PROPOSAL OF A BUSINESS MODEL FOR A FLEXIBLE TRANSPORT SERVICE - CASE DE STUDY OF FARO AIRPORT

João Amaral Santos
Department of Civil Engineering, Architecture and Georesources, IST, Technical University of Lisbon
Av. Rovisco Pais, 1049-001 Lisbon, Portugal, j.amaral.s@gmail.com

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ABSTRACT: In order to improve the connection between Faro Airport and the several destinations was created a business model of a flexible transport service (FTS). For this were analyzed the concepts of FTS, Intemodality and Business Model. Was also analyzed the alternative and the passengers' opinions, presented in HERMES's survey, to understand their needs. Following the methodology of Osterwalder and Pigneur were thought the nine blocks of a business model. The business model created contemplates a transport service without fixed routes, without fixed schedules and is a shared transport, presenting similar characteristics to the taxi and the shuttle services, but with lower costs. The integration with air transport occurs at different levels: ticketing level with a hypothesis with one ticket for the two services and the possibility of to buy the ticket during the flight; operational level, where the handling of the passengers' luggage is at the operator charge, allowing a seamless trip and transfer. The communication channels were relevant aspects, allowed under several forms and online platform is the main channel. The partnerships are another important aspect for a great implementation and operation of the new business model. Created the business model, it was modeled the service for one day of operation, to determine the cost structure and analyze their economic viability. The same analyze were made for each destination and theses were clustered in three groups according to its economic sustainable. For each group were suggested distinct strategies in order to keep the destination available to passengers.
Keywords: business model, flexible transport service, intermodality, airport.

1. INTRODUCTION

Nowadays, consumer feedback is a strong tool to improve products, boosted by how modern society is linked, being social networks an example of that.

Faro's airport manager has identified, through the active role of consumers, the lack of acceptable transport services linking the airport to the aviation passengers' final destinations. Subsequent surveys revealed that discontentment was due to the mismatch between the needs of passengers and existing offers, namely its transport costs, waiting times, travel times and terminal conditions.

So the main purpose of this dissertation was the creation of a new business model of a transport service that solves the identified mismatch. The business model is based on the concept of flexible transport service, which allows a service to adapt to the demand at any time, making its components flexible, decreasing the costs for passengers and at the same

time offers a service with the required features. This is the perspective of the author for this dissertation.

Methodology

The methodology of this dissertation is consisted by three groups: key concepts; creation and modeling of business model; and main conclusions. It starts with the key concepts that aggregate:

- Flexible Transport Service (FTS), being the basis of the entire business model it is important to know: its meaning, its origins, its evolution to the present day, and at the same time how it works and how it is implemented.
- Intermodality: being this service complementary to the airplane transport intermodality is a key concept, so it is essential to know how to coordinate two services.
- Business model: it is important to know the origin of the concept and the methodology used.

The next step to create the new business model is divided in two parts: "The Case Study", which includes the geographic and airport operation study, alternative services and the identification of potential passengers' characteristics; and the second part where it is modeled one day of operation of this new service, in order to know their costs, and then forecast the economic viability of each destination.

Finally, the last part includes the main conclusions of this dissertation and the limitations of this study.

2. FLEXIBLE TRANSPORT SERVICES

"Historically, public transport has been regarded as an inflexible transport option, particularly when compared with the most flexible form of motorized transport – the private car." (Brake & Nelson, 2007, p. 264)

Concept

This is the starting point for the emergence of the concept of Flexible Transport Service, making the public transport more flexible and more suited to current needs. This adaptability is provided for the level of flexibility of service elements (dimensions). According to Ambrosino *et al.* (2003, p. 1) there are three different service dimensions, the route, the vehicle and the schedule, being considered a flexible service if at least one of these dimensions vary. In 2006, Nelson, Brake and Mulley added to this definition other three new dimensions: type of operator, payment method and type of passenger (See Figure 1).

