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MSc Thesis

A new trend in air travel?

Exploratory Research into self-help hubbing and its consequences

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Faculty of Civil Engineering and Geosciences

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Exploratory Research into self-help hubbing and its consequences

by

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Summary

Self-help hubbing is the process of transferring between airlines that do not offer a transfer service. In theory, self-help hubbing can take place at any airport between any airline but in practice it often includes at least one low-cost carrier. Self-help hubbing is used by passengers that are searching for lower fares or routes that lack a conventional transfer connection. Passengers book at least two separate tickets and organize the transfer themselves. The decision includes the trade-off between costs, risks and the level of service. Literature seems inconclusive about the airport types that have the most potential and whether self-help hubbing has potential at all. In practice however, airports and sales channels already started delivering supporting services to improve self-help hubbing. This thesis aims at providing more insight into self-help hubbing. In particular, it aims at clarifying the differences compared to conventional transfer, estimating its potential and describing the implications for the aviation industry.

A literature research was conducted to point out why self-help hubbing is something 'new' in aviation and how it differs from the conventional way of transfer. While common practice in public transport, self-help hubbing in aviation cannot be compared to self-help hubbing in public transport. Travel distances are significantly longer, frequencies are lower and prices are higher. Therefore, the risk associated with a missed connection in aviation is higher in both monetary terms and schedule delay. The comparison of self-help hubbing and the conventional transfer revealed three main differences. The first difference is the booking process. Self-help hubbing alternatives can only be found via a limited number of meta-search engines and require multiple transactions while conventional transfers are bookable as single ticket via any sales channel. The second difference is the airport terminal process that includes several extra processes and more queuing which is time consuming compared to conventional transfers (Figure 1).

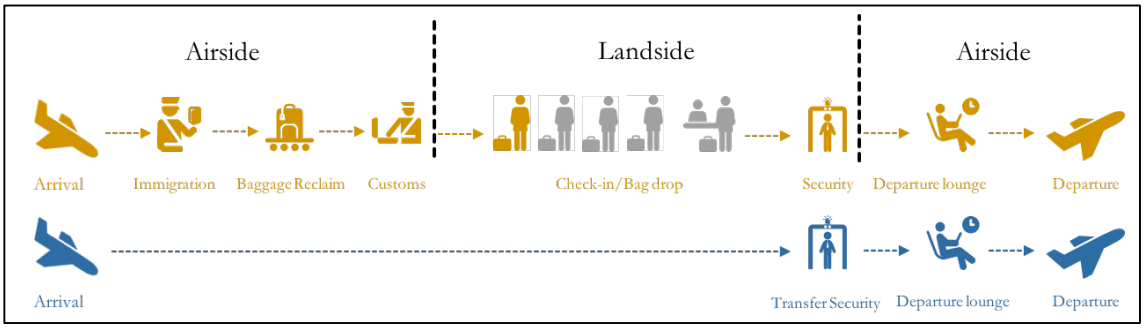

Figure 1 – The airport process of conventional transfer versus self-help hubbing. The yellow path indicates the airport processes for self-help hubbing passengers.

The third difference is in the details. Purchasing separate tickets in order to transfer between non-partnering airlines or airlines that do not facilitate transfer results in a shift in responsibilities. This means that the responsibility for transferring baggage between flights and making the connection in time is for the passenger. The main differences also reveal the ways in which the passenger can be supported in self-help hubbing. Support can be offered by providing a simple booking experience, improving the airport process for example by dedicated baggage drop-off desks and security lanes, and providing an insurance for missed connections.

Qualitative data is gathered by conducting interviews with industry experts, consultants and researchers, a seminar about self-help hubbing and CAPA, an aviation industry analytics provider. The analysis of CAPA reports and news suggests that self-help hubbing started to become interesting to industry experts between

2011 and 2012. However, recent articles are announcing more significant content like actual data, airports that express their interest, Ryanair that announces transfer trials and the first actual low-cost alliance in Asia in 2016. Its potential seems to be recognized by the industry. Content analysis of the interviews and seminar data, based on a coding scheme, revealed that airports require a mixture of airline business models and a network mixture of short-haul and long-haul routes. The visibility of self-help hubbing alternatives increased due to innovative sales channels which is the main reason that more travellers are considering them. Self-help hubbing itineraries must work in both ways and will most likely attract the individual, price sensitive, savvy and experienced traveller without any airline preference. In theory, self-help hubbing can take place at any airport but in practice, secondary airports have the highest potential. The European network is already properly served and most savings can be found on long-haul routes, therefore the long-haul routes have the highest potential to attract self-help hubbing passengers.

Quantitative data analysis revealed that Barcelona El-Prat, Amsterdam Airport Schiphol and Paris Charles de Gaulle are the European airports that offer the highest low-cost carrier or full-service carrier frequency. These airports seem to have the highest potential for self-help hubbing between full-service and low-cost carriers. Airports with dominant low-cost carrier presence such as London Stansted, London Luton and Manchester are also suggested to have a high potential for self-help hubbing between low-cost carriers. Network analysis was conducted by an adapted version of the NetCost model. This model estimated route choice probabilities based on flight time, transfer time, ticket fare and connection type; conventional, self-help hubbing or supported self-help hubbing. The model concluded the exact opposite of the qualitative conclusion regarding the route potential. The short-haul segment has significantly more potential than the long-haul market. Self-help hubbing on the short-haul routes can result in more significant savings and might even result in more efficient flight schedules.

Self-help hubbing is or will become the new trend in air travel. It brings the passenger closer to the theoretical optimal flight in terms of time and costs while beneficial for the main stakeholders. Its implications are expected to be small. Self-help hubbing requires no major investments, policy changes nor will it replace conventional connections. It might even result in more convenient flight schedules or efficient routes which is more environmentally friendly. For airports and airlines, it can be beneficial since it brings additional revenues and ancillary revenues. For sales channels, self-help hubbing might result in extra revenues by double transaction fees or for example an insurance product. On the other hand, primary airports with a home carrier might not be interested in cannibalizing existing transfer flows and disturbing existing terminal operations by a self-help hubbing product that increases stress on their baggage handling system. Also airlines, especially full-service carriers, might not be interested in the low-yield self-help hubbing passenger. Unsupported self-help hubbing however remains the decision of the passenger.

The results of this thesis regarding the route type with the highest potential for self-help hubbing are inconclusive. Each respondent has a certain connection with self-help hubbing which might bias the data in a pro self-help hubbing way, while the adapted model was not based on empirical data. Further research is proposed into the actual benefits of self-help hubbing. Using large scale flight data and by calibrating the model with empirical data, more certainty is achieved regarding the route type with the highest potential. Recent developments show that airlines take action to start providing a paid intralining transfer service. Further research into the willingness to pay for these services, their effect on the competitive landscape and the sharing of risks is proposed since this affects the potential of self-help hubbing in the future.

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Appendices

1 Introduction

Transfer in aviation is often solely associated with alliances and hub-and-spoke networks. It is however a misconception that individual low-cost carriers, operating a point-to-point network do not connect. This thesis is about a new format of transfer called *self-help hubbing*. Self-help hubbing allows passengers to transfer between any airline, at any airport. Self-help hubbing is a term, used when the passenger travels from airport A to airport C via airport B by multiple separate tickets.

Self-help hubbing should not be considered as an additional service on top of conventional transfer. Compared to conventional transfer, the level of service actually goes down but the number of travel options go up. Self-help hubbing enables the passenger to get closer to the optimal flight in terms of costs and travel time. By self-help hubbing, passengers might benefit from a lower fare and a more convenient flight schedule or fly on routes that are only served via intermediate services and not via partnering airlines or alliances. The major drawback of self-help hubbing is the shift in responsibilities. In case of a delay and a missed connection, the passenger is financially responsible. Passengers also have to transfer their own baggage at the transfer airport while for a conventional transfer, baggage is checked through to the final destination and automatically transferred.

This thesis is about self-help hubbing, its potential and consequences for the aviation industry. The topic is rather new and unfamiliar to many and therefore this thesis starts with the rationale of self-help hubbing (1.1). Self-help hubbing is hard to research because it is not measured. This might be one of the reason that the current state of literature is fairly limited while in practice several developments are already taking place (1.2). The problem statement and its relevance is posed in section 1.3. The research objectives and questions to solve this problem are defined in section 1.4 and 1.5. The overall thesis outline is depicted in section 1.6.

1.1 The rationale of self-help hubbing

To understand the rationale and concept of self-help hubbing, the two main network types in aviation need to be introduced: the hub-and-spoke network and point-to-point network. The hub-and-spoke network emerged after the European aviation deregulation in 1997, when airlines started to reconfigure their networks because bilateral air-service agreements were no longer required. Airlines were free to compete on ticket price, frequency, networks and service levels within Europe. The existing, often national, carriers reconfigured their networks into hub-and-spoke networks to consolidate passengers from several origins at the hub-airport to generate sufficient demand to fill long-haul flights to transatlantic destinations, Africa and Asia. Besides the development of the hub-and-spoke system, low-cost carriers entered the market with a point-to-point network. These low-cost carriers used a different strategy than the hub-and-spoke carriers and did not focus on long-haul, high-yield routes and hub-and-spoke networks but concentrated on high-volume routes, using secondary airports and the offering of low fare tickets with no frills (Burghouwt, 2007).

No airline is likely to develop a global network on its own. The option to travel from anywhere to everywhere came closer when full-service airlines started cooperating with each other by combining their networks (Goedeking, 2010; CAPA, 2015). The network of for example KLM, a full-service carrier, is centralized at Amsterdam Airport Schiphol and the network of its partner Delta is centralized at Atlanta International Airport (Figure 2 left). The cooperation between KLM and Delta enabled passengers to travel on both networks with a transfer at one or two of the hub-airports on one single ticket.

Figure 2 - Hub and Spoke versus point-to-point network. Left: KLM and its partners. Right: EasyJet Source: Openflights.org

Low-cost carriers operate a point-to-point network. Due to low fares, they fill their flights by attracting passengers from full-service carriers and travelers that could not have flown otherwise (de Wit & Zuidberg, 2012). Their markets proved to be large which enabled low cost-carriers to develop extensive point-to-point networks (Figure 2 right). Transfer however brings complexity in flight planning and responsibilities for baggage transfer and missed flights. Therefore transfer is not common amongst low-cost carriers.

Some passengers started to organize self-help hubbing in search of lower fares than the full-service carriers were offering or in search of itineraries that were only served via intermediate services. This means that the passengers book at least two separate tickets and transfers between flights of any airline at any airport. The choice to use self-help hubbing is a trade-off between costs and risks or hassle. When the arriving flight is delayed, the risk of a missed connection (e.g. a new ticket, a hotel or food) is the passenger's responsibility. Besides this risk, baggage transfer is also the passenger's responsibility which causes the airport process to take longer.

To illustrate the rationale of self-help hubbing, a trip from Cork (A) to Budapest (C) is used as example. Meta-search engines like Skyscanner, Dohop, Momondo or Kayak reveal that no direct flights are provided. There are however numerous of connecting alternatives; both conventional and self-help hubbing. Excluding addition baggage fares, transaction costs, airline preference or desired departure or arrival times, the example results in the following choice experiment[1], visualized in (Figure 3):

- The fastest option via a hub-airport costs €380 and takes 4,67 hours
- The cheapest option via a hub-airport costs €200 and takes 7,17 hours
- The self-help hubbing alternative via a non hub-airport (B) costs €100 and takes 7,75 hours.

[1] Travel time and ticket prices are obtained from Dohop.com on April 20th, 2016 for a flight on July 7th, 2016.

The self-help hubbing trade-off is as followes: Is the passenger willing to pay €280 extra for 3,08 hours of travel time reduction and the additional transfer service?

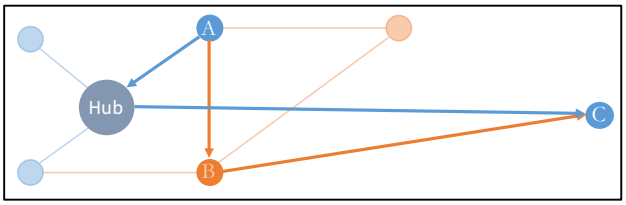

Figure 3 – Self-help hubbing example. Hub-and-spoke network in blue and point-to-point(low-cost) network in orange.

In Europe, the use of self-help hubbing tends to increase. A survey in 2005 at two Irish airports revealed that over 17% of Ryanair's passengers were transferring to other carriers via London Stansted, its home base (O'Connell & Williams, 2005). In 2015, estimations for London Stansted even go up to 40% which corresponds to about 4,5 million passengers already at one airport (CAPA, 2015).

1.2 Self-help hubbing in literature and practice

Self-help hubbing is already taking place but only little is known about it. This sections presents the current state of literature and the actual developments to identify the knowledge gaps.

1.2.1 Literature

Literature about self-help hubbing reveals that self-help hubbing is attractive for the low-cost carrier passenger (Burghouwt, 2007). Low-cost carrier passengers are characterized by a low willingness to pay for air travel and a low value of travel time (Malighetti, Paleari, & Redondi, 2008). This category is relatively young and travels mostly for leisure purposes (O'Connell & Williams, 2005). While being consistent for the passenger type, though only briefly described, and the importance of the low-cost carrier, literature also revealed two inconclusive topics:

1) The type of airport that has potential for self-help hubbing, varying from smaller low-cost airports, to low-cost carrier bases up to conventional hub-airports.
2) The potential of self-help hubbing.

The first topic relates to the type of airport that has potential for self-help hubbing. Franke (2004) mentions the main bases of low-cost carriers in general. He describes the US low-cost carrier Southwest that allows customers to make random connections at its main hubs. Malighetti, Paleari & Redondi (2008) seem to refer to any type of airport. Burghouwt (2007) seems to focus on conventional hub-airports with both the presence of a low-cost carrier and a full-service carrier that operates a hub-and-spoke network. Others refer to smaller low-cost airports that might use self-help hubbing as an opportunity to attract more passengers (Jimenez, Claro, & Pinho de Sousa, 2014). In conclusion, literature tends to be inconclusive about the type of airport that has potential varying from the smaller low-cost airport and larger low-cost carrier base up to the conventional hub-airport.

The second topic relates to the potential of self-help hubbing itself. Some argue that airports compete for transfer traffic and that self-help hubbing can be a method to compete for medium haul transfer passengers (Jimenez, Claro, & Pinho de Sousa, 2014). Airports are also claimed to be no longer

exclusively infrastructure providers but should focus on route development, self-help hubbing and inter-carrier connections (Fageda, Suau-Sanchez, & Mason, 2015). Also empirical evidence has been collected for the use of self-help hubbing and indicates that passengers are willing to accept the risks of a missed connection (O'Connell & Williams, 2005). Others are skeptical about self-help hubbing and point out that low-cost carriers are almost unusable for connecting flights due to their single fare pricing and lower frequencies (Dennis, 2005) or the lack of total connectivity (Graham, 2009). Therefore, literature being positive as well as skeptical about the potential of self-help hubbing, seems inconclusive.

1.2.2 Practice

Recent developments go beyond the before mentioned inconclusive literature findings. Recent developments show that airlines, airport and travel agents are taking action to facilitate the passenger in self-help hubbing.

Some airports started providing a self-help hubbing product An example is London Gatwick with the GatwickConnects service[2] to facilitate self-help hubbing passengers. They provide the option to search for connecting flight via their airport and offer services to cover the risk and improve the transfer process. Besides these so-called airport-led transfer products at for example London Gatwick, some low-cost carriers take action as well. Low-cost carrier Vueling started offering transfer flights at Barcelona El-Prat since 2010 (Airlinetrends.com, 2010). In 2012, Vueling started a partnership with two full-service carriers to combine networks (Vueling, 2012) and in 2014 a second transfer airport was announced (Bloomberg, 2014). A transfer between Vueling flights or its partners is therefore equal to a conventional transfer and can no longer be considered as self-help hubbing. In April 2016, Ryanair mentioned partnering agreement with Norwegian to feed long haul[3] routes (Irish Independent, 2016a) and a transfer trial between Ryanair flights (Irish Independent, 2016b). Also travel agents take action. Several meta-search engines like Skyscanner, Dohop, Momondo and Kayak display the self-help hubbing travel options and online travel agent Kiwi provides a guarantee for self-help hubbing options by taking care of the risk[4]. These developments seem to suggest that airports and travel agents facilitate self-help hubbing to attract passengers, while some low-cost carriers are starting to facilitate transfer and improve the offered services.

1.3 Problem statement and relevance

Literature seems inconclusive about the airports that have potential for self-help hubbing and whether self-help hubbing has potential at all. Several stakeholders however are already taking several actions to facilitate the self-help hubbing passenger. Airports and travel agents try to improve the self-help hubbing process while some airlines consider to start offering transfer. This suggest a knowledge gap about the extent to which the self-help hubbing trend may develop, what its implications are and how it can be facilitated best. This thesis aims to contribute in filling these knowledge gaps.

[2] http://www.gatwickairport.com/at-the-airport/flight-connections/gatwick-connects/

[3] Short, medium, long and ultra long haul flights take respectively less than 3, 3 to 6, 6 to 12 and over 12 hours of flight time (Wikipedia, 2016a).

[4] https://kiwi.com/nl/content/guarantee

This thesis has an academic and social relevance. This thesis contributes to the current state of literature about self-help hubbing and its implications. Besides this scientific relevance there is also a societal relevance. When air travel becomes cheaper, more people are able to travel, which increases the desire for an air transport network from anywhere to everywhere. Self-help hubbing enable travelers to travel cheaper or on new routes. Insight in self-help hubbing is relevant for the the aviation industry because for example, airlines should understand what is happening to act accordingly and benefit from the developments. Some low-cost carriers are already taking action other airlines have to decide whether they want to increase for example their loadfactors, passenger satisfaction and loyalty by offering transfer or whether self-help hubbing is a threat instead of an opportunity. Airports might have a position in the air transport network that is ideal for self-help hubbing and might want to consider to facilitate these passengers in this process. For governments this thesis provides insights into the current state of self-help hubbing and the consequences of the developments which can provide guidance in policy to improve connectivity.

1.4 Research objectives

This thesis delivers a contribution to get grip on the identified knowledge gaps. The main objective of this thesis is to *provide more insight into self-help hubbing, the potential and consequences*. To support the main objective, this objective is divided into three research objectives:

1. Assess the differences between conventional transfer and new transfer formats in terms of booking, risks and airport processes.
2. Identify the potential of self-help hubbing
3. Identify the expected implications for the aviation industry

1.5 Research questions

Three main research questions are posed to achieve the three research objectives:

RQ1 - What is self-help hubbing and how is it different from conventional transfer?

RQ2 - What is the potential of self-help hubbing?

RQ3- What are the implications for relevant stakeholders?

To structure the approach, sub research questions are used to answer the main question and meet the research objectives (Table 1).

Table 1 – Sub Research Questions Per Objective

Assess the differences between conventional transfer and new transfer formats in terms of booking, risks and airport processes. 1. What types of connectivity exist in aviation and how does this relate to other modalities? 2. What are the differences between conventional transfer and new transfer formats in terms of the way of booking, airport procedures and responsibilities?
Identify the potential of self-help hubbing 3. What does the industry think about self-help hubbing? 4. What are the self-help hubbing requirements for success and who are the users? 5. What products can be observed that facilitate the passenger in self-help hubbing? 6. What type of airports and routes would have potential for self-help hubbing?
Identify the expected implications for the aviation industry 7. What are the overall expected consequences for the relevant stakeholders?

1.6 Report structure

After this introduction, the report continues with a literature research to get a better understanding of the context. **Chapter 2** serves the first research objectives and question by providing a theoretical perspective on transfer and comparing transfer in aviation to transfer in other modalities. The chapter also discusses the relevant stakeholders and important corresponding aspects such as segmentation, processes or partnering. By doing so, the potential effects of self-help hubbing are described. The stakeholder analysis and potential effects of self-help hubbing serve as input to the research approach. **Chapter 3** presents the research approach which is separated into qualitative and quantitative research methods. **Chapter 4** serves the second and third research objective by presenting the results from the qualitative and quantitative data analysis. The analyses are used to draw preliminary conclusions. **Chapter 5** presents the quantitative analysis that is conducted to confirm some of the preliminary conclusion on research questions 2 and 3. The chapter ends with a discussion of quantitative results and how they compare to qualitative conclusions. **Chapter 6** is the final chapter and contains the conclusions, recommendation and a reflection if this thesis. The conclusions answer the question, posed in the title of this thesis by answering the main research questions while the recommendations provide suggestions for further research and practical implementations. The reflection is used to reflect on the chosen research approach, how the research was conducted and how the conclusions compare to other working papers. The chapters, their relation, research questions and titles are illustrated in Figure 4

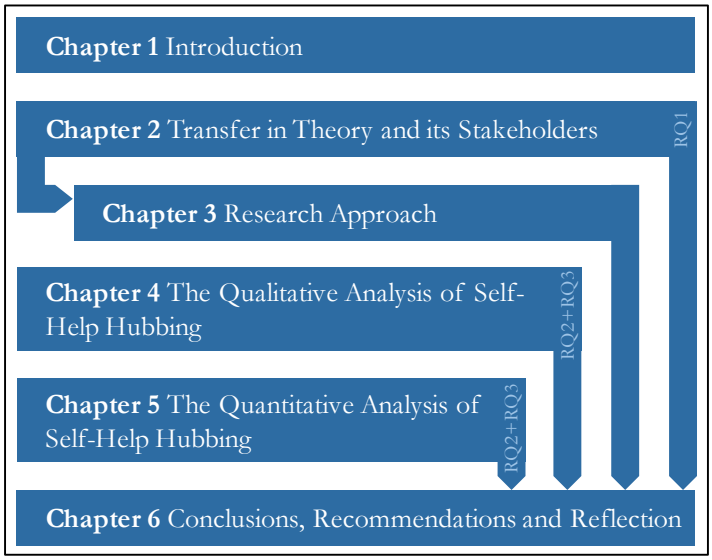

Figure 4 - Report Structure

2 Transfer in Theory and its Stakeholders

2.1 Introduction

Before a research approach can be proposed, proper understanding of self-help hubbing and the aviation industry is required. This chapter will *assess the differences between conventional transfer and new transfer formats like self-help hubbing in terms of the booking process, airport procedures and responsibilities.*

In the previous chapter, a self-help hubbing alternative was compared to conventional transfer options. The different ways of transfer are introduced by the term connectivity and compared to other modalities. To assess the differences, the main stakeholders of the transfer process are identified as well as the potential impact of self-help hubbing for them. This chapter will answer the first two sub research question:

1) What types of connectivity exist in aviation and how does this relate to other modalities?
2) What are the differences between conventional transfer and new transfer formats in terms of the way of booking, airport procedures and responsibilities?

This chapter presents the results of a literature research. To assess transfer, literature was searched by using search terms like self-connect, self-help hubbing, connectivity, transfer, aviation, public transport, hub-and-spoke and point-to-point. Peer reviewed literature was mainly found via Google Scholar. Also Google was used to search for other trustworthy sources like the aviation market intelligence provider company CAPA. Besides the internet, also books were used. To compare aviation with other modalities, literature was searched by terms such as transfer, public transport, network hierarchy and multimodal transport.

This chapter starts with an introduction of the term connectivity and the different ways of transfer in aviation (2.2). To identify why self-help hubbing in new in aviation, while common practice in for example public transport, the differences between and public transport are assessed in section 2.3. To assess the differences between self-help hubbing and conventional transfer in aviation, the main stakeholders are discussed and relevant aspects are identified. A mindmap of all stakeholders in aviation is presented in Appendix I. Based on the stakeholder's involvement in the transfer operations, the majority can be scoped out for this thesis. Only airports, airlines, passengers and sales channels are relevant if transfer is considered. The airport (2.4) and airline (2.5) are the infrastructure and resource providers for air transport. Passengers (2.6) are the actual customers and sales channels (2.7) link airlines and passengers by enabling the search for available flight options and the actual purchase of a ticket. Section 2.8 provides the conclusions and discusses the important aspects that are used as input for the research approach in the next chapter.

2.2 Connectivity in aviation

Connectivity is the degree to which nodes in a network are connected to each other (Burghouwt & Redondi, 2013). To approach self-help hubbing from a theoretical perspective, connectivity is an essential term. Burghouwt and Redondi (2013) describe connectivity along a number of different dimensions of which accessibility and centrality are most relevant for self-help hubbing. *Accessibility* considers airports being connected either direct of indirect. *Centrality* is the dimension, where the

airline concentrates departing and arriving flights at an airport during a certain time windows to maximize the number of possible connections. Therefore, three types of connectivity exist; direct, indirect and central hub. The central hub connectivity type is also indirect but not vice versa. Generic representations are provided in Figure 5.

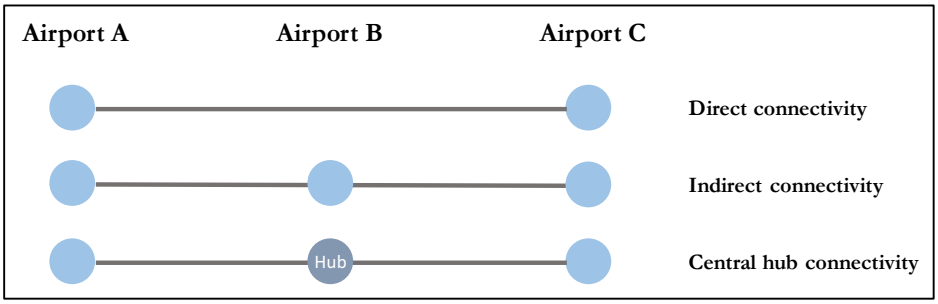

Figure 5 – Different types of connectivity. Adapted from (Burghouwt & Redondi, 2013)

Self-help hubbing refers to indirect connectivity because self-help hubbing itineraries are not coordinated by airlines. With respect to transfer two types of airlines can be distinguished; airlines are either partnering of not. More details on partnerships between airlines is provided in section 2.5.

The major difference between partnering and non-partnering airlines is the responsibility of transport between A to C. Partnering airlines or airlines that offer transfer between their own flights, called intralining, take responsibility to transport the passenger from A to C. An example of such an airline is KLM. They transfer any baggage and if a connection is missed, they rebook the passenger to an available alternative flight[5]. When self-help hubbing, the passenger purchases two separate tickets. Therefore, the responsibility for the first and second leg are no longer connected. In case of delayed flight from A to B, the passenger might miss the onward connecting flights from B to C but airlines do not bare the responsibility of for example a new ticket and a hotel if required. An example of such an airline is Ryanair. In their terms & conditions, Ryanair states that they cannot facilitate transfer of passengers or their baggage to any other flight[6].

To set clear boundaries of what is considered as self-help hubbing and what not, the indirect connectivity types are combined with the airlines either partnering or not (Table 2). Airlines that do not offer transfer do not concentrate flights during a certain time windows and therefore the combination of central hub connectivity and transfer between these airlines does not exist.

Table 2 – Connectivity types in aviation versus airlines and the possible partnerships.

	Partnering airlines	Airlines that do facilitate intralining	Non-partnering airlines	Airlines that do not facilitate intralining
Indirect Connectivity	Conventional Transfer	Conventional Transfer	**Self-help Hubbing**	**Self-help Hubbing**
Central Hub Connectivity	Conventional Transfer	Conventional Transfer	N/A	N/A

[5] www.klm.com/travel/pe_en/customer_support/customer_support/you_can_count_on_klm/index.htm
[6] www.ryanair.com/gb/en/useful-info/help-centre/terms-and-conditions/termsandconditionsar_1560777886

2.3 Differences compared to connectivity in other modalities

Self-help hubbing seems to be a new transfer format for the aviation industry. Other modalities like public transport however are very familiar with self-help hubbing. Public transport is defined as a system of vehicles that are operated at regular times on fixed routes and are used by the public. Aviation also exactly matches this definition. But why is connectivity in public transport different from aviation? It is different in many ways due to the offered frequencies, the ticket validity and highly subsidized nature of public transport.

The major difference is the served network level. Van Nes (2002) uses the term multimodal transport and network level, referring to a transfer between different transport modes. A network level refers to the spatial structure which is served by the transport mode such as a district a city or between cities. A transfer between transport modes in the same network level is considered as intramodal transfer while intermodal transfer deals with different network levels. While a metro might operate on a low network level that serves districts, trains serve a higher network level by connecting cities. The average trip of a Dutch travelers by bus, tram or metro is about 9 km while it is about 43 kilometers for a train. (Bakker, Zwaneveld, & Berveling, 2009) Aircraft operate between countries or continents which is again a higher network level. The average trip distance of passengers, departing from Schiphol, is over 3500 kilometers according to statistics of the Dutch Ministry (Appendix II). A network level is associated with several characteristics like the offered frequency, distance between stops and transport velocities. For higher network levels, frequency tends to decrease, the distance between stops increases as well as the transport velocity.

