Article

An Empirical Investigation: Does the New Airport Infrastructure Affect the Improvement of Customer Experience?

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Abstract: Airports are often the centers driving economic development of the local community in which they are located and have a significant impact on the national economy. Therefore, the infrastructural development of the airport is of great importance. On the other hand, passengers are becoming more experienced, more informed and more demanding in achieving their own satisfaction related to the level of quality of the service provided. The new airport infrastructure has an impact on improvement of customer experience, but with the assumption that certain physical and operational conditions are met. The research found that, in addition to the facilities that are part of the passenger operations, passengers pay significant attention to the commercial facilities, design and ambiance of the passenger terminal. It can be concluded that with the new airport infrastructure development such as passenger terminal, a wow effect at the customers will be achieved, but that only right design of ambient, simplified passenger flows and organization of commercial areas with a diverse offer and acceptable prices will ensure long term customer satisfaction and that the experience gap remains positive and sustainable.

Keywords: airport infrastructure; passenger terminal; customer experience; passenger satisfaction; passenger expectations; passenger operations; commercial facilities; wow effect

1. Introduction

The aviation industry is one of the fastest growing and most profitable industries in the world. Accordingly, airports also developed physically and operationally, as one of the fundamental subsystems of air traffic. Analyzing the 21st century history, the rapid airport development era began in the 60s with the introduction of jet-powered aircraft for commercial purposes. Airport development at the global level depended, basically, on their geographic location, and then on other factors such as the degree of development of the region's economy, the natural features of the area, the population number and composition, etc. In addition to the above, the key of the successful airport development is its infrastructural development, which should be reflected in the implementation of modern technologies for the aircraft, passengers, baggage, cargo and mail handling, the implementation of modern information and communication technologies, the development of facilities for commercial purposes, the provision of a satisfactory level of service quality and the development of complementary airport facilities such as Airport City. Airports, as key players in the industry, are increasingly rebranding themselves as destinations, gateways to countries, instead of just thoroughfares [1]. Regarding their basic activity, the change of passenger and cargo mode of transport, which directly places airlines with their aircraft in the foreground, airports compete with each other in business in order to have as many of airlines as possible attracted. Airports in the 21st century began to compete fiercely, namely in introducing novelties in air traffic,

 doi:10.20944/preprints202306.0759.v1

attracting as many of the number of low-cost airlines that have by their appearance created a significant disturbance on European airspace in the operations of full-service and charter carriers, acquiring and increasing transit traffic and increasing the transportation of cargo and mail. Even the Airport Council International (ACI) Europe identified it in 1999 different forms of competition between airports, of which, in the context of this paper, competition in the implementation of new services for its customers can be singled out. However, the question is: "*Is it enough to develop a modern airport infrastructure in order to increase overall customer satisfaction and ensure airport sustainability?*".

According to the Transportation Research Board (TRB) [2], customer satisfaction can be defined as follows: Customer satisfaction is the degree to which a product, service, or experience meets a customer's expectation. The customer's needs, wants, preconceived notions, personal standards, and perceptions of any anticipated product, service, or experience influence their expectations. The customer satisfaction gap is the difference between the customer's perception of performance and his or her expectation of performance.

As a key user of airport services, the passenger comes first. Therefore, it is important to provide him with an adequate level of service which is closely related to passenger experience and affects the airport market positioning. In order to define the level of service quality at the airport, International Air Transport Association (IATA) developed the level of service quality concept, named *IATA LoS*. The version of the IATA Airport Development Reference Manual (ADRM), from 2019, provides a new level of service concept, which takes following elements for level of service determination: space (defined in square meters per passenger), maximum waiting time (defined in minutes) and seating capacity. Taking into account mentioned elements, the following categories of service levels of airport passenger terminal facilities are identified: Under-Provided, Sub-Optimum, Optimum and Over-Design [3]. The goal is, understandably, to achieve the Optimum quality level of service, which implies the compatibility of available space, time and seating occupation. It is crucial to consider that *LoS* is a variable value that is mostly affected by daily peak hours and annual traffic demand fluctuations.

Likewise, ACI has developed a global Airport Service Quality (ASQ) benchmarking program that uses surveys to measure and improve passenger experience, placing particular emphasis on the satisfaction level of passengers flying business class. Given that greater passenger experience makes airports more competitive, they compete in their category every year in order to stand out as the best. The fact is that passengers continuously demand a higher level of service. Therefore, airport service providers are paying more and more attention to the service quality provided. Competition among airports is enormous as structural and ownership changes have brought new models and stakeholders into the aviation industry. Today, airports are tourist centers with a wide range of services on offer, and as such have become key drivers of social and economic progress of cities, regions and countries around the world.

It should also be noted that passenger experience directly affects the increase in non-aeronautical airport revenues. During the nineties, the majority of the airport's income were aeronautical revenues (around 80%), and only a small share were non-aeronautical (20%). In the last 20 years, this share is changing and today aeronautical revenues represent 55% and 45% came from non-aeronautical revenues [4]. Considering that non-aeronautical revenues are primarily generated by passengers, the focus was on them and their needs. Figure 1 summarizes what customers need, want and expect from the airport experience. If a passenger experiences any factor in a negative way, the said experience can reflect badly on the airline or the airport, since the passenger often does not know who the actual service provider is.

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Figure 1. Key Drivers for Customer Satisfaction [2]

Furthermore, customer satisfaction is closely related to the level of stress that occurs during travel. When stress decreases, the level of feeling safe increases. The periods immediately before and during passenger processing are those in which travelers experience elevated levels of negative emotions, including stress and anxiety. The trend of the stress line during the passenger movement through the passenger terminal is shown in the Figure 2. The stress line increases when passengers pass through the passenger terminal. It starts at the moment of trip departure because of the fear of being late for the flight. The stress intensity experienced by passengers depends on many factors, such as taking care of documents, crowds in front of the check-in counters, etc. The stress line culminates at the security check and passport control for international passengers, after which it gradually decreases. At that moment, passengers use commercial facilities to the greatest extent. Airport authorities are familiar with the effects produced by the stress line, so they place commercial contents in the terminal areas in a way that visually separates them from the control points.