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Figure 1 - Variação da flexibilidade ao nível dos componentes. (Brake, Mulley, & Nelson, Good Practice Guide for Demand Responsive Transport Services using Telematics, 2006)

FTS is the aggregation of different types of flexible services created by different possible combinations that the variation of level of flexibility of each dimension permits. These types of services go from the conventional public transport, known for being inflexible, to taxi, the most flexible transport service. Demand Responsive Transport (DRT) and Special Transport Services (STS) are examples of subcategories of FTS. DRT operates only when requested and is a door-to-door service, being dimensions like route and schedule completely flexible; and STS which is restricted to disabled and elderly people, and has certain dimensions adapted, such as vehicles and routes more suitable to their needs.

The classification presented in the final report of INTERMODE: Innovations in Demand Responsive Transport (Enoch, Parkhurst, & Smith, 2004, p. 37) shows the different possible schemes, according to their main function. These schemes are classified in four categories: Interchange DRT, which provides feeder links to conventional public transport; Network DRT, a service integrated in a network that provides additional services, such as feeder conventional public transport, additional capacity and the expansion of existing markets; Destination-specific DRT, developed to serve a particular destination and passengers, such as employment locations; Substitute DRT, which replaces conventional public transport services.

FTS up to today

Late 70's in US and some European countries appeared the first flexible transport services, with distinctive denominations, but with the same aim - social inclusion. Paratransit in US, restricted to disabled people, and Special Transport Services (STS) in UK and Sweden, restricted to disabled and elderly people, appeared to counter the inadequacy of transport infrastructure, especially the buses and the localization of fixed stops, impossible to use for these passengers (Nelson, Wright, Masson, Ambrosino, & Naniopoulos, 2010, p. 243).

In that time the operation of these services was almost archaic, so the costs increases and become obsolete in environments with more passengers. This problem was solved in the early 90's with the emergence of the concept of Intelligent Transportation System, which allows an automatic planning service better and faster, becoming closer to a private transport in terms of flexibility and operating costs in the range of conventional public transport. Resulting from the introduction of telematics technology and European research projects (SAMPO 96/97 and SAMPLUS 98/99) in the early 2000's this service concept spread to rural areas, areas with similar problems as original problem, with a low and dispersed demand, financially unsustainable for conventional public transports.

Until then the main objective was social inclusion over financially sustainability, but in mid-2000's FTS starting open to other markets niche, where profits was the aim. These markets were willing to pay higher values for exclusive services more comfortable and quicker, instead of conventional public transport. The classification by Enoch *et al* (2004, p. 16) classifies that market as Premium service.

Nowadays the big question for FTS is their integration, with other services and especially in urban environment, improving the perception of public transports for usual and potential passengers, with services more suitable for their needs (Brake & Nelson, 2007, p. 271).

FTS around the world

Expansion of the FTS concept was all over the world, existing practically in all continents, with different level of implementation and sophistication and multiple functions. Some examples, such as CallConnect at UK (Grosso, Higgins, Mageean, & Nelson, 2002), Flexlinjen at Sweden and SuperShuttle at US show the different possibilities for flexible transport, in the first case localized in a rural area with a low demand as a substitute to the conventional public transport, second is an exclusive service to elderly people and the last is an intermodal service to connect US airports to city centers. In Portugal there are different schemes of FTS, "Linha Azul" in several Portuguese cities with a tourist view, "Serviço Mobilidade Reduzida Especial" a door-to-door service focus to people with reduced mobility, in Lisbon, and in 2012 started operating a complementary service to a conventional public transport, for night shifts, based on a FTS in Oporto.

Costs

Associated costs for implementing and operating a FTS are divided in three different categories, according to Brake *et. al* (2006, p. 7): administrative costs, capital costs and operating costs.

Administrative costs: energy (e.g. electricity heater); telecommunications; human resources management; advertising, computer maintenance and consumables.

Capital costs: vehicle acquisition; infrastructure rental; software and hardware for operation, on board equipment; office equipment.

