CALCULATION OF AEROTAXI SERVICES

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Summary: The paper investigates way of calculating aerotaxi services with consideration of time value. Calculation considers variables and define their possible values. Methodology of aerotaxi service cost calculation is also applicable for traditional air transportation and transportation by car. Conclusion of the paper is comparison among various alternative way of transportation on chosen route.

Key words: Aerotaxi service, time value, alternate way of personal transport

INTRODUCTION

In countries with limited road network or with large area is commuting by small plane necessity not luxury. Road network is not the limit in Europe. Europe has completely different problem and that is congested road network. Is this congestion, driver to move to air even for short trips with couple of employees? Possible solution is so called aerotaxi service. Those services have been expensive in past years. Technologies of today are making flying safer and more economically efficient therefore aerotaxi should be more accessible for companies' business travels. The question is how much todays technologies reduce cost of aerotaxi services. This is the reason why authors are studying this area.

Focus of some aircraft manufacturers, such as Cirrus Aircrafts, Diamond Aircrafts, Honda aircraft, Cessna aircrafts and others, to produce Very Light Jet (VLJ) (1), VLJ aircraft is proof that market is eager for cheap, fast, comfortable, on demand air transport, aerotaxi. Unfortunately, global financial crises of 2008 (2) affected investments of aircraft manufacturers in way that some of the project has been stopped or even cancelled. Some of the VLJ have been certified just before financial crises (1). Some with more radical design, e.g. single engine configuration, has been certified only recently, such as Cirrus Vision SF50 (3).

Calculation in this paper is focused more on predecessor of VLJ and those are Single Engine Propeller aircrafts (SEP), such as Cessna 182 series, Cirrus SR series and others. Unfortunately, SEP type aircrafts are not allowed to realized aerotaxi services in Europe, in contrast to the USA or Australia. Calculation shows feasibility of providing aerotaxi services in Europe.

1. FORM OF RESEARCH

1.1 Semi-structured interview

Basic component of semi-structured interview is to ask question in purpose of gathering information from respondent, in this case specialized in aviation. Describing specific question for narrator use is ineffective in this type of research. Narrator should focus mostly on subjects he or she is interested in. Wide analyses and paper reviews are needed before any

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interview, not to waste time on information that are available through other sources. Sources analysis is also good source of information for creating the most effective narrators guide. Problem during process of defining narrators guide is to stay neutral and not to intrude respondent ideas for example by improper theme order.

Respondents, experts, approached during interview have been carefully selected from both sides of commercial relationship. They are both customers, agents, and providers, operators of aerotaxi services. Few of approached respondents are both provider and consumer of service. Those respondents are usually owners of SEP aircrafts who use it for they own business trips. Common factor among those respondents is that they own or work for international company. Total number of approached respondents was seven from both Czech and Slovak market.

1.2 Interview result interpretation

Information gathered during interviews had to be reduced to form that is possible to record and analyze. Process of defining response categories was difficult due to mind set of researchers, they have been influenced by their own knowledge and already predefined conclusions. Responses have been recorded directly to narrator's guide paper and upon this records analyses took place. Unfortunately, due to confidentiality reason the paper cannot contain example of narrator's record.

One of the most interesting result from interviews is the existence of premise that low interest in aerotaxi services in Czech-Slovak Region is due to high costs. Main reason for high cost of aerotaxi services is type of used aircraft. Some of aerotaxi providers own suitable[2] type of aircraft for providing more accessible service. Use of such aircrafts for aerotaxi is very limited since their profitability is low as shown in chapter 3 of this paper. SEP aircrafts are mostly used for pilot training due to legislative reason which doesn't permit using such aircraft for aerotaxi. Result of this strategy is high costs of aerotaxi services.

Premise based on high price of aerotaxi services create demand only from wealthy segment of market such as politicians, sportsmen, successful businessmen. This type of demand create pressure on aerotaxi providers to buy more expensive and more luxury aircrafts which have higher cost of operations. Impact of pressure for luxury on aerotaxi service market is high since only expensive services are on supply and almost none of aerotaxi service providers is focusing on providing cheaper alternatives.

Lack of cheap aerotaxi services forced some of the successful businessmen to consider even buying their own plane which they can operate themselves or with little help of third party.

2. AEROTAXI SERVICES

Aerotaxi is concept which describe company or service that provides express on demand air transportation of people or cargo. Main determinant of aerotaxi is irregular transport realized upon customer demand. Aircraft is waiting for customer, not customer for aircraft.

[2] SEP or VLJ

Customer are usually wealthy part of society or multinational companies, considering purpose and costs of travel by aerotaxi.