The major similarity is the perceived disutility or adverse and harmful effect, associated with transfer. Transfer times, both shorter and longer than the preferred time is perceived as a disutility in public transport (Schakenbos, La Paix, Nijenstein, & Geurs, 2016). A similar result is found in aviation where Theis (2006) reveals that short connection times lead to the risk of misconnections and transfer anxiety.

Self-help hubbing in aviation can be considered as intra- and intermodal transfer. A transfer between two low-cost carriers at the same network level (e.g. Europe) is considered as intramodal while a transfer between a continental flights and intercontinental flight is considered as intermodal transport because both flights operate on a different network level. While transfer is causing disutility in aviation and public transport, the amount of disutility differs significantly. Public transport tickets are often valid for routes, regardless of a specific departure time while airline tickets are limited to a specific flight, time and airline. This flexibility in ticket use can also be observed in aviation but is more expensive and focused on business travelers (Mason K. , 2001). A missed connection in aviation requires a new ticket which is extremely expensive compared to public transport due to the lack of government subsidies (Gordijn & van de Coevering, 2006) and price discrimination (Stavins, 2001). Besides the risk in monetary terms, the risk in terms of schedule delay is higher due to the relatively low frequency compared to public transport. This might result in additional costs for a hotel.

A missed connection in aviation is therefore, in comparison to public transport, associated with:

1. A longer delay due to the lower frequencies
2. An expensive new ticket and addition expenses such as food and a hotel

2.4 Airports

Previous sections took a generic approach to get grip on self-help hubbing. This and following sections will introduce the main stakeholders, the important aspects related to transfer and their relation to self-help hubbing. The first main stakeholder is the airport. Airports are essential in the transfer process since they provide the infrastructure to do so. Halpern and Graham (2013) divide the airport product into three elements: the core, the actual and the augmented element. The core is defined as the ability to board or disembark an aircraft. The actual product is for example the runway and check-in desks or baggage handling. Transfer facilities belongs to the augmented product, defined as additional customer services, built around the core and actual product.

Airports differ in size, facilities and infrastructure but when considering transfer, the main determinant is the airport's position in the air transport network. Self-help hubbing and its potential is therefore related to the airport's position in a network (2.4.1). When using self-help hubbing, passengers transfer between flights without any support. The passengers therefore have to collect baggage and check it in for the onwards connecting flight. This airport process is described in section 2.4.2.

2.4.1 Segmentation

The transfer potential is directly related to the type of airport. Until now, several terms like hub-airport, secondary airport or low-cost airport were used to differentiate hub-airports from non hub-airport or to specify the airline using the airport. In literature there seems to be no common airport classification (Wald, Fay, & Gleich, 2010). Airports can be classified by their facilities, the passenger numbers, transfer shares or its status.

Examples are full-service airport versus low-cost airport, referring to the facilities offered at the airport (Hanaoka & Batari, 2011) This distinction is no longer applicable when the low-cost carrier EasyJet operates a point-to-point network from the hub-airport Amsterdam Airport Schiphol. To create common understanding, this thesis requires a clear airport classification based on the airport's position in an airline network.

Wald, Fay and Gleich (2010) provide an overview of the different airport types used by governments, policy institutions and in literature to illustrate the lacking commonality. Airport segmentation tends to be subjected to amongst other:

- the number of passengers
- The share of transfer passengers
- The status of being a hub-airport or the position within a network.
- Catchment area served
- Infrastructure characteristics

The airport segmentation that will be used in this thesis is presented in Table 3.

Table 3 – Airport categories and their characteristics

	Primary	Secondary	Regional
Number of passengers	High	High/Medium	Small
Percentage of transfer passengers	High	Low	-
Hub status	Home-base of large network carriers	Home-base of smaller network carriers	No
Network type	Hub-and-spoke	Hub-and-spoke point-to-point	Spokes to hub Point-to-point
Catchment area	Large	Large/Medium	Small
Infrastructure characteristics	Very often high peak capacity, temporal concentration, Capacity/Slot constrained	May or may not have carriers, operating a wave system May or may not be capacity/slot constrained	Small airports No wave system Not capacity constrained
Example airports	Amsterdam Airport Schiphol, Frankfurt and London Heathrow	London Gatwick, Brussels and Copenhagen	Malaga, Edinburgh, Shannon and Groningen Airport

2.4.2 The airport process

New transfer formats like self-help hubbing and airport-led transfers, follow a different process at the airport than the conventional transfer format. While conventional transfer takes place at airside, self-help hubbing takes place via landside. Landside is accessible to both visitors and passengers while airside is only accessible to passengers with a ticket. Transferring via landside requires additional airport processes. The difference between self-help hubbing and conventional transfer is illustrated in Figure 6 where blue represents the conventional transfer process and yellow the self-help hubbing process.

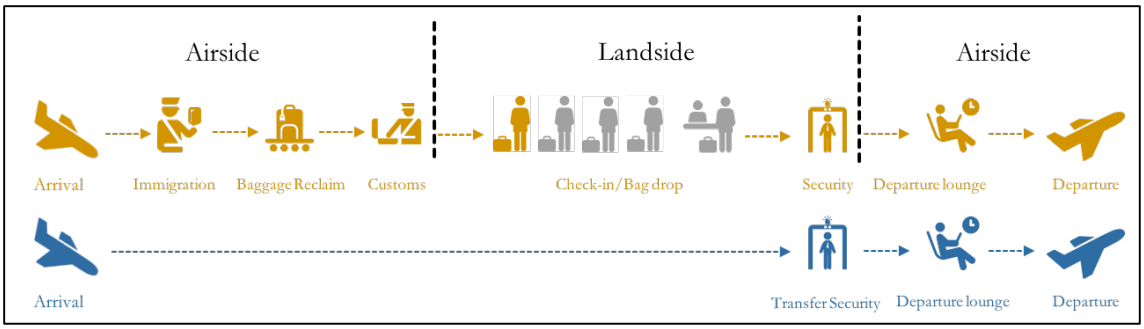

Figure 6 – The airport process of conventional transfer versus self-help hubbing. The yellow steps indicate the airport processes for self-help hubbing passengers.

During a conventional transfer, any baggage is transported to the connecting flight and facilities are provided to print a new boarding pass. After disembarking the aircraft, the passenger only needs to get a new boarding pass and proceed to dedicated security and passport checks if required. The passenger is now ready to board the connecting flight.

For self-help hubbing this transfer process is different (Baldwin, 2015). Passengers disembark the aircraft, pass through immigration, collect their baggage and proceed through customs and leave airside. Because passengers proceed through immigration, a visa may be required for the country of transfer. Now the passenger needs to proceed to a check-in desk and baggage drop off for all departing passengers to receive the boarding pass and check in the baggage for the connecting flight.

After receiving the new boarding pass, the passenger can proceed towards security to access airside again to board the connecting flight. This process including extra activities and queueing. Therefore, the process is more time consuming which increases the required minimum connecting time. Because the baggage is also going through extra processes, self-help hubbing might also increase the stress on baggage handling systems at airports.

Connecting time is essential in the transfer process. The connecting time is the scheduled time between the arrival of a flight and the departure of a subsequent connecting flight. The minimum connecting time is published by airports and contains the minimum amount of time required for a conventional transfer between flights before it is considered to be feasible. The difference between the minimum connecting time and the actual connecting time is buffer time (Theis, Adler, & Clarke, 2006). Self-help hubbing therefore requires extra buffer time for the additional processes. While taking into account the financial and time consuming risk of a missed connection, the passenger is likely to be more averse to short connecting times. A longer connecting time however decreases the attractiveness of a certain travel option as discussed before. Gaining trust by airport products such as GatwickConnects therefore increases the attractiveness for passengers.

2.5 Airlines

The airport as infrastructure provider is used by airlines, providers of air transport. The deregulations allowed airlines to choose their own strategy. This resulted in diversification of airline business models. A business model defines a company its structure and design. For airlines the main determinants to describe their business models are their network, schedule, fleet, marketing, products and pricing concepts (Figure 7) (Wald, Fay, & Gleich, 2010).

Figure 7 – Business Model Determinants

Within passenger airlines, the main distinction is between the full-service carrier and the low-cost carrier business models. Therefore these models are discussed into detail, based on Wald et al. (2010). According to Wald et al. (2010) it took a while before the full-service carriers started to take the competition of low-cost carrier seriously but ever since, business models are converging where full-service carriers are charging additional baggage fees and low-cost carriers offer frequent flyer programs. The business models, between the two extremes are called hybrid carriers. Conventional connections between different airlines are possible because these airlines are cooperating. The basics of airline cooperation are described in 2.5.4.

2.5.1 Full-Service Carriers

Full-service carriers are also called network carrier and mainly consider traditional national carriers like KLM, Lufthansa, Air France or Singapore Airlines. They focus on operating a complex and therefore costly network of routes in order to combine a large continental network with a considerable intercontinental network by means of the hub-and-spoke principle. The ability to transfer is therefore essential in their business model. All new formats of transfer would result in more choice alternatives and therefore create extra competition. The main characteristics of the full-service carrier business model are provided in Table 4.

Table 4 – Full-Service Carrier Business Model Characteristics

Network	• Primary airports • Secondary airports • Airports with large and complex infrastructure • Hub-and-spoke network • Time between landing and take-off up to 3 hours
Schedule	• Moderate to high frequency • Delay spreads because aircraft wait for connecting passengers
Fleet	• Multi-type fleet for short- and long-haul routes • Different manufacturers • No optimal aircraft utilization
Marketing	• Travel agents, internet, call centers • Conservative and product-oriented
Product	• Multi-class aircraft layout • Low seat density • Free in-flight services
Pricing	• High fares, complex yield management • More highly experienced and expensive employees • Pension funds and subjected to unions

Source: (Wald, Fay, & Gleich, 2010)

2.5.2 Low-Cost Carriers

Low-cost carrier refers to a carrier that is strictly focusing on low costs. The core of the low-cost carrier business model is focused on minimizing the costs and flying from point to point. This keeps the operations simple. Transfer is an additional service that is not required for a point-to-point network and therefore not facilitated. Low-cost carriers operate a point-to-point network that mainly link secondary airports, with lower landing charges and less congestion. Routes to regional airports can also be operated with lower frequencies. They focus on short turnaround times to maximize aircraft utilization and have with high seating density and single class aircraft to transport transport as many passengers as possible with a low-cost service level. A summary of the other typical low-cost carrier characteristics is provided in Table 5.

Table 5 – Low-Cost Carrier Business Model Characteristics

Network	• Secondary airports • Airports with sufficient capacity to avoid congestion • Point to point network • Time between landing and take-off less then half an hour
Schedule	• Low frequency • High punctuality
Fleet	• Single aircraft type • High aircraft utilization
Marketing	• Limited use of travel agents. Focus on direct sales • Aggressive and focus on direct fare comparison to others
Product	• Single aircraft layout • High seat density • In-flight services sales at high prices
Pricing	• Low fares, simple yield management • Competitive wages, no tariff-base and stock option programs • Long working hours and focus on maximizing efficiency.

Source: (Wald, Fay, & Gleich, 2010)

2.5.3 Hybrid Carriers

Both full-service and low-cost carriers have shown a tendency to converge their business models. Neither pure full-service or low-cost airlines are typical in the industry of today. The business models that lie in-between are called hybrid carriers and are characterized by a mixture of both business models. Daft and Albers (2015) studied the development of airlines business models from 2004 to 2012 by empirical data and find proof that business models are converging and that low-cost carriers shift towards the full-service carrier model. De Wit and Zuidberg (2012) conclude that the low-cost carrier business model is approaching its growth limits. They reveal that the continental markets are saturating, causing a slowdown on the growth of low-cost carriers. This growth limit forces them to adopt new, more full-service strategies like shifting to primary airports, transfer activities, partnering activities and acquiring other airlines. There is a large variety in hybrid carriers, because this category contains all possibilities between the two extremes; full-service and low-cost carriers. An example of a hybrid carrier is Aer Lingus. Characteristics are described in Table 6

Table 6 – Hybrid Carrier Business Model Characteristics based on Aer Lingus

Network	• Primary airports • Point to point network with transfer • Short time between landing and take-off
Schedule	• Frequency is higher compared to low-cost carriers but lower than full-service carriers. • High punctuality
Fleet	• Multi-type fleet for short- and long-haul • Single manufacturer
Marketing	• Focus on direct sales but bookable via travel agents • Product oriented
Product	• Single aircraft layout but business class on long haul • High seat density • Mixture of both free and –paid in-flight services
Pricing	• Low fares, relatively simple yield management

Based on the Aer Lingus Website

2.5.4 Airline Cooperation

The origin of self-help hubbing is directly related to airlines that do not have a partnership. Airlines that are in a partnership facilitate transfer in the conventional way. There are several reasons to avoid partnering. This section will introduce the basics of partnerships between airlines to understand one of the reasons, why not to transfer; costs.

Airlines can choose for basic cooperation with interline agreements or more enhanced cooperation aimed at marketing. Basic cooperation includes for example prorating to divide revenues and seat agreements. More enhanced cooperation includes sharing supply (i.e. available seats), code sharing which focusses on scheduling and aircraft sharing, or combined frequent flyer programs. More detail on the cooperation can be found in Wald, Fay & Gleich (2010, pp. 196-201).

Related to transfer, an interline agreements is the most relevant format. An interline agreements formally refers to an agreement between airlines to handle passengers travelling on routes that require different airlines. There are two main ways to set up an agreement:

1) Multilateral Interline Traffic Agreement (MITA), concluded through the concurrence of IATA
2) Bilateral Interline Traffic Agreement (BITA), concluded directly between two airlines.

The main difference is that a BITA is an extension of the MITA. Because the MITA is the most basic format, this requires an IATA membership which comes at a price. Being member of IATA means a one-time fee of $15,000 to apply and an extra $15,000 once accepted. Once the airline is an official member, an annual fee of $14,450 has to be paid excluding variable fees[7].

Airlines should agree on revenue sharing while it increases complexities due to the cooperation which might decrease efficiency. In conclusion, airline cooperation does not match the low-cost carrier business model due to the extra costs and implications.

2.6 Passengers

Next to airports and airlines, self-help hubbing is also changing the aviation industry for passengers. The transfer process itself is meant for and used by the passengers and therefore the passenger is an essential stakeholder. Literature is consistent in mentioning that the emergence of low-cost carriers changed the way people travel and how they make choices. Passengers differ from each other by amongst other things, their price elasticity and value of travel time. The increasing market share of low-cost carriers caused a shift in the mixture of business and leisure travelers. The leisure passenger segment, with a relatively high price elasticity and low value of time grew and the business passenger segment became more price sensitive (Dresner, 2006). This development changed the competitive position of several airlines. Young people show a strong preference for low-cost carriers. Low-cost-carriers also attract the self-employed and small-medium sizes enterprise business passenger but larger corporation often have corporate deals with full-service carriers. Passengers can be grouped into segments based on several parameters (Dresner, 2006). An often used parameter is the travel purpose which can be leisure, business or visiting friends and relatives.

Certain travelers are willing to connect via secondary airports and accept lower service in exchange for lower fares (O'Connell & Williams, 2005). In the future, the business traveler wants a better value for money which will lead to the end of business class services in short-haul markets. Leisure passengers will increasingly take advantage of low fares and fly more frequently both in and outside the European Union (Mason & Alamdari, 2007). Self-help hubbing and its significance is likely to increase in the coming years but one major hurdle is the visibility of these self-help hubbing alternatives. Therefore, sales channels must follow the trend and show these alternatives.

2.7 Sales channels

Airport, airlines and passengers are connected to each other; either directly or via sales channels. Sales channels is the term, used for the parties that distribute tickets. This party is an important stakeholder

[7] http://www.iata.org/about/members/Pages/fees.aspx

because they are the link that connect the passenger to the airline. Sales channels includes travel agents, search engines and airline websites (Cikánek, 2012). Before the introduction of the internet, tickets were solely sold via travel agents. The introduction of the internet caused them to become the main suppliers by several innovations like the global distribution systems that connected many airlines to many travel agents. This system has the benefit that airlines can distribute their tickets across the world, but it comes at a price. Therefore, low-cost carriers used their own system to distribute tickets. When full-service carriers started to offer direct sales as well, travel agents were forced to become travel consultants that guaranteed for example the lowest fare (Buhalis, 2004). The price-sensitive traveler will use meta-search[8] engines, online travel agencies or the airline's own website to receive different fares for the same itinerary (Harteveldt, 2012). Analysis from Google showed that a typical traveler uses 22 websites before booking a trip. This also includes other stages of travel such as for example hotels. According to IATA, most trips are purchased via the airline followed by search engines (IATA, sd). Both findings point out the importance of choice. Online travel agents play an essential role in the trend of self-help hubbing since the alternatives are not present in most existing distribution systems. Over twenty percent of the travelers have no idea where to start in order to research and uncover the self-connecting alternatives. Conventional sales channels often stick to the rules of alliances and formal partnerships such as codeshare agreements. Self-help hubbing therefore requires innovative sales channels like search engines and travel agents to invest in simplification of the booking process (OAG, 2016).

2.8 Conclusion and discussion

This chapter had the objective to assess the differences between conventional transfer and new transfer formats like self-help hubbing in terms of the booking process, risks and airport processes. The chapter therefore answered the first two sub research questions:

1) What types of connectivity exist in aviation and how does this relate to other modalities?
2) What are the differences between conventional transfer and new transfer formats in terms of the way of booking, airport procedures and responsibilities?

2.8.1 Sub research question 1

Connectivity is the degree to which the nodes in a network are connected to each other. They can be connected either directly or indirectly. Indirect connections can be random or temporal concentrated to maximize connectivity. In aviation, transfer is often associated with hub-airports and full-service carriers or alliances where the passenger books a single ticket from A to C via B. Transfer between non-partnering airlines is also possible by separate tickets from A to B and from B to C. In the latter case, also referred to as self-help hubbing, the passenger has the responsibility to transport baggage and to be on time for the second flight.

[8] Meta search engines like Kayak, described as a technological company, aim to improve the online search for air travel. They use the traveler' search query to search at many other sites. They only provide the traveler with the search results and forward you to the corresponding website to book the trip.

In other public transport modes like busses, trams, metros and trains, the same connectivity principles apply and transfer is also perceived as a disutility. Major differences are travel distance and frequency. Distance is significantly higher and frequency is significantly lower in aviation. The higher distance results in a higher fare and the lower frequency causes higher schedule delays if connections are missed. Therefore, new formats of transfer like self-help hubbing have more severe consequences in terms of time and costs in case of a missed flight.

2.8.2 Sub research question 2

The conventional transfer format was introduced after the deregulation when traditional carriers reconfigured their networks and started partnering. Carriers started to cooperate by forming alliances to combine networks which resulted in transfer between partnering airlines. New formats of transfer relate to a transfer between non partnering airlines such as full-service carriers and low-cost carriers or between flights of a single airline that does not offer transfer like most low-cost carriers. The main characteristics of both are provided in Table 7.

Table 7 - Comparison of conventional transfer and self-help hubbing

	Conventional	**Self-help hubbing**
Booking process	Via airlines, travel agents and online meta-search engines. One single ticket	Two separate tickets. Flights can only be found by a limited number of meta-search engines.
Airport process	Only on airside and the passenger has to get a boarding pass and might face security checks or passport control. Relatively short	Baggage reclaim, leave airside via customs. Queue for check-in desks, drop off baggage and proceed to airside via security check and passport control. Relatively time consuming.
Responsibility	The airlines take care of baggage and the risk of a missed connection.	The passengers takes care of baggage and the risk of a missed connection.

2.8.3 Discussion

The chapter also introduced the main stakeholders; airports, airlines, passengers and sales channels. These stakeholders will face the implications of self-help hubbing.

- Airports are essential since they provide the required infrastructure for air transport. For new formats of transfer, the airport process is different since passengers have to collect their baggage at the conveyor belt, pass through customs and leave airside in order to check-in for the connecting flight. This might stress certain airport processes.
- Airlines are essential because they provide the required resource for air-transport and offer the network of connections. Airlines are characterized by their business model. However, business models start to merge when full-service carriers start to charge a fee for baggage and low-cost carriers start to fly at primary airports and offer frequent flyer programs. Self-help hubbing only exists because not all airlines have partnerships. The lack of partnerships might be caused by the addition complexities and costs.
- Passengers are essential because they are the actual customers. Passengers are characterized by their travel purpose such as leisure, business or visiting friends and relatives. All passengers, even some business passengers became more price sensitive over the past years which is an opportunity for self-help hubbing. It might however have more potential for European flights or domestic flights since some transfer locations require a visa.

- Sales channels are essential because they connect passengers to airlines by distributing tickets. Sales channels include three main parties; meta search engines, travel agencies and airline's themselves with their website to distribute tickets via direct sales. Self-help hubbing alternatives are hard to find which poses an opportunity for sales channels by gaining market share when facilitating the self-help hubbing passenger.

Combining flights of different airlines and finding these self-help hubbing options might be one of the first challenges. The author's expectation is that self-help hubbing will increase the role of sales channels and decrease the direct relation between passengers and airlines. In the first chapter it was observed that airports offer self-help hubbing products via sales channels. This creates an additional relation between the sales channel and airports that does not seem to be present currently. The relations are depicted in Figure 8 where blue indicates the conventional transfer and orange the self-help hubbing relations. The thickness of the lines indicates the importance of the stakeholder relation.

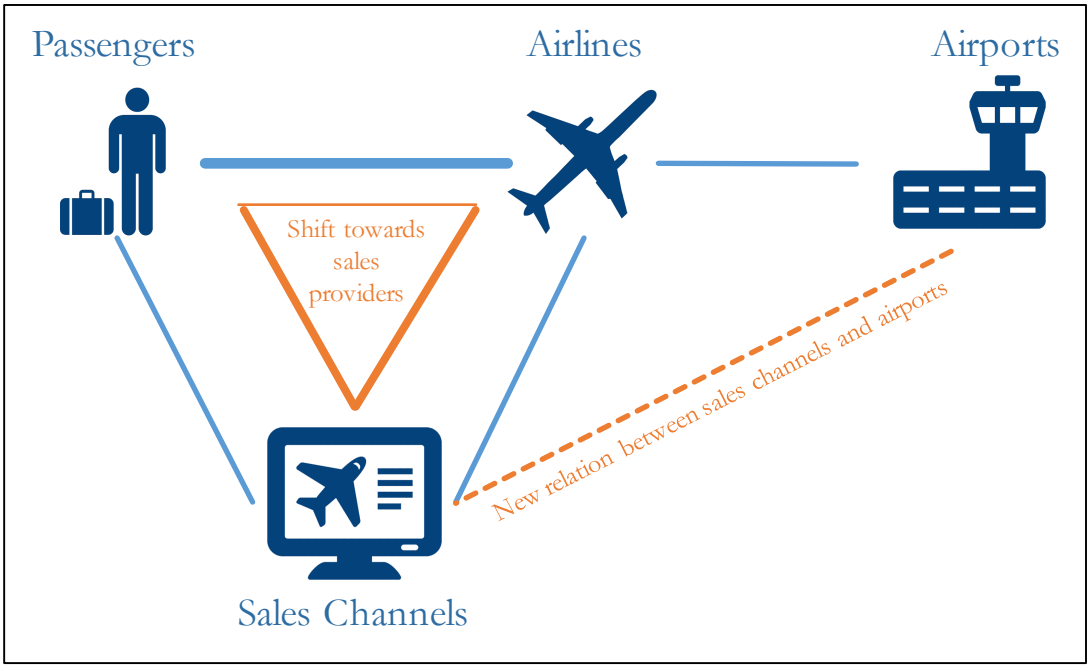

Figure 8 – Conventional relations between key stakeholders in blue, and self-help hubbing relations in orange.

This chapter showed that the main differences between conventional transfer and self-help hubbing relates to the costly and time consuming risk of a missed connection. Other differences such as the airport process and and the booking process have smaller implications. The schedule delay, caused by a missed connection is also increased by the low frequencies that are offered by low-cost carriers. The main stakeholders are identified but it remains unclear who the passenger is. The research approach should therefore focus on airports, airlines and sales channels to gather data about self-help hubbing, the passengers, and its implications.

3 Research Approach

Based on the current state of literature, the first chapter revealed that topics like the potential of self-help hubbing, why to use it, requirements for success and industry's reaction are left untouched. The second chapter assessed the differences between conventional transfer and new transfer formats. By doing so two main findings should be taken into account for this research approach

- The main difference is the costly and time consuming risk of a missed connection and the differences in the airport and booking process have a smaller implication but are essential for the support and visibility of self-help hubbing alternatives.
- More knowledge is required to identify the self-help hubbing passenger, therefore data should be gathered from the remaining stakeholders; airports, airlines and sales channels.

The first research objective was to assess the differences which was achieved in the previous chapter. The research approach should be focused on achieving the latter two research objectives. In order to identify the potential of self-help hubbing and its consequences, the following sub research questions were posed. Each sub research question has a corresponding approach.

SRQ 3 - What does the industry think about self-help hubbing?
An overview of what industry experts think about self-help hubbing is important when assessing its potential. To get this overview, a news analysis is conducted to reveal the industry's opinion over time and the development of self-help hubbing (3.1).

An other method could be interviews. Interviews are useful in exploratory stages of research. However, it would require a large sample to extract the overall opinion (Sekaran & Bougie, 2013) and it is not possible to assess the opinion over time, given the time constraint of this thesis.

SRQ 4 - What are the self-help hubbing requirements for success and who are the users?
To get more grip on the passengers who are using self-help hubbing and what persuades them in doing so, knowledge of industry experts is required. By interviewing the stakeholders, self-help hubbing can be assessed from multiple perspectives and disciplines. Respondents to the interview are related to self-help hubbing in order to achieve the best results.

A seminar on the topic of self-help hubbing was used as additional input on top of the interviews. A seminar, compared to interviews, has the benefit that it creates discussion amongst stakeholders. Both qualitative methods as well as the content analysis method are described in section 3.2.

SRQ 5 - What products can be observed that facilitate the passenger in self-help hubbing?
The industry is already taking actions to support this new format of transfer, whether it is identified as trend or not. In order to assess the true potential of self-help hubbing, an overview of these product, services and guarantees is required since they might influence the decision making process for passengers. Basic knowledge about the topic of supporting self-help hubbing is obtained from the qualitative data sources (3.2). More extensive details about the products or service is extracted from corresponding websites.

SRQ 6 - What type of airports and routes would have potential for self-help hubbing?
Airports were segmented by their location within the air transport network. CAPA, and aviation market intelligence provider, provides an airports database that includes quantitative data about flights, capacities, destinations and more. This data is used to estimate what airports might have self-help hubbing potential (3.3). To identify what kind of routes have high potential for self-help hubbing, a network analysis is conducted with a route choice model to simulate the passenger and the trade-off between price and risks or hassle (3.4).

SRQ 7 - What are the overall expected consequences for the relevant stakeholders?
This research question is used as topic during the interviews and was also one of the the topics during the seminar. Information to answer this question is therefore gathered from the qualitative data from experts by interviews and the seminar (3.2).

3.1 CAPA news analysis

The CAPA news analysis is conducted to reveal the industry's opinion about self-help hubbing over time. CAPA – Center for Aviation is a leading provider of independent aviation market intelligence, analysis, reports and data services. A global team of writers and analysts cover the entire spectrum of commercial aviation.

Using CAPA is more reliable compared to for example the Google news search tool. News articles, once published, will be reposted by several other sources. Therefore, the same news articles might appear multiple times in Google which will bias the results. On the other hand, CAPA is focused on aviation whereas the results from a Google news analysis also include other industries which will bias the results even more.

CAPA posts about self-help hubbing with the term 'self-connect'. The search results up to May 2016 include news, analysis reports and short briefs of for example conferences. The search only includes posts where the exact term "self-connect" appears. Articles including either 'self' or 'connect' have no relevance for this analysis. The search resulted in 73 posts. Each post is ordered by date and Microsoft Excel was used to plot the number of articles over time. By further investigating the articles, relevant statements and opinions can be extracted to create a summary of all articles that reveals the industry's opinion over time.

3.2 Qualitative data analysis

Qualitative data is obtained to validate and extend literature. Data is obtained from two sources: Interviews (3.2.1) and an Airneth Seminar (3.2.2). The data analysis method is explained in 3.2.3.

3.2.1 Interviews

Interviewing is a useful data collection method, especially for the exploratory character of this thesis (Sekaran & Bougie, 2013). There are three types of interviewing; unstructured, semi-structured and structured. Unstructured interviews are suitable to bring preliminary issues to the surface so that the factors for further research can be determined (Sekaran & Bougie, 2013). A semi-structured interview allows the respondent to express their views in their own terms including facts, opinions and their attitude (Cohen & Crabtree, 2006). Semi-structured interview gather information about a set of

central topics and are useful when further detail on these topics is required (Wilson, 2014). Structured interviews are more suitable when the outset of required information is known up front. The method that fits this thesis best is the semi-structured interview method.