Operating costs: vehicle maintenance; vehicle insurances; fuel; wages of operators and drivers; tolls.

The operating costs still can be divided in two other categories, fixed and variable costs. Fixed costs are independent of system's productivity and variable costs are proportional, increasing or decreasing in accordance with system's activity (Zografos & Androutsopoulos, 2005).

Legal framework in Portugal

In Portugal there isn't a specific legal framework for FTS, being this legal framework focus in conventional public transport. Even so there are some possible categories in Portuguese legislation for flexible services, **occasional services (**The Law of Land Transport Systems, Decree-Law 3/2001, and Article 14) and **special transport service regular (**The Law of Land Transport Systems, Decree-Law 3/2001, and Article 1).

3. INTERMODALITY

According to EU Commission "Passenger intermodality is a policy and planning principle that aims to provide a passenger using different modes of transport in a combined trip chain with seamless journey" (2004, p. 3). EU Commission still complements, in White Paper 2011 – Transport, that the use of Information Technologies can make intermodal services more effective and better alternatives to a door-to-door mobility (Comissão Europeia, 2011).

In the specific case of airports, Vespermann and Wald argue that the main reasons for supporting intermodal services are: to increase of airline capacity of the airport; to provide passengers proper solutions to make the remaining leg of your trip; and the reduction of traffic and consequently the congestion created by private transport (Verspermann & Wald, 2011, p. 192).

Being the new business model based on a bus service to complement air transport service, the possibility of being created as an intermodal service can have advantages, making the connection between airport and final destination a seamless door-to-door trip for passengers. For integrating services, Müller *et al.* (2004, p. 26) identifies four main categories: networks and interchanges, information, ticketing/fares and booking/payment and baggage handling.

The development of FTS with an intermodality view was considered in SAMPLUS project with the need of these services be integrated with conventional public buses and refers three relevant aspects to a full integration (University of Newclastle upon Tyne, 1999). Nowadays there are integrated intermodal services, being one of the parties a FTS. Most are connecting transport services to other modes of mass transport and in the case of Airport Taxi, finnish company that operates in Helsinki Airport, there is a discount if passenger have a membership card from FinnAir an airline, promoting an intermodal trip.

4. BUSINESS MODELS

The use of the term Business Model appears associated with the dot-com firms and its exponential growth in late 90's, but nowadays is a transversal matter to any organization, according to Osterwalder *et al.* (2005).There are many definitions for business model, but in all there is a common point: business model is created to represent, to describe or to schematize a certain service/product in order to create value and to be purchased by customers.

Maggreta affirms that the great strength of business model as a planning tool is its holistic perspective and how all the elements working together, almost as a scientific method – starting with a hypothesis which is tested (Magretta, 2002).

Osterwalder and PigneurI (2010) created a simple and systematic methodology to think a business model. This methodology aggregates nine blocks: value proposition, client segment, channels, customer relationship, key resources, key activities, key partners, revenue and costs.

5. CASE STUDY

The proposed business model is located in Algarve, south region of Portugal, and connects the Faro Airport to different localizations in that region. It is the main airport in south Portugal and southeast of Spain, and the third at national level, in terms of passengers. As region of sun and beach tourism, the months of summer, between May and October, are the most crowded, with a ratio of 3.3 times over winter months.

Passengers

Most passengers of Faro Airport are from United Kingdom, values above 50%, followed by Germany, Ireland and Netherlands, being Portugal in fifth place (ANA Aeroportos de Portugal, 2010). The origin countries being in northern Europe may show that the main trip motivation is leisure and the preferential language of communication between the new service and passengers most probably will have to be the English. The passenger profile is an important key to create an appropriate business model, and the HERMES survey (Macário, et al., 2011), conducted between 3 and 11 September 2011, question about the trip, the current offer of transport services and about new possible features for a new transport service.

About the trip itself the reason given by 85% of interviewees to travel to Algarve is leisure, 71% of which travel in family, 18% alone and 11% with friends. The Internet is the preferred tool for organizing the trip, and in 66% of cases are the passengers themselves who organizes it (Macário, et al., 2011).