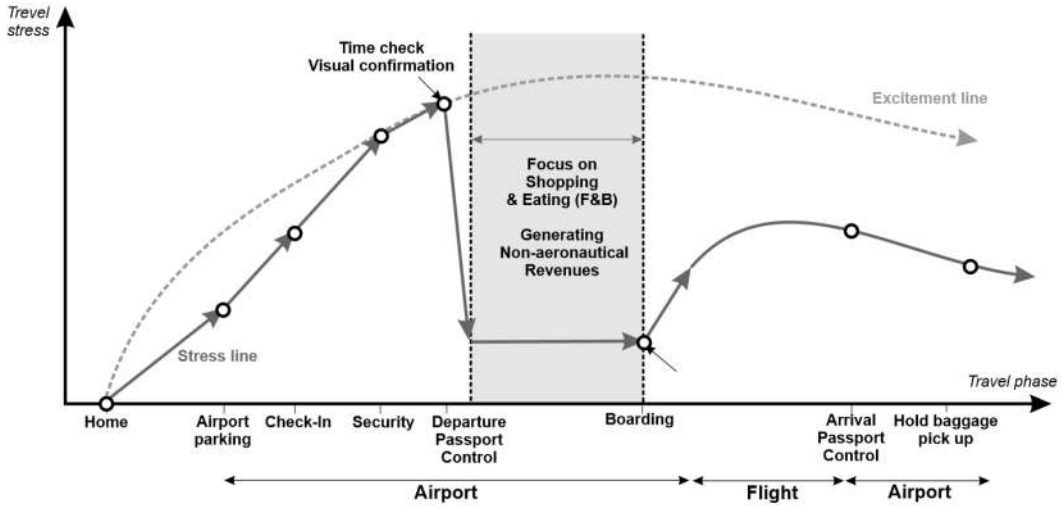

Figure 2. The Travel Stress Curve [5]

There are various recent researches that elaborate relation between new airport technologies and customer satisfaction [1, 6], quality of service and customer satisfaction [7-10] or impact of airport service quality on airport choice [10]. Therefore, there is a lack of understanding of how new airport infrastructure affects the improvement of customer experience. To that end, this paper aims to: 1) analyze the impact of the new airport infrastructure, together with its facilities, on the improvement of customer experience and 2) propose corrective measures based on the obtained results. Furthermore, the article aims to make a practical contribution to airport management in order to meet and anticipate the needs of its customers as successfully as possible.

The paper is organized as follows. The first part considers the growth of air travel, airport infrastructure development factors and customer relations' elements. Next, data sources, research

 doi:10.20944/preprints202306.0759.v1

methodology and a case study at Franjo Tuđman Airport are described. The study results analysis is then presented and discussed data sources, research methodology and a case study at Franjo Tuđman Airport are described, including passenger satisfaction numerical indicators with airport services during the transition from the old to the new passenger terminal. Following, a proposal for corrective measures was presented with the aim of increasing the airport customer experience. The paper concludes by considering the study's limitations and theoretical and practical implications, suggests areas for future research and recapitulates the main research findings in this paper.

2. Materials and Methods

For the purposes of this research, several scientific methods were used as follows. The descriptive method is applicable in all parts of the paper, but it is mainly present in the background to describe elements of airport service quality and customer experience. Furthermore, this method is also present where the paper describes the passenger satisfaction with a certain service at Franjo Tuđman Airport based on a research conducted. The comparison method was applied in the research where the features of the old and new passenger terminals of Franjo Tuđman Airport are stated, then in the parts of the work where examples of good practice of airports in the world are given, and in the research where improvements in the provision of services are proposed in relation to the current situation at Franjo Tuđman Airport. The method of analysis and synthesis were used when presenting passenger ratings related to satisfaction with services at the old and new passenger terminals and discussing the results obtained. The method of induction and deduction was applied in the research for impact evaluation of the introduction of new airport infrastructure to increase the overall customer experience, increase the airport's revenue and the sustainability of the airport. The classification method is applied in the part of the paper that describes the categories of passenger satisfaction evaluation, that is, where it refers to the two basic groups of services - passenger operations and commercial content. This method is also used when dividing passengers into international and domestic in the context of satisfaction with the service provided at the airport. The compilation method is used in all parts of the research in which customer experience is connected with previous research, international recommendations and standards.

The statistical method is the key method of this research, and it was used to obtain numerical values/ratings with which passengers expressed their level of satisfaction with services at the old passenger terminal, in the period of transition to the new passenger terminal and in the post-transition period. In addition to the statistical method, the sample method is also important since it is based on the number and category of passengers who participated in the valorization of the airport infrastructure. Also, a mathematical method of calculating the average value of passenger ratings during the winter (research period/waves: March and December) and summer (research waves: June and September) flight schedules was used. In addition to the mentioned methods, a very important method in this research was the measurement method, which was used to present the gap in passenger satisfaction with the services provided at the old and the new passenger terminal.

The basic hypothesis of this paper is that the new airport infrastructure certainly has an impact on improvement of customer experience, but with the assumption that certain physical and operational conditions are met.

2.1. Data Collection

In order to precisely define relationship between the implementation of the new airport infrastructure and the improvement of customer experience, it was necessary to collect detailed data on the factors affecting passenger satisfaction in several categories. As mentioned earlier, since the key airport infrastructure customers are passengers, this research is based on their marks in each rating category. Data collection was accomplished separately for departing and for arriving passengers. For research purposes, as rating categories for departing passengers, the sixteen of them were taken into account.

Given the fact that there are fewer mandatory and desired contents during the passenger arrival, there are also slightly fewer rating categories on which passenger experience with the airport

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infrastructure is based. Accordingly, arriving passenger experience marks are based on the seven rating categories.

Most of the rating categories have been taken over from the ACI customer satisfaction survey. A detailed list of parameters on which passenger experience is based in each rating category for departing and arriving passengers is provided in Table 1.

Table 1. Airport passenger experience rating categories and subcategories.

Rating category	Rating subcategory	Rating parameter Departing passengers	Rating parameter Arriving passengers
Overall satisfaction with airport	Overall satisfaction with airport	Quality of service Employee courtesy Value for money	Quality of service Employee courtesy Value for money
Ground transportation to/from the airport	Taxi – overall opinion of your ground transportation service Shuttle bus - overall opinion of your ground transportation service Rent-a-car - overall opinion of your ground transportation service	Ease of finding Proximity to arrival gates	Ease of finding Proximity to arrival gates Availability Employee courtesy (only for shuttle bus)
Access road	Overall opinion of the access road	Ease of finding Amount of traffic/Availability Landscaping	N/A*
Car park service	Overall opinion of the car park service	Distance from parking to departure gates	N/A
Information service	Overall opinion of the information counter	Degree of employee expertise Quickness of response	N/A
Finding your way	Overall opinion	Ease of understanding airport signage Usefulness of airport signage	N/A
Baggage cart/trolley	Overall opinion	Availability	Availability
Bank/ATM facilities/money changers services	Overall opinion (only arriving passengers)	Availability Quality	Availability Quality
Check-in	Overall opinion	Queuing time Courtesy of check-in staff Expertise of check-in staff	N/A
Security screening	Overall opinion	Queuing time Expertise of security staff	N/A
Transfer services	---	Waiting time at queuing counter Convenience of services	N/A
Flight information screens	---	Location (ease of finding information) Quality of information provided	N/A
Shopping	Overall opinion	Quality of products Product variety Service time (quickness of service) Convenience of shopping facilities	N/A
Food and beverage	Overall opinion	Quality of offerings	N/A