Interviewing the main stakeholders will generate knowledge about multiple topic such as the self help hubbing passenger, the benefits and the expected developments:

- Characteristics of the passengers that use self-help hubbing
- Why passengers consider the use self-help hubbing
- The requirements for success of self-help hubbing
- How the passenger can be supported in the process of self-help hubbing
- The benefits of self-help hubbing for the main stakeholders
- Expected growth and future developments of self-help hubbing

These topics are being approached from different perspectives. For the airport segments, only the primary and secondary airports play a role in transfer and therefore the first two perspectives are primary and secondary airport. The third perspective is a low-cost carrier. Full-service carriers are focused on their conventional transfer product and feeding operations of low-cost carriers are a sensitive and confidential matter. Therefore, the full-service carrier perspective is excluded. The fourth and last perspective are sales channels.

Passengers are excluded because it is unknown who the passengers are and what drives them in the choice of self-help hubbing. Interviewing passengers would also require a large sample to draw valid conclusions which does not serve the exploratory character of this thesis. More knowledge about the passenger is therefore extracted from the other stakeholders. An overview of the interview respondents is provided in Table 8. Gerben Broekema represents a primary airport. He is senior advisor at Schiphol Group and his departments conducts research into threads and opportunities for the industry and Schiphol Airport. Vittorino Capobianco works for Milan Malpensa Airport and was involved in the development of the first airport product related to self-help hubbing. William Vet is commercial manager at EasyJet and represents a low-cost carrier. He is not involved in self-help hubbing but has a clear opinion about it. Faical Allou and Paul Argyle represent sales channels. Faical is business development manager at Skyscanner and published a blog about self-help hubbing. Paul is starting a new product where he connects full-service carriers to low-cost carriers for improves connection between Latin-America and Europe.

Table 8 – Overview of the interview respondents

	Name	Description
Primary Airport	Gerben Broekema	Senior Advisor Group Strategy & Development at Schiphol Group
Secondary Airport	Vittorino Capobianco	Business Service and Destination Development at Milan Malpensa
Low-cost Carrier	William Vet	Commercial Manager at EasyJet, responsible for the BeNeLux and Denmark
Sales Channels	Faical Allou	Business Development Manager at Skyscanner Analytics
	Paul Argyle	Managing Direction of Selfconnect.flights

Summaries all each interview are provided in respectively Appendix IV to Appendix VIII. The diverse group of industry experts are all connected to self-help hubbing. Therefore, they have insight knowledge but might also be biased by their position and believe in the success of self-help hubbing. To compensate, also critical responses are desired. This is achieved by a panel discussion at the end of the Airneth Seminar.

3.2.2 Airneth Seminar

The second source for qualitative data is a seminar about self-help hubbing. The seminar took place at May 18th, 2016 at the Ministry of Infrastructure and Environment in The Hague. The seminar was open to the public and recorded by the author. The seminar supports the explorative character of this thesis due to presentation from the stakeholders' perspective, reactions and the panel discussion with other industry experts. The presentations are publicly available but the recordings are not. Statements from attendees like representatives of alliances and governmental institutions are therefore only used anonymously. One of the speakers had no time for discussion afterwards, therefore an interview was organized with Vittorino Capobianco on beforehand. An overview of the speakers is provided in Table 9.

Table 9 – Overview of the seminar speakers

	Name	Description
Researcher	Paolo Malighetti	Researcher at the University of Bergamo, Italy.
Secondary Airport	Vittorino Capobianco	Business Service and Destination Development at Milan Malpensa Airport
Sales Channel	David Gunnarsson	Managing Director at Dohop
Consultant	Kata Cserep	Vice President at ICF International

This seminar adds a more critical perspective to the qualitative data due to presentations of a scientific researcher and an independent consultant. By interviews and the seminar, a large amount of qualitative data will be obtained. It is therefore crucial that the content analysis is conducted in a structured way.

3.2.3 Content Analysis

To analyze the data, obtained from the interviews and the seminar, a structured method is required. A structured method helps to get grip on the meaning of all qualitative data and make sense of the whole. Hsieh and Shannon (2005) discuss a content analysis method, widely used for qualitative research. Content analysis is considered as a single method but practical applications show three distinct approaches. The conventional method is more explorative while the directed is guided by existing theories or earlier research results. The summative method involves counting and comparison of keywords. The conventional method is an inductive way while this qualitative analysis is used to verify or extend the literature. Therefore the more deductive and directed method is required (Elo & Kyngäs, 2008). There are three main steps in deductive and directed data analysis (Sekaran & Bougie, 2013):

1. Data reduction; coding and categorizing data
2. Data display; presenting the data by quotes, a matrix, graph or illustration
3. Drawing conclusions

Data reduction

Data reduction is the first step, required to start analyzing the content. Data reduction is required because the amount of qualitative data is often enormous and therefore difficult to structure. A method to do so is content coding (Sekaran & Bougie, 2013). By analyzing the interviews and presentations, repeating patterns are revealed. For example, the requirements for self-help hubbing success is a topic that is repeatedly discussed. All statements that relate to requirements are bundled in order to create codes that cover the different aspects. Code labels cover the content in a simple form such as the label 'lack of a direct flight'. By analyzing the coded content, the frequency of occurrence of the 'lack of flights' provide a rate for the importance of this requirement in the data. By analyzing all qualitative data, 6 categories are created. Some categories are divided into sub categories to cover the meaning of the content in more detail. A total of 41 codes are created (Table 10). One code might appear several times for a single respondent. This is done to capture the essence of the discussion instead of equal scores across respondents. The passenger characteristics are for example discussed more often than the requirements and the code label 'price sensitive' was often mentioned which suggest agreement across respondents.

Category	Sub category	Code Label	Code
Requirements		Long-haul and short-haul mixture	R1
		Variety of business models	R2
		Lack of a direct flight	R3
		No shorter conventional connection	R4
		Bi-directional	R5
		Frequency	R6
The passengers	Characteristics	Young	PC1
		Millennial	PC2
		On-line	PC3
		Adventurous	PC4
		Tail of the demand distribution	PC5
		Individual	PC6
	Travel behavior	Not bonded to an airline	PT1
		Experiences	PT2
		Price Sensitive	PT3
		Savvy	PT4
		Travel on unusual routes	PT5
Reasons	To consider	Lack of conventional connection	RY1
		Lower fare	RY2
		Convenient flight schedule	RY3
		Transfer part of holiday	RY4
		More choice	RY5
		Convenient flight schedule	RY6
		Visibility of self-help hubbing options	RY7
		Increased passenger acceptance	RY8
	Not to consider	Complex booking process	RN1
		Risk of a missed connection	RN2
		Hassle at the airport	RN3
		Worries about the connection	RN4
How to support		All time support	SUP1
		Free of charge or low fare support	SUP2
		Streamlined airport process	SUP3
		Single booking experience	SUP4
		Single money transaction	SUP5
		Single confirmation email	SUP6
		Single ticket	SUP7
		Single customer service	SUP8
Benefits			BEN
Expectations	Growth		EG
	Potential		EP
	Developments		ED

Table 10 – Coding, used for content analysis

All codes are rather straightforward and capture the experts' opinions. Only code labels were created that represent the full message of what was said or presented by the respondents. Therefore, the implications, benefits and expectations are not as specified as the other categories. These codes

require further analysis. The actual coding is added in superscript to the interview summaries in Appendix IV to Appendix VIII. The presentations and corresponding coding are included in Appendix IX to Appendix XI. It should be noted that the interviews are summarized which might have influenced the coding. It might affect the frequency of occurrence but still represents the relative importance of several codes.

Data display and conclusions

The frequency of code occurrence provides insight into their occurrence and significance in the data. Based on the main categories the analysis is split up in 4 main topics. Therefore, the analysis can be split up in the following four sections:

- Requirements for success
- The passenger; including the characteristics, travel behavior and reasons to use self-help hubbing
- Facilitating self-help hubbing; including the 'how to support' category
- Implications for the aviation industry; including the benefits and expectations

3.3 CAPA airport analysis

CAPA – Center for Aviation provides an extensive database with airport characteristics such as flights, capacities, destinations and more. This data provides insight in what airports are used by what carriers, how many destinations can be reached and how they rank, compared to each other. This data is used to compare airports in Europe and find which airports have potential for self-help hubbing.

Preliminary results of the qualitative data indicate that self-help hubbing has potential at airports with a mixture of short-haul and long-haul routes and a variety of business models. The analysis therefore starts with a ranking of all European airports based on the frequencies, offered by low-cost carriers and full-service carriers. Airports that appear in both rankings provide a mixture of business models and by plotting the low-cost and full-service frequency on the x and y-axis respectively, the best airports and the spectrum of business model mixtures are revealed. By linking the top 15 airports to their geographical location and offered network, their potential markets are revealed.

This analysis is limited in several ways. It only takes into account network aspects such as airlines, frequencies, geographical location and network. Other factors that might play a role such as terminal configuration, walking distances and ways to spend your time are not taken into account. The analysis is focused on the airports with a mixture of business models and does not include airports that may be suitable for self-help hubbing, solely between low-cost flights. The ranking however provides insight into the airports with the highest low-cost carrier frequencies. These airports are therefore likely to have potential for self-help hubbing.

3.4 Network analysis

The network analysis reveals what routes are likely to have most potential. It is an addition to the expected potential, discussed in the qualitative data analysis and contributes by making self-help hubbing more quantitative. The potential is dependent on the passenger and therefore the network

analysis is where the passengers' perspective comes in. The passenger is represented by a choice model that is used to calculate how passenger will distribute over certain routes based on their trade-off between costs, time and hassle. The basic route choice model is introduced in this section.

3.4.1 Choice Models in Aviation

Developing a choice model is not part of this thesis due to the limited amount of time. Already a lot of work is done and published. Many of the aviation related choice models try to estimate airport or airline choice (Harvey, 1987; Hess, Adler, & Polak, 2007). Regarding route choice models, most of the models are not suitable for this thesis due to one of the following reasons:

- They are too complex and require too much input for the exploratory character of this thesis (Coldren, Koppelman, Kasturirangan, & Mukherjee, 2003)
- The route choice model is part of a larger model and therefore too simplified (Kroes, Lierens, & Kouwenhoven, 2005).
- The model is based on empirical data which makes it impossible to adapt (Kanafani & Ghobrial, 1985; Grammig, Hujer, & Scheidler, 2005).
- The model is based upon a principles, different than discrete choice modelling (Adler, 2005; Martín & Román, 2004).

Several papers were found that uses the so-called NetCost model (Burghouwt, Lieshout, & Veldhuis, Competition between hub airports: the case of Amsterdam Airport Schiphol., 2009; Lieshout, Veldhuis, de Wit, & Matsumoto, 2009; Lieshout & Matsumoto, 2012). The NetCost model calculates market shares for airports and airlines in a certain market based on route choice probabilities. Examples of its use can be found in the Netherlands and Japan. The full mathematic description of the NetCost model is presented in Appendix XII.

In essence, the model uses network data (e.g. routes, arrival and departure times, frequency, competition, carrier type etc.) as input in order to calculate generalized travel costs. The generalized travel costs represent the costs, associated with travel. These costs do not only depend on ticket fare, but also on for example the travel times, multiplied by the value of travel time. The passenger with a high value of travel time is more likely to choose a more expensive, but direct flight over a cheaper and indirect flight. The generalized travel costs express travel time, frequency and ticket fare in monetary terms. The generalized costs are translated to a dimensionless value that represents utility. Utilities of different options are then used to calculate choice probabilities by applying a logit model. The route choice probabilities are then, used to estimate market shares for airports and airlines. The latter part however serves no purpose in this thesis and therefore, only the route choice probability part of the model is used (Figure 9).

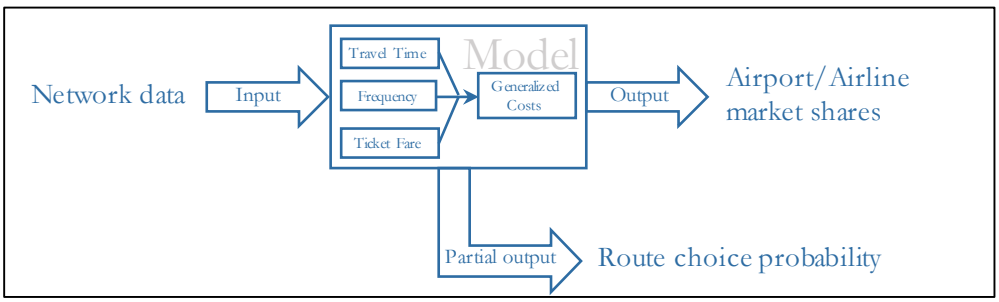

Figure 9 – Simple NetCost model representation

The model has several strengths. Applied in this thesis, it is a strength that the model is generic and requires calibration before actual use. This allows for rough estimations, based on the generic model. The model is not based on empirical data but on experience of the developers. For this thesis, this is beneficial because it allows the model to be adapted and extended for self-help hubbing. Another strength is that the model is only based on generalized costs which keeps it simple. In reality, route choice might depend on more factors such as the airline or departure airport but increasing the level of complexity means that the results require more input data which delivers only limited extra value if only rough estimations are desired.

The model also has several weaknesses. First of all, the model seems to be based on experience rather then scientific literature. The model is explained without citing related scientific literature that supports the use of certain parameters, punishment factors, and reasoning. Secondly, the model contains an airfare module which is not able to capture the dynamic pricing in the aviation market. It is in line with literature and experience but fails to capture true fares. The validity of this airfare module is tested and it appears that on average, the prices are overestimated by 37% (Flier, 2008). The validity of the NetCost model as a whole was also researched and it was recommended to add parameters like changing between terminals and a value of destinations to capture the dynamic complexity (Mason, Suau-Sanchez, & Budd, 2015).

In this thesis, the airfare module will not be used and parameters will be added to better represent the self-help hubbing choice. These adaptations are a result of the qualitative analysis and are therefore discussed and explained in the chapter with the results of this quantitative analysis.

The model is applied for two long-haul routes and two short-haul routes. The routes are randomly chosen by the author with the following requirements:

- No direct flight is available
- A connection is available every day.

Data is obtained via flight search engine Skyscanner for a single week from Monday to Friday to plot the estimated potential over time. Data is limited in the amount of routes and time. The amount of data is however still sufficient to reveal whether the results match with the qualitative results.

3.5 Conclusion

After chapter 2 achieved the first research objective to assess the differences between self-help hubbing and conventional transfer by means of a literature study, it was concluded that the self-help hubbing passenger characteristics are unknown. A research approach was created to achieve the latter two research objectives; estimating the potential of self-help hubbing and assessing its impact. To estimate the potential, more knowledge about the self-help hubbing passenger is required. This chapter has the objectives to explain the methods that are used to draw conclusion on the potential of self-help hubbing and its implications, based on the following sub research questions:

3) What does the industry think about self-help hubbing?
4) What are the self-help hubbing requirements for success and who are the users?
5) What products can be observed that facilitate the passenger in self-help hubbing?
6) What type of airports and routes would have potential for self-help hubbing?
7) What are the overall expected consequences for the relevant stakeholders?

Two qualitative and two quantitative methods are chosen for this research approach. The CAPA news analysis will reveal the industry's opinion on self-help hubbing which provides insight about what industry experts think and expect from this potential new trend. This answers sub research question 3. Qualitative data, obtained via interviews and a seminar is used to get more knowledge about the passenger characteristics and reasoning of self-help hubbing as well as the requirements for success of self-help hubbing to answer sub research question 4. Qualitative data is also used to explore ways to support the passenger in self-help hubbing. These services can be described in more detail, based on information from corresponding websites and terms & agreements documents to answer sub research question 5.

Preliminary results by developing a coding scheme for the qualitative data content analysis suggest amongst others that self-help hubbing works best at airports with a mixture of business models and has the most benefits on long-haul routes. both preliminary conclusions are tested by quantitative research methods. The CAPA airport analysis provides insight into the airports with high potential in Europe and a network analysis based on route choice probabilities is conducted to get better understanding of the magnitude of self-help hubbing potential on example routes. These two methods are used to answer sub research question 6.

Expert opinions from the qualitative data analysis are used and combined with relevant other conclusions from quantitative methods to answer sub research question 7. An overview of the research questions and corresponding research methods is provided in Table 11

Table 11 – Overview of research method per sub research question

Sub research question	Method
3	CAPA news analysis
4	Quantitative data analysis by coding
5	Quantitative data analysis by coding + Terms and agreements of services
6	CAPA airport analysis + Network analysis by route choice probabilities
7	Quantitative data analysis + CAPA airport analysis + Network analysis

4 The Qualitative Analysis of Self-help Hubbing

4.1 Introduction

The research approach presented in the previous chapter contains two qualitative methods and two quantitative methods. This chapter presents the first part of the results, the results from the qualitative methods. Together, the fourth and fifth chapter achieve the second and third research objective to *identify the self-help hubbing* and *identify the expected implications* by answering the following sub research questions:

8) What does the industry think about self-help hubbing?
9) What are the self-help hubbing requirements for success and who are the users?
10) What products can be observed that facilitate the passenger in self-help hubbing?
11) What type of airports and routes would have potential for self-help hubbing?
12) What are the overall expected consequences for the relevant stakeholders?

This chapter will answer the majority of the questions but some of the conclusions will be verified by the next chapter. This chapter is structured, based on proposed research method and research questions. The recent developments regarding self-help hubbing are identified by a CAPA news analysis that also reveals the industry's opinion about self-help hubbing (4.2). All other sections are based upon the qualitative data analysis from the respondents (Appendix IV to Appendix XI). Based on the qualitative data, the requirements for the success of self-help hubbing are determined (4.3) and the self-help hubbing passenger is characterized (4.4). To facilitate the passenger, several developments were already identified in section 1.2 but this chapter will describe the products of several stakeholder in more detail based on qualitative data and information about these services, available on the internet (4.5). Based on the qualitative data, several expectations are revealed regarding the current state, its potential for growth and the benefits for the main stakeholders (4.6). The conclusions, drawn from the qualitative data are provided in 4.7.

4.2 CAPA news analysis

A news analysis is conducted to capture the appearance of self-help hubbing in the news over time and the industry's opinion about self-help hubbing. CAPA, centre for aviation publishes up to 400 daily news briefs, collected by senior industry experts in the aviation industry. They refer to self-help hubbing with the term *self-connect*. News briefings include short news briefings and more extensive analysis reports. News briefings can be as short a three sentences related to a statements of a certain stakeholder and the analysis reports are for example about 7 pages.

The first related news article was published back in 2008 and stated that Finnair was suffering heavily from the growing savvy[9] of short haul European travelers who are increasingly able to self-connect. Ever since, new articles were being published with an average frequency of about one article every month (Figure 10).

[9] Savvy means experienced, well informed and able to make good judgements according to dictionary.com

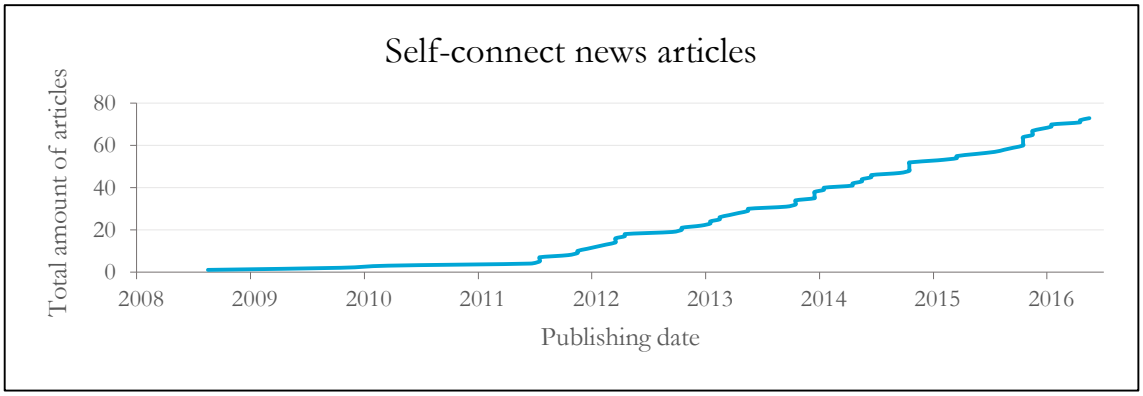

Figure 10 - CAPA news analysis for 'self-connect' up to May 2016

The news analysis suggests that self-help hubbing took a leap between 2011 and 2012. The first articles started by reporting ideas related to connectivity and statements whether or not self-help hubbing is an opportunity. After 2014, the articles start to provide numbers about self-help hubbing for particular airlines and in the beginning of 2016, more significant news articles are being published, related to cooperation between low-cost carriers and other carriers, airports that express their expectations of the potential and the announcement of the first low-cost carrier alliance to improve connectivity. The next paragraph will describe the content.

After the post about Finnair that suffered from passengers that were increasingly self-connecting back in 2008, news articles mainly consider the market between Asia and Europe. AirAsia X, an Asian long haul, low-cost carrier, for example switched operations from London Stansted to London Gatwick to fly into EasyJet its comprehensive short-haul network for better connectivity. In 2013 the commercial director of EasyJet stated to believe that the already high loadfactor precludes the need for connecting flights. EasyJet is interested in the point-to-point market and does not pursue connecting passengers. Later that year, statements were made that it is a misconception that low-cost carriers do not connect. By the start of 2014 possibilities of outsourcing hub feeding to low-cost carriers were discussed and the main hurdles are identified as IT systems and baggage transfer. In April 2014, data was provided by AirAsia X. Of all their passengers, 43% were connecting at Kuala Lumpur. About 57% of these transfer passengers paid an additional fee to receive a connecting boarding pass and baggage transfer while the remaining share opted to self-help hubbing. In 2015, Dublin airport stated that airports cannot execute a shift to self-help hubbing. Airports require a volume of connections to sell services for self-help hubbing passengers. By the end of 2015, the trend of self-help hubbing starts to take off in Europe. The CEO of Aer Lingus talks to Ryanair about transfer connections. Customer are already self-connecting so there is need for an improved proposition for passengers. Copenhagen airport estimated the number of self-help hubbing passengers to be in the range of 2-3% of their departing passengers and Dublin claimed to be perfectly positioned to benefit from self-connecting passengers. Ryanair announced to start a trial with transfer and interlining in the summer of 2016 from London Stansted and Barcelona El-Prat. Also London Gatwick is mentioned where Ryanair is close to an agreements of feeding into Norwegian's long-haul routes. In may 2016 even the first low-cost alliance, called Value Alliance, was created in Asia to provide greater service, connectivity and choice to travel in Asia and Australia.

4.3 Requirements for success

In the previous section is was revealed that self-help hubbing and its significance is growing. This poses the question what the requirements are for self-help hubbing to become a success and a viable alternative. A viable alternative can be defined as an alternative that might be advised by sales channels. The input for this section in the qualitative data analysis, conducted on the interview and seminar material.

The requirements for self-help hubbing were mainly discussed by Paolo Malighetti and Kata Cserep. Both did not focus on the success in particular but more on the set of requirements or rules that were used in a model to estimate the self-help hubbing potential for airports. The frequency of code occurrences in the data is shown in Figure 11.

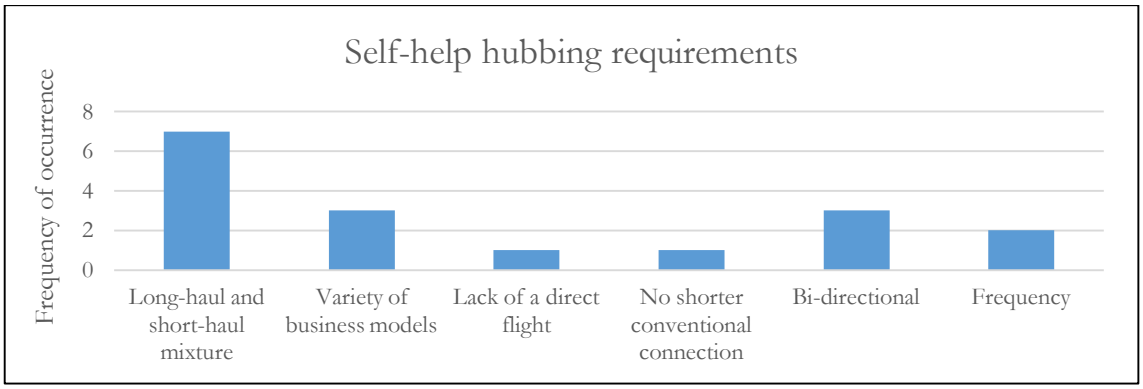

Figure 11 – Frequency plot for self-help hubbing requirements

Both Paolo Malighetti and Kata Cserep discuss the mixture of long-haul and short-haul as the main requirements for an airport, supported by David Gunnarsson and Vittorino Capobianco. This matches the requirement of a variety of business models. If both full-service and low-cost carriers are present at an airport, the network is likely to shows both long-haul and short-haul opportunities which seems to be a success factor for self-help hubbing. passengers prefer the most attractive route, which can be for example the fastest flight. According to Paolo Malighetti, a self-help hubbing alternative is only attractive when no direct flight is available which relates to a preference for faster flights. In addition, he poses the lack of a faster connecting flight as another requirement which suggest that the preference for faster flights is significant. Bi-directionality is mentioned once by three respondents and might sound obvious but with the typical low frequencies for low-cost carriers, this tends to be a relevant requirement. The bi-directional arguments is also mentioned in a conference presentation by Grimme (2011) about a failure at Cologne Bonn due to the lack of bi-directionality. Besides the ability to fly the route in two directions, the frequency of the alternative is also important to ensure several viable option throughout the week.

The bi-directionality requirement is open for discussion. Obviously an origin and destination should be connected in both ways but the argument is mentioned in an airport context which makes sense in a model context. In practice it is however open for discussion because passengers do not prefer a transfer airport (Talen, 2014).

4.4 The passenger

This section provides answer to the question related to whom the actual self-help hubbing users are. Literature study in chapter 2 did not specify the self-help hubbing passengers and therefore the stakeholder interviews and the Airneth seminar included topics related to:

1) Characteristics of the passengers that use self-help hubbing
2) Why passengers use self-help hubbing

Both topics were extensively discussed and several characteristics occur more often compared to others. It however still indicates the frequency related to how often the specific coding is discussed.

4.4.1 Who

All respondents agree that self-help hubbing passengers are price-sensitive. The most extensive description is given by Faical Allou and Kata Cserep. Young is a characteristic that is mentioned relatively often. Young however depends on the moment, and does not describe the characteristics over several years. William Vet refers to the millennial generation[10]. They are young, critical and often connected to the internet. They are adventurous and willing to take the risk for the savings. According to Kata Cserep however, risk is a matter of perception because low-cost carriers are extremely punctual and the chances for a missed connection are relatively low. The threat or idea of a missed connection is however so terrifying that the self-help hubbing passenger should be really adventurous.

David Gunnarsson mentions that self-help hubbing becomes more visible, due to improved IT technology. Before these technologies, self-help hubbing passengers needed intimate knowledge of airlines and their routes while experiencing an unusual booking process This suggest that the self-help hubbing passenger might change over time due to improved services. Both Paolo Malighetti and Kata Cserep state that the self-help hubbing passengers are at the tail of the demand curve and fly on unusual routes with too little demand for a direct or connecting flight. This seems to make sense because tickets for connecting flights are cheaper than direct flights. This suggest that purchasing two direct flights as self-help hubbing alternative is more expensive than an existing connecting flight on a certain route. Low-cost carriers however offer fares that might be competitive, based on price. An anonymous attendee from a large European governmental organization claimed that self-help hubbing exists because airlines have chosen not to get into it. Therefore, the discussion considers the "breadcrumbs on the table", considering the tail of the demand distribution. Self-help hubbing passenger travel alone because the extra risks of a missed flight and the lower level of service is not desired when travelling in groups. Gerben Broekema refers to a young and extremely price-sensitive passenger that travels individually and is very time insensitive. Paul Argyle states that there are different kind of self-help hubbing passenger and refers leisure travelers and the 'visiting friends and relatives' passengers.

Figure 12 provides an overview of the frequency of codes. It can be seen that being price sensitive was the main characteristics in the presentations and discussions. Also age, experiences, being savvy

[10] According to Wikipedia (2016b), millennials are the demographic cohort, born between the early 1980s and the early 2000s.

and the unusual routes are discussed more often and some arguments are mentioned only once or twice which suggest that they describe the self-help hubbing passenger to a lesser extend but still do make sense. Kata Cserep states that it is about segmenting the market and developing services accordingly. Different passengers have different requirements for the level of service and the self-help hubbing passenger is on the lower end of this continuum. In the discussion she also mentions that the business passenger of small and medium sized enterprises, the more price conscious segment, might be attracted to self-help hubbing.