The current situation of transport offer in Faro Airport is considered by 53% as being good or very good and 46% of surveyed are unsatisfied or very unsatisfied. These 46% may be due to low levels of satisfaction of certain parameters as the waiting time, the transportation cost or the travel time, with about 40% of passengers unsatisfied or very unsatisfied, as shown by the survey (Macário, et al., 2011).

New features as ticketing integration are received with satisfaction by 82% of the interviewees (Good idea, very good idea or excellent idea), as well as the acquisition of transfer ticket during the flight or at the airport. Other question was about the inconvenience of sharing a vehicle, being accepted by the most answers (64%) (Macário, et al., 2011).

Data from ANA, manager of Faro Airport, shows that the seven destinations for most of the passengers, about 80% are: Albufeira, Portimão, Vilamoura, Tavira, Lagos, Faro and Almancil (descending order). Figure 2 locates these destinations.

Figure 2 - Localization of main destinations of airport passengers.

Agents

According to Osterwalder and Pigneur (2010) to identify local agents, possible future partners, is an important step in a creation of a business model, to reduce their risks. In this particular case were identified seven agents: managing body of Faro Airport, airlines, municipalities, hotel units, transport service operators, travel agencies and local entities.

In order to improve the airport connections the managing body of airport is an important agent of cooperation. May supporting in financial or physical level and with his influential power, as a link between agents at the airport (airlines), may sponsor an integration of services. At local level, the municipalities may have a similar role as drivers of integrating services, especially with hotel units, or on the other hand with a direct involvement. Travel

agencies with your integrated functions could be good partners to spread the concept and to integrate services.

Transport service operators are, in first instance, competitors of the new business model, being important to know your characteristics and to identify your strength and weakness. This competition situation doesn't invalidate the possibility of cooperation with these agents, especially with agents with distinct scales, allowing a better offer from both.

Finally, local entities can function as points of information and commerce, positioning the service closer to the customer.

The Current Offer

From Faro Airport to their destination, the passengers have five options: conventional bus, shuttle, taxi, rent-a-car or private transport.

The business model of the conventional bus is based on a shared transport service with fixed routes and fixed stops, as well as schedule and destinations. Communications with customers is established through its own website, phone and local spots.

Shuttle makes a door-to-door service, without intermediate stops, to a set of possible destinations. It is also flexible in your schedule, varying with demand at the time. Through your website it is possible to book a service. This model business is targeted to foreign people and a clear communication in every moment of the service is a key feature.

Taxi is the most exclusive service at the airport, a door-to-door service with total flexibility of routes, schedule, stops and destinations.

	Strengths	Weakness
Conventional Bus	• Low prices; • Possible of acquired at moment; • High capacity for people and your luggage; • Price per passenger; • Website with relevant information available in English.	• Long waiting time; • Long trip time; • At least one transhipment; • Only ticket acquisition in person.
Shuttle	• Website with many features in several languages; • Ability and ease of booking online; • Flexibility of vehicle capacity; • Without waiting time; • Door-to-door service; • English fluency by shuttle drivers; • Exclusivity.	• Impossibilidade de aquisição no momento de utilização; • Maximum capacity - 12 seats; • in many cases charge per vehicle instead per passenger; • Many companies with different schemes, creating a lack of consistency of the service.
Taxi	• Door-to-door service; • Exclusivity; • Possibility to book or buy it at the moment of service; • Inexistence of waiting times; • Easy location in the airport terminal.	• Inexistence of an online platform with information and booking features; • Low capacity for passengers (4) and their luggage; • Lack of fluency in English by drivers.

Figure 3 - Strength and Weakness of alternatives.

Furthermore, at the airport is possible to rent a car, an option targeted for long periods of time, instead of just to make the connection to the final destination. Private transport is

commonly used by residents, family or friends, and rarely by tourists. These two options being targeted to long time periods won't be considered for terms of comparison with the new business model.