Aerotaxi providing company usually owns few aircrafts suitable for transporting small number of passengers on short or medium distances[3]. Ownership of aircraft of any type comes with need of accomplishment of several certificates. Those certificates are for operations and self-servicing and are issued by civil aviation authority of every country. Those certificates are not permit for commercial activities. Provider, a part of certification, must be also licensed for execution of commercial activities in aviation.

Initial cost of establishment of aerotaxi service provider are high not only due to necessity of aircraft, which can be leased, but mainly because of fulfillment of all certification criteria and receiving of license for commercial activities. One way of cost optimization is to lease or purchase, economically effective modern aircrafts which can provide services for low cost, see calculation in next chapter.

3. SERVICE CALCULATION

This chapter provides definition and approach to calculation. Definition of variable are either result of interview analyses or data analyses, mainly cost analyses.

Definition of all variables is needed to understand equation definition and calculation result.

Tv_F – Value of free time express in CZK per hour
Tv_W – Value of working time express in CZK per hour
P_{CA} – Air ticket price (FSC[4], LCC[5]) [6]
P_{AET} – Price of available aerotaxi service [7]
P_{CAR} – Price for car travel
N_{EMP} – Number of employees on business trip
Tt_{CA} – Time of travel by airline (FSC, LCC) [8]
Tt_{AET} – Time of travel by aerotaxi [9]
Tt_{CAR} – Time of travel by car

Relationship of defined variables can be recorded as equations 1 – 3. For this experiment, only three ways of transportation has been chosen. There is no known limitation for usage of slightly modified equation for any of available transportation. Few things are not considered as variables and that is time of travel alternation due to bad weather, traffic jam or any other technical problem or vis mayor.

$$\text{Costs of aerotaxi}: \sum_{n=1}^{n=N_{EMP}} \left[\left(Tt_{AET} \times Tv_W \right) + \left(Tt_{AET} \times Tv_F \right) + P_{AET} \right] \qquad (1)$$

[3] 3 – 8 passangers, 1000 – 3000 km (1)
[4] Full service carrier
[5] Low cost carrier
[6] Including price of taxi trip to and from airport
[7] Including price of taxi trip to and from airport
[8] Including time of taxi trip to and from airport
[9] Including time of taxi trip to and from airport

$$\text{Costs of air ticket}: \sum_{n=1}^{n=N_{EMP}} \left[\left(Tt_{CA} \times Tv_{W} \right) + \left(Tt_{CA} \times Tv_{F} \right) + P_{CA} \right] \quad (2)$$

$$\text{Costs of car trip}: \sum_{n=1}^{n=N_{EMP}} \left[\left(Tt_{CAR} \times Tv_{W} \right) + \left(Tt_{CAR} \times Tv_{F} \right) + P_{CAR} \right] \quad (3)$$

Source: Authors

Considering all variable, we need to determine cost of aerotaxi price as first. Following tables contain basic determinants for cost.

Tab. 1 - Fixed costs	
Mandatory insurance	27 000 CZK
Accident insurance	15 840 CZK
Annual check	15 000 CZK
Unexpected repairs	50 000 CZK
Repairs of limited parts (propeller, brakes, etc.)	80 000 CZK
Aircraft depreciation	1 936 000 CZK
Total	2 123 840 CZK

Source: Author

Table 1 shows fixed cost for one accounting year with calculation of aircraft depreciation with purchase value of 23 760 000 CZK. Other fixed costs are provided as average from various service and insurance companies. Costs can be significantly different based on mutual negotiations among business parties.

Tab. 2 – Maintenance service cost of operation	
100-hour service	10 000 CZK
Number of services per year	6,3072
50-hour service	5 000 CZK
Number of services per year	6,3072
Total service costs	94 608 CZK

Source: Author

Tab. 3 – Number of flight hours	
Number of flight hours per day	1,44
Total time (h)	630,72

Source: Author

There is direct relationship between table 2 and 3 considering service operation determined by number of flight hours.

Tab. 4 – Cost of fuel		
Consumption (l)	19 gal * 4	76
Price per liter		34 CZK
Hours consumption in CZK	76 * 34	2 584 CZK

Source: Author

Consumption is generally expressed in gallons per hour therefore conversion to liters was needed. Actual price of AVGAS 100LL fuel is around 50 CZK. Depends on respective national legal framework but in Czech Republic it is possible to subtract excise duty from aviation fuel if there is no known intention to resell it. Result price for aviation fuel is therefore approximately 34 CZK.

Tab. 5 – Overall costs for one flight with 1,2-hour fly time

Fixed costs / flight time	4 041 CZK
Fuel	3 101 CZK
Maintenance service costs	216 CZK
Parking	877 CZK
Personal wage (3 employees by 3 hours)	3 600 CZK
Total	11 834 CZK

Source: Author

Table 5 shows very important cost distribution per flight. Included in costs for one flight are gross wages of three employees.