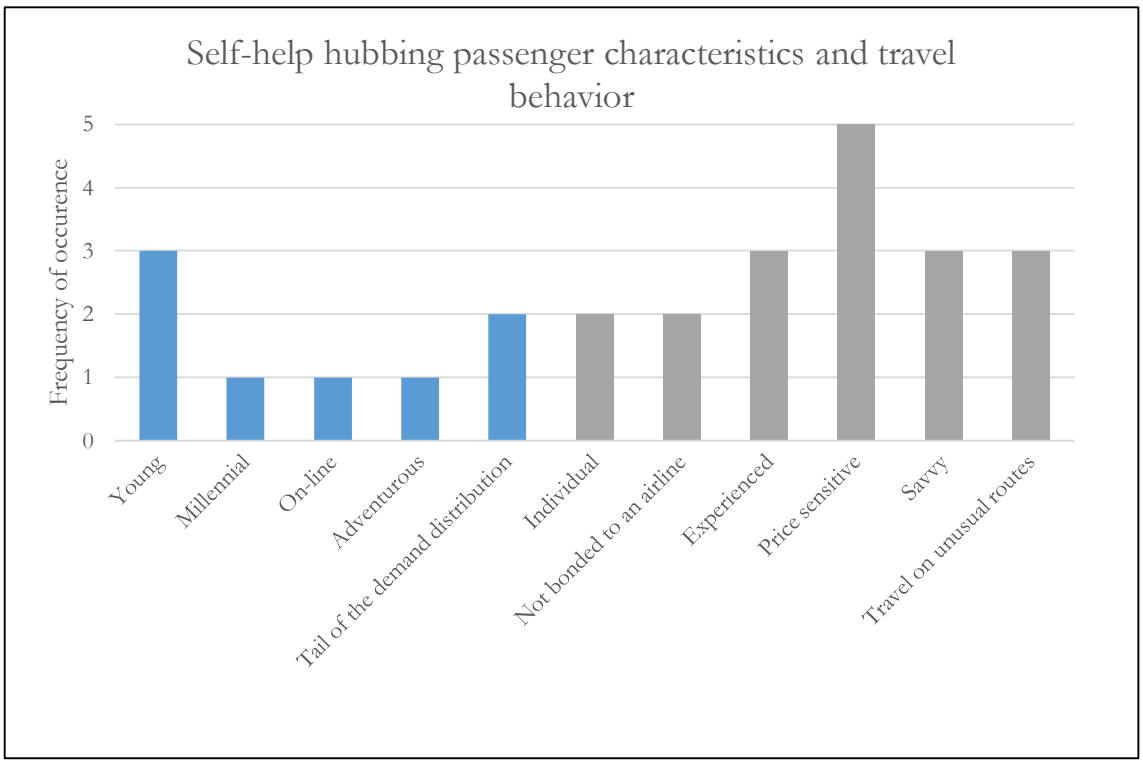

Figure 12 – Frequency plot for passenger characteristics and travel behavior codes. The blue and grey color indicate respectively the characteristics and travel behavior of the passenger

4.4.2 Why (not)

The previous section showed the self-help hubbing passenger characteristics. It does not mean that each passenger with these characteristics will use self-help hubbing. This section describes the qualitative data on why passengers choose for a self-help hubbing alternative or not.

Self-help hubbing is optional for most travelers. Some travelers might however have no other option because no conventional connection is available on the desired route. As identified earlier in chapter 2, the visibility of self-help hubbing alternatives for travelers is a challenge. Improved IT solution for sales channels ensure that self-help hubbing solution appear more often in the large online meta-search engines. The increased visibility of self-help hubbing alternatives is the main reason according to almost every respondent, why more people start considering self-help hubbing. People also want to see the self-help hubbing options, to be sure that they have the full set of available option to choose from. Gerben Broekema is the only respondent, questioning why people would accept the extra hassle and risks if the savings are not significant. Faical Allou states that travelers do no longer want to be forced into the conventional way of transfer. Unbundling of the transfer product and pay for what you get therefore provides more freedom and flexibility. This is what the self-help hubbing

passenger is looking for. Faical emphasizes on the savings by mentioning that passengers do not want to take the risk for a small amount of money and that most savings are therefore on the long-haul markets where tickets are more expensive. Paolo Malighetti refers to the balance between time, costs and convenience. Some passengers however might have other reasons. Faical refers to a short holiday layover in for example Amsterdam or Barcelona, which might be on the list of cities that the traveler would like to visit and self-help hubbing might help them including a visit in their holiday. The main reasons, not to consider self-help hubbing are the risk of a missed connection and the additional hassle at the airport. Other reasons might be the complex booking process of multiple tickets or worries about the connection; conventional connections are supported by ground staff from the airline while self-help hubbing is not.

The frequency plot (Figure 13) clearly shows that the visibility op self-help hubbing alternatives is by far the most frequent discussed topic related to the reason why passengers consider self-help hubbing. The risk and hassle are the most frequent discussed topic why not to consider self-help hubbing.

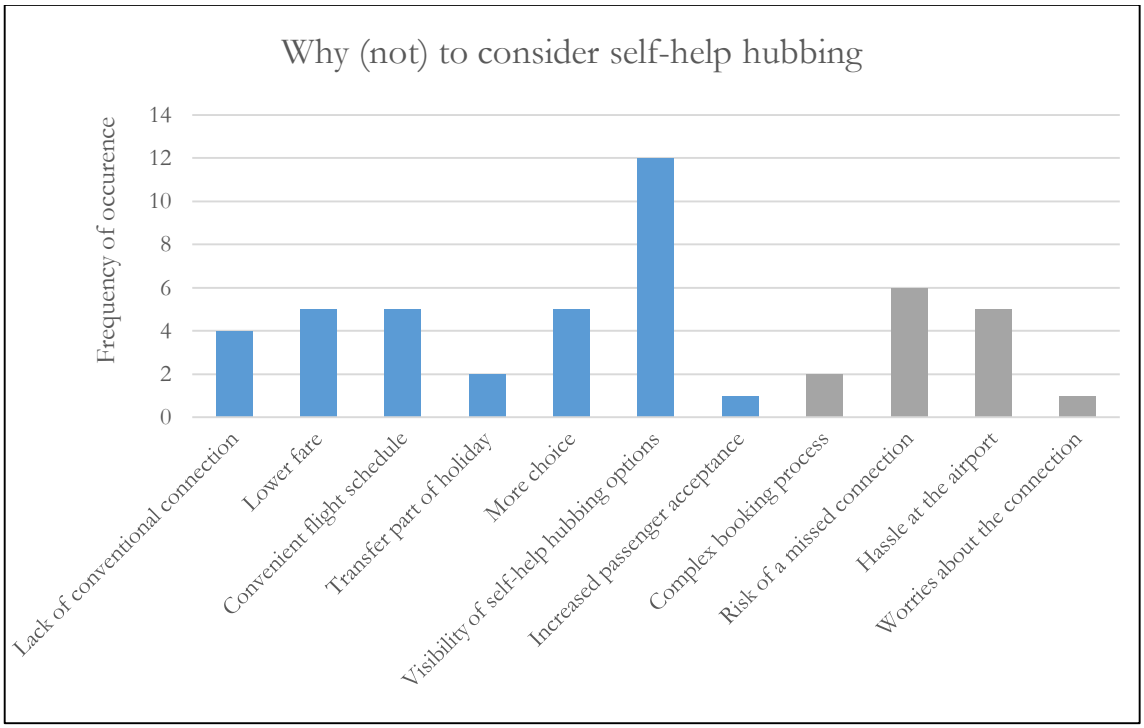

Figure 13 – Frequency plot for self-help hubbing reasoning. The blue and grey color indicate respectively the reason why and why not to consider self-help hubbing.

4.5 Facilitating self-help hubbing

The reasons not to consider self-help hubbing relate to the booking process, the risk of a missed connection and additional hassle at the airport. To support the passenger in the process of self-help hubbing, several ways of support can be offered. An example is risk insurance. From the frequency plot in Figure 14, it can be observed that topics related to the support of self-help hubbing, mainly relate to risk coverage, a streamlined airport process and a single booking process. This verifies that the booking process, the risk of a missed connection and the additional hassle at the airport and are the main hurdles of self-help hubbing. Based on these hurdles several services can be created to support the passenger with self-help hubbing.

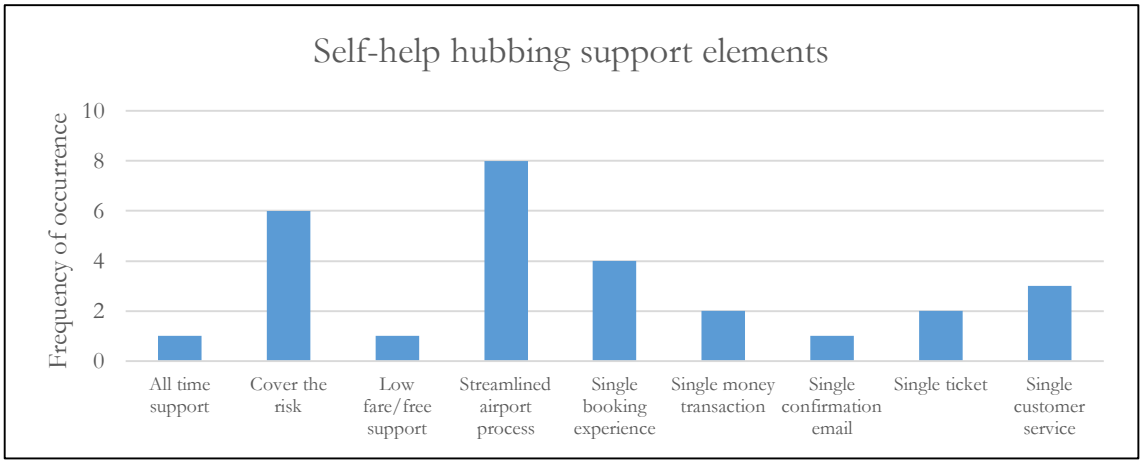

Figure 14 – Frequency plot for self-help hubbing support

William Vet states that a supporting service has to be developed from the passenger's perspective. Faical Allou claims that the transfer product should be unbundled[11] in order to let passengers compose their own transfer product. According to him, bag transfer is the most challenging. Adding this service would therefore make self-help hubbing more attractive. Paul Argyle claims that an airport product should be available 24/7 and for all connections. He also mentions cooperation with airlines to limit the marketing expenses and keeping the product cheap or free. According to him, distribution is the essence of support; it should be easy to find and book self-help hubbing alternatives.

Vittorino Capobianco emphasizes on the importance of transfer time. Reducing the required connecting time increases the amount of viable travel within the minimum time and therefore the attractiveness of self-help hubbing. Vittorino also mentions the amount of money transactions for booking. Being able to book tickets and the supporting product in one transaction would increase its attractiveness. David Gunnarsson talks about two different models. The first model is easy for the airport, requires multiple transaction and therefore the passenger receives multiple confirmation emails and might be confused about customer service. The second model is easy for the passenger and includes a website where you perceive a single booking process which requires only a single money transaction. The passenger will receive one ticket, one confirmation email and customer service is centralized. Besides customer service he also mentions that airport processes should become more streamlined.

In chapter 2, three main stakeholders were identified that are related to the process of transfer; the airport, the airlines and the sales channels. Each of these party is already providing examples of self-help hubbing support. The next section will discuss examples how each of these 3 parties can support self-help hubbing based on the three main hurdles.

[11] Unbundling refers to the service unbundling that has taken place in aviation. The ticket fare no longer includes services like a preferred seat, beverages baggage,.

4.5.1 The Airport

Two main examples of airports, facilitating self-help hubbing, are London Gatwick and Milan Malpensa. The products may differ from each other but are equal in their support for the three main hurdles. Booking an itinerary requires one or more websites and multiple transactions. The risk of a missed connection is covered and passengers have to collect baggage and transfer via landside through immigration services. The hassle of the additional check-in and baggage drop off is compensated by dedicated baggage and security facilities. The ViaMilano[12] product is free of charge while GatwickConnects[13] has a fee of €6,45[14]. In the terms and conditions several limits are posed. Insurance is for example provided up to a certain amount of money and insurance only applies if the pre-booked connection is missed due to delay or cancellation of the inbound flight.

Airport are able to provide risk insurance and an improved airport process but booking is outside their scope (Table 12).

Table 12 – Self-help hubbing support that can be offered by airports

	Risk covered	Baggage and transfer process	Single Booking
Airport	Yes	Yes	No

4.5.2 The Airline

Airlines might also support in self-help hubbing but partnering airlines are excluded from the self-help hubbing definition as posed in this thesis. There is however an interesting development that is relevant to consider. This development considers intralining, considered as self-help hubbing if it is unsupported. Norwegian, a low cost carrier, advise their passengers in self-help hubbing and suggest to make sure to take into account at least two hours of transfer time, collect their baggage and check it in for the connecting flight, and to take out travel insurance in case anything goes wrong. Next to self-help hubbing, Norwegian also offers an alternative[15]. For a fee of €9 per person and leg, Norwegian provides a single ticket, checks through any baggage to the final destination and covers the risk of a missed connection. This type of transfer is therefore no longer considered as self-help hubbing but is a new transfer format compared to the conventional way of transfer because the passenger is able to choose.

The airline is therefore able to take care of all hassles. It is however no longer considered as self-help hubbing (Table 13).

Table 13 – Self-help hubbing support that can be offered by airlines

	Risk covered	Baggage and transfer process	Single Booking
Airline*	Yes	Yes	Yes

* Airlines offering transfer can be compared to the conventional transfer product and is therefore no longer considered as self-help hubbing.

[12] http://www.flyviamilano.eu/en/docs/ViaMilano%20service%20conditions.pdf

[13] https://connects.gatwickairport.com/img/booking_gatwick/Gatwick_Connect_website_terms_and_condit ions.pdf

[14] GBP 5,00 will be charged. The fee is not specified in the terms and conditions and therefore might vary over time.

[15] http://www.norwegian.com/nl/booking/booking-information/connecting-flights/

4.5.3 Sales Channel

During the seminar and in interviews, a company called Skypicker was mentioned. Since June 2016 their name has changed into Kiwi, but the product remains the same. They are an online travel agent that shows all available options including the self-help hubbing options. Self-help hubbing options can be booked in a single booking process and include a so-called Kiwi guarantee. The Kiwi guarantee is an insurance and service in case of schedule changes, flight delays and cancellations. Passengers still have to collect their baggage, pass through customs and recheck their bags but in case of a missed connection, Kiwi offers support. Kiwi offers a customer service that will provide an alternative flight, transportation to an alternative airport, overnight accommodation and a compensation for food if required. Kiwi provides one single fare and the service is included and not provided as an option. Still no support from airlines or airports is given so it still is considered as self-help hubbing.

Sales channels are therefore able to provide insurance as well as a single booking process but are unable to influence airport processes (Table 14).

Table 14 – Self-help hubbing support that can be offered by the sales channels

	Risk covered	Baggage and transfer process	Single Booking
Travel Agent	Yes	No	Yes

4.6 Implications for the aviation industry

The implications for the industry are based upon the current state and future developments regarding self-help hubbing (4.6.1). The implications are assessed by means of the pros and cons for the main stakeholders (4.6.2).

4.6.1 The current state and future growth

The current state was discussed by several respondents. Paolo Malighetti states that self-help hubbing is significant in size. William Vet expects that 1% of their passengers to and from Schiphol are self-help hubbing. This would correspond to about 50.000 passengers while Vittorino Capobianco reported half a million users of the ViaMilano product in the first year. These number cannot be compared because the 50.000 holds for one airline while the half a million holds for an airport. Another difference is marketing, which is lacking in the case of Schiphol and easyJet. Real numbers are hard to get but Faical Allou expects single digit percentages as well. Faical however expects the variation to be tremendous and expects around 40% on the top self-help hubbing routes. Kata Cserep provides an estimation as well, which corresponds to 4% of the European transfer passengers. Gerben Broekema is skeptical about self-help hubbing. Profit margins are very low across the aviation industry and if a large price difference exists, it will most likely be compensated by airlines to increase profits.

Growth is expected for self-help hubbing. Kata Cserep estimated the market size that could be captured by an airport on all possible self-help hubbing connections. For Milan, London Gatwick and Schiphol this corresponds to respectively 13, 30 and 40 million passengers per year. A note is made that the market is extremely competitive and that there are more options than only the before mentioned airports. Growth in the short-haul market is likely to be limited due to the lack of city pairs that are not properly served according to Faical Allou, supported by Paolo Malighetti and Kata

Cserep. Vittorino Capobianco expects a centralized platform that provides the basic guarantees and information about self-help hubbing airports. He also notes the increased use of hand baggage that might decrease the need for dedicated baggage and security facilities at airports. Gerben Broekema expects the most potential for secondary airports. He perceives self-help hubbing support as cannibalism of the conventional transfer flows. Primary airports are often congested which might pose a risk for missed connections. Therefore, self-help hubbing is expected to have more potential for secondary airports that are less congested.

Another frequently discussed topic is the cooperation between full-service carriers and low-cost carriers. The majority of the respondent expect this to happen. According to Gerben Broekema the main hurdles are product consistence and agreement on employment contracts. Kata Cserep mentions that self-help hubbing will not replace conventional connections. Airlines and airport themselves should determine whether self-help hubbing is a threat or an opportunity and act accordingly.

Growth for self-help hubbing is expected on long-haul routes by the majority of the respondents. Paul Argyle envisions low-cost carriers that demand self-help hubbing facilities. Therefore, new demand will be attracted and recognized by other carriers. If full-service carriers join, the trend will grow rapidly and eventually spill back to primary airports.

4.6.2 Pros and cons

For the passenger, self-help hubbing allows the passenger to get close to the theoretical optimum in terms of travel time and costs according to Paolo Malighetti.

Airports that are used for self-help hubbing gain additional passengers. They are no longer only used by passengers flying to and from the airport, but also by passenger that might transfer via the airport. The airport, primary, secondary and even regional, appear in more travel itineraries than without self-help hubbing. Secondary and regional airports might benefit from a larger network without the costs and complexity of a hub-airport operation. The extra passengers will bring additional revenues, both passenger fees and ancillary revenues by shopping according to Paolo Malighetti and David Gunnarsson. Gerben Broekema states that for primary airports, the benefits are not worth the effort. It requires investment and attention, which will disturb the existing operation and does not contribute to the hub function because self-help hubbing is not temporal concentrated.

Airlines benefit freely from the network and demand opportunities according to Kata Cserep, David Gunnarsson, Vittorino Capobianco and Paolo Malighetti Ticket sales will increase and the higher loadfactor which will result in extra revenues and ancillary revenues. It is also likely to partly result in new demand as well as extra competition. Gerben Broekema poses an interesting counterargument. In the airline industry it is yield that matters instead of volume. Additional low yield demand from self-help hubbing passengers that are very price sensitive, might therefore not even be the desired by airlines.

Sales channels benefit from double transaction fees, insurance revenues and other ways of yield management according to David Gunnarsson. It depends on the sales channel whether this is an opportunity. Skyscanner is for example primarily used by young, savvy and price sensitive people

according to Faical Allou. This creates opportunities for Skyscanner while other website focus on for example business travelers or complete holiday packages which might not be interested in self-help hubbing alternatives.

4.7 Conclusions and discussion

The fourth chapter focused on the qualitative analysis of data, obtained from the news and respondents from the seminar and interviews. This chapter is dedicated to the second and third research objective but provides the answers to the following questions, solely based on qualitative data:

3) What does the industry think about self-help hubbing?
4) What are the self-help hubbing requirements for success and who are the users?
5) What products can be observed that facilitate the passenger in self-help hubbing?
6) What type of airports and routes would have potential for self-help hubbing?
7) What are the overall expected consequences for the relevant stakeholders?

4.7.1 Sub research question 3

The news analysis revealed a steady increase in the amount of news publications about self-help hubbing since 2011. The first post about self-help hubbing were published in 2008 and the first articles reported ideas related to connectivity and statements whether or not self-help hubbing is an opportunity. After 2014, the articles start providing numbers about self-help hubbing for particular airlines and in the beginning of 2016, more significant news articles are being published, related to cooperation between low-cost carriers and other carriers, airports that express their expectations of the potential and the announcement of the first low-cost carrier alliance to improve connectivity. Based on this data, self-help hubbing seems to become a topic that is known amongst all industry experts. The articles show that self-help hubbing is growing and that airlines and airports are taking action. This seems to suggest that the industry is positive about future developments of self-help hubbing

4.7.2 Sub research question 4

To make self-help hubbing a success, several requirements can be set. For self-help hubbing to work, the quantitative data seems to suggest that airports need a mixture of long-haul and short-haul flights as well as a variety of business models. Data also suggest the lack of a direct flight and shorter conventional connections but this seems to relate to models instead of practice. Self-help hubbing has to work in both ways and the frequencies of the alternatives should be sufficient to provide the passenger with a proper amount of options.

The self-help hubbing passenger is an experienced traveler from the millennial generation born between the 1980s and 2000s, not bonded to a specific airline. He or she is very price sensitive, savvy and likely to travel individual on unusual routes with low demand. Self-help hubbing is chosen due to the lack of a conventional connection or in search of lower fares or a more convenient flight schedule. Self-help hubbing provides more choice and is mainly considered due to the increased visibility of the alternatives by sales channels. Another reason to use self-help hubbing might be a visit to the city of transfer as part of the holiday. The main drawbacks or reasons to avoid self-help

hubbing are the more complex booking process, the risk of a missed connection, the hassle at the airport and worries about making the connection without support.

4.7.3 Sub research question 5

To facilitate the passengers in the process of self-help hubbing, a product offered by a third party should:

- enable a single booking process;
- cover the risk;
- and streamline the airport process.

Besides these main supporting services, self-help hubbing would be more appealing if support is offered at all times, free of charge and with a single customer service The booking process can be improved by offering a single money transaction, confirmation e-mail and ticket.

Not all stakeholders are able to offer each service. An airport is unable to provide a single booking process because this is outside their scope. Airport can only cover the risk and streamline the airport process. Examples of airport product can be found at London Gatwick and Milan Malpensa. Airlines are able to offer all supporting services, but this is no longer considered as self-help hubbing. Norwegian is an example of a low-cost airlines that advises the self-help hubbing passengers but also offers an additional paid service that takes care of all hassles. The last main stakeholder is the sales channel. They are able to cover the risks and provide a single booking, but they are unable to support in streamlining an airport process. An example is the sales channel Kiwi.com (Table 15).

Table 15 – Self-help hubbing support that can be offered by the main stakeholders

	Risk covered	Baggage and transfer process	Single Booking
Airport	Yes	Yes	No
Airline*	Yes	Yes	Yes
Travel Agent	Yes	No	Yes

* Airlines offering transfer can be compared to the conventional transfer product and is therefore no longer considered as self-help hubbing.

4.7.4 Sub research question 6

Kata Cserep estimated the market size for self-help hubbing that could be captured by self-help hubbing. For Milan, London Gatwick and Schiphol this corresponds to respectively 13, 30 and 40 million passengers per year. The note is made that the transfer market is very competitive and that passengers on routes might also have other option than the considered airports. It however still suggests that primary airports such as Schiphol have more potential than secondary airports like Milan Malpensa and London Gatwick. Gerben Broekema however expects the highest potential for secondary airports. Self-help hubbing does not support the hub function of a primary airport with a home carrier and requires extra attention while the additional flows of passengers might disturb the existing traffic flows. Complex hub-operations also cause congestion at airports which affects the on-time performance of operating airlines Therefore, self-help hubbing will not be supported by primary airports with a hub carrier and has a higher chance of success at secondary airports that are less congested.

Faical Allou expects that the total number of self-help hubbing passengers in Europe considers a single digit percentage for 2016 and the coming years. Faical however expects the variation to be tremendous and expects around 40% on the top self-help hubbing routes. Most short-haul routes in Europe are already properly served and for this reason the data seems to suggest that the potential of self-help hubbing is found for the long-haul segment. On the long-haul routes, prices are higher which allows for more savings.

4.7.5 Sub research question 7

Self-help hubbing is beneficial for passengers because it brings them closer to the theoretical optimum in terms of travel time and costs. The expected consequences for the other main stakeholders are dependent on the actual potential. While some respondents state that self-help hubbing is significant in size, others are talking about single digit percentages. Single digit percentages might seem small but consider several millions of travelers which might be sufficient for a business case.

Airports can benefit from the larger network that can be offered without the complex and costly hub-airport infrastructure and operations. The additional passengers create revenues by additional passenger fees as well as additional ancillary revenues by for example shopping. Airport might also perceive self-help hubbing as a disadvantage when it disturbs the existing operations and cannibalizes the existing transfer flows of a home carrier. Airlines benefit from extra passenger demand which increases ticket sales. Transporting more passengers with the same aircraft increases the loadfactor which is often one of the airline's key performance indicators so self-help hubbing might result in better performances. The extra passengers also bring ancillary revenues. However, not al airlines are focused on these price-sensitive self-help hubbing passengers and might not even be interested. Sales channels benefit from double transactions fees and revenues from insurance fees. The self-help hubbing passenger might however not be relevant for sales channels that focus on business travelers and holidays packages. Therefore, only sales channels that focus on price sensitive and savvy travelers might benefit from self-help hubbing.

The overall implications are not expected to be significant due to the relatively small size of self-help hubbing. Self-help hubbing, it remains a passenger initiative which takes place without major investments, policy changes or control. But because of its size, it will most likely not cause significant implications for the aviation industry

4.7.6 Discussion

In the conclusions of chapter 4, three main findings are open for discussion. The requirements related to a mixture of business models, a network with a mixture of long-haul and short-haul flights and bi-directionality of the connection.

Airports should have a variety of business models. This can be concluded, based on qualitative data. The requirement does make sense to a certain extend because self-help hubbing can take place between low-cost and full-service carriers. On the other hand, self-help hubbing can also take place between two low-cost or two full-service carriers. Therefore, is can be posed that the essence of self-help hubbing is not in the mixture of business models but in the lack partnerships between airlines.

Airports should offer a network with a mixture of long-haul and short-haul flights and the short-haul market in Europe is properly served so the true savings are on the long-haul market. This conclusion is rather static but not based on true and actual data. A note can be made that most respondents approached self-help hubbing from the airport perspective and the long-haul segment might attract more demand which is required to make a business case. From the passenger's perspective however, self-help hubbing on the short-haul is as attractive, or even more than the long-haul. No visa is required for a transfer within Europe and if the tradeoff between time and costs works, the option becomes attractive.

Bi-directionality is the third argument, open for discussion. It seems obvious that a return flight or connection should be available, but respondents approached this from an airport perspective while passengers do often not have a specific preference for a transfer airport. If a more convenient flight schedule can be achieved via another airport, this does influences the models used by respondents, but it will most likely not influence the potential of self-help hubbing.

5 The Quantitative Analysis of Self-help Hubbing

5.1 Introduction

The previous chapter achieved the second and third research objective related to the potential and implications of self-help hubbing for the aviation industry. Answers were based on qualitative data and some conclusions were open for discussion. Amongst others it was concluded that self-help hubbing has potential on the long-haul market. This chapter will verify and extend the qualitative data in order to complete the answer to the following sub research question:

6) What type of airports and routes would have potential for self-help hubbing?

Regarding the type of airport, both primary and secondary airports were mentioned while another respondent stated that primary airports with a hub-carrier are unlikely to show interest in self-help hubbing. Therefore this qualitative result is expanded by quantitative data analysis based on the CAPA airport database (5.2). To verify whether the long-haul market has more potential than the short-haul market, the passengers' choice is simulated by a route choice model. This model is used to conduct a network analysis. The model also serves the exploratory objective to get a sense of the magnitude of self-help hubbing (5.3) The results suggest that the short-haul segment has more potential than the long-haul segment. The conclusions and a discussion in provided in 5.4.

5.2 CAPA Airport Analysis

The qualitative data suggested that airports need to have a variety of business models and a network with a mixture of both long-haul and short-haul routes. Besides this, the offered frequency of flights plays a role in the amount of options and attractiveness of self-help hubbing at a certain airport.

The CAPA database provides information about airports. The weekly frequencies to and from the airport per business model can be extracted. Other data relates to for example aircraft types, destinations and regions. Because self-help hubbing from the passengers' perspective can be attractive both on the short-haul and long-haul, the destinations are not included in this analysis.

A ranking of European airports is created based on both the frequency offered by full-service carriers and low-cost carriers. This resulted in two lists of airports, based on the offered frequencies. The lists only include the airports with at least 1.000 frequencies per week. The airport with the highest low-cost frequency is Barcelona El-Prat while London Heathrow offers the highest full-service carrier frequencies. Both lists are compared and the top 15 airports with the highest low-cost frequency, that appear in the full-service carrier list as well are selected. London Heathrow is an example of an airport that no longer is included due to the lack of low-cost carrier frequencies. The airports with both a relatively high low-cost and full-service carrier frequency are plotted in Figure 15.