New Proposal

The new business model is based on a flexible transport service to connect Faro Airport and destinations in Algarve region. Below will be presented the nine blocks of this business model, according to the methodology of Osterwalder and Pigneur (2010) (See Figure 3).

Value proposition (VP): Transport service to connect Faro Airport to destinations of the passengers. Main feature of this service is your flexibility, allowed by flexible routes, door-to-door services and non-fixed schedule and their operating vary with demand. Other feature is your integration/articulation with air transport allowing a seamless trip. Two features to make a quality service. The service's flexibility will let to decrease waiting times, problem identified in HERMES survey, in comparison with conventional bus, establishing 15 minutes as maximum waiting time. In association with shared vehicles the service will have lower prices than shuttle and taxi services. The integration with air transport is possible at ticketing level and luggage handling. In ticketing, a complete integration of the two services with only one ticket is an idea accepted by 78% of the interviewees of HERMES survey. Another possibility is the sale of new service's tickets during the flight, only rejected by 24% of interviewees. Regarding the operational integration, luggage handling, will allow passengers have a seamless transshipment to road transport.

Customers segment (CS): According to HERMES survey the most of passengers travel in group, family or friends, being the main motive leisure, and want to reach the final destination in an efficient and comfortable way and for competitive prices. In most cases the passengers are autonomous to organize the trip (research and acquisition).

Channels (CH): There are direct and indirect channels of communication and acquisition. In direct channels, the main channel is the internet, more specifically your own website, being possible, through this, to know some information, to book and to acquire the services. There are other channels, such as via phone or information desks.

Customer relationship (CR): In online platform all actions are taken by the client, in a self-service way. In the other hand it is possible a personal assistance, via phone or in the information desks. Both types of relationship established are for get information or to acquire the service. Currently with the strength of social networks and the reviews of certain service can be established a relation of co-creation.

Key resources (KR): Being a transport service the fleet is an important resource of the business model, having vehicles with 15 and 24 seats and drivers fluent in English. The infrastructure is another vital resource, such as communication infrastructure for a full operation of the service, and website infrastructure for being the main channel of communication between the service and the customers.

Key activities (KA): The main activity is the transportation of passengers between Faro Airport and their final destination, within Algarve region. Is a collective transport in a door-to-door service, suited to the demand.

Key partnership (KP): Faro Airport manager is a crucial partnership by its influence on the agents at the airport and your manager role in an intermodal terminal, sponsoring integrated services, especially with airlines. Municipalities also have an important role as an intermediate

entity with other services in their region, even being possible the direct intervention in this business model, if the gains outweigh the losses. The hotel units being the final destination of the most of the airport passengers are an important partner of this business model. These wishing have good connections to the airport, which can be performed by this service. With other agents such as local shops and travel agencies can be established partnerships.

Revenues ($R): The main revenue will come from the acquisition of the service by customers, the sale of ticket. Other source is the advertising referred by Osterwalder and Pigneur (2010), and strengthened by Veloutsou e O'Donnell (2005).

Costs ($C): There are three categories of costs: administrative, capital and operational. Administrative costs include energy, telecommunication, administrative human resources and advertising costs. About capital costs these contemplates vehicle acquisition, lease/acquisition infrastructure, operational software and hardware. Then operational costs refer to vehicle maintenance, vehicle insurances, fuel, wages of operators and drivers and tolls.

6. COST STRUCTURE ANALYSIS

Sizing of main resources

In order to understand the viability of this business model it is necessary to know your cost structure discriminated. A methodology was applied to determine the major costs associated with the service operation, relating to vehicles and drivers.

The first step was to estimate the demand. By the absence of a perspective which the modal share of the new service, the option was to scroll the entire spectrum of modal shift between alternative modes of transport (competitors) - private shuttle service, public bus service and taxi service - and the FTS business model proposed. Then ten different scenarios were created that represent the percentage of modal shift from 10% up to 100%. Flights were considered with an occupation rate of 95%, with a maximum capacity of 150 seats (peak season of Algarve region).