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	of food and beverage	Variety of offerings	
Business/executive lounge	Overall opinion	Availability of the lounge services Quality of the lounge services	N/A
Comfort of the waiting/gate areas	Overall opinion regarding the gate area	Availability of the waiting areas Comfort of the waiting areas Ambiance in the waiting areas	N/A
Baggage delivery	Overall opinion of the baggage delivery	N/A	Delivery time
Customs services	Overall opinion of the custom services	N/A	Waiting time at customs
Overall cleanliness of airport public areas	Overall opinion	N/A	---

*N/A – no applicable

In order to obtain a more precise insight into the ratings fluctuation of each individual evaluation parameter, it is necessary to continuously monitor them over a certain period. For the purposes of this research, they were monitored over a period of three consecutive calendar years. Additionally, in each of those years they were monitored in four quarterly periods (Q1/Q4 - winter flight schedule, Q2/Q3 - summer flight schedule).

2.2. Franjo Tuđman Airport Case Study

Several airports in the Republic of Croatia have undergone major infrastructural and operational changes in the last few years, but they were the most significant at Franjo Tuđman Airport. The period after the Homeland War (1991-1995) was characterized by a strategy of long-term planning to attract an increasing number of passengers and destinations, larger aircraft and a greater cargo traffic. Likewise, the air traffic market liberalization in 2000 caused an expansive growth of air traffic at all airports, which resulted in the need to define an airport development strategy. For Franjo Tuđman Airport, this included the construction of a new passenger terminal. The beginning of the concession period and the opening of the new passenger terminal with an area of 65,000 m² in March 2017 enabled a rapid increase in passenger traffic, since the old passenger building with an area of 15,000 m² reached its maximum capacity, which was especially evident during peak hours and during summer season. In addition, it no longer met the conditions of modern air traffic in terms of transport, technology and infrastructure. Franjo Tuđman Airport old and new passenger terminals are shown in Figure 3.

Figure 3. Old and new passenger terminal at Franjo Tuđman Airport, Croatia.

Franjo Tuđman Airport, as the busiest Croatian airport with 3.4 million passengers in 2019 (pre-COVID-19), has the function of a hub and base airport of the national air carrier Croatia Airlines, and with the aim of increasing regional competitiveness, it should continue to focus on strengthening that

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relationship. One of the basic prerequisites for achieving airport competitiveness is its infrastructural development. However, the question raised in this research is *Is it sufficient to increase its customer experience?* In order to obtain an answer to the previous question, an evaluation of the passenger experience was executed at Franjo Tuđman Airport, separately for departing and for arriving passengers, using the data from customer satisfaction report mentioned in Chapter 2.1. during three characteristic consecutive years:

1. 2016 – old passenger terminal in operation;
2. 2017 – transition from the old to the new passenger terminal (opening on March 28, 2017)- old terminal was closed;
3. 2018 - new passenger terminal in operation.

In each of those years the rating parameters were monitored in quarterly four-time waves – March, June, September and December.

The research was conducted on a sample of a total of 350 departing passengers in international and domestic traffic and 150 arriving passengers in international air traffic.

The range of marks per category was from 1.00 to 5.00, with mark 1.00 representing the lowest and mark 5.00 the highest possible mark of the evaluation criteria. In order to display the impact of the new airport infrastructure on increasing the user experience as clearly as possible, it is presented in a table using the colors for the rating marks in each category as follows: the greener the better, the redder the worse. Figure 4 presents the marks in colors of departing and arriving passengers in the rating category of overall satisfaction with the airport in the specified research period.

Departure statistics	Old passenger terminal				Transition 28 Mar 2017 NPT opening				New passenger terminal			
	2016				2017				2018			
Category	Mark	Mark	Mark	Mark	Mark	Mark	Mark	Mark	Mark	Mark	Mark	Mark
Season	Winter	Summer	Summer	Winter	Winter	Summer	Summer	Winter	Winter	Summer	Summer	Winter
Month	March	June	September	December	March	June	September	December	March	June	September	December
Wave	1	2	3	4	1	2	3	4	1	2	3	4
OVERALL SATISFACTION WITH AIRPORT												
Overall satisfaction with airport	3,8	3,5	3,5	3,6	3,6	4,1	4,1	4,2	4,0	4,2	4,3	4,1
Quality of service	3,9	3,6	3,7	3,6	3,7	4,2	4,1	4,2	4,0	4,2	4,3	4,2
Employee courtesy	4,1	3,8	3,8	3,9	3,9	4,2	4,2	4,3	4,2	4,0	4,3	4,2
Value for money	3,7	3,4	3,5	3,5	3,5	3,9	3,9	3,9	3,7	4,0	4,0	3,9

Arrival statistics	Old passenger terminal				Transition 28 Mar 2017 NPT opening				New passenger terminal			
	2016				2017				2018			
Category	Mark	Mark	Mark	Mark	Mark	Mark	Mark	Mark	Mark	Mark	Mark	Mark
Season	Winter	Summer	Summer	Winter	Winter	Summer	Summer	Winter	Winter	Summer	Summer	Winter
Month	March	June	September	December	March	June	September	December	March	June	September	December
Wave	1	2	3	4	1	2	3	4	1	2	3	4
OVERALL SATISFACTION WITH AIRPORT												
Overall satisfaction with airport	4,3	4,5	4,4	4,2	4,1	4,8	4,8	4,1	4,5	4,4	4,3	4,5
Quality of service	4,2	4,3	4,3	4,1	4,1	4,7	4,7	4,0	4,7	4,4	4,2	4,4
Employee courtesy	4,3	4,5	4,3	4,2	4,2	4,6	4,7	4,1	4,5	4,4	4,3	4,5
Value for money	4,1	4,3	4,1	3,9	4,0	4,6	4,6	4,0	4,5	4,3	4,1	4,3

Figure 4. Evaluation of departing and arriving passengers in the category of overall satisfaction with Franjo Tuđman Airport in the period from 2016 to 2018.

3. Results

The research results at Franjo Tuđman Airport differ by rating category, both for departing and arriving passengers. The lowest mark of departing passengers during the research period was achieved in the *Car Park Service* category (mark: 2.7; research wave: September 2016), and the highest in the *Check-in* category (mark: 4.5; research wave: September 2018). On the other hand, the lowest mark of arriving passengers during the research period was achieved in the *Ground Transportation from the Airport* category (mark: 3.4; research wave: December 2017), and the highest (4.8) in several categories: *Overall Satisfaction with Airport* (research wave: June and September 2017), *Baggage Delivery*, *Customs Services*, *Overall Cleanliness of Airport Public Areas* and *Ground Transportation from the Airport* (all in research wave: June 2017).