To create a clear figure, abbreviations are used. The abbreviation are defined in Table 16. On average the airports offer just below 1950 low-cost frequencies and just over 3200 full-service frequencies. The plotted results show that Amsterdam Schiphol Airport is the only airport that scores above the top 15 average values on both axes. The **green line** indicates the frontier of airport that offer the highest frequencies and the **blue surface** indicates the region with airports that score below average. Barcelona El-Prat and London Gatwick offer the highest low-cost carrier frequency while Paris Charles the Gaulle and Amsterdam Schiphol Airport offer the highest full-service frequency.

Table 16 – Airport abbreviations

BCN	Barcelona El Prat Airport	MXP	Milan Malpensa Airport
AMS	Amsterdam Schiphol Airport	MAD	Madrid Barajas Airport
PMI	Palma de Mallorca Airport	CPH	Copenhagen Kastrup Airport
DUB	Dublin Airport	CDG	Paris Charles de Gaulle Airport
OSL	Oslo Airport	HAM	Hamburg Airport
FCO	Rome Fiumicino Airport	LGW	London Gatwick Airport
ORY	Paris Orly Airport	SAW	Istanbul Sabiha Gokcen Airport
DUS	Duesseldorf Airport		

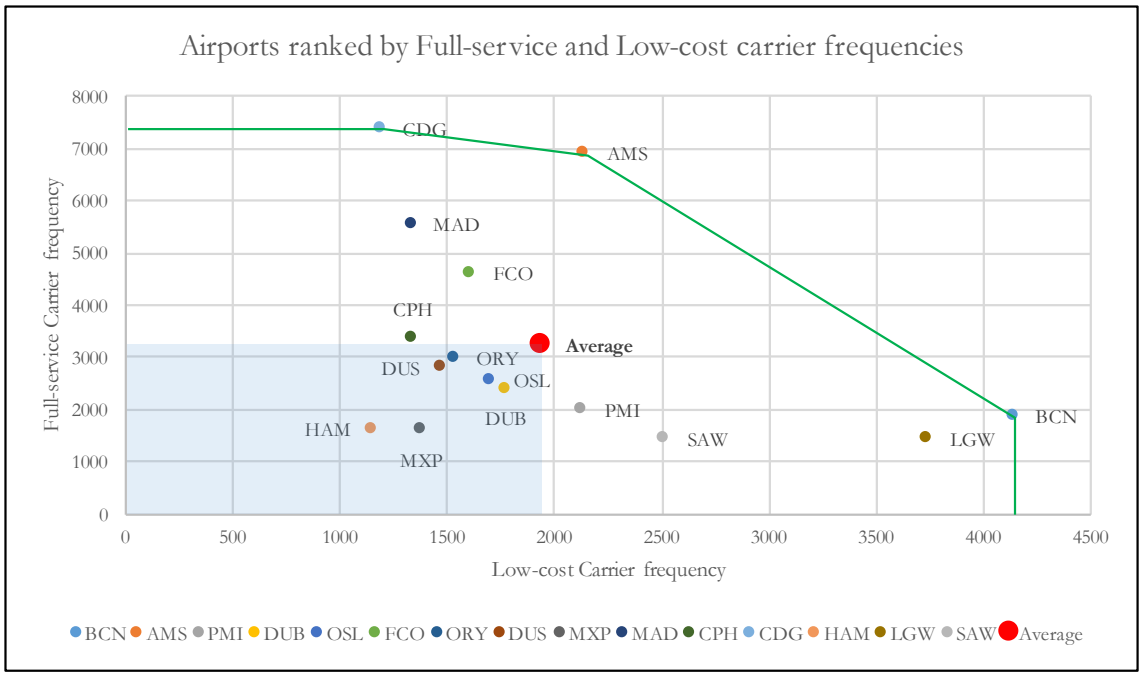

Figure 15 – Airports top 15 that show both high low-cost and full-service carrier weekly frequencies. The green line represents the frontier of airports with the highest frequency and the blue surface indicates airport below the top 15 average

All airports that score above average are located on the map in Figure 16. Destination data is obtained from OpenFlights.org. Both AMS and CDG have a relatively high full-service carrier frequency which suggest that these airports have the highest potential for transfers from a long-haul route to a short haul route. MAD and FCO are outperformed by AMS and CDG but might serve as self-help hubbing airport that connect the region to the rest of Europe and the world. LGW and BCN are located in Western Europe and based on the high low-cost frequencies they have potential to serve indirect short-haul routes within Europe by self-help hubbing. CPH connects northern Europe with both short-haul and long-haul destination. PMI is a popular holiday destination and might serve as transfer point for short-haul travel but its location is far from a geographical center which might lead to longer and inefficient flying. SAW has potential to connect Europe and the Middle-East by self-help hubbing.

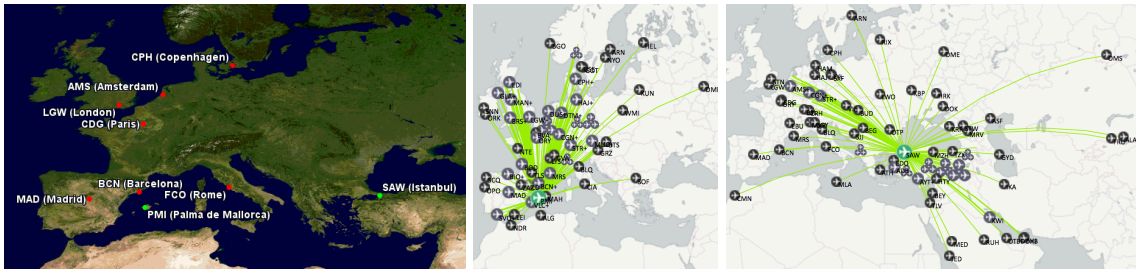

Figure 16 – Geographical location of Top 15 self-help hubbing airports (left), PMI network (middle) and SAW network (right).

Airports, dominated by low-cost carriers such London Stansted, Manchester Airport and London Luton do not appear in the ranking due to the low full-service carrier frequency. These airports might have potential for self-help hubbing between low-cost carrier flights on short-haul to short-haul routes.

In the qualitative analysis, the self-help hubbing potential for London Gatwick and Amsterdam Schiphol Airports was identified. The results show respectively 30 and 40 million passengers per year. Milan Malpensa was estimated to have a self-help hubbing potential of 13 million passengers per year. The 30 and 40 million passengers are on the green line while the 13 million is amongst the airports that score beneath average. This suggest that the offered frequency by full-service and low-cost carriers are an indication for self-help hubbing potential and that MAD, FCA, CPH, PMI, SAW and BCN have a self-help hubbing potential between 13 and 40 million passengers per year. These values from the qualitative data are likely to be overestimated because the transfer market is highly competitive. This overestimation therefore also holds for the latter suggestion.

5.3 Network Analysis

To validate the statement that long-haul routes show more potential than short-haul routes because true savings are found on long-haul routes, a network analysis is conducted. The original NetCost model was already introduced in chapter 3 but several adaptations are required to use it in this thesis. These adaptations are described in 5.3.1.

The model is applied to four existing scenarios; Two long-haul routes and two short-haul routes (5.3.2). For these scenarios, the model determines the choice probability of the self-help hubbing alternative which is used to draw conclusions about the potential (5.3.3).

5.3.1 NetCost Model Adaptation

The generalized costs, associated with the original model are determined by the ticket price, the travel time and the offered frequency. If one has to choose between an itinerary the main criteria are travel time and price. The preferred itinerary depends on the value of travel time. A route with a high frequency is more likely to depart or arrive, closer to the desired departure or arrival time. This decreases the average schedule delay and might therefore be more preferred. This however is not sufficient to estimate a self-help hubbing choice probability. To adapt the model, several modifications are made.

- The ticket price estimation is replaced by actual ticket prices
- The self-help hubbing passenger is introduced
- The frequency component, which required a lot of data, is replaced by a self-help hubbing component
- Self-help hubbing support services are added

The ticket price estimation module was already discussed in the research approach. The average price is overestimated and while the module starts with a base fare of €80, in reality ticket of for example €20 can be purchased as well. Therefore, the ticket price module is replaced with actual price data. Prices in aviation are however highly dynamic and might change during the day. Therefore, price data

for all scenarios is obtained from a single source, on a single day, during a single hour to guarantee a fair comparison.

The self-help hubbing passenger is more price sensitive, less averse to long travel time and able to find the cheapest fares. They are assumed to be on the lower end of the continuum of business and leisure passengers. To include this passenger in the route choice probability estimations, the assumptions are extended with a new passenger type, called the millennial. The category is characterized by a value of time, half the value of a leisure passenger.

The reason not to choose self help hubbing related to the complex booking process, the risk of a missed flight and additional hassle at the airport. According to a survey amongst self-help hubbing passengers, 40% wants to save at least $100 (OAG, 2016). This leads to the following assumption: *If a self-help hubbing alternative is $100 cheaper than the identical flight with a conventional connection, the generalized travel costs are equal.* If this assumption is inversed, the generalized costs for two identical alternatives is $100 higher for the self-help hubbing version compared to the conventional transfer. For simplicity, self-help hubbing is assumed to add €100 to the generalized travel costs.

In the presentation of Kata Cserep, a small internal survey revealed that 23 out of 46 respondents stated that the additional airport hassle was the reason not to choose self-help hubbing. 5 respondents complained about the booking process and 18 respondent mentioned the risk (Appendix XI). Based on this survey data it is assumed that 50% of the generalized travel costs, related to self-help hubbing are caused by the additional airport hassle. 39% is caused by the risk of a missed connection and the remaining 11% is caused by the complex booking process. The generalized travel costs, associated with self-help hubbing were assumed to be €100. If the ticket is booked via Kiwi.com, the passengers experience a single booking process and get an insurance for missed connections. Therefore, in the case of alternative, booked via Kiwi.com, the self-help hubbing effect on the generalized travel costs is no longer €100 but only 50% which corresponds to €50.

The above mentioned adaptation can be translated into an adapted NetCost model where the total generalized travel costs, associated with an alternative are the sum of:

1) Lowest ticket price of the day for an itinerary between A and B
2) Travel time (flight time and transfer time via X) multiplied by the value of time
3) The connection type at airport X; conventional (€0), self-help hubbing (€100) or supported self-help hubbing (<€100)

$$GTC_{\text{axb}} = c_{ab}^{time} + c_{x}^{Self-help\ Hubbing} + c_{ab}^{airfare}$$

The generalized travel costs for self-help hubbing are based on three dummy factors:

- A streamlined airport process, yes=1
- The covered risk of a missed connection, yes=1
- The single booking process, yes=1

$$c^{Self-help\ Hubbing} = €100 * (1 - 0{,}5 \cdot D_{airport} + 0{,}39 \cdot D_{Connection} + 0{,}11 \cdot D_{Booking})$$

The model produces a generalized travel costs component for all alternatives. The lower the generalized costs, the higher the perceived utility of an alternative. Therefore the generalized travel costs component is multiplied by parameter according to the original model[16] (Lieshout, Veldhuis, de Wit, & Matsumoto, 2009), set to -0,015 A logit model is used to determine the choice probability based on the perceived utility of the conventional alternative (A) compared to the perceived utility of the available self-help hubbing or supported self-help hubbing alternative (B).

$$P(B) = \frac{e^{B}}{e^{A} + e^{B}}$$

An illustration of the model is provided in Figure 17 where SHH means Self-Help Hubbing.

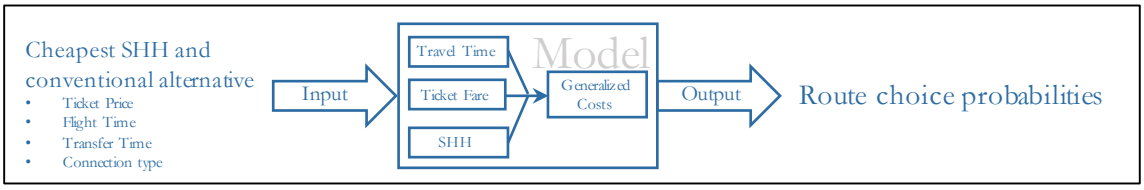

Figure 17 – Adapted NetCost model representation

5.3.2 Route scenarios

To verify the qualitative conclusion that self-help hubbing has most potential on long-haul routes, the model is tested in four scenarios; two long-haul routes and two short-haul routes. The routes are subjected to only two based requirements:

- There is no direct flight
- There are conventional transfer and self-help hubbing alternatives on every day
- The routes at least depart from or arrive at a secondary airport.

The routes are shown on the map in Figure 18. The intercontinental long-haul routes include Cork to Singapore and Madrid to Kochi. The European short-haul routes include Glasgow to Oslo and Catania to Lisbon.

Figure 18 – Scenario representation on the map of the 4 routes[17].

[16] This value is not given in the cited paper. The value is provided by Guillaume Burghouwt, aviation researcher at SEO during a phonecall.

The only fixed parameters in the search query is the origin, destination and date. The exact route might vary over the week. Therefore, transfer takes place at several airports. To illustrate the variance of transfer airport, the routes from Cork to Singapore are mapped in Figure 19. In the map[17], it can be seen that there is only one route (via Munich) with a single transfer. All other routes require two or even three transfers. The orange routes are conventional connections while the green routes represent self-help hubbing alternatives. More information on the different routes can be found in Appendix XIII to Appendix XVI.

Figure 19 – The cheapest available routes from Cork to Singapore from September 12 to 16, 2016. Green routes are self-help hubbing alternatives and orange routes are conventional connections. Mapped by gcmap.com

5.3.3 Results

The results of the adapted NetCost model verify that costs can be saved by self-help hubbing. The results however show that short-haul routes have more potential compared to long-haul routes. Qualitative data suggested the exact opposite. This can be explained by the data where the short-haul routes show an even more convenient flight schedule for self-help hubbing compared to the conventional transfer. On the long-haul routes the self-help hubbing flight schedule are a lot less convenient and conventional transfers are clearly better coordinated in terms of transfer time, which compensates the higher fare in terms of generalized travel costs.

Data is obtained from Skyscanner on June 9th, 2016. Skyscanner provides optimal solutions. Optimal solutions are not always the cheapest; a flight that is €10 more expensive but saves 5 hours of travel time is for example perceived as optimal. Data is limited to the cheapest but optimal self-help hubbing solution and the cheapest but optimal conventional connection. Data is obtained for September 12th to 16th, 2016.

Many self-help hubbing alternatives are offered via Kiwi, an online travel agent. Kiwi offers a single booking experience and takes responsibility for the connection. Therefore, the traveler has the benefit of a single booking experience and insurance of all risks. The generalized travel costs, related to self

[17] The curvature of the routes is cause by the projection of the earth. The routes show the shortest path on a globe, which is projected onto a flat rectangular earth.

help hubbing are therefore lower for flights, offered via Kiwi. No airport-led or airline-led self-help hubbing alternatives appeared in the results Results are obtained for four routes:

1. Cork to Singapore
2. Madrid to Kochi
3. Glasgow to Oslo
4. Catania to Lisbon

Cork to Singapore

The self-help hubbing alternatives have an average travel time of 27:45 hours and an average fare of €452,40. The conventional options have an average travel time of 19:11 hours and an average fare of €523,33. Self-help hubbing might therefore save travel costs by a lower fare, but the generalized travel costs increase due to the additional travel time. The highest choice probability was seen on Tuesday where the self-help hubbing alternative saved €93 and took 7,5 hours extra. Transfer time however is calculated with a punishment factor and therefore the generalized travel costs for all passenger types are lower for the conventional connection.

Based on this result we can conclude that the majority of the passengers, travelling form Cork to Singapore in this particular week will use a conventional connection. It depends on the actual demand on this route to estimate the potential, but the option is only attractive for an average of 14,7% of the millennials and 2,5% of the leisure traveler. More detailed results are depicted in Figure 20.

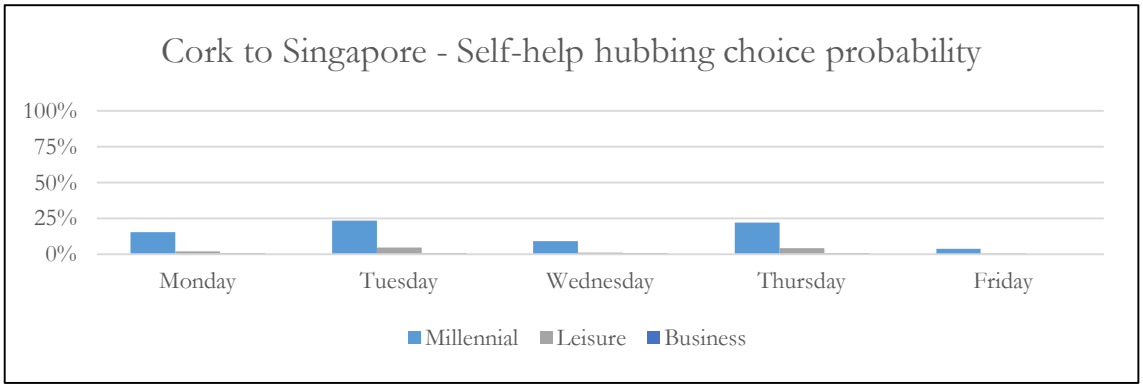

Figure 20 - Choice probability estimates for long-haul route 1

Madrid to Kochi

The self-help hubbing alternatives have an average travel time of 25:12 hours and an average fare of €395,4. The conventional options have an average travel time of 21:03 hours and an average fare of €415,32. The self-help hubbing alternatives therefore take about 4 extra hours for only €20 of savings. Based on the estimated generalized costs, the self-help hubbing alternative on this long haul route is always perceives as more expensive.

For the millennial, leisure and business passenger the average choice probability is respectively 11,7%, 3,8% and 0%. More detailed results are depicted in Figure 21.

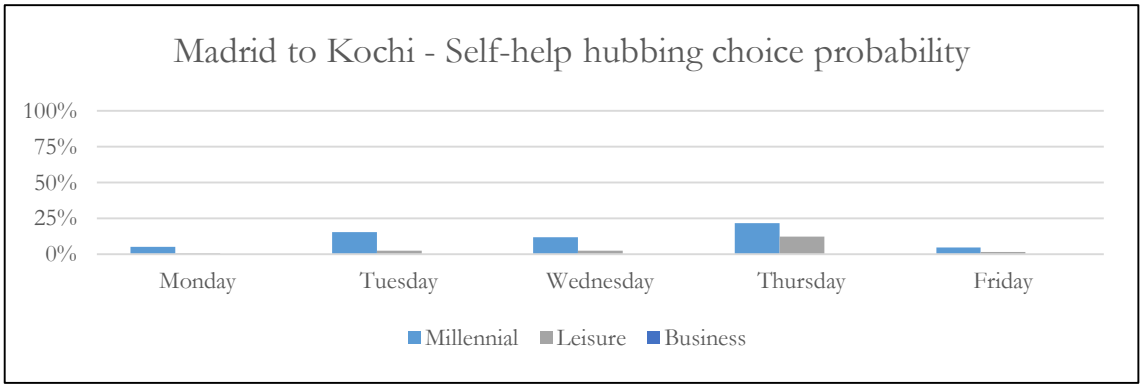

Figure 21 - Choice probability estimates for long-haul route 2

Glasgow to Oslo

For this short-haul routes, self-help hubbing perform significantly better compared to the long-haul routes. The self-help hubbing alternatives show an average travel time of 6:15 hours and an average fare of €90,82. The conventional options have an average travel time of 5:11 hours and an average fare of €185. For the millennial, leisure and business passenger the average choice probability is respectively 39,8%, 25,2% and 8,5%. More detailed results are depicted in Figure 22.

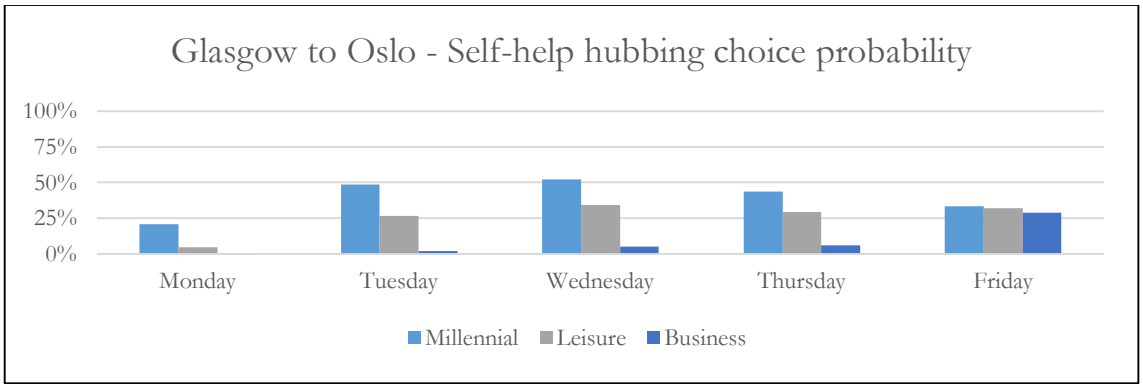

Figure 22 - Choice probability estimates for short-haul route 1

On Wednesday the self-help hubbing choice probability is highest; 52%. A closer look in the choice set of Wednesday shows that the self-help hubbing alternative itinerary is more efficient. If we take a closer look on the map (Figure 23), it can be observed that the self-help hubbing itinerary requires less flight time . It also and saves €105 but the transfer time of the self-help hubbing alternative is over twice as long which results in additional generalized costs for travel time. Insurance is provided by Kiwi and in the end, the generalized travel costs for millennials are €7 cheaper compared to the conventional alternative.

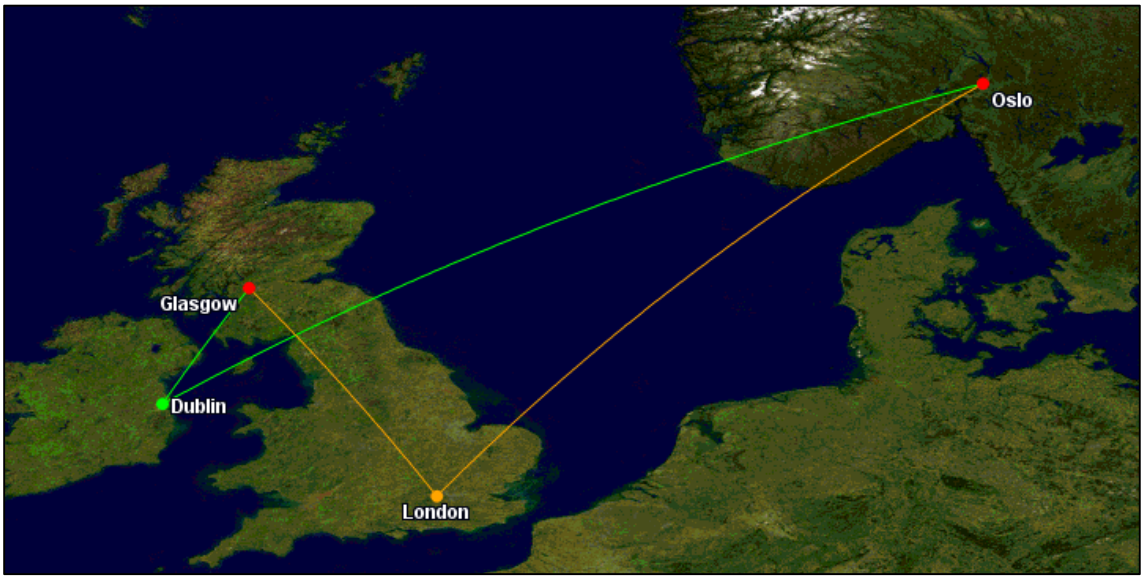

Figure 23 – Choice alternatives between Glasgow and Oslo on September 14th. Self-help hubbing alternative offers a more efficient flight.

As for all scenarios, the true potential is dependent on the demand between Glasgow and Oslo. The choice probabilities for millennials, leisure and business travelers are substantial. It might suggest that on the route between Glasgow and Oslo, self-help hubbing is actually competing with conventional connections.

Catania to Lisbon

The self-help hubbing alternatives showed an average travel time of 9:24 hours and an average fare of €121,25. The conventional options have an average travel time of 9:37 hours and an average fare of €156,4. This route is particularly interesting because Monday, Tuesday and Thursday show a more convenient flight schedule for the self-help hubbing alternatives. On top of a more convenient flight schedule, the tickets are also less expensive varying between €23 and €62.

For the millennial, leisure and business passenger the average choice probability is respectively 43,8%, 48,9% and 53,1%. Also shorter routes can be observed for self-help hubbing. More detailed results are depicted in Figure 24. On the one hand, a cheaper and more convenient flight is always more preferred. On the other hand, business passengers are often member of frequent flyer programs and prefer a certain airline. It might also be the case that they book via a company travel agent that does not consider self-help hubbing alternatives. The model is only based on generalized travel costs and therefore only sensitive for the cost aspects. It can be suggested that in a group of passengers, not bonded to an airline and willing to use self-help hubbing, the majority or even everyone will choose the self-help hubbing alternative.

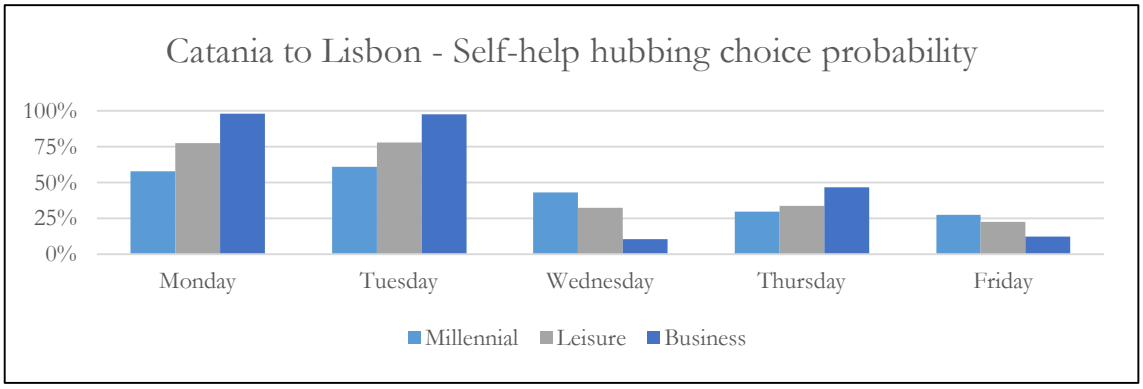

Figure 24 - Choice probability estimates for short-haul route 2

It is unknown what the demand is between Catania and Lisbon but on this short-haul route, self-help hubbing is a true competitor of conventional connections. It is therefore very likely that on this route at least several passengers, assuming they are willing to use the self-help hubbing alternative.

5.4 Conclusions and discussion

This chapter focused on the following research questions; What type of airports and routes would have potential for self-help hubbing? This questions was already answered in the previous chapter by means of qualitative data from interviews and the seminar. This chapter had the objective to extend earlier conclusions by quantitative data and to get a sense of the magnitude of self-help hubbing.

5.4.1 Sub research question 6

The qualitative data concluded that amongst others both primary and secondary airport might have potential. Primary airport with a home carrier however might be less interested because it does not support the hub function and could cannibalize the current transfer flows. Quantitative research based on the frequency of flights, to and from airports in Europe revealed the top 15 European airports. Combined with qualitative data, a relation can be suggested between the offered frequencies, mixture of business models and the self-help hubbing potential. Other airports with outstanding offered frequencies were Barcelona El-Prat and Paris Charles de Gaulle. Given the estimated potential for Milan Malpensa, London Gatwick and Schiphol airport, the potential for the airports in between lie between 13 and 40 million passengers per year. This conclusion can however not be validated as it is highly dependent on the offered network of destinations.

Related to route type, qualitative data showed that short-haul routes only had little potential for self-help hubbing because the European network was properly served. True savings were said to be found on the long-haul routes. The adapted NetCost model however shows the opposite. Long-haul routes in combination with self-help hubbing have a less convenient time schedule and less savings. The amount of money saved on average is 13,5% for Cork-Singapore and 4,8% for Madrid-Kochi while the travel time increases by respectively over 40% and 19%. On the short-haul route from Glasgow to Oslo, the average price saving was 51% while travel time only increased by 19%. On the short-haul route from Catania to Lisbon, the average price saving was only 22,5% but the average travel time was 2% lower than the conventional connections. Based on these scenarios it can not be concluded that true savings can be found on the long-haul route and that potential on the short-haul is little because the model shows the exact opposite.

5.4.2 Discussion

The CAPA airport analysis indicated both secondary and primary airports in the top 15 airports with self-help hubbing potential. The airports are selected, based on the offered frequency only. The CAPA airport analysis showed that Milan Malpensa scores relatively low in the top 15 while London Gatwick and Schiphol Airport score far above the top 15 average frequencies. This seems to match with the qualitative results. The true self-help hubbing potential of an airport is however not only related the the mixture of business models and the offered frequencies. It also depends on other factors such as the network of destinations, demand, operating airlines and terminal configuration.