Tab. 6 – Price of 1 one way flight on market (Praha - Ostrava, independent on number of travelers' max 3 persons)

Aerotaxi Company A	28 930 CZK
Aerotaxi Company B	35 100 CZK
Average price	32 015 CZK

Source: Author

From publicly accessible price lists of aerotaxi services where chosen two which has relevant services which can be compared. Computed average price of service was used as base for determining price of model service. Model service price was reduced by 10% to result value of 28 814 CZK which is still profitable price with profit of 16 979 CZK. Calculated average price of market is included with empty leg, return trip of empty aircraft. To achieve comparable result with average market price we must add cost of return trip without passengers, which, according to table 5, will costs 11 834 CZK. End profit with empty return leg will be 5 145 CZK which is still profitable.

Conclusion of this calculation is that if the considered costs and number of flight will be achieved with 630 flight hours per year, company will be profitable on this aircraft. Calculation consider also flights to other airport in vicinity of Prague, eg. Bratislava, Krakow, Munich, Wien, which are all in flight distance of one hour. Model calculation also do not consider empty return flights and grounded time of aircraft due to maintenance operations.

4. ALTERNATIVES EVALUATION

This chapter is focused on decision making process over aerotaxi service and when aerotaxi services results as better option to other forms of transportation such as automobile. Equations from previous chapter have been used for overall calculation. Time value determination has two possible options. One source of relevant data are local statistical

institutes other is process of experimenting. Experimenting process was chosen with aim to determine approximate value of time when aerotaxi is preferable way of transportation.

Whole calculation abstracts factor of actual needed time of travel. Traveler is sometime forced to accept only few or solo option for travel by traditional airline. Limited number of option to travel can significantly increase time spent on business, particularly if travelers is forced to spend night in destination This restriction in possible options is difficult to quantify therefore is excluded from calculation. Another restriction is ratio of free time versus working time spend on travel. Determinant for spend time ratio was taken from interview analyses, results are represented in table 7.

Tab. 7 – Ratio of time spend on travel

Ratio of free time and working time - Automobile	0,5	0,5
Ratio of free time and working time - Airline	0,4	0,6
Ratio of free time and working time - Aerotaxi	0	1

Source: Author

Time ratio is expressed as percentage value defined in range of values 0 to 1 where 0 represent 0% and 1 represent 100%.

Tab. 8 – Entry values for calculation

P_{CA} – Air ticket price	4935 CZK	Including 800CZK cost of taxi Prague and Ostrava
P_{AET} – Price of available aerotaxi service	10404,5 CZK	Including 800CZK cost of taxi Prague and Ostrava
P_{CAR} – Price of car travel	1236,7 CZK	
N_{EMP} – Number of employees on business trip	3	
T_{tCA} – Time of travel by airline (FSC, LCC)	3,5 hour	Including one hour flight
T_{tAET} – Time of travel by aerotaxi	2 hour	Without waiting time
T_{tCAR} – Time of travel by car	4,5 hour	
Distance traveled by car	371 km	

Source: Author

Table 8 content all relevant variables excluding time values. All variables are taken from various sources such as statistical agency or international agencies. It is important to recognized added costs of taxi travel from city center to airport, which is special issue at Ostrava where the airport is 24 km away from city center. Taxi prices are calculated as average taxi price for certain location.

Important to consider is also time spend on whole travel, not only travel by plane but also time spent waiting for plane to depart or to get to correct departure point. This is eliminated in car travel but unfortunately time travel by car is always longer than any other way of transportation. Due to consideration of time spent on waiting and getting to and from airport is air travel by traditional airline only one hours quicker than car travel, in this case. There is also need to abstract for delays on highway between Prague and Ostrava which is famous for its lengthy and usual traffic jams. This is result of congested European roads (4).

Time value variables were changed during experiment to achieve result of overall calculation in favor of aerotaxi as is shown on figure 1.

	Employee 1	Employee 2	Employee 3
TvF – Value of free time expressed in Kč per hour	3 900 Kč	3 950 Kč	3 900 Kč
TvW – Value of working time expressed in Kč per hour	1 415 Kč	1 424 Kč	1 446 Kč
Aerotaxi	13 235 Kč	13 253 Kč	13 297 Kč
Aerolinka	13 367 Kč	13 455 Kč	13 432 Kč
Auto	13 195 Kč	13 328 Kč	13 265 Kč

Employee 1	Employee 2	Employee 3
Aerotaxi Total:	39 784 Kč	
Aerolinka Total:	40 254 Kč	
Auto Total:	39 789 Kč	

Source: Author

Fig. 1 – Result of model calculation

Value of time was examined for three different employees with different time values. Value of time was linearly adjusted using slider function of Microsoft Excel. Result of experimental calculation were adjusted until aerotaxi option was as the most preferred in terms of cost. It is obvious that values of time for all employees are much higher than usual value (statistic agency average hourly wage). Main conclusion is that if person values his or her time highly enough aerotaxi services can be preferable.