The following phase is referent to the sizing the main resources, vehicles and drivers. This process is a semi-heuristic methodology, where the routes determination will be through optimized processes, based on an algorithm, and the determining the number of vehicles and drivers as a heuristic process. The problem of determination routes is a typical Vehicle Routing Problem, because there is only one origin (airport), multiple destinations, each with a certain demand (number of passengers to this destination), and the distribution is performed by several vehicles with known capacity. The optimized algorithm used was adapted from an example of the Xpress-MP - "Heating oil delivery" - with the same constraints: one origin, multiple destinations with known demand, and several vehicles. The aim was to determine delivery routes for all customers in a way that the number of kilometers to be minimized.

After the determination of the routes, was followed by the sizing of vehicle fleet, heuristic phase, being the vehicles allocated to a trip, through a first-in first-out process:

- Vehicle number 1 is allocated to the first trip;
- The vehicle number 1 will make the respective route, which it ends at the airport, at a certain time of day;
- When finished it will be placed in a "deposit" and will be available again for a new trip;

- If the arrival time is earlier than the departure time of the next trip, the vehicle 1 is again allocated. Otherwise, it will be a new vehicle, vehicle 2, allocated to this trip;
- And so on throughout the day. The allocated vehicle to a trip is the lowest-numbered available in the "deposit".

To determine the number of drivers the methodology was a simple distribution of drivers for each vehicle. Considering an 8h work day, the total number of drivers was a quotient between the work hours of the vehicles and the work hours of the drivers.

Cost Structure

From the previous process it was possible to know the number of vehicles, the number of trips through the day, the number of work hours, the number of drivers and total distance traveled for each route, important data for discriminate the business model costs.

As already mentioned, these costs are categorized in three ways, administrative, capital and operation costs, but for obtaining better results was aggregated in two categories: fixed and variable costs. These costs are presented as daily costs (operation day - September 9th of 2012) and for comparison terms associated to each destinations, being proportional to their average travel times.

In fixed costs were considered administrative costs (*e.g.* other human resources and communication), capital costs (*e.g.* vehicle acquisition and infrastructure renting) and the operational costs (*e.g.* vehicle maintenance, annual insurance, annual fees, fuel consumption and driver's wages). The values for each cost were based on the values from HERMES project (Macário, et al., 2011). Variable costs are composed by two parcels, refers to operation costs: fuel and toll cots. Chart 1 represents the distribution of costs in the different scenarios.

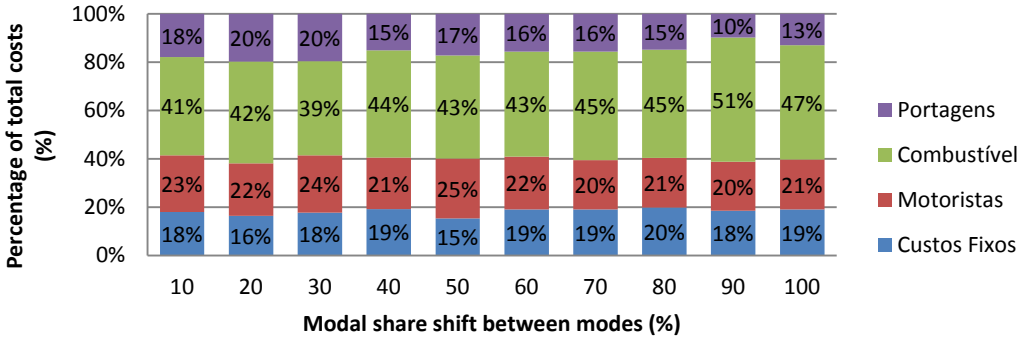

Figure 4 - Distribution of costs in different scenarios. Source: Own

In an individual analysis, for each destination, it is possible to aggregate the destinations in three clusters, with similar behavior. The first group congregates Albufeira, Faro, Portimão and Tavira, destinations that show from beginning costs per passenger lower than the prices of competitors' alternatives (shuttle and taxi services) and in some cases even lower than conventional bus.