The adapted NetCost model, simulated the choice probability of passengers. The input were four routes, randomly chosen by the author. No direct flight is available and both the conventional and self-help hubbing alternative are available on every day of the specific week. The entire spectrum of long-haul and short-haul routes is however not represented by only four routes. Therefore, the conclusions, based on the specific routes, are correct but extrapolating the conclusions to long-haul versus short-haul might be tricky.

The model only took into account generalized travel costs in terms of flight time and transfer time, ticket price and the connection type. Transfer time is perceived as more disutility and is therefore multiplied by a punishment factor, originating from the original model. In 4 cases however (i.e. route 1 on Monday) the conventional connection required less transfer points compared to the self-help hubbing alternative and in 2 cases (i.e. route 4 on Wednesday), the self-help hubbing alternative required less transfer points compared to the conventional connection. For each transfer, the passenger experienced additional hassle due to leaving the aircraft and the risk of a missed connection increases. The amount of transfer points is likely to influence the choice probability but is not included in the model.

The model represented the business passenger by means of a higher value of travel time. The business traveler might however not even consider the use of self-help hubbing due to airline preference or because the flight is booked by a company travel agent. Therefore, this representation is open for discussion and it should be noted that is only represents the price-sensitive business traveler that is not bonded to a specific airline.

6 Conclusions, Recommendations and Reflection

This thesis conducted an exploratory research into self-help hubbing to provide more insight into the potential and the consequences of self-help hubbing. This final chapter suggests an answer for the title question; *A new trend in air travel?* This is done by answering the main research questions:

1) What is self-help hubbing and how is it different from conventional transfer?
2) What is the potential of self-help hubbing?
3) What are the implications for relevant stakeholders?

The first section provides an answer to the title question of this thesis by means of the three research questions. This thesis both had a scientific and practical relevance which led to several recommendations for further research and implementation in practice. Finally, this chapter is closed with a reflection which reflects not only on the chosen research method but also on the results. Reflection on the results is done since self-help hubbing is a very active topic for research and relevant working papers were presented at the 2016 World Conference of the Air Transport Research Society.

6.1 A new trend in air travel?

According to the author, self-help hubbing will be a new trend in air travel. The phenomenon is nothing new but once more and more people started doing, stakeholders took action to exploit its potential and generate revenues by offering products to improve the process of self-help hubbing process.

6.1.1 What is self-help hubbing and how is it different from conventional transfer?

Self-help hubbing is the process of transfer between airlines that do not offer transfer. In theory, self-help hubbing can take place at any airport between any airline but in practice it often includes at least one low-cost carrier. Purchasing two or more separate tickets in order to transfer between any non partnering airline at any airport without support is not attractive to everyone. Self-help hubbing alternatives are more difficult to purchase, since it might require different websites and multiple money transactions which results in multiple confirmation e-mails and different customer services. Self-help hubbing also requires additional processes and queuing at the airport compared to a conventional transfer as illustrated in Figure 25. Next to the booking and airport process, there is also the risk of a missed connection which is not covered by the airline. Therefore, self-help hubbing is a tradeoff between costs and risk of hassle which is most attractive for individual travelers that are very price conscious, savvy and experienced in flying without any airline preference. More details on the differences is provided in Table 17.

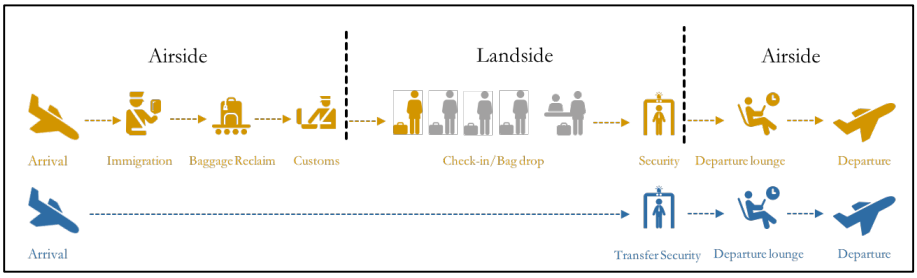

Figure 25 – The airport process of conventional transfer versus self-help hubbing. The yellow steps indicate the airport processes for self-help hubbing passengers.

Table 17 - Comparison of conventional transfer and self-help hubbing

	Conventional	Self-help hubbing
Booking process	Via airlines, travel agents and online meta-search engines. One single ticket	Two separate tickets. Flights can only be found by a limited number of meta-search engines.
Airport process	Only on airside and the passenger has to get a boarding pass and might face security checks or passport control. Relatively short	Baggage reclaim, leave airside via customs. Queue for check-in desks, drop off baggage and proceed to airside via security check and passport control. Relatively time consuming.
Responsibility	The airlines take care of baggage and the risk of a missed connection.	The passengers takes care of baggage and the risk of a missed connection.

6.1.2 What is the potential of self-help hubbing?

The industry seems to recognize the trend of self-help hubbing. About 4% of the European transfer passengers are using self-help hubbing. The variation for specific routes however is large and estimations even go up to 40%. Between 2011 and 2012, the amount of news articles published by CAPA, an aviation market analytics provider, increased rapidly. The industry is taking action to exploit the potential of self-help hubbing. Airports are providing free or paid services to attract and support the passenger. The passenger is attracted by a dedicated search engine to find the self-help hubbing alternatives, airport facilities like dedicated security lanes and baggage drop-off points, and an insurance to cover the risk of a missed connection. More and more sales channels such as online meta-search engines and travel agents are also supporting self-help hubbing. The visibility of self-help hubbing at website like Skyscanner, Momondo, Kayak, Dohop and Kiwi are the main reason why travelers are increasingly considering self-help hubbing.

Self-help hubbing, in theory, works at any airport; primary, secondary and regional. Primary airports with a home-carrier are however unlikely to support this trend because it might cannibalize the existing transfer flows and disturb passenger flows in the terminal. Primary airports are often congested, which increases the risk of a missed connection. Therefore, primary airports are less attractive for self-help hubbing. Regional airports often offer a relatively small network and therefore most self-help hubbing potential is for secondary airport. A respondent estimated that Milan Malpensa, a secondary airport could attract 13 million passengers per year by self-help hubbing connections. London Gatwick, a secondary airport dominated by low-cost carriers, might even attract 30 million passengers and Amsterdam Airport Schiphol, a primary airport with relatively high frequencies for both full-service and low-cost carriers, even 40 million passengers per year. An airport analysis based on frequency revealed the top 15 European airports for connecting between full-service and low-cost carriers, based on the weekly frequency offered by low-cost and full service carriers (Figure 26). The frontier of best performing airports is represented by the green line and the airports that score below the top 15 average are within the blue surface.

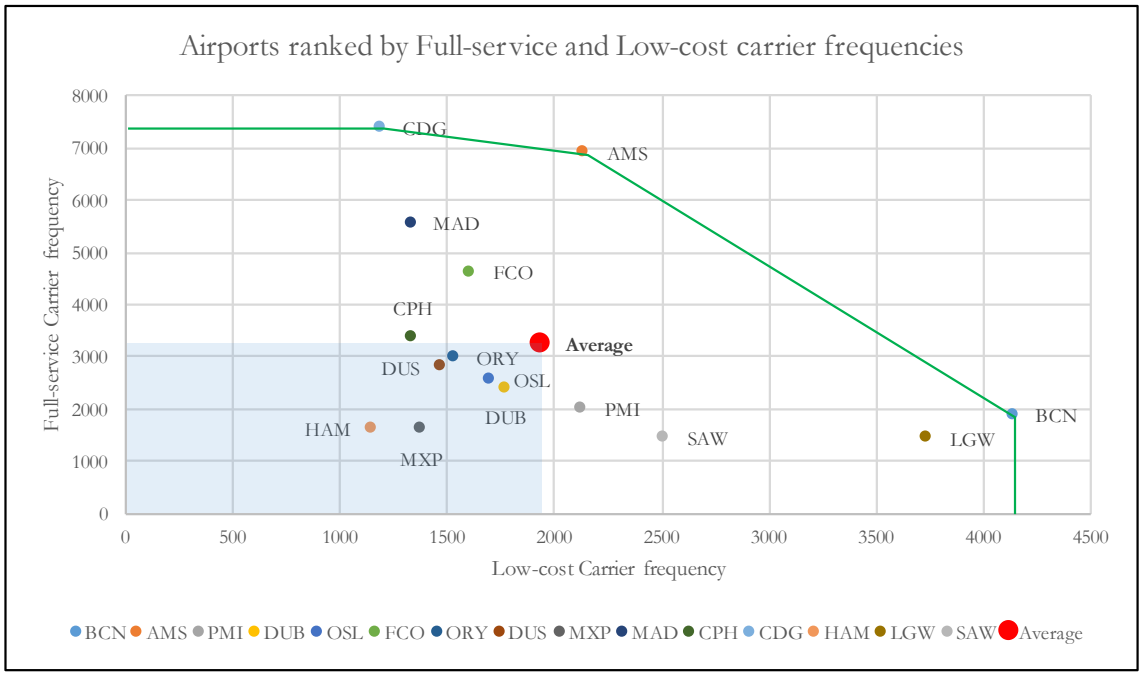

Figure 26 – Airports top 15 that show both high low-cost and full-service carrier weekly frequencies. Green line represents the frontier of airports with highest frequency and blue surface indicates airport below the top 15 average

Combining the estimated potential with the airport analysis suggest that there are several other airports that might attract between 13 and 40 million passengers per year. Airports that are dominated by low-cost carriers like London Stansted, London Luton and Manchester do not appear in the analysis but certainly have potential for self-help hubbing between low-cost carriers.

The actual demand for self-help hubbing is however based on the trade-off between costs, time and risk. It is suggested that self-help hubbing only works for routes between unusual city pairs with too little demand for a direct flight. Qualitative data suggests that long-haul routes have most self-help hubbing potential because this segment results in true savings while the short-haul route network in Europe is already properly served which limits the use of self-help hubbing. A network analysis based on route choice probabilities was conducted by an adapted version of the NetCost model. The results, based on actual data of four example routes however suggests the exact to opposite. True savings can be found on the short-haul while the savings on the long-haul are relatively little. On top of this, short-haul self-help hubbing alternatives actually might show a more convenient time schedule. On long-haul flights, self-help hubbing alternatives considers a significantly more inconvenient time schedule. Therefore, contradicting conclusions were found on the route type with most self-help hubbing potential.

6.1.3 What are the implications for relevant stakeholders?

This new trend in air travel will not be a great shock. Self-help hubbing connections will not replace conventional connections, do not require major investments by stakeholders or policy changes. It might bring some passengers closer to their optimal itinerary in terms of travel costs and travel time. It is also beneficial for airports and airlines since it might bring additional revenues, ancillary revenue and an increased loadfactor. On the other hand, not all airlines are interested in this very price-sensitive passenger segment. For primary airports it might disturb existing passenger flows and result

in more stress of the baggage handling system. Sales channels benefit from self-help hubbing since it results in double transaction fees en additional revenues by for example the insurance product.

6.2 Recommendations

This thesis is relevant for academic literature and transport practice. The state of literature as identified in the first chapter was fairly limited and seemed inconclusive. In the mean time, the industry was already taking action. Therefore, exploratory research was needed to get more grip on self-help hubbing, its potential and implications. Based on the results, the conclusions stated that self-help hubbing will become a new trend in aviation that changes the way of travel for some of us. The impact will not be shocking, but nevertheless several recommendations are posed.

6.2.1 For further research

The main inconclusive finding in this thesis is the route type with most potential. The majority of the involved industry experts in this research think that the potential is on long-haul routes. A relatively simple choice model was used to analyze passenger choice probabilities in a route network. An existing model was adapted and actual input data was obtained from Skyscanner. The results showed the exact opposite and suggested that the true potential is for short-haul routes instead of long-haul. Therefore, further research about the type of route is suggested. The model has to be estimated based on true empirical data and input data should be extracted from Skyscanner and Kiwi on a larger scale to get grip on the true passenger choice and trade-offs between costs and time for a larger network.

Developments also show that for example Norwegian and Ryanair in Europe and AirAsia in Asia provide a paid intralining transfer service. So-called same metal transfers seem to be the first step towards a supported transfer between low-cost transfer and other airlines. When intralining, the risks are internalized and manageable within the airline. The question rises what the additional demand is, that gets attracted by these services, what the willingness to pay will be for these services and how it changes the competitive landscape of the aviation industry.

Another development is a partnership between full-service carriers and low-cost carriers. An example is Vueling. Insights in these partnership might provide knowledge about how partnerships can be arranged while maintaining the low-cost carrier profile and minimize costs. Will the risks of lost baggage and missed connection be covered by both airlines or is the responsibility for the full-service carrier?

6.2.2 In practice

Self-help hubbing can be either an opportunity or a threat. Airports might consider self-help hubbing as a way to compete in the transfer market. Especially the airports, identified as top 15 in Europe with potential for self-help hubbing are advised to take a closer look at the actual potential and demand that can be captured by attracting these passengers. Another important aspect to be researched is marketing which is lacking for self-help hubbing. As de Wit and Zuidberg (2012) concluded, future growth for low cost carriers can be achieved by transfer activities to attract additional demand. Therefore, both airlines and airports should determine what benefits self-help hubbing can deliver for them.

Neither airport nor sales channels can provide the level of service for transferring that airlines do. Cooperation between for example Kiwi and airports might be a solution that helps to create an experience, almost equal to that of airlines. This might generate additional revenues for airports and sales channels while airlines are likely to show a willingness to cooperate because it saves them expensive partnership contracts and IATA membership fees.

6.3 Reflection

The methodology, applied in this thesis is based upon two qualitative data sources and a quantitative model. The reflection reflects on the interviews (6.3.1) and the model (6.3.2). Also the results will be reflected upon since the topic of self-help hubbing is a very active topic amongst researchers. This poses questions on how the conclusions in this thesis relate or differ from the others (6.3.3).

6.3.1 The interviews

The chosen approach was suitable for the exploratory character of this study but several limitations are posed. Including the interviews and the seminar, data was obtained from a total of 8 respondents. These respondents can be considered as experts but a larger group of primary airports, secondary airports, full-service or home carriers and low cost carriers and consultants would create a better sample to guarantee validity of the data. Next to this, the 8 respondents did not represent all stakeholders and therefore the results might be biased. The respondents' statements, perspectives and corresponding conclusions might be too positive about self-help hubbing due to their position and connection to self-help hubbing. The perspective of actual passengers, a full-service carrier and a hybrid carrier were lacking which might have created a more critical perspective on self-help hubbing. A second limitation regarding the data analysis method was the fact that interviews were summarized. Content analysis is meant for actual interview transcription which might have limited the research method.

6.3.2 The adapted model

The adapted NetCost model served its purpose well by providing a sense of feeling regarding the magnitude and choice probability of self-help hubbing. The model is however used for only four routes, which is not representative for the entire spectrum of long-haul or short-haul routes. The model therefore loses its generic character and does only draw preliminary conclusions for the global network size. The added component for self-help hubbing was based on a small internal survey from a respondent. This is sufficient for the exploratory character but true empirical data from a larger survey would have been better in the sense that the model becomes a better representation of reality.

6.3.3 Other working papers

Other researchers identified knowledge gaps as well. At the 2016 World Conference of the Air Transport Research Society two relevant papers were presented. The results of two relevant papers will be compared to the conclusions of this research.

Maertens, Pabst and Grimme (2016) research the development of low-cost, one-stop connecting services in Europe. Based on data from OAG, not accessible by the author of this thesis, they concluded that low-cost carriers allow for about 162.000 connection per week in 2016. An increase

compared to 2006 but still significantly lower that full-service carriers with 725.000 connection per week. Low-cost carriers connect 15.900 airports while full-service carrier connect 25.300. They identified Barcelona, London Gatwick, London Stansted, Dublin and Oslo as the largest transfer points, responsible for almost 50% of the available weekly connections. Concluding remarks are given about the potential benefits for full-service carriers that rely on low-cost carriers as feeders into their hub-airports and a required solution to ensure self-help hubbing. The example of Dusseldorf is given that allows for airside connection by a pathway between three terminal areas.

These conclusions seem to match the conclusions that self-help hubbing will not replace conventional connections. They only include the low-cost carrier in their analysis. The analysis in this thesis was focused on the offered frequencies by low-cost and full-service carriers. If only the low-cost carrier frequency is taken into account, frequency seems a good performance indicator for self-help hubbing. Their results are additional to this thesis but do not show major differences regarding the potential of self-help hubbing.

Suau-Sanches, Voltes-Dorta and Rodríques-Déniz (2016) research the potential for self-help hubbing in the global air transport market. They used Market Information Data Tapes (MIDT) from global distribution systems, inaccessible to the author of this thesis. They used three scenarios for the development of self-help hubbing where either 4%, 7% and 15% of the total bookings involve at least one self-help hubbing transfer. They show that self-help hubbing is heavily concentrated in Europe, North America and Asia-Pacific. The intra-regional self-help hubbing represents approximately two-third of the global self-help hubbing transfers. The highest frequencies for self-help hubbing alternatives are observed for short-haul routes with a length of 2.000 km. They emphasize that the requirement for a network mixture of long-haul and short-haul destination to capture self-help hubbing passengers can be relaxed. Their results also specify that the largest amount of self-help hubbing connections are found at the major hubs like London Frankfurt, Atlanta, Chicago, Hong Kong and Dubai. However, they show that once self-help hubbing will continue to develop, the increase in self-help hubbing connections is highest for the secondary airports with substantial low-cost carrier presence like Barcelona, London Gatwick and Manchester.

Their results support the outcome of the adapted NetCost model regarding the potential for the short-haul market compared to the long-haul market. Their statement about relaxing the requirement of the long-haul/short-haul network mixture, one of the outcomes from qualitative data, is surprising. If this requirement is not that important, it can be suggested that self-help hubbing only matters for low-cost carrier transfers. They however draw the conclusion that the largest amount of self-help hubbing connections are found at major hub-airports. This is likely to be caused by extensive networks of full-service carriers. The conclusion that the growth however takes place at airport, dominated by low-cost carrier however is an addition to the thesis.

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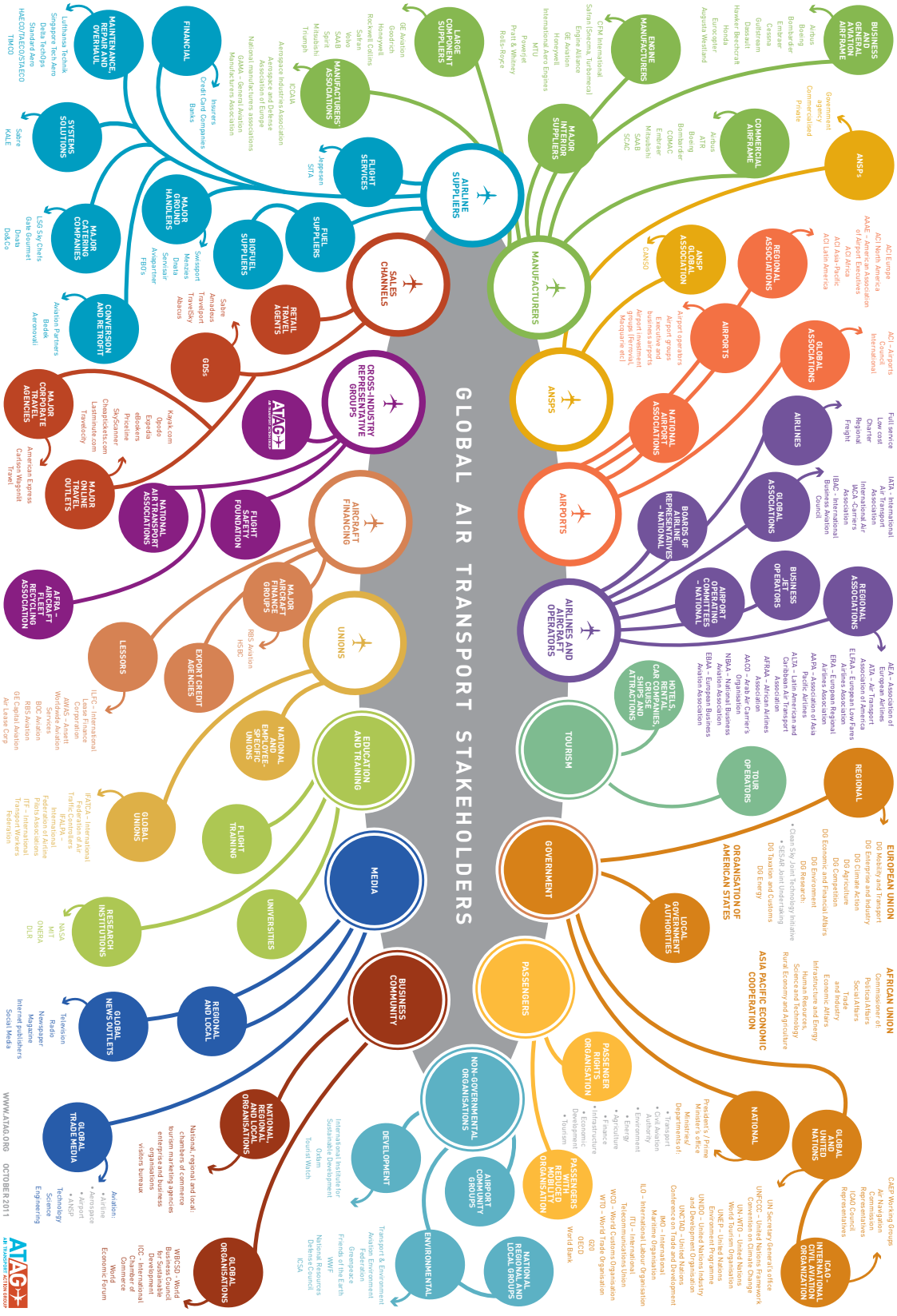
Appendix I. Aviation Stakeholders



Appendix II. Dutch Air Travel behavior at Schiphol

This table provides the amount of Dutch travelers that traveler from Schiphol as well as the travel distance the flew. Dividing this provides the average distance for each traveler departing from Schiphol Airport.

Year	# travelers (10^6)	Traveled distance (10^9 km)	**Distance/traveler (km)**
2005	15,11760105	52,85940064	3496,546869
2006	15,81597895	55,68474133	3520,790051
2007	15,9406143	56,03053997	3514,954877
2008	15,85661732	56,3997814	3556,860853
2009	14,50779446	52,20023313	3598,081933
2010	15,39117637	56,61466198	3678,384331
2011	16,95996693	59,18967222	3489,963893
2012	17,15153681	60,28016795	3514,563658
2013	17,3159416	59,46401417	3434,061833
2014	18,474908	64,28399284	3479,529795

Appendix III. Airneth Seminar Program

Seminar 18 May 2016

Ministry of Infrastructure and the Environment, The Hague

Room F-1.38, Plesmanweg 1-6, 2597 JG, The Hague

New Forms of Transfer in Air Transport Networks

Program

13.00-13.15	Walk-in
13.15-13.30	**Welcome and opening by the chairman**
	Prof. Jaap de Wit, University of Amsterdam
13.30-14.00	**The potential of new transfer formats**
	Prof. Paolo Malighetti, University of Bergamo
14.00-14.30	**Airport-led transfer schemes: ViaMilano**
	Vittorino Capobianco, Milan Malpensa Airport
14.30-14.50	Coffee break
14.50-15.20	**Current state of self-connect**
	David Gunnarsson, Dohop
15.20-15.50	**The future of self-connect and the implications for the Dutch aviation sector**
	Kata Cserep, ICF International
15:50-16:20	**Panel discussion**
16.20-16.30	Closing
16.30-17.30	Drinks

Appendix IV. Interview with Schiphol Group

The Setting

The interview took place on June 9th, 2016 at the Schiphol Group office around 09:30. The respondent was Gerben Broekema. Contact with Gerben was established by contact with other graduates at Schiphol Group. Gerben Broekema represents the perspective of a primary airport

The Respondent

Gerben Broekema

Source: Knect365

Gerben Broekema is Senior Advisor Group Strategy and Schiphol Group. He coordinates the group strategy and international development for Schiphol Group. He develops amongst other, long term spatial development plans and the aviation business area strategy.

Summary

Gerben discusses 4 types of connectivity; intralining, interline, selfconnect and self-connect between separate airlines. His hypothesis is that the potential of self-connect is marginal because airlines would have taken action by means of cooperation otherwise[EP]. The pricing system in the aviation industry often includes a fare reduction to compensate the addition hassle due to transfer. Departing from a primary hub however is relatively expensive and therefore he cannot imagine that routes are cheaper when self connecting via a primary hub-airport[EP].

Margins in the airline industry are limited and therefore Gerben does not expect significant price differences[RY2]. If self-help hubbing not results in a significantly lower fare, why would a passenger accept the hassle of self-help hubbing[RN3]? On the other hand, if the price gap is indeed present, airlines will notice this and increase their prices. Transferring at an airport that might be unfamiliar with the risk of missing the connecting flight is not attractive from a passenger's perspective[RN2]. From the perspective of technology providers, it is arranged quite well and several provides enable the traveler to reveal the self-help hubbing alternatives [RY7]. From the perspective of a primary airport with a successful home carrier, the support of self-help hubbing would not make sense. It would not support the home carrier and cannibalize the existing stream of transfer passengers[BEN]. Connecting other airlines to each other might be an opportunity but the required services on our behalf require too much attention compared to the benefits[ED]. The extra passenger flows will disturb the current processes and there is already shortage of capacity.

Cooperation between full-service carriers and low-cost carriers will grow in the future[ED]. It however requires product consistency to offer a certain service level and agreement on employment contract. It is already happening and carriers are increasingly cooperating outside Europe. Self-help hubbing might stimulate airlines to cooperate more closely[ED]. In the airline industry the focus is not based on volume but it is the yield that matters. By focusing on self-connect, the focus shifts to volume, based on low-yield passengers. It requires a lot of effort for low yields[EP]. An example is mentioned of an

airline that changed its strategy in the opposite direction by focusing on lowering costs by smaller aircraft with less seats. The lower number of seats cuts of the tail of the demand curve and only the high yield passengers remain.

The self-help hubbing passenger has to be extremely price-sensitive[PT3]. The passengers are young[PC1] and travels individual for leisure purposes[PC6]. Being price-sensitive, they are also very time insensitive. The risk of a missed flights will be more of a hassle than the baggage re-check[RN2]. Even for conventional transfer it might happen that baggage cannot be labeled through. In this case the passenger has to do this as well. To minimize the risk of a missed connection, the self-help hubbing process is most likely to take place at smaller and less congested airports[EP].

Appendix V. Interview with Milan Malpensa Airport

The Setting

The interview took place on May 18th, 2016 at the Ministry of Infrastructure and Environment. The respondent was Vittorino Edoardo Capobianco. Contact with Vittorino was established via Airneth. Vittorino was one of the speaker at the airneth seminar but due to an early flight he was unable to stay afterwards to answer some questions. Therefore I opted to invite him before the Airneth seminar for an interview.

The Respondent

Vittorino Capobianco

Source: affaritaliani.it

Vittorino Edoardo Capobiance is head of Aviation business services and destination development for SEA Milan Airports. He has experience in IT systems and distribution, marketing and strategy in aviation. Currently he develops initiatives to enhance customer experience and airport usability. One of his projects was de ViaMilano service that allows passengers to connect between non-partnering airlines.

Summary

Vittorino introduced the ViaMilano service after Alitalia, the home-carrier of Milan Malpensa airport, moved all their operations to Rome Fiumicino to concentrate all operations and save costs. As consequence of the above decision of Alitalia, the numbers of Passengers in transit dropped and as a solution to partially recover from this loss, Milan Malpensa took the role of an airline network manager to link non partnering airlines. They started by combining schedules of arriving and departing flights to create a network without involving the airline. To improve the passenger process, check in desks and baggage drop-off points were created on airside[SUP4]. To move passengers between flights, a minimum connecting time of 90 minutes was used for transfers within a single terminal and 100 minutes for different terminals. They also implemented a shuttle service every 7 minutes to connect the terminals.

After the product was complete including participation agreements with airlines free of charge, agreements with the ground handling agent, agreements with hotels and insurance agreements, the product was being promoted to passengers[RY7]. Not only by means of advertising but also by linking ViaMilano to GDS like Amadeus and Travel Port (only in the Italian market). Vittorino notes that very little cases occurred of missed connections[RN2]. The market for this product was the south of Italy. The airport over there have almost no long-haul connections and flying to Milan with an EasyJet flight could be a good alternative compared to flying via Rome with Alitalia[R1]. The product also contains for example access to a lounge which supports his statement that no specific focus on passenger type was used. The first year about half a million passengers used the ViaMilano product[EP]. However, several conditions changed ever since. Once the passenger got used to the product, they stopped registering for the ViaMilano product but still use the self-connecting facilities. Another change is the increased use of hand baggage and smartphones which decreases the need for these

expensive baggage facilities and check-in desks at airside[ED]. Currently the product is free[SUP3] but ready for an update because passenger requirements change and money can be saved.