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For the purposes of easier understanding of the research results, they are clearly presented in Figures 5, 6 and 7. The first presents overall satisfaction with the airport, the second presents marks in the segment of departing and arriving passenger operations and the third presents passenger marks in the segment of commercial facilities in the airport passenger terminal.

Figure 5. Marks of Overall satisfaction (Arrival/Departure) at Franjo Tuđman Airport in the period from 2016 to 2018. Legend: Green/Red bar transition from old to new passenger terminal

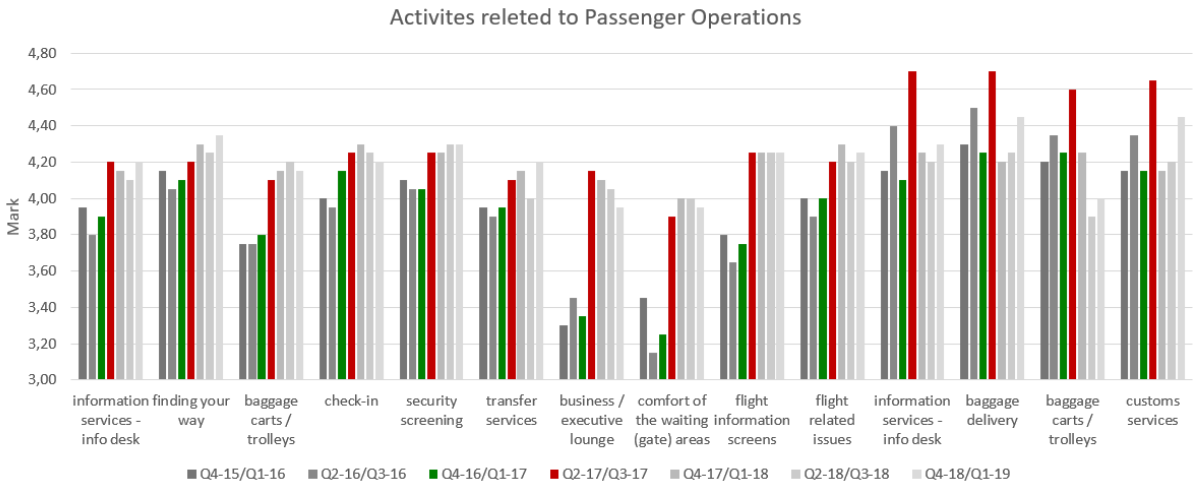

Figure 6. Marks of activities related to the Passengers operations at Franjo Tuđman Airport in the period from 2016 to 2018.

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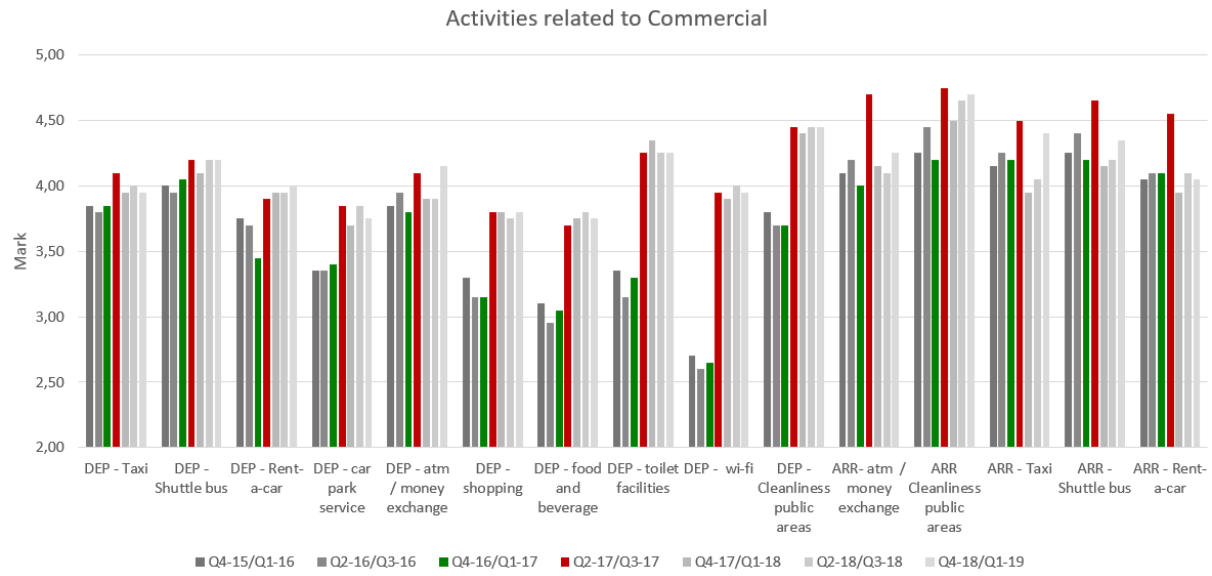

Figure 7. Marks of activities related to the Commercial facilities at Franjo Tuđman Airport in the period from 2016 to 2018.

Franjo Tuđman Airport has a very conspicuous seasonality, which largely coincides with the IATA winter and summer flight schedule. During the winter flight schedule, in the Franjo Tuđman Airport passenger structure, the majority are local passengers with only a small share of tourists. This means that the traffic average in the first and fourth quarters of the year is approximately the same, and the same applies to the second and third quarters. For this reason, and in order to make the presentation of the research results as clear and simple as possible, the height of the column in Figures 6 and 7 represents the average mark of Q1 and Q4, that is, Q2 and Q3 in the selected years of the research.

Overall satisfaction with the airport does not reflect the same pattern for departing and arriving passengers. Among the rating categories of departing passengers, this category is characterized by the highest increase in airport passenger satisfaction, with the lowest mark of 3.5 in June and September 2016 and the highest mark of 4.3 in September 2018. An exception is the *Value for money* subcategory, which does not follow the aforementioned trend of passenger satisfaction growth. This is confirmed by a mark of 3.9 in as many as four out of seven time waves of the survey since the opening of the new passenger terminal. The arriving passengers marks of this rating category fluctuate considerably more, but are generally higher compared to the marks of departing passengers. The lowest mark of 4.1 was recorded in March 2017 at the old passenger terminal, but also in December 2017 at the new passenger terminal. The highest mark of passenger satisfaction in this category of 4.8 was achieved in the research time wave immediately after the opening of the new passenger terminal and in the following third quarter of 2017. Marks of the subcategory *Value for money* among arriving passengers roughly follow the marks fluctuation of the main category and the subcategories *Quality of service* and *Employee courtesy*, but are lower on average by 0.2. Especially for arrivals, it is evident that during the season (Q2 and Q3) the ratings are better, and when local passengers travel, they give lower ratings.