In the second cluster, the destinations are Lagos and Vilamoura, characterized by lower costs than alternatives prices from a modal shift of 40% and 50%. These destinations have two options while present negative margins, one is if the destinations from first group have enough positive margins capable of making the business model sustainable as a whole. In case of this

isn't possible the option will be to find other ways of sustain these destinations, having the partnerships, as municipalities or hotel units, a great importance. If for their strategy the existence of this service to these destinations is vital, they may to sponsor the new business model.

Last, the third group incorporates Almancil that only in three situations presents lower costs than alternative's prices. This occurs because of their high average travel times in some routes, and consequently high associate costs. In this case the option could be to partner to other competitors, as an outsourcing service, especially with taxi services, by your complementarities.

7. CONCLUSION

Managing body of Faro Airport identifies, through a bad feedback by their passengers, a lack of offer to connect airport to their final destinations. In that way this dissertation develops a new business model of a flexible transport service (FTS) capable of meet the needs required.

To create this business model were analyzed: first, what FTS's capacities that allow a perfect operation in this specific case, the importance of intermodality, since this service is complementary to air transport; second were analyzed the alternatives business models already implemented, specifically of conventional bus, shuttle and taxi services; and third it was based on a passenger survey, developed under the HERMES project.

So the business model created, represented in Figure 3, is based on a shared FTS, which have similar characteristics with shuttle and taxi services, such as door-to-door service and schedule flexible, allowing at the same time good levels of performance and comfort with lower prices than these alternatives, features required by **customers (C)**. Beyond this features, the **value proposition (VP)** contemplates service integration with air transport, accepted by customers, at ticket level with only one ticket, and at operational level with an automatic luggage transfer, performed by proper operators, in order of the passengers have a trip and transfer without breaks.

Other relevant aspect, for a successful implementation, is the communication and the acquisition **channels (CH)**. Being the internet the main interface used by customers, a website with information and booking features is a **key resource (KR)**, in addition the possibility of phone and information desk for a more personalized **relationship (CR)**. As key resource are also considered the fleet of vehicles and the fluency in English of drivers and operators.

Relatively to possible **partnerships (KP)**, managing body of Faro Airport and municipalities may have aggregated functions and even direct intervention. Airlines are key partners in the integration of the two services, being one of the parties. Local shops and travel agencies may also be partners.

The last two blocks, **revenues ($R)** and **costs ($C)** are composed by ticketing and advertising sources, in the first block, and by administrative, capital and operational costs, in the second.

After business model's blocks identification the service has been modeled for one operating day, September 9th of 2012, to determine and to discriminate the cost structure. For that modeling was followed a semi-heuristic optimization model to determine the size of fleet vehicles and drivers. In the first phase were resolve a typical vehicle routing problem, where the optimized routes were identified, and in the second moment the allocation of vehicles to these routes, by heuristic processes.

With the determination of all costs it was possible to analyze individually each destination, regarding its financial viability, and group them according their situation. So in the first group were Albufeira, Faro, Portimão e Tavira, destinations with lower costs than the alternatives prices, since the initial scenarios of modal share shift. The second cluster was composed by Vilamoura and Lagos, destinations individual financially sustainable from a modal share shift of around 50%. For this group the partnerships and a holistic view may be the solution to keep these destinations available for passengers. Last, Almancil only presents lower costs than alternatives prices in three situations (60%, 90% and 100% of modal share shift). The solution for Almancil may be outsourcing other services or cooperation with taxi service, the most complementary service.

Study limitations

The main limitations of this study refers to the optimization model, by the non-inclusions of constraints, maximum number of stops and maximum trip time, within the source code of Xpress-MP software and so is not guaranteed that the routes are the optimal routes.

Another limitation is that the analysis of the cost structure is for one day of operation, and if the time spectrum was larger conclusions about the use of resources could be better supported and obtain other results.