In the beginning Milan was a pioneer with this self-connect product but ever since other airports started to copy the service. The airport product will continue to involve and information should be shared to improve the industry. Currently the self-help hubbing requires some rules that are equal for all airports to create a basic and common platform that provides basic guarantees for airports where passengers can add services they want[ED].

A via-airport product at all airports is beneficial for everyone. Business models of airlines are changing and Vittorino expect the low-cost carrier, feeding the long-haul carrier[ED]. Today it is not common but we see developments like Ryanair that offers to connect between their flights and in Asia a low-cost carrier alliance was created recently. Compared to the ViaMilano product, where multiple money transactions are required[SUP6], this has the benefit of one transaction. In the future Vittorino foresees the insurances also being part of the booking process to allow for a single transaction. Vittorino states that the insurance of a missed connection might remain responsibility of the airport to attract passengers[SUP2]. If the passenger has a value of €20, the insurance might decrease this revenues, but still the leftover is more than if the passengers would use another airport[BEN]. It is a tradeoff between less revenues per passenger or less passengers.

Alitalia is currently operating from Milan malpensa with a number of flights but they asked for the use of ViaMilano to benefit from the extra network opportunities and demand, offered by for example EasyJet[BEN]. However, not every airline is willing to join and benefit from this program. Other airlines prefer not to participate due to commercial reason, and alliance restrictions.

Vittorino denies that the ViaMilano product serves the purpose of increasing tourism in Milan[BEN]. Milan has a number of long haul destination in the morning and the evening. Passengers therefore might have long transfer times and to make this less of unattractive, the ViaMilano product offers the overview of attractions in the city of Milan.

Appendix VI. Interview with EasyJet

The Setting

The interview took place on March 18th, 2016 at Schiphol Airport around 09:00. The respondent was William Vet. Contact with William was established after EasyJet opted a self-connect product in a letter to the Ministry of Infrastructure and Environment. William represents the perspective of a low-cost carrier.

The Respondent

William Vet

Source: LinkedIn

William Vet is commercial manager at Easyjet. He is responsible for the Benelux and Denmark. His main focus is to serve the business market. This is done by flying to the right destinations, the right airports and at the right times.

Summary

EasyJet operates a point-to-point network and they do not wait for passengers that arrive too late. A transfer between flights is not offered because easyJet operates on dense and direct markets where the transfer product does not offer a significant additional benefits. Offering a transfer product would imply the responsibility of taking care for the passenger if a connecting flight is missed and additional costs for the lose of baggage and fees for delays.

EasyJet is not in favour of nor averse to concepts like GatwickConnects or ViaMilano. They admire the philosophy of thinking from the perspective of passengers. The passenger pays and therefore determines what should be offered in a free market. The aviation industry tends to think in a more traditional way but the new so-called millennial generation[PC2] just wants to go from A to B at the right time[RY3] and for the right price[RY2] and have no bonding to an airline[PT1]. Parties like Kayak and Skyscanner offer the option to arrange a connecting flight yourself[RY7] but marketing is still lacking[RY7]. Previously, legacy carriers facilitated the transfer passenger but including other carriers, the network grows significantly large that the number of available options grow[RY5]. William mentions a flight to Amsterdam where he experiences many different nationalities and cultures. He expects that many of them don't go to, but through Schiphol. What is their purpose and how did they booked their flight? William expects that less then 1% of their 5 million passenger to and from Schiphol are self-transfer passengers[EP] because there is no marketing for this new way of transfer.

The hassle remains that passengers need to collect their baggage at the belt and check in again[RN3]. No data is available but William is convinced that this trend is growing[EG]. During the start of GatwickConnects, it was used only dozens of times per day but this increased to several hundred times a day by now[EG]. The product, offered to facilitate al self organized connection, is not yet perfect and continues to develop[ED]. Until now, mainly airports take initiative by a product where they mitigate the risk of a delayed flight [SUP2] and take care of the baggage[SUP4]. This is in line with thinking from the passenger's perspective. As an airline, easyJet is not involved at all. No contract, agreement,

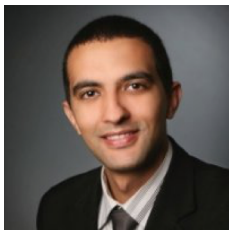
reserved seats, price deals or whatsoever. The concept of low-cost carriers, feeding into the hub-and-spoke networks is a great concept but far away from operational. EasyJet is willing to cooperate but it is up to other parties to step in and take care of this process. He mentions an example of Amsterdam-Dubrovnik. This leg is mainly used by tourists but the return leg allows Croatian citizens to depart from their local airport to connect at Schiphol. The routes with the highest potential are intercontinental flights because in Europe, most flights are offered directly[EG].

Appendix VII. Interview with Skyscanner

The Setting

The interview took place on May 10th, 2016 via Skype around 15:00. The respondent was Faical Allou. Contact with Faical was established after I contacted the author of a blog, posted by Skyscanner about self-connect[18]. Faical represents the perspective of a service provider.

The Respondent



Faical Allou

Source: LinkedIn

Faical Allou is business development manager of Skyscanner Analytics. Based in Edinburgh he is responsible for the development of the so-called next gen airline data and analytics product. Faical has a background as amongst others a network planning managers for Royal Air Maroc, Senior Consultant for Lufthansa Consulting and as account director for Sabre Airline Solution.

Summary

The two main reasons to use self-help hubbing are the lack of a normal conventional connection[RY1] and the search for a lower price[RY2]. Because Skyscanner has the objective to provide the traveler with the best alternatives, self-connecting alternatives are presented to provide a complete overview. Self-help hubbing can be linked to the unbundling of the air transport product where passengers choose the product they want by paying extra for for example baggage, food, a preferred seat or entertainment. When it comes to connecting, the traveler is however limited to one product; the conventional transfer[RY5]. Travelers get more savvy[PT4] and they do not want to be forced to take a certain connection, they want flexibility[RY5]. Travelers become more experienced[PT2] while less and less travelers are first-time travelers. There will always be people who prefer the conventional transfer options but this will be extended by unbundling the connection product and being able to combine any flight which provides more freedom[RY5].

In the infographic of Skyscanner, the definition of self-connect is different and includes a lot more than only the non-protected self transfer option on their website. A so-called self-connect is detected when for example a user with a IP address in Amsterdam is searching for a flight from Singapore to Bali. This definition could include everything from a quick transfer within hours up to a holiday[RY4] in Barcelona whereafter the traveler continuous to Rome. Skyscanner does not want to track individual users for privacy reasons and therefore ticket prices are unknown.

The infographic states that an average of 12.6% of the users per route choose self-connect. For the top three routes, Faical wouldn't be surprised if the percentage is around 40%[EP]. Faical agrees that this percentage is rather biased because it excludes the demand figures on certain routes being higher than others[PT5]. No real numbers are available but regarding the non-protected self transfer, Faical expects the percentage to be single digit[EP]. The non-protected self transfer alternatives on Skyscanner

[18] http://en.business.skyscanner.net/en-gb/blog/inforgraphic-top-airports-for-flight-self-connections-revealed

are presented with a warning and this scares people. If people book this flight but miss it, they will complain to Skyscanner about providing this option and therefore this warning is provided. Some people do understand the concept but the many people are confused by this option.

The users of Skyscanner are more price sensitive[PT3], savvy[PT4] and younger than the global average[PC1] and search for the best deals. Skyscanner does not have clients like the business travelers or older people that fly as part of their holiday with an organized tour. These latter groups are unlikely to use self-help hubbing[EP]. Faical expects the self-help hubbing market in the United Kingdom, Germany and the Netherlands to have a high potential. These countries have a lot of young people[PC1] that are used to travel[PT2] and go online[PC3]. Amsterdam to Bali is a significant route for self-help hubbing. Faical states that there are limited opportunities on the short-haul market because of the already cheap flights and the lack of origin destination pairs that are not properly served[EP]. Besides this, the true savings[PT3] are on the long haul. Travelers are not going to take the risk[RN2] for ten euro's but he mentions an example where about 200 pounds were saved due to self-help hubbing.

Faical does not expect major cooperation between low-cost carriers because transfer comes along with a lot of complexities and constrains[ED]. The main challenge is the transfer of bags[SUP4]. This is something that low-cost carriers don't want to get into. According to Faical his own opinion, this should be an airport's responsibility instead of an airline's responsibility. If people want the bag to be transferred, they should pay for it. Airport-led transfers will therefore become more common in the future[ED] but Faical expects it to be unbundled with the choice to transfer your bag and an option to add a missed connection insurance.

Transfer is amongst one of those things why airlines often don't make money. Getting rid of the complexity and using a third party to arrange the service[SUP4] an insurance[SUP2] might become a new business model.

Appendix VIII. Interview with Flight Directors

The Setting

The interview took place on May 16th, 2016 via Skype around 11:00. The respondent was Paul Argyle. Contact with Paul was established after I contacted him via one of his websites selfconnect.fligts. Paul represents the perspective of a service provider.

The Respondent

Paul Argyle
Source: LinkedIn

Paul Argyle is Managing Director of Flight Directors. Flight Directors is consultancy service that advises airlines in new market, additional revenues generations and in improving overall profitability. One of his projects focused on an IT solution to search for self-help hubbing alternatives.

Summary

Paul Argyle believes that self-help hubbing is the future[ED]. The low-cost carriers and full service carriers are getting closer to each other in terms of their business models. There is no carrier that is pure full-service or low-cost anymore. The challenge for low-cost carrier will be to achieve transfer with its complexity and risks at the lowest possible costs. Self-help hubbing will not only consider intralining between the same low-cost carrier but also interlining between low-cost carriers and full-service carriers. The selfconnect.flights project is a product for long-haul airlines in particular. They could use the technology to combine their networks with more extensive short-haul networks. They were supported by the European offices of two long-haul carriers but the website strategy was determined from the head offices in Southern America and this is the main reason why its currently dormant.

Paul describes that they focused on involving the airline to avoid tremendous marketing costs and expensive access to global distribution systems[RY7]. A lot of airlines themselves are looking at how to react to the new trend of self-connecting. Conventional long-haul carriers are for example very nervous about Norwegian that operates long-haul operations from London Gatwick with the feed from their own short-haul flights. Paul also discussed this topic with EasyJet and they are only interested if the benefits but do not want to invest in any way.

Airport see the urge to take action. Like they provide check-in desks on landside, they also have to do it airside for the self connecting passengers[SUP4]. Paul expects low-cost carriers like Ryanair to start partnering with other carriers and demand self-help hubbing facilities at their bases, mainly secondary airports. This will then spill back to primary airports. It will start by recognizing demand of passengers connecting themselves whereafter airport' infrastructure will catch up with it[EG]. Currently we are at the beginning and the GatwickConnects product is growing but it has limitation. They are not active 7 days a week[SUP1], connections are not always bidirectional[R5] and they do not offer all connections. They however do it in the right way, such that the passengers see it[RY7]. The airport process including

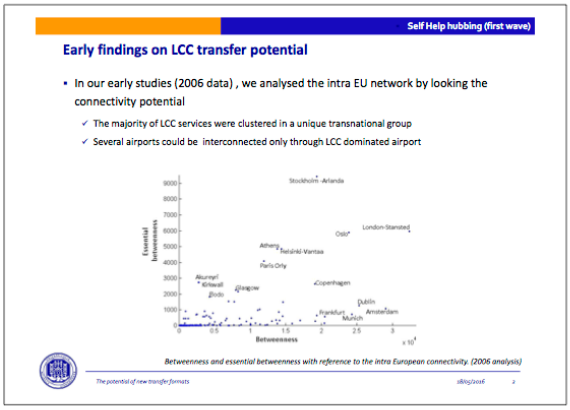
customs and security is however part of the transfer process that could be improved to smoothen the process. Airport products like GatwickConnects improve the process and shorten the required connecting time but baggage still remains a hassle[SUP4]. Soon, Easyjet will start operating from one terminal at London Gatwick instead of two, which is in line with a smoother process for self-help hubbing.

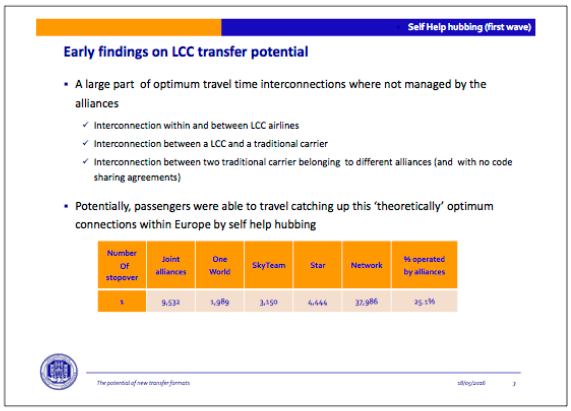
It depends on the type of self-help hubbing why the passenger would use it. Paul convinced the long-haul airlines to take responsibility for missed connections both ways. They also determine their own minimum connecting time and terms & conditions. He had contracts with the station managers and they were willing to take the risk. The acceptance of the short-haul carrier was not necessarily required. They only need the credentials of the passengers flying in by the low-cost carriers. The other way around is also covered due to their high punctuality. The target group is the experienced[PT2], price conscious[PT3] VFR passengers that look at all available options. Conventional transfers sometimes lead to inefficient connections[RY3] while these VFR passengers often also prefer to use their national carrier that does not offer this connection[RY1].

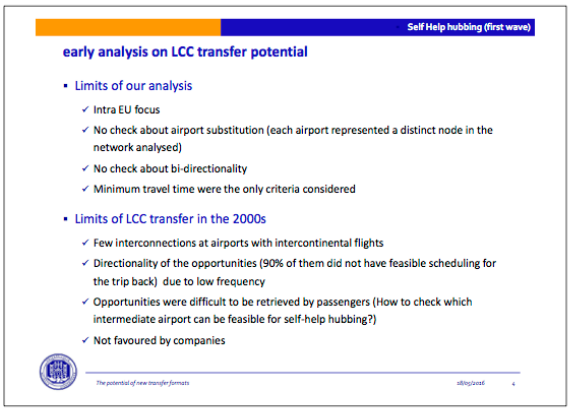
Selfconnect.flights was only meant as a technology provider to allow travellers to book these options via their own national carrier. This makes it unique compared to online travel agencies like Skypicker or search engines like Skyscanner. To get this product working without the airline, a tremendous marketing budget should be present in order to become known amongst travellers[RY7] while cooperating with airlines is a way to reduce the need for marketing because airlines are already known amongst travellers. The aviation industry tends to think from the low-cost carrier perspective, but according to Paul this is wrong because low-cost carriers already have very high load-factors. Self-help hubbing should be approached from the full-service carrier perspective on long haul flights. Self-help hubbing helps to increase load-factors and profitability. The industry is waiting for a long-haul carrier that looks beyond the existing distribution network

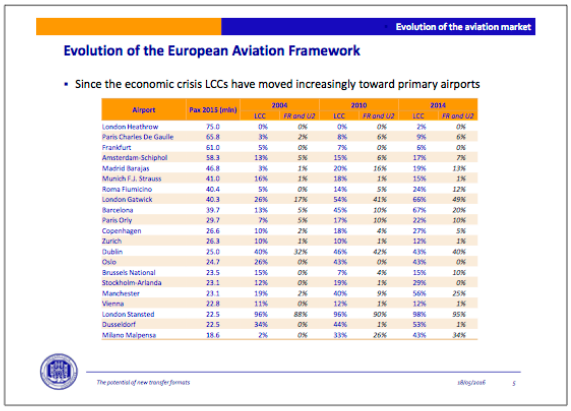
Appendix IX. Airneth Presentation of Paolo Malighetti

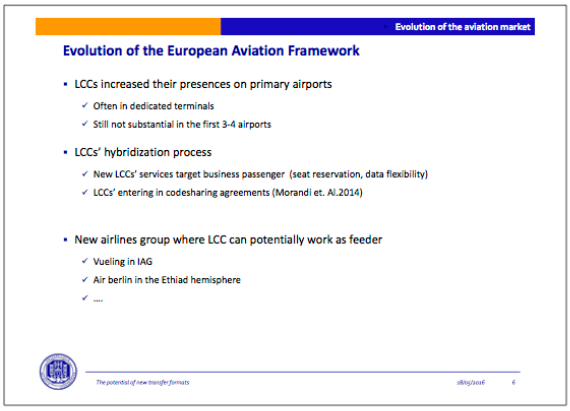
Sheet	Coding	Sheet	Coding
3	EP	17	EP, PT5, PC5, BEN, RY3
4	R5, R1, RY2	19	RY7, RN3
8	RY7, R1	20	R2, R7
10	RY3, RY2	21	EP, BEN
13	R3, R4	22	SUP2, SUP5, SUP9
15	R1, R2		











Evolution of the European Aviation Framework

- LCCs' hybridization and hubbing

Time consuming process, making Ryanair reluctant to guarantee its connections

Mr O'Leary's priorities are changing.

The idea is to woo more business travellers.

The Economist

Gulliver
Business travel

Secret connections

Ryanair experiments with hub-and-spoke transfers

Business travellers will not be the only beneficiaries. Search for flights from Marrakech to Edinburgh, for example, on Ryanair.com and the booking engine comes up blank. Most comparison websites follow suit, instead suggesting expensive over-night connections via Madrid (with full-service Iberia) or London Gatwick (with full-service British Airways). It is only by breaking up the journey into two stages—Marrakech to London, and London to Edinburgh—that Ryanair and Stansted emerge as the clear first choice, offering cheap transfers with a short layover.

Evolution of the European Aviation Framework

- Interconnections are much easier to be found thanks to new IT technologies
  - ✓ Nowadays web-search engines can recognize new opportunities of self connecting flights!!
  - ✓ Including ground transportation
  - ✓ Ranked or filtered by several specific need (cost, time, etc...)
- New long haul smaller aircrafts increase the probability to have intercontinental flights departing from non-main hub airports

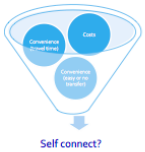
Airport	Delta direct connection 2004-15 toward North America	Airport	Delta direct connection 2004-15 toward North America
BRU	4	VIE	1
BCN	6	VCE	4
LIS	5	GVA	2
ARN	4	ATH	2
OSL	5	EDI	2

Evaluation of the current transfer potential

- OAG recent findings (2016)
  - ✓ When saving $100, only 16 percent of non-millennial travelers are willing to justify a layover of more than four hours, while 28 percent of millennials are willing to wait at least four hours to save that same money.
  - ✓ As savings rise, travellers are more willing to take on longer layovers. In order to save $200, the number of travellers willing to wait more than four hours more than doubles to 37 percent. For millennials, that number skyrockets to 55 percent
  - ✓ On opposite traveller are willing to pay a premium for more convenience *"respondents are willing to pay more for convenience when self-connecting, but not enough to significantly eat into the savings that a self-connecting itinerary would provide"*

Evaluation of the current transfer potential

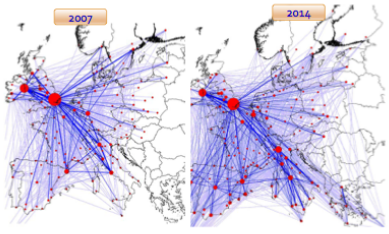
- Delicate balance between time, costs, affordability
  - ✓ Further in Europe secondary airports, in some cases, have their own catchment area (at least some percentage points in term of population served)
- How many interconnection with feasible or convenient travel time exist?
- Which transfer mode will receive greater success?
  - ✓ LCC hubbing
  - ✓ LCC feeder a specific airline alliance
  - ✓ Self help hubbing intra EU
  - ✓ Self help hubbing toward non EU connection



Self connect?

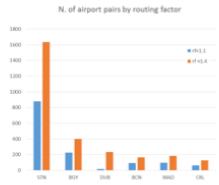
Some examples (LCC hubbing)

- Ryanair's hubbing
- The size of the network facilitate interconnection



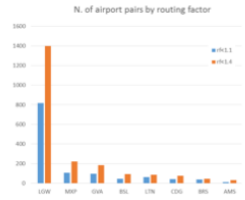
Some examples (LCC hubbing)

- Ryanair's hubbing
  - ✓ No direct connection among the 2 airports
  - ✓ No other 2 step faster (>10% differences) connection between the 2 airports
  - ✓ No other direct connection among alternative airports (<100 km)



Some examples (LCC hubbing)

- easyJet' hubbing
  - ✓ No direct connection among the 2 airports
  - ✓ No other 2 step faster (>10% differences) connection between the 2 airports
  - ✓ No other direct connection among alternative airports (<100 km)



Some example: Interlining LCC – traditional long haul

- Within IAG: Vueling -> Vueling, British and Iberia Flights
  - ✓ Indirect connection where no direct connection exist
  - ✓ No other 2 step faster connection among the 2 airports
  - ✓ No other direct connection among alternative airports (<100 km)

Hub	<1,05	1.1	1.2	1.3	1.4	1.5	Overall <2
BCN	206	613	319	217	120	70	1824
MAD	43	103	30	18	35	50	324
LHR	4	55	58	32	23	13	196
FCO	6	21	39	20	7	8	141
LGW	1	33	12	5	1	17	83
PMI	14	7	12	4	4	7	49

Some example (full airport interlining)

- All feasible interconnection with final destination outside EU1 area with LCC involved in one leg at least
  - ✓ 1h minimum connecting, no direct connection, no other faster direct connection, no direct connection with alternative airports within airlines
  - ✓ Further restriction: only to <1.1 routing and equivalent speed (accounting also for waiting time) >400 km/h

	AF	AS	LA	MI	NA	overall
CDG	60	243	92	10	68	473
AMS	29	232	61	15	75	412
MAD		6	214	7	13	240
LHR	15	35	26		137	213
MUC	10	136	8	8	6	168
LGW			46	9	78	133
FRA	4	91	15		18	128
FCO	1	42	40	10	15	108
DUS		54	7	6	29	96
BCN		2	39	21	17	79

Summary

New Intra EU transfer(1/3)

- Interconnections currently unmanaged by the airlines are theoretically significant in size and also in term of value provided to passenger
- They represent an option that, thanks to recent development, nowadays is more realistically exploitable
- In some airports, hundreds of interconnections that may improve services in term of travel time between airports currently bad connected exist
- These options are able to interconnect most likely unusual destination pairs (particularly those without enough demand for direct connection?)
- It is a way for serving the tails of the demand distribution (in term of O-D)
- It is way for adding some percentage points to existing direct flight
- Exploring new efficient interlining options

New Intra EU transfer (2/3)

- About business model in which LCC facilitating/start hubbing activity

Pro

- ✓ Main LCCs can take advantage of their intra European network which is the most developed
- ✓ Information can be offered directly by the LCC web page
- ✓ Special operation can be set up by the company in order to treat this passenger

Cons

- ✓ On intra European routes LCCs and the traditional business model are going to be even more undistinguishable
- ✓ How to avoid increasing cost of complexity
- ✓ Like for traditional business model some direct connection may be replaced by indirect connection

New Intra EU transfer (3/3)

- Self help hubbing (with different airlines, LCC or traditional)

PRO

- ✓ Exploit option that already exist in the network and that can be easily found thanks to new IT technologies
- ✓ Passenger empowerment (Passenger take themselves the best choice)

Cons

- ✓ Do airlines really want to facilitate interlining ?
- ✓ If interconnections are not efficient and seamless it will remain difficult to fully exploit these opportunities

New transfer toward non EU

- We considered the extension of LCC –LCC or LCC –traditional as the new option (even if also two unallied carrier can be considered in self connection)
- (In term of competitive travel time) at main airports hundreds of options can be added to traditional hub and spoke network
- This new options are made available thank to the increasing presence of LCC also at the main hubs
- Airlines group/Alliances may increase their willingness to accept and interconnect feeder traffic from LCC
- Self connected paths toward extra EU destinations can be more expensive rather than cheaper (due to double marginality, direct connection

Airport and Airline opportunities

- Airlines
  - ✓ Self connection is an opportunity that can revolutionize (again) the airlines' business model. It poses question about future of code sharing agreements and traditional hubbing activities. Further it can exacerbates indirect competition further lowering fares on feeder/point to point routes.
- Airports
  - ✓ They can potentially gain passengers that do not come from their catchment areas without the cost complexity of the hub structure
  - ✓ Most likely they have more incentive to favour self connection compared to airlines

What airports and airlines can do

- Airlines
  - ✓ Standardize and further simplify procedures
  - ✓ Monitor self connected routes and adjust-optimize scheduling
- Airports
  - ✓ Services that can manage multi-airline operation (self baggage check in , self kiosk)
  - ✓ Small-medium airport can facilitate interconnection by taking advantages of the simple and uncongested environment
- Third parties
  - ✓ Manage the overall door to door trip
  - ✓ Provide assurance and services in case of delays/missing flight etc (hotel cost cover, automate rebooking procedures, alternative routes path, etc..)

Ryanair interconnection of bigger airport

hub	depart	arrival	overall travel time
STN	MAD	GOT	5.17
STN	MAD	NYO	5.33
STN	NYO	MAD	5.42
BVA	MAD	NYO	5.42
STN	ATH	DUB	3.83
CGN	CPH	TFS	6.42
LTN	TFS	CPH	8.35
BGY	IBZ	CPH	4.75
MAD	KAK	CPH	6.83
MAD	FUE	CPH	3.67
STN	RLO	DUB	3.17
VLC	IBZ	DUB	3.50
BCN	IBZ	DUB	3.75
CRL	BUD	MAN	3.58
STN	ATH	EDI	3.75
BGY	PMO	DUB	4.75
STN	PSA	DUB	3.50
BRS	MLA	DUB	5.67
GRO	MLA	DUB	4.67
LTN	MLA	DUB	4.67
MAD	DUB	RAK	5.67
BGY	CAG	DUB	4.00
LPL	VNO	DUB	3.08
BGY	BOS	DUB	3.92
STN	BOS	DUB	4.33
STN	ATH	GLA	4.25
STN	KTW	DUB	3.50
BRS	CHQ	DUB	4.50

EasyJet: interconnection of bigger airport

hub	depart	arrival	overall travel time
NRS	FCO	MAN	3.2
BSL	FCO	MAN	3.4
BSL	TLV	LGW	5.6
BSL	FCO	LTN	3.2
LGW	FCO	EDI	4.2
MXP	FCO	EDI	3.3
AMS	FCO	EDI	4.5
LTN	MAD	GLA	3.8
LGW	FCO	GLA	3.9
BRS	BCN	GLA	3.3
MXP	LCA	CDG	5.8
LGW	ACE	ANR	0.5
LGW	AMS	ACE	5.4
LGW	LPA	CPH	0.9
LGW	PMI	EDI	3.5
LGW	DME	LPA	7.6
LGW	AMS	PUE	5.5
LGW	FUE	ANR	0.4
HAM	ATH	EDI	3.8
GVA	FCO	KEF	7.4
MXP	CPH	CTA	4.7
LGW	FCO	BFS	4.3
MAN	CPH	TFS	6.4
LGW	MAD	AGZ	3.7
LGW	MXP	GLA	3.0
CDG	MXP	GLA	3.3
LGW	DME	FAO	5.8
LGW	GVA	GLA	2.5

Appendix X. Airneth Presentation of David Gunnarsson

Sheet	Coding	Sheet	Coding
9	RY5	16	SUP5, SUP6, SUP7, SUP8, SUP9
10	RN1, RN2, RN3	19	BEN, R1
12	BEN, SUP2, SUP4	20	BEN, BEN, BEN, BEN
13	SUP5	21	SUP4, SUP9
15	SUP8	22	ED, ED, ED, ED

Our technology

- Our technology is based on airline schedules.
- We pre-build all possible itineraries, disregarding any rules except minimum connection time.
- Our search is extremely fast and flexible.
- We are currently handling ~500,000 searches per day.

7

B2C vs. B2B

- Our Dohop.com website drives 60% of our revenue.
- Relationships with over 400 airlines and OTAs.
- We can customize our technology to the needs of travel industry partners - airlines, airports, and travel websites.
- B2B partners: ViaMilano, GatwickConnects, Yandex, Jetairfly.

8

Why Self-Connect

- The phenomenal growth of LCCs
- Airlines waking up to self-connect
- A wealth of options to compete with expensive interline tickets
- So far not for everyone

9

Pains of Self-Connect

- Travelers need an intimate knowledge of airlines and routes.
- Travelers have to go to two different websites to book.
- Risk of missing a connection.
- Border control, luggage re-check, security.

10

The Current Landscape

- New players entering the market.
  - Skyscanner
  - Skypicker
- Multiple categories of players taking a look
  - Airlines
  - Airports
  - Technology providers

11

Airports stepping in

- Uniquely positioned to facilitate transfer.
- Increasing the number of transfer passengers.
- Pioneered by MXP - ViaMilano, powered by Dohop.
- ViaMilano includes connection insurance and luggage transfer.