The facilities that are part of passenger operations in Figure 6 are arranged according to the passengers flow at the airport - from the departing flow activities to the arriving flow activities. The satisfaction of departing passengers in the categories of providing information services, wayfinding, check-in, security screening and transfer services at the end of the survey did not significantly increase compared to passenger satisfaction in the first time wave of the survey. The increase in the level of passenger satisfaction in the mentioned categories varies from 0.25 to 0.4. The research results show that, at the moment of transition from the old to the new passenger terminal, departing passengers expressed the greatest increase in satisfaction with the business/executive lounge and the comfort of the waiting area. The former indicates an increase in marks of 0.8, and the latter of 0.65 at

 doi:10.20944/preprints202306.0759.v1

the time of transition. However, none of these two evaluation categories still reflects a high level of passenger satisfaction. The largest increase in the satisfaction rating of arriving passengers of 0.6 at the time of transition was recorded by information services. Passenger satisfaction with baggage delivery, baggage carts and customs at that moment recorded an increase in marks from 0.3 to 0.45. Although the ratings of arriving passengers presented higher satisfaction with the new passenger terminal compared to departing passengers, the results in all rating categories of arriving passengers indicate a decrease in passenger satisfaction after the end of the transition to the new passenger terminal.

Analyzing Franjo Tuđman Airport commercial facilities, the greatest increase in the satisfaction of departing passengers at the new passenger terminal is recorded with the Wi-Fi service, with an increase in the satisfaction mark of 1.3 at the time of transition. The lowest marks in this group of services at the old and new passenger terminals refer to satisfaction with shopping and food and beverage offerings. They range from 2.95 to 3.8. Ratings of the ground transportation quality indicate a slight increase in the satisfaction of departing passengers when transferring to the new passenger terminal. Although the rent-a-car service indicates the greatest increase in passenger satisfaction at the time of transition (0.45), passengers were still less satisfied with the aforementioned service than with taxi and shuttle bus services. Car parking service marks are very similar to the ratings of the rent-a-car service and range from 3.35 at the old to 3.85 at the new passenger terminal. From the results of the research on passenger satisfaction with the airport's commercial facilities, it is possible to notice that the marks of arriving passengers are higher than the marks of departing passengers in all rating categories, but also their obvious drop after the end of the transition to the new passenger terminal.

In conclusion, based on the obtained research results, it is possible to determine the following general patterns of variation in passenger satisfaction ratings with the airport, as its main users:

- the increase in the level of passenger satisfaction at the time of the transition to the new passenger terminal is reflected in all rating categories, including passenger operations and commercial facilities;
- arriving passengers are generally more satisfied with airport facilities than departing passengers in every aspect, from passenger operations to commercial facilities;
- overall satisfaction with the airport among departing passengers was in an almost continuous increase after the transition to the new passenger terminal, in contrast to the satisfaction of arriving passengers, which fluctuated after that moment, but the ratings of arriving passengers were still higher compared to the ratings of departing passengers;
- in 16 out of 29 or 55.2% of the presented rating categories, the highest ratings of passenger satisfaction were recorded precisely at the moment of transition to the new passenger terminal;
- in 19 out of 29 or 65.5% of the presented rating categories, a decrease in the level of passenger satisfaction was recorded after the end of the transition period to the new passenger terminal;
- the drop in the level of passenger satisfaction after the end of the transition to the new passenger terminal is greater for arriving passengers than for departing passengers

4. Discussion

The aim of this study was to investigate how the introduction of new airport infrastructure affects the overall customer experience. As already established at the end of the previous chapter, the introduction of the new airport infrastructure, i.e. the new passenger terminal of the Franjo Tuđman Airport with all its facilities, had an impact on the improvement of the passenger experience, but if one takes into account the increase in space and the cost of the introduction of the new infrastructure compared to increasing passenger ratings, then it is below passenger expectations. The new passenger terminal is four times larger than the old one, it was built 58 years after the old one, it also includes certain modern trends in the aviation industry, new equipment and facilities, but passenger ratings do not confirm this, except that they showed a wow effect in the first few months. In order to determine the reasons for such research results, it is necessary to analyze in more detail all segments of Franjo Tuđman Airport infrastructure development.

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First of all, it is necessary to discuss the reason for the sudden increase in passenger ratings at the moment of transition to the new passenger terminal, and then their decline. The fact is that the old passenger terminal, due to its technological obsolescence and lack of capacity, could no longer maintain the level of service quality at an adequate level, so the ratings were aligned with that. This was especially evident in the rating category *Comfort of the waiting/gate areas* for departing passengers and in the *Overall satisfaction with the airport* category for arriving passengers in the period immediately before the transition to the new passenger terminal (green line in Figure 6). In 2016, Franjo Tuđman Airport handled over 2.7 million passengers, which was about 180% of the old passenger terminal capacity. Therefore, it is understandable that the waiting area was crowded with passengers, which resulted in a decrease in the comfort and availability of the seating area, and thus in a decrease in passenger satisfaction. Likewise, the space for operations of arriving passengers, especially passport control and baggage reclaim area, was no longer adequate, which was particularly evident during the peak hours. In 2018, Franjo Tuđman Airport handled about 3.3 million passengers, which is about 66% of the new passenger terminal capacity built so far in accordance with the Concession Agreement Phase 1. The new passenger terminal, with all its innovations and advantages, should have enabled a permanent increase in passenger satisfaction, i.e. an improvement of the passenger experience. But that didn't happen. Passenger satisfaction ratings increased at the time of the transition to the new passenger terminal (red line in Figure 6) and then began to decrease. The question is *Why?* The answer to this question could be interpreted as follows: it is possible that passengers experienced the *wow-effect* or the *effect of impressiveness* when the new airport infrastructure was introduced. This is confirmed by the fact that the architects who designed the terminal received the prestigious American Architecture Prize for their architectural solution. According to ArchDaily's opinion and the architects' textual description, the new aerodrome complex is a synthesis of structural engineering, architectural art and superb functionality as well as urban contextualizing, becoming a new reference point in Croatian 21st century architecture. The structure's expressiveness derives from its organic shaping in conjunction with the powerful algorithm of the complex curves of the roof. The undulating silhouette helps it to fit into the surrounding context, signals the city in which the structure is located and openly evokes the skyline of the mountains surrounding Zagreb. [11]. The results of a study conducted in 2008 at Amsterdam Schiphol Airport showed that passengers preferred a passenger area with a curvilinear roof and a curved layout [12]. Franjo Tuđman Airport followed exactly this trend. Therefore, when the wow-effect stopped affecting the passengers, they again began to give more realistic ratings, which were lower than the ratings at the time of transition. Functionality should be primary in the passenger flows and passenger operations facilities, rather than the design itself, which is equally important but secondary.