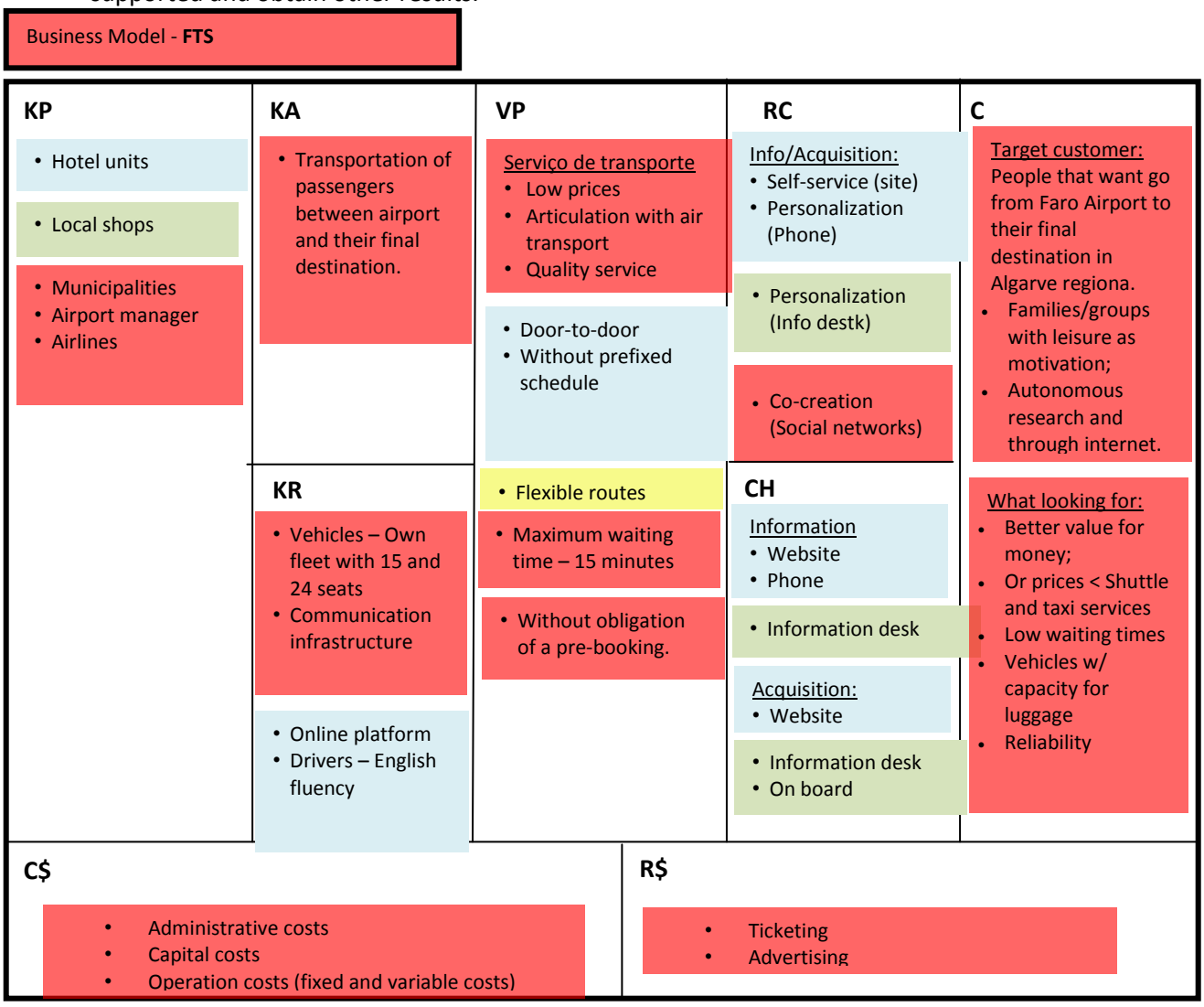

Figure 5 – Proposed business model for flexible transport service. Source: Own

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