Question of quantification of free time value was raised during interviews and unified result was achieved. None of asked respondents could exactly determine value of free time. Therefore, need for control calculation was described where free time was without value. Difference in aerotaxi service was least influenced by free time value, other two mentioned transportation types has been influenced due to higher time value ratio as described in table 7. Time value ratio determine difference between considered way of transportation. Calculation without value for free time is on figure 2.

	Employee 1	Employee 2	Employee 3
TvF – Value of free time expressed in Kč per hour	- Kč	- Kč	- Kč
TvW – Value of working time expressed in Kč per hour	1 415 Kč	1 424 Kč	1 446 Kč
Aerotaxi	13 235 Kč	13 253 Kč	13 297 Kč
Aerolinka	7 907 Kč	7 925 Kč	7 972 Kč
Auto	4 420 Kč	4 441 Kč	4 490 Kč

Employee 1	Employee 2	Employee 3
Aerotaxi Total:	39 784 Kč	
Aerolinka Total:	23 804 Kč	
Auto Total:	13 351 Kč	

Source: Author

Fig. 2 – Result of control calculation

Price of aerotaxi service is not that dependent of time value because it provide the highest time saving. If you consider value of time spend on travel, airline and automobile transportation are significantly more expensive than in control calculation. Price for car travel raised by approximatly 26 000 CZK and air travel by traditional airline raised by approximatly 16 000 CZK.

As a result, car travel from Prague to Ostrava is calculated as the most economic way of travel, when time spent on travel is not taken into account.

Other calculations can be performed with different data to determine exact decision point considering distance of travel and value of free and working time. The best way how to make the most economical decision is to calculate overall price of travel for every business trip considering more accurate entries.

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CONCLUSION

Calculation provided in this paper shows way of determining cost or aerotaxi services using available data. Process of cost determination is transparent and simple to describe. Cost calculation will help evaluate feasibility of possible business case based on chosen route and type of aircraft.

Calculation for alternative type of travel for business people shows that under specific condition, there is option of aerotaxi as the most economical way of transport. The biggest prerequisite for this result is that people starts to value their time, especially free time. There can be big saving of time and financial resources if, for example, employee will not be forced to spend night at the place of business meeting just because of unsatisfying travel connections.

Equations and process described in this paper are designed to be used in following researches. There is number of variables which can be described and quantified for more exact calculation such as overnight business trip. There is also way of improvement in calculations by adding probability of delays due to traffic jams or bad weather.

REFERENCES

(1) Very Light Jet - VLJ. In: Global Security [online]. Alexandria, Virginia: Global Security, 2015 [cited 2016 Nov 07]. Available from: http://www.globalsecurity.org/military/world/very-light-jet.htm

(2) Global economic crisis has cost the aviation industry two years of growth: IATA [online]. CAPA Center for Aviation, 2009 [cited 2016 Nov 07]. Available from: http://centreforaviation.com/analysis/global-economic-crisis-has-cost-the-aviation-industry-two-years-of-growth-iata-15921

(3) Cirrus Aircraft Vision Jet Achieves FAA Certification [online]. Duluth, Minnesota: Cirrus Aircraft, 2016 [cited 2016 Nov 07]. Available from: http://cirrusaircraft.com/cirrus-aircraft-vision-jet-achieves-faa-certification/

(4) Yearbook 2014-2015 - European Union Road Federation [online]. 2015, 2015(1) [cited 2016 Oct 26]. Available from: http://www.irfnet.eu/images/Statistics/BAT-AD-Stats-2015Inside-ERF.pdf

(5) Transport: Economic crisis stops air transport growth [online]. 2009, 2009(91) [cited 2016 Oct 26]. ISSN 1977-0316. Available from: http://ec.europa.eu/eurostat/documents/3433488/5279925/KS-SF-09-091-EN.PDF/84a2ec4c-4ba6-4a4c-b7cc-c2509ce92c88

(6) Marshall, Catherine a Gretchen B. Rossman. (1999) Designing qualitative research. 3rd ed. Thousand Oaks, Calif.: Sage Publications, ISBN 0761913408.

(7) Ten Have, Paul (1999): Doing Conversation Analysis. A Practical Guide, Thousand Oaks: Sage.