Furthermore, it is necessary to analyze the reason for the generally lower ratings of departing passengers compared to the ratings of arriving passengers. It is a fact that departing passengers are under much more stress than arriving passengers, so they notice more disadvantages than advantages of the new infrastructure. In addition, considering that the departing passenger flow takes longer, passengers pay more attention to the facilities offered to them because they stay longer at each of them, while the main goal for arriving passengers is to leave the airport as soon as possible. Finally, the third reason lies in the complexity of the process, i.e. in the departing flow, certain operations (check-in, security screening) are significantly more complex than certain operations at arrival, therefore passengers cannot clearly assess their real duration and will generally give lower ratings. The complexity of the process is also influenced by two stakeholders in the process over whom the airport administration has no authority (Ministry of Interior and Customs).

Furthermore, it is necessary to analyze the facilities that are part of the passengers' operations. Ratings of the information service hardly changed during the study period. This is completely understandable since the new passenger terminal still has one information counter with employees who worked at the old passenger terminal. When considering check-in, passengers are more satisfied with the courtesy and expertise of the staff, but the key element that has not been significantly improved at the new passenger terminal is the queuing time. The fact is that the employees are kind, but due to the larger number of check-in counters at the new passenger terminal, it was necessary to

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increase the number of employees, some of whom are unprofessional, so the queuing time did not decrease despite the new and faster technologies for passenger and baggage registration. The increase in security screening ratings, especially in terms of queuing time, was influenced by the acquisition of modern hand baggage security equipment that enables 5-6 times faster passenger flow, and thus less waiting time for passenger screening. Wayfinding has hardly been improved at all. IATA recommends [13] as simple and linear passenger flows as possible with as few level changes in the passenger terminal as possible. All passenger flows at the old passenger terminal took place on the ground floor, while at the new passenger terminal, at least four levels in the departing passenger flow need to be changed: they arrive on the zero level, check-in on the second level, then go up to the third level to security screening, and then they go down to first or zero depending on where their gate is. The new passenger terminal still has only one transfer counter at international and one at domestic arrivals, so it is understandable that the ratings could not increase considering that the total annual number of passengers was continuously increasing (until the emergence of the global COVID-19 pandemic), so the waiting time for passengers at the counter increased, which was especially evident during the summer flight schedule (e.g. during the research time wave in June 2018). Ratings of the business lounge and the comfort of the waiting area indicate an increase in passenger satisfaction, but it is lower compared to other rating categories. There are too few business lounge contents in relation to passenger requirements. The problem of the business lounge stems from the fact that it is available only for international passengers. Therefore, business class passengers arriving in Zagreb from the world's best airports such as Dubai did not have the opportunity to stay in the business lounge if they continued to travel to domestic destinations such as Dubrovnik. This caused great dissatisfaction among such passengers. In general, it can be considered to be a lower class of business lounge. Similarly, when designing the waiting area, neither the trends of modern airports [14, 15] nor the recommendations of IATA ADRM were followed. Today's airports should be an indicator of the local community and its culture. Synergy with the local community can also be achieved through the color, shapes and arrangement of seats in the waiting area. In these areas, it is also desirable to have as much greenery and white materials as possible [12]. Figure 8 shows the waiting area of Franjo Tuđman Airport with standard seats and the modern waiting area of Hobart Airport in Tasmania.

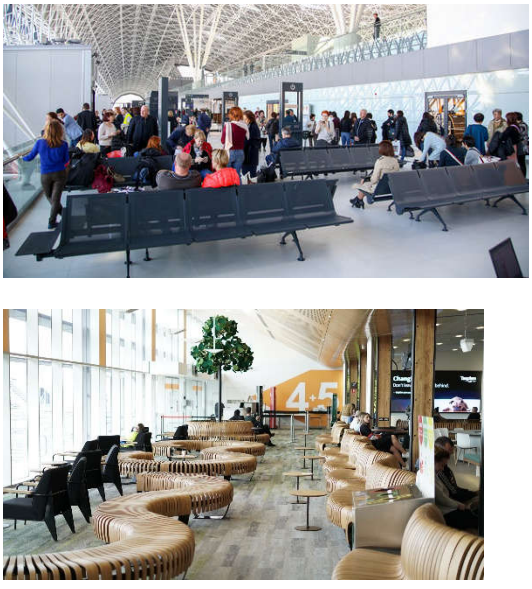

Figure 8. Comparation of waiting areas at Franjo Tuđman and Hobart Airport.

It is very well known that when passengers feel good and relaxed, they tend to do more enjoyable things like eat more, shop more or just read a book while waiting for a flight [14]. This is extremely important because in this way the retail effect shown in Figure 9 is achieved.

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Figure 9. The retail effect [14].

Analyzing the facilities of arriving passengers, it is possible to observe a significant increase in passenger satisfaction with the services of baggage delivery and passport control in the transition period, and then a significant decrease in the level of passenger satisfaction in the winter period immediately after that. Such a phenomenon can be explained as follows: the number of tourists at Franjo Tuđman Airport increased significantly during the summer season, and they experienced a wow effect due to the new passenger terminal, which was filled with passengers. In December, after that, the majority were local travelers who compared the warmth of the old and the coldness of the new half-empty passenger terminal. The new passenger terminal is equipped with modern baggage carousels that increase their capacity, but during the research period there were only two such baggage carousels, which affected the waiting time. Also, some aircraft use parking positions at the old apron which is far from the new passenger terminal, therefore it takes more time to transport baggage from the aircraft to the passenger terminal. Furthermore, Franjo Tuđman Airport has not implemented any biometric technologies at the new passenger terminal to verify the passenger identity at passport control, which could enable a faster passenger flow. Since passport control is performed by employees of the Ministry of the Interior, the number of which cannot be influenced by the airport authorities, it is clear that the number of open counters is often lacking, which increases the waiting time at passport control.

Although the research showed that there is room for improvement in the segment of passenger operations at Franjo Tuđman Airport, it also points to a significantly greater problem of passenger satisfaction with commercial facilities, which is confirmed by lower ratings than ratings of facilities that are part of passenger operations. The fact is that the architects have provided space for commercial facilities in the middle of the passenger terminal, which limits their further expansion. The transport connectivity of Franjo Tuđman Airport at the local and regional level has been improved multiple times, but exclusively by road, which does not follow the trends of modern airports, especially not those on the main traffic routes in air traffic at the global level, where, in the aforementioned context, rail connections dominate [16]. Regarding ground transportation services, passengers at the new passenger terminal are the most satisfied with the proximity of taxis that have direct access to the Kiss & Fly zone for domestic and international departures with the possibility of a short stay. The new passenger terminal is located about two kilometers east of the old one, which is why a new road connection to the eastern part of Zagreb was opened, but this did not affect the increase in passenger satisfaction. Regarding the parking area, no new services have been implemented. There is no garage, no carport - everything remains the same, only the capacity is larger and the service is more expensive.

