parameter a VLJ will be used to offer the fastest travel time and a piston aircraft will be used to offer the lowest price. Since costs are desired to be kept at a minimum, a wide fleet variety offer may not a good idea. Keeping maintenance costs to a minimum and optimize them accordingly demands a fleet of at least 15 aircraft of the same type. The technical and operational consequences of the fleet choice are obvious[20]. But such a fleet configuration, with a mixed fleet, also has consequences on a service level, since the experience of flying is different in a VLJ than a piston aircraft.

The market in this business model targets the business passenger. A focus on the price awareness of the customers is apparent, yet a broader public can be attracted by combining Business Model 1 and Business Model 3 into one business model generating a differentiation strategy.

Additionally, semi on demand services and selling empty legs flights can increase the profitability.

The brand image in this business model addresses a larger target market by offering `cheap' SAT flights as well as fast and more luxurious flights. Costs are minimized, which is demonstrated to the passenger by offering aircraft sharing programs, semi on demand flying or buying empty legs, if desired. The wider variety offer has a positive influence on the brand image, which is a very important aspect to business travelers.

Summarized, the priority parameters are:

- Ticket price: Low (for chosen aircraft type)
- Aircraft type: Piston and VLJ
- Target market demand: The business passenger (and more, by selling empty leg seats)
- Brand image: Low service, yet with aircraft upgrade possibility; tickets per seat initially (variable in model to evaluate the effect on profitability); both on demand as semi on demand
- Alliances: Variable in model to assess the effect on profitability

4.5 Business Model 5

The fifth and final business model is a response to the entire market demand and so fully differentiated. By adapting the ticket prices to a minimum, while offering different aircraft for different prices so the passenger can choose his own level of service (attracting a broad target market with a broad brand image), a final attempt is made to increase the demand (and revenue) to a maximum while keeping the costs as low as possible; without ignoring the demand of more affluent business travelers. A strategic presentation of the parameters and their level of importance is given in Figure 4.5.

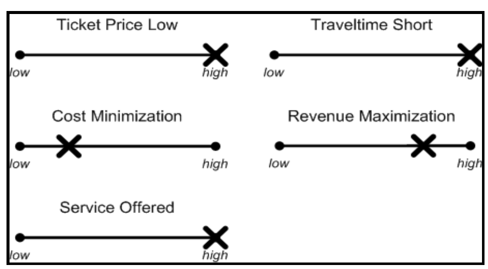

Figure 4.5: Scenario Business Model 5

4.5.1 Scenario effects

Figure 4.5 shows that four of the five scenario parameters are more important, except cost minimization, and have a higher effect on the respective business model. The parameter short travel time, low ticket price and service offered are the most important ones.

The way to accomplish the scenario of Business Model 4 is as follow:

- Fleet: Mixed fleet (see paragraph 4.5.2)
- Delays: Implemented and evaluation studied (e.g. due to bad weather)
- Ticket price: As low as possible per aircraft choice, minimum 10% profit on costs
- Target market/ demand: The business passenger (and more, by selling empty leg seats)
- Alliances: Variable

- Dynamic pricing: Variable
- Cancellation and flexible tickets: Variable
- Frequent flyer program: Variable
- Ownership model: Variable

4.5.2 Priority parameters

The fleet composition should fulfill the demand; hence supplying each demand segment and improving the service level. Low ticket prices are important in this part of the model (conf. sensitivity analysis WP1.2). With their inherent low direct operating costs it is concluded that piston aircraft represents 66% of the demand. Turbofan aircraft (33% of the demand) will form an intermediate between the cheap but slower piston aircraft and the faster yet more expensive VLJ aircraft. As for the VLJ aircraft which only forms the remaining 4% of the demand, a low cost alternative should be included. In addition to keeping costs as low as possible, an option should always be presented as to how the passenger can upgrade its demand for a certain price. In order to keep costs as low as possible, the goal is to create as much as possible aircraft commonality to reduce costs. The technical and operational consequences of the fleet choice are obvious[20].

The brand image in this business model addresses the entire target market by offering `cheap' SAT flight as well as fast and more luxurious flights. Costs are minimized, which is demonstrated to the passenger by offering plane sharing, semi on demand flying or seats of empty leg flights, (which means both options will be worked out in the simulation). In addition, customers can choose for extra services for an extra price therefore offering unblended and unbundled services.

Summarized, the priority parameters are:

- Ticket price: From as low as possible for air taxi to a luxury price within the air taxi market (for chosen aircraft type)
- Aircraft type: Piston, turboprop and VLJ
- Target market/ demand: The business passenger (and more, by selling empty leg seats), both average as more affluent
- Brand image: Level of service can be chosen; tickets per seat initially (variable in model to see the effect on profitability); both on demand as semi on demand
- Alliances: Variable in model to see the effect on profitability

5 CONCLUSION

The major objective of the SAT-Rdmp project is to demonstrate and understand the role that small-size aircraft operating on scheduled or non-scheduled flights can play as a component of the Air Transport System to satisfy the needs of transportation in regions where transport networks are underdeveloped. In this context, the present deliverable, title as “Business case subscriptions with operational characteristics” aimed primarily in analyzing the potential business cases and business case generations in general, and define those being relevant for the European small air transport system.

After a short introduction, this deliverable defined four different operational scenarios in which SAT-system is envisioned by the consortium. These are ranging from scheduled and non-scheduled commercial to personal operations with various operational costs, covering single and multi engine pistons, turboprops, jets up to 19 passengers. Based on the assumptions on the operational details, and by using the SAT-Rdmp demand model – as presented in “D1.2: Demand of small air transport aircraft analysis” – the passenger demand numbers for all four scenarios were assessed for 2030. The highest yearly passenger demand was found to be 66 205 120. It was related to demand scenario 4, defining small aircraft movements including advanced scheduled and non-schedules business as well as personal operations with relatively high annual flight hours and thus low total operating cost.

Results were also validated with the demand estimations of the EU EPATS project, as well as the EUROCONTROL predictions. The difference in the predicted passenger demand between for example the SAT-Rdmp and the EPATS project was found to be 11.42%, which is marginal, by considering that the assumptions were not fully identical.

A sensitivity analysis was also made, which showed that one of the most significant influencing factor (on the passenger demand) is the SAT fare. This finding is fully in line with the expectations and the literature related to demand modeling.

Before identifying the relevant business cases for SAT system, chapter 3 gave the basic method of business case generation. Finally this deliverable identified the most reasonable business models for the European Small Air Transportation System. A total of five business models were defined, based of 5 key parameters including ticket price, travel time, cost minimization, revenue maximization and service offered. The alternatives were ranging from simple minimized ticket prices to minimized travel time and maximized service offered. For each of the five scenarios, the effects (e.g. fleet composition, targeted market, programs and ownership models offered) and the priority parameters (such as the travel time or the ticket price) were given.

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