Passengers' dissatisfaction with bank/ATM/money changers services stems from the fact that bank and post office existed at the old passenger terminal, while the new passenger terminal is equipped only with ATMs and exchange offices.

A crucial problem for departing passengers in terms of commercial facilities is shopping, food and beverages. As already established earlier, in these categories passengers were the most dissatisfied both at the old and at the new passenger terminal of Zagreb Airport. The gastronomy offer consists of only four cafes and restaurants (Spread, Caffe Nero, Needstop and Brewmark Pub) which are centered around Duty Free Shop (Aelia Duty Free – Art of the gift) [17]. In addition to the duty free shop, passengers can shop in one store with clothes, fashion accessories and jewelry, and one with audio equipment and various electronic gadgets. Low ratings of passenger satisfaction in

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these categories result from the overall opinion of the mentioned services, but also the quality of the products or offerings and their variety.

In general, due to passenger terminal design, the possibility of developing a zone of commercial facilities is limited, and this will be a significant problem in the future during the development of the Franjo Tuđman Airport. In other words, the problem of commercial facilities is related to the design of the pier itself, which is not of adequate width and does not leave enough space for the possibility of implementing commercial facilities.

Based on all the presented research results, the question arises: What could Franjo Tuđman Airport have done differently when it modernized the infrastructure in order to significantly improve the experience of its users? The issue of the design of the new passenger terminal of Franjo Tuđman Airport can be viewed from the perspective of four trends driving airport terminal design. According to the design company RS&H, they are: enhanced flexibility that allows for future growth, embracing touchless technology, passenger amenities and reflecting community culture in design [18]. These four trends are shown in Figure 10.

Firstly, it is extremely important to have a strong connection and appreciation of competences between experts in architecture, construction and transport when developing new infrastructure facilities, the value of which often reaches millions. In addition to following contemporary trends in architecture, it is necessary that the newly built infrastructure meets the conditions of the technological processes for which it is intended. At the new passenger terminal, the first noticeable discrepancy is the size of the central processor that houses the check-in counters and the pier with the gates. The fact is that the central processor will not seem half-empty as it is now when the traffic increases to five (phase 2A) and after to (phase 2D) eight million passengers and when 30 new check-in counters are opened (60 in total) [19]. However, at that moment it is completely understandable that the pier width will be to narrow and that in the future new passenger terminal will have lack of space in the pear area.

Figure 10. Four trends driving airport terminal design.

Furthermore, before commissioning the new passenger terminal, over 1,000 different tests were performed and an Operational Readiness and Airport Transfer (ORAT) team was formed. Although Franjo Tuđman Airport has put new infrastructure into use and thereby ensured satisfactory spatial capacities, there is significant room for progress in terms of technology, which would have a direct impact on passenger satisfaction. For example, the technology used in passenger check-in systems is also outdated. Today, airports around the world use biometric systems that significantly speed up the passengers flow and improve the quality of service. The number of self-service passenger registration counters should also be increased given that they also significantly speed up the

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passenger registration process. Biometric technologies should also be applied to the passport control in the outgoing and incoming passenger flow. Recent researches indicate that passengers have an increasing need for contactless and touchless technologies, which was especially pronounced during the COVID-19 global pandemic due to the fear of infection [20].

Various studies analyze how the choice of interior colors affects the customer experience [12, 21, 22]. The authors [21, 22] found that travelers prefer cool colors (blue, green and purple) more than warm colors like yellow or red. The authors [23] state that bright colors encourage consumers to explore the environment, and that these colors took precedence over dark colors. In the passenger area, cold colors may be preferred over warm colors, as these colors calm people who may have higher levels of stress than usual [21, 24]. Franjo Tuđman Airport new passenger terminal appears to be quite black and white. Black color predominates at the check-in counters, flight schedule panels and information panels. All the seats in the waiting area are also black, as are the ventilation systems inside that area. The ceiling of the passenger terminal is dominated by white. Although the entire ceiling was to be made of glass in order to let in as much daylight as possible, a tin ceiling with several glass openings was constructed.

The group of authors study results indicated key satisfiers in the airport context such as cleanliness and pleasant environment to spend time in. On the other hand, security check, confusing signage and poor dining offer are recognized as major dissatisfiers in the airport setting [25]. Poor gastronomic offer is one of the evaluation categories that, including shopping, indicates low passenger satisfaction at Franjo Tuđman Airport. In order to increase passenger satisfaction in the mentioned segments, it is necessary to provide additional space for such facilities. The problem of Franjo Tuđman Airport is that there is not enough space for the expansion of commercial facilities such as shopping, food and beverages, because there are gates with seats in the waiting area in the immediate vicinity. The food and beverage area is located in the middle, it is bordered by offices and passenger corridors, and there is no possibility of expansion, so the service is improvised in the waiting area. Some airports offer to bring food and drinks to those gates that are far away if passengers are afraid of being late for their flight, and this also has a positive effect on passenger consumption and their satisfaction with the service provided [26]. This model can also be applied in the case of a lack of capacity in restaurants at the airport, which will certainly appear with the increase in traffic.

In order to present all the corrective measures that could affect the increase of the passenger experience at Franjo Tuđman Airport as clearly as possible, they will be presented in Table 2 together with the existing situation.

Table 2. Proposal for corrective measures at Franjo Tuđman Airport with the aim of improving the customer experience.

Subject of evaluation	Existing situation	Improvement proposal
Passenger terminal interior	No greenery, dominant colors: black and white, no community culture reflection in design	More greenery, more blue, green and purple colors, Zagreb County culture reflection in design
Ground transportation modes	Shuttle bus, taxi, rent-a-car	Railway
Car parking area	Uncovered car parking area, single level car parking without much greenery	Covered car parking area, multi-level car parking connected directly to the terminal decorated with greenery, online parking reservations
Information service	One counter at departure level	One counter at departure and arrival level
Bank/ATM and money changers services	ATM, currency exchange	Bank, post office
Wayfinding	Light blue letters and signs on a black background	Yellow letters and signs on a black or white letters on dark blue background (illuminated signs), mobile apps, use of Bluetooth, beacons, and

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Waiting time	No information about waiting time at certain checkpoint	GPS technology that communicates directions via the customer's smart phones, operational alerts indicating delays and congestion Technology monitoring waiting times and length of queues, advising customers of waiting time at the queue using Bluetooth, beacons, etc., alerting passengers of checkpoints with the shortest queues, using biometric data
Check-in	30 check-in counters, 1 baggage drop-off counter, 8 self-service check-in kiosks, online check-in	Touchless technologies, off airport check-in, information about the opening time of the check-in counter, self-tagging of baggage, radio-frequency identification (RFID) bag tags
Security screening	Metal detector for passenger screening, 2 baggage belts	Upgrading security equipment from Standard 2 to Standard 3
Passport control	Counters with employees	Self-service passport control (biometric passport control)
Flight information screens	Passenger information panels positioned at passenger eye level	Higher position of information panels at a suitable angle, a large panel with flight information
Business/executive lounge	Availability to international passengers only	Availability to international and domestic passengers, greater variety of products and services
Comfort of the waiting area	Metal seats, seats in rows, no greenery, ventilation system inside the seating area	More comfortable seats, passenger rest seats, seat arrangement that encloses a certain shape, more greenery, no ventilation system inside the seating area
Gates	Gate counters	Automated gates
Shopping	Duty free shop, 2 shops	More shops, more variety of products
Food and beverages	4 restaurants and bars	Gate-delivery service, more restaurants
Kids Playground	No playground (neither outdoor nor indoor)	Kids playground in front of and in the passenger terminal

A whole series of elements for improvement can be noticed from the previous table, which are missing and which, according to passenger perception, classify the new infrastructure as somewhat average in terms of quality.

Finally, it is important to emphasize that customers (passengers) perceive the travel experience as a continuum and judge an airport's performance on the collective yet interdependent performance of all of the airport business partners and stakeholders [2]. Therefore, it is crucial that all stakeholders - airport operators, airlines, terminal operators, service contractors, concessionaires, and governmental agencies, including security, customs, and immigration - participate in the creation of the airport as a customer-centric organization with the aim of improving the customer experience. Figure 11 illustrates a customer-centric airport.

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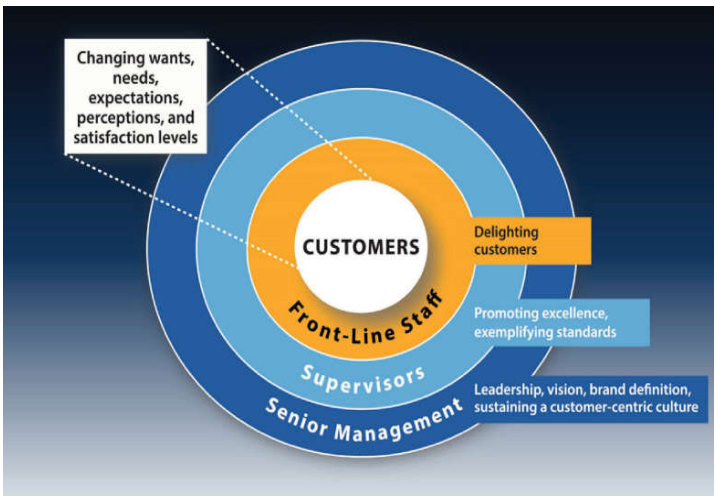

Figure 11. Customer-centric airport

The limitation of the research relates to the following: it should be emphasized that the case study for the purposes of this research was conducted at an airport in the category of up to five million passengers per year. Franjo Tuđman Airport has the status of the primary airport of the Republic of Croatia and the base airport of the national air carrier Croatia Airlines. According to the statistical airport data for 2018, the traffic volume on domestic flights was 15.7%, and on international flights 84.3%. Therefore, at airports with a different character, with higher traffic, a different ratio between full service and low cost carriers, a different level of economic development, there may be a discrepancy with the research results stated here.

This study opens various questions for new research. The key questions related to the justification of the introduction of new airport infrastructure and its impact on the overall customer experience, and therefore on the long-term airport sustainability, are as follows:

- understanding the passenger profiles with the aim of organizing and reorganizing the facilities of the passenger terminal;
- research on the passenger preferences who will be users of the new infrastructure in the segment of passenger operations and commercial facilities;
- the contribution of passenger flow monitoring using smart technological solutions to the passenger experience;
- the impact of providing live information (about the number of passengers in the queue, waiting time and walking time, etc.) on increasing passenger satisfaction;
- analysis of the impact of the customer experience on airport sustainability discussed in the broadest context possible.

5. Conclusions

To summarize, airports are often the centers driving economic development of the local community in which they are located due to the physical size of the airport, and they often have a significant impact on the national economy. Therefore, the infrastructural development of the airport is of great importance and implies the development of infrastructure and technology on the both airport airside and landside and the development of appropriate airport commercial facilities.

Passengers are becoming more experienced, more informed and more demanding in achieving their own satisfaction with the level of quality of the service provided. Therefore, airport management is faced with an increasing challenge and requires a multidisciplinary approach and mutual cooperation of experts from various fields in order to meet the needs of passengers. Such an approach enables the airport to be competitive on the air transport market, increase profits, but also long-term sustainability.

Improved passenger satisfaction is important for two main reasons. First, as aforementioned, it affects the increase of the airport's revenue. Furthermore, customer experience affects customer loyalty.

Based on the conducted research, it can be concluded that despite large investments and infrastructural development of the airport, there may be micro-problems that obstruct the passenger handling processes, and thus affect the decrease in passenger satisfaction with the airport. The research also confirmed that the implementation of new airport infrastructure is not a sufficient prerequisite to increase passenger satisfaction.

Airports need to create a wow effect, but in order to sustain it, the following is necessary: (1) detailed knowledge of its customers and their wants, needs and expectations, (2) enable a strategic customer-oriented response and provide a service delivery strategy, and (3) managing the physical and emotional aspects of the passenger experience so that the difference in customer satisfaction remains positive and sustainable.

This study confirmed that passengers pay special attention to the airport's commercial facilities, even though they have no influence on passengers' main reason for coming to the airport, which is to take a flight. Therefore, this fact confirms that the airport management should specifically deal with this area when designing new infrastructure in order to improve customer experience and airport sustainability.

Author Contributions: Conceptualization, K.B. and I.Š.; methodology, K.B.; validation, K.B, I.Š. and M.B.; formal analysis, K.B., I.Š., M.B. and J.P.; investigation, K.B. and I.Š.; resources, I.Š.; data curation, K.B. and I.Š.; writing—original draft preparation, K.B.; writing—review and editing I.Š., M.B. and J.P.; visualization, K.B. and I.Š.,; supervision, I.Š.; project administration, K.B.; funding acquisition, K.B., I.Š. and M.B. All authors have read and agreed to the published version of the manuscript.

Funding: This research was paid by the University of Zagreb—Faculty of Transport and Traffic Sciences (and is part of the post gradual doctoral study of author Karmela Boc).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Acknowledgments: No additional support or contribution was made in this paper except authors.

Conflicts of Interest: The authors declare no conflict of interest.

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