12

Malpensa overview

- Came to us late 2011, launched early 2012.
- Ground product - ViaMilano - already in place.
- Insurance and baggage, but multiple bookings.
- Next step is single booking capability.

13

Gatwick overview

- Came to us late 2014, launched September 2015.
- GatwickConnects already in place, wanted to add online piece with single booking.
- The goal is a seamless user experience.
- Generate revenue from insurance and premium transfer services to offset the cost of ground operations.

14

Other players

- Airlines are joining the party.
- Airports all over the world are exploring.
- Skyscanner and Skypicker more focused on this, along with additional technology providers.
- Some OTAs provide single-ticket self-connect on select routes.

15

Two models - Gatwick

- Single booking experience - multiple transactions.
- Tickets directly via airlines.
- Simpler in terms of customer service.
- User gets multiple confirmation emails.

16

Two models - OTA

- Single booking experience - single transaction.
- Single ticket issued by OTA.
- OTA needs to handle customer support.
- Single confirmation email.

17

Pros and cons

- Both models work - it's a question of customer service.
- We provide post-booking / pre-travel service.
- The Gatwick model makes it easy for the airport.
- The OTA model makes it easier for the passenger.

18

The airline perspective

- Simple to connect two airlines via a participating airport.
- Long-haul to low-cost connections.
- Increased ticket sales.
- Key partnerships on feeder routes.

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Who benefits from Self-Connect

- Airlines
  - Additional revenue from higher load, ancillaries.
- Airports
  - More transit passengers, additional revenue stream.
- Technology providers
  - Per-transaction fees, insurance, yield management.
- Passenger
  - More options at lower prices.

20

What's missing?

- Baggage through-check
  - Evolution of baggage handling, e.g. OSL.
- Electronic bag tags.
- Streamlined transit procedures.
- Streamlined customer service procedures.

21

What's next?

- LCCs partnering with traditional carriers, e.g. Ryanair + Aer Lingus.
- Airline / airport networks
  - Without the cost and complexity of interline.
- Self-connect more widely bookable in single-ticket.
- More viable option for all kinds of travelers.

22

Where to find me?

- In Iceland
- davidg@dohop.com
- https://is.linkedin.com/in/dgunnars
- +354 869 3694

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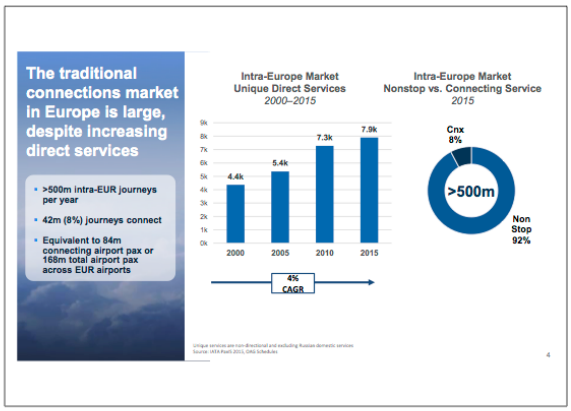
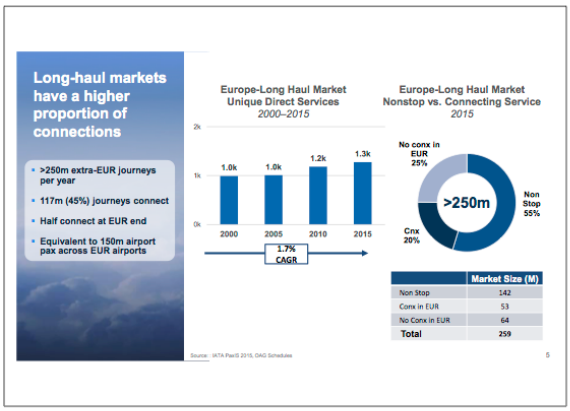
DOHOP

Anywhere. Simple.

Appendix XI. Airneth Presentation of Kata Cserep

Sheet	Coding	Sheet	Coding
3	RY1, RY2, RY3, RN 1, RN2, RN3, RN4	12	EP
6	EP	18	EP
7	EP	22	SUP2
10	R1, R2, R5, R6, RY2	23	PT1, PT3, PT5, RY8, RY7, EP, R6, R1, R2, ED, ED
11	EP		



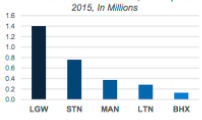


Self-connections are estimated at 15m a year in Europe

- UK CAA surveys 100k+ passengers
- ~4% of independent LCC pax connecting
- Europe-wide 16m airport pax or 4m O&Ds

UK SURVEY:

Estimated Self-Connections, UK Airports
2015, In Millions



	Self Conx
Total	~3M
% of LCCs self-conx	3.7%

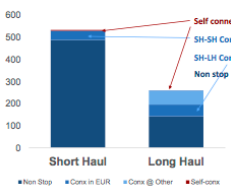
EUR ESTIMATE:

Survey Research on Conx Shares → >220m Pax on top 'independent LCCs' / Other airline market demand → c16m Self Conx airport pax

Source: CAA Survey, 2015
Independent LCCs are Ryanair, easyJet, Norwegian and Wizz

This represents <10% of all transfer pax or 1% of total European airport pax

2015 European Passenger Market Summary
(O&D, Millions)



	Market O&Ds	EUR Airport Pax
Self connections	4M	16M
SH-SH Connections	42M	168M
SH-LH Connections	53M	150M
Non stop	630M	1,200M

Top Candidates for Self-Connect

Self-connect is most likely to take off at unaligned carriers

Incremental passengers and revenue are the name of the game…
…ideally without incremental cost

UNALIGNED CARRIERS
easyJet, Emirates, RYANAIR

LONG HAUL LOW COST
norwegian, virgin atlantic, WESTJET

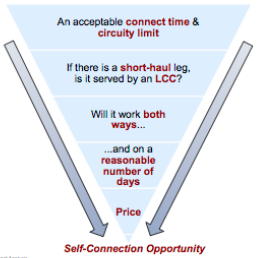
NON HUB
flybe., transavia

Source: BP Statistical Review of World Energy June 2015, ICF International Analysis

Airports with certain characteristics will be best placed to benefit

- Scale of network
- Variety of business models, including LCC
- Long haul helpful
- Geography helpful

Identifying Suitable Self-Connect O&Ds

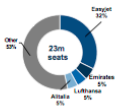


Source: ICF International Analysis

Milan is an obvious candidate for self-connections

- 132 destinations from MXP
- 17k theoretical connecting markets
- 2,500 with reasonable circuity and connection time
- 800 unique markets that work in both directions
- 360 more than 4pw
- 40% of these no direct service
- 13mppa in these O&Ds

Annual Seat Capacity
2015



SH/LH Split of Self-Connection O&Ds at MXP

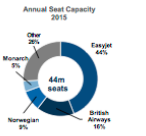
Potential Self-Connecting O&Ds

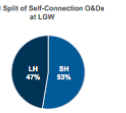
Top 360 Self Connections at MXP by Addressable Market

Source: ICF International analysis, PaxIS June 2016 schedules

....So is Gatwick

- 188 destinations from LGW
- 36k theoretical connecting markets
- 5,600 with reasonable circuity and connection time
- 2,200 unique markets that work in both directions
- 900 more than 4pw
- 65% of these no direct service
- 30mppa in these O&Ds



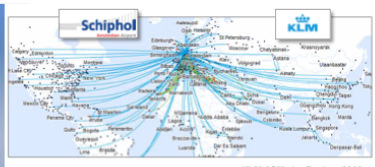


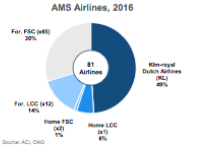
Source: ICF International analysis, Pax3 June 2016 schedules

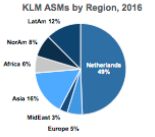
12

Schiphol and KLM and world class aviation names, dominating Dutch aviation

- AMS 58mppa, 40% transfer
- 5th busiest airport in Europe
- 14th busiest airport globally
- KLM 28mppa, 70% transfer
- 8th highest international pax







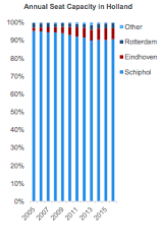
Source: ACI, OAG

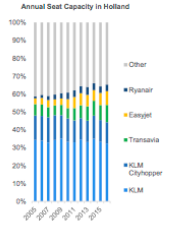
14

Schiphol accounts for over 90% of Dutch aviation capacity

- LCC penetration remains low by European standards

It's not all about KLM at AMS....but it is pretty much

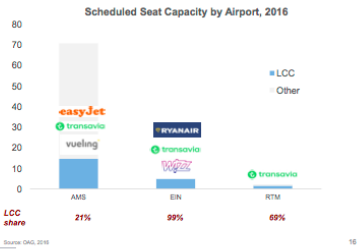




Source: OAG

15

LCCs are making their mark outside AMS but scale is limited



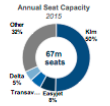
Source: OAG, 2016

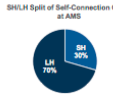
16

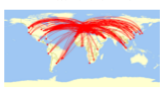
Schiphol is not a typical self-connect airport....

- 238 destinations from AMS
- 57k theoretical connecting markets
- 7,500 with reasonable circuity and connection time
- 2,400 unique markets that work in both directions
- 1,000 more than 4pw
- 50% of these no direct service
- 40mppa in these O&Ds

....but it offers significant self-connect potential for passengers, mostly on long-haul







Source: IATA Pax/S, OAG, ICF analysis

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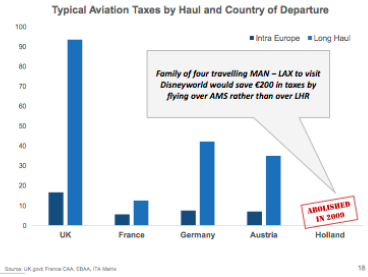
Taxation adds a further element of risk or opportunity; depending on where you are



Source: UK govt; France CAA, EBAA, ITA Matrix

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Where Next?

The LCCs are evolving, competing with each other and with legacy carriers

Own metal Cnx

LCC Alliance in Asia

Source: OAG Data, ICF International Analysis

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ICF believes that distribution and risk sharing are the key hurdles

Who will raise awareness and availability of self-connections?

Meta search | Airports | Airlines | OTAs | Other??

Who will shoulder the risk of missed connections?

- Schedule risk
- Lost bags
- Directionality
- Compensation (EC261)

- Operating airline
- Travel Agent
- Airport
- Third party insurance
- Handling Agent

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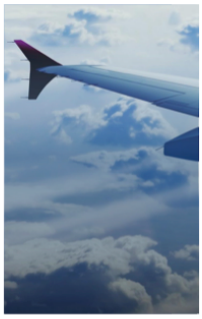

In Summary…

- Self-connections have always existed, mostly used by independent, price-sensitive travellers on unusual itineraries
- Technology, network densification and passenger acceptance are leading to increased opportunities for self-connections
- Some of this activity will compete with traditional connections; some will lead to new demand
- Largest opportunity at airports with network scale, large share of LCC, some long-haul and helpful geographic location
- Even hubs such as AMS may see some opportunity, especially in the face of large taxation differences (e.g. ADP)
- Although potential is significant, hurdles to large-scale take-up remain and self-connect is not likely to replace traditional online and interline connections any time soon
- The key business decision for airlines and airports is whether this is a threat or an opportunity and to plan accordingly

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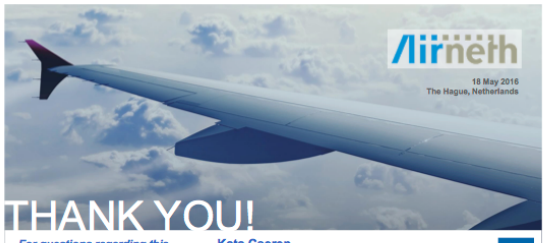

THANK YOU!

For questions regarding this presentation, please contact:

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With thanks to Nishaan Rama and Rob Walker, ICF

Appendix XII. NetCost Model

This appendix present the NetCost Model as presented in (Lieshout, Veldhuis, de Wit, & Matsumoto, 2009). The model is based on the concept of generalized costs and includes three components:

1) Travel time
2) Frequency
3) Travel costs

Each of these components will be explained in the following sections. The three components together result in the total generalized costs which can be expressed as utility that is used to determine the choice probability of a connection via hub h with an airline a for the market between x and y

$$GTC_{xhya} = c_{xhy}^{time} + c_{xya}^{frequency} + c_{xya}^{airfare}$$

$$U_{xhya} = -0{,}015 * GTC_{xhya}$$

$$CV_{xhya} = f_{xhya} \cdot U_{xhya}$$

$$P_{xhya} = \frac{CV_{xhya}}{\sum_h \sum_a CV_{xhya}}$$

Travel time

The first component of the generalized travel costs is the travel time. Flight time t is a parameter, represented by three sub-parameters (formula 1):

- The flight time in hours between the origin airport and destination airport
- The circuity time in hours caused by the detour of a connection in case of indirect connections
- The connecting time in hours between intermediate landing and take-off

$$t_{xhy}^{total\ travel\ time} = t_{xy}^{flight} + t_{xhy}^{circuity} + t_{h}^{connecting} \quad (1)$$

The different components however, do not result in the same degree of inconvenience and therefore the circuity time and connecting time receive a penalty factor dependent on the flight distance (formula 2). On top of this penalty, another penalty is applied to differ circuity time from connecting time, which is perceives as more inconvenient (formula 3).

$$\mu_{xy} = 3 - 0{,}075 \cdot t_{xy}^{flight} \quad (2)$$

$$t_{xhy}^{perceived\ travel\ time} = t_{xy}^{flight} + \mu_{xy} \cdot t_{xhy}^{circuity} + 1{,}25 \cdot \mu_{xy} \cdot t_{h}^{connecting} \quad (3)$$

To translate a perceived travel time into the costs, associated with time, perceived travel time should be multiplied by the Value of Travel Time (VoTT) which differs for different passenger segments (formula 4).

$$c_{xhy}^{time} = VoTT \cdot t_{xhy}^{perceived\ travel\ time} \quad (4)$$

Frequency

The higher the frequency, the closer the flight departs or arrives at the desired moment. This is often called schedule delay at the associated costs increase when frequency decreases. In the NetCost model, one day is assumed to have 16 operational hours. This corresponds to 112 hours per week. The average schedule delay for an airline *a* is therefore half the average time between the frequencies (formula 5).

$$t_{xya}^{schedule\ delay} = \frac{0{,}5 \cdot 112}{f_{xya}^{direct}} = \frac{56}{f_{xya}^{direct}} \quad (5)$$

For indirect connection the schedule delay is dependent on the frequency on the first and second leg (formula 6).

$$t_{xhya}^{schedule\ delay} = \frac{56}{f_{xha}^{direct}} + \frac{56}{f_{hya}^{direct}} \quad (6)$$

Schedule delay is an inverse function of frequency and vice versa. The total frequency is the sum of the direct frequency and the indirect frequencies (formula 7).

$$f_{xya}^{total} = f_{xya}^{direct} + \sum_h \frac{56}{t_{xhya}^{schedule\ delay}} \quad (7)$$

This results in an average schedule delay that provides unrealistically high average schedule delays. For frequencies of once per week, this would result in 56 hours of schedule delay which is in reality not perceived in this way. Therefore two average schedule delay functions are provided (formula 8).

$$t_{xya}^{schedule\ delay} = 3.96 - 0{,}07 \cdot f_{xya}^{total} \quad if\ f_{xya}^{total} < 28 \quad (8)$$

To translate a perceived schedule delay into the costs, perceived schedule delay should be multiplied by the Value of Waiting Time (VoWT) which differs for different passenger segments (formula 9).

$$c_{xya}^{frequency} = VoWT \cdot t_{xya}^{schedule\ delay} \quad (9)$$

Airfare

Airfare or ticket price is the hardest to model since data and information is limited. Therefore a systematic airfare is determined based on distance. Besides distance, also other factors determine the ticket price. The NetCost model takes into account:

- Route type; direct of indirect (π_r)
- Carrier: full-service carrier or low-cost carrier (π_0)
- Passenger its travel purpose; Business or leisure (π_p)
- Competition level (π_c)

The estimated airfare is there expressed by the distance based fare time, dbf times all these factors (formula 10).

$$c_{xya}^{airfare} = dbf \cdot \pi_r \cdot \pi_o \cdot \pi_p \cdot \pi_c \quad (10)$$

In the NetCost model, the following assumptions are made for leisure passengers and business passengers (Table 18).

Table 18 – Parameter assumption of the NetCost model

	Leisure passenger	**Business Passenger**
Value of Travel Time	*€20*	*€50*
Value of Waiting Time	*€8*	*€20*
Distance based fare	*€80+€40∗* t_{xy}^{flight}	
Route type (π_r)	*1,05 for direct* *0,95 for indirect*	
Carrier (π_o)	*1 for full-service carriers* *0,7 for low-cost carriers*	
Passenger travel purpose (π_p)	*0,75*	*1,25*
Competition level (π_c)	*0,75 for competition* *1,25 for monopoly*	*0,9 for competition* *1,1 for monopoly*

Appendix XIII. Data and model results for long-haul route 1

Long-haul Route 1 from Cork to Singapore

Day	Alternative	Flight	Duration	Fare
Monday	Cheapest Self-help hubbing alternative	Cork Paris CDG	1,67	
		Transfer	8,17	
		Paris CDG Guangzhou	11,75	€ 434,00
		Transfer	1,33	
		Guangzhou Singapore Changi	4,08	
	Cheapest Conventional alternative	Cork Munchen	2,17	
		Transfer	3,92	€ 508,56
		Munchen Singapore Changi	11,83	
Tuesday	Cheapest Self-help hubbing alternative	Cork Paris CDG	1,67	
		Transfer	8,17	
		Paris CDG Guangzhou	11,75	€ 434,00
		Transfer	1,33	
		Guangzhou Singapore Changi	4,08	
	Cheapest Conventional alternative	Cork Londen Heathrow	1,42	
		Transfer	3,17	
		Londen Heathrow Kuala Lumpur	12,83	€ 527,02
		Transfer	1,17	
		Kuala Lumpur Singapore Changi	0,92	
			7,50	€ 93,02
Wednesday	Cheapest Self-help hubbing alternative	Cork Schiphol	1,83	
		Transfer	4,42	
		Schiphol Moskou Sheremetyevo	3,17	
		Transfer	2,08	€ 481,00
		Moskou Sheremetyevo Bangkok Suvarnabhumi	9,17	
		Transfer	4,33	
		Bangkok Suvarnabhumi Singapore Changi	2,42	
	Cheapest Conventional alternative	Cork Londen Heathrow	1,42	
		Transfer	3,17	
		Londen Heathrow Kuala Lumpur	12,83	€ 527,02
		Transfer	1,17	
		Kuala Lumpur Singapore Changi	0,92	
Thursday	Cheapest Self-help hubbing alternative	Cork Paris CDG	1,67	
		Transfer	8,17	
		Paris CDG Guangzhou	11,75	€ 439,00
		Transfer	1,33	
		Guangzhou Singapore Changi	4,08	
	Cheapest Conventional alternative	Cork Londen Heathrow	1,42	
		Transfer	3,17	
		Londen Heathrow Kuala Lumpur	12,83	€ 527,02
		Transfer	1,17	
		Kuala Lumpur Singapore Changi	0,92	
Friday	Cheapest Self-help hubbing alternative	Cork Londen Heathrow	1,33	
		Transfer	11,92	
		Londen Heathrow Mumbai	9,17	€ 474,00
		Transfer	2,08	
		Mumbai Singapore Changi	5,67	
	Cheapest Conventional alternative	Cork Londen Heathrow	1,42	
		Transfer	3,17	
		Londen Heathrow Kuala Lumpur	12,83	€ 527,02
		Transfer	1,17	
		Kuala Lumpur Singapore Changi	0,92	

		Monday Generalized Costs	Monday Utility	Monday Choice Probability	Tuesday Generalized Costs	Tuesday Utility	Tuesday Choice Probability	Wednesday Generalized Costs	Wednesday Utility	Wednesday Choice Probability	Thursday Generalized Costs	Thursday Utility	Thursday Choice Probability	Friday Generalized Costs	Friday Utility	Friday Choice Probability
Millennial	Self-help Hubbing	€ 858,39	€ 12,88-	15%	€ 858,39	€ 12,88-	23%	€ 933,66	€ 14,00-	9%	€ 863,39	€ 12,95-	22%	€ 997,48	€ 14,96-	4%
	Conventional	€ 744,03	€ 11,16-	85%	€ 779,57	€ 11,69-	77%	€ 779,57	€ 11,69-	91%	€ 779,57	€ 11,69-	78%	€ 779,57	€ 11,69-	96%
Leisure	Self-help Hubbing	€ 1.233,78	€ 18,51-	2%	€ 1.233,78	€ 18,51-	5%	€ 1.337,32	€ 20,06-	1%	€ 1.238,78	€ 18,58-	4%	€ 1.471,96	€ 22,08-	0%
	Conventional	€ 979,50	€ 14,69-	98%	€ 1.032,12	€ 15,48-	95%	€ 1.032,12	€ 15,48-	99%	€ 1.032,12	€ 15,48-	96%	€ 1.032,12	€ 15,48-	100%
Business	Self-help Hubbing	€ 2.359,95	€ 35,40-	0%	€ 2.359,95	€ 35,40-	0%	€ 2.548,29	€ 38,22-	0%	€ 2.364,95	€ 35,47-	0%	€ 2.895,40	€ 43,43-	0%
	Conventional	€ 1.685,90	€ 25,29-	100%	€ 1.789,78	€ 26,85-	100%	€ 1.789,78	€ 26,85-	100%	€ 1.789,78	€ 26,85-	100%	€ 1.789,78	€ 26,85-	100%

Appendix XIV. Data and model results for long-haul route 2

Long-haul Route 2 from Madrid to Kochi																																			
		Monday					Tuesday					Wednesday					Thursday					Friday													
	Cheapest Self-help hubbing alternative	Flight	Duration	Fare			Flight	Duration	Fare			Flight	Duration	Fare			Flight	Duration	Fare			Flight	Duration	Fare										
		Madrid	3,00				Madrid	4,25				Madrid	4,25				Madrid	4,25				Madrid	3,00											
		Boedapest					Istanbul Sabiha					Istanbul Sabiha					Istanbul Sabiha					Bratislava												
		Transfer	12,67				Transfer	2,25				Transfer	2,25				Transfer	2,25				Transfer	4,50											
		Boedapest	5,42				Istanbul Sabiha	4,58	€	349,00		Dubai	4,58	€	361,00		Istanbul Sabiha	4,58	€	426,00		Dubai	5,42	€	467,00										
		Dubai Al Maktoum					Dubai					Transfer	8,83				Transfer	8,83				Transfer	5,50											
		Transfer	3,50	€	374,00		Transfer	8,83				Dubai	4,00				Dubai	4,00				Dubai	4,08											
		Dubai Al Maktoum	1,08				Kochi	4,00				Kochi					Kochi					Kochi												
		Hamad																																	
		Transfer	1,50																																
		Hamad	4,58																																
		Kochi																																	
	Cheapest Conventional alternative	Flight	Duration	Fare			Flight	Duration	Fare			Flight	Duration	Fare			Flight	Duration	Fare			Flight	Duration	Fare										
		Madrid	2,08				Madrid	8,25				Madrid	2,67				Madrid	2,58				Madrid	2,67											
		Paris CDG					Riyad					Frankfurt					Schiphol					Frankfurt												
		Transfer	1,92				Transfer	5,92				Transfer	3,92				Transfer	2,92				Transfer	3,92											
		Paris CDG					Riyad					Frankfurt					Schiphol					Frankfurt												
		Mumbai	8,92	€	446,26		Kochi	5,17	€	412,65		Colombo	10,00	€	386,48		Mumbai	9,08	€	434,90		Colombo	10,00	€	396,29										
		Transfer	6,92									Transfer	2,67				Transfer	6,33				Transfer	2,67											
		Mumbai	2,00									Colombo	1,33				Colombo	2,00				Colombo	1,33											
		Kochi										Kochi					Kochi					Kochi												
		21,83					19,33					20,58					22,92					20,58												
			Generalized Costs		Utility	Choice Probability		Generalized Costs		Utility	Choice Probability		Generalized Costs		Utility	Choice Probability		Generalized Costs		Utility	Choice Probability		Generalized Costs		Utility	Choice Probability								
Millennial	Self-help Hubbing	€	993,08	€	14,90-	5%	€	808,61	€	12,13-	15%	€	820,61	€	12,31-	12%	€	885,61	€	13,28-	22%	€	898,81	€	13,48-	5%								
	Conventional	€	799,85	€	12,00-	95%	€	694,27	€	10,41-	85%	€	686,95	€	10,30-	88%	€	799,93	€	12,00-	78%	€	696,76	€	10,45-	95%								
Leisure	Self-help Hubbing	€	1.563,16	€	23,45-	0%	€	1.219,22	€	18,29-	3%	€	1.231,22	€	18,47-	3%	€	1.206,22	€	19,44-	12%	€	1.281,63	€	19,22-	1%								
	Conventional	€	1.153,45	€	17,30-	100%	€	975,89	€	14,64-	97%	€	987,42	€	14,81-	97%	€	1.164,95	€	17,47-	88%	€	997,23	€	14,96-	99%								
Business	Self-help Hubbing	€	3.273,39	€	49,10-	0%	€	2.451,06	€	36,77-	0%	€	2.463,06	€	36,95-	0%	€	2.528,06	€	37,92-	0%	€	2.430,06	€	36,45-	0%								
	Conventional	€	1.153,45	€	17,30-	100%	€	975,89	€	14,64-	100%	€	987,42	€	14,81-	100%	€	1.164,95	€	17,47-	100%	€	997,23	€	14,96-	100%								

Appendix XV. Data and model results for short-haul route 1

Short-haul Route 1 from Glasgow to Oslo		Monday			Tuesday			Wednesday			Thursday			Friday		
		Flight	Duration	Fare	Flight	Duration	Fare	Flight	Duration	Fare	Flight	Duration	Fare	Flight	Duration	Fare
Cheapest Self-help hubbing alternative		Glasgow Amsterdam Transfer (kiwi) Amsterdam Oslo	1,58 5,25 1,75	€ 110,00	Glasgow Dublin Transfer(kiwi) Dublin oslo	1,00 3,17 2,17	€ 76,00	Glasgow Dublin Transfer(kiwi) Dublin oslo	1,00 2,75 2,17	€ 80,00	Glasgow Dublin Transfer (self) Dublin oslo	1,00 3,17 2,17	€ 60,59	Glasgow Gatwick Transfer(self) Gatwick Oslo	1,42 1,58 1,08	€ 127,51
Cheapest Conventional alternative		Glasgow London Heathrow Transfer London Heathrow Oslo	1,50 1,83 2,25	€ 185,00	Glasgow London Heathrow Transfer London Heathrow Oslo	1,50 1,17 2,25	€ 185,00	Glasgow London Heathrow Transfer London Heathrow Oslo	1,50 1,17 2,25	€ 185,00	Glasgow London Heathrow Transfer London Heathrow Oslo	1,50 1,83 2,25	€ 185,00	Glasgow London Heathrow Transfer London Heathrow Oslo	1,50 1,17 2,25	€ 185,00

		Generalized Costs	Utility	Choice Probability	Generalized Costs	Utility	Choice Probability	Generalized Costs	Utility	Choice Probability	Generalized Costs	Utility	Choice Probability	Generalized Costs	Utility	Choice Probability
Millennial	Self-help Hubbing	€ 372,80	€ 5,59-	21%	€ 266,02	€ 3,99-	49%	€ 255,63	€ 3,83-	52%	€ 301,61	€ 4,52-	44%	€ 308,17	€ 4,62-	33%
	Conventional	€ 284,80	€ 4,27-	79%	€ 262,15	€ 3,93-	51%	€ 262,15	€ 3,93-	48%	€ 284,80	€ 4,27-	56%	€ 262,15	€ 3,93-	67%
Leisure	Self-help Hubbing	€ 586,60	€ 8,80-	5%	€ 407,03	€ 6,11-	27%	€ 382,26	€ 5,73-	34%	€ 442,62	€ 6,64-	30%	€ 388,84	€ 5,83-	32%
	Conventional	€ 384,61	€ 5,77-	95%	€ 339,30	€ 5,09-	73%	€ 339,30	€ 5,09-	66%	€ 384,61	€ 5,77-	70%	€ 339,30	€ 5,09-	68%
Business	Self-help Hubbing	€ 1.226,01	€ 18,42-	0%	€ 830,08	€ 12,45-	2%	€ 762,14	€ 11,43-	5%	€ 865,67	€ 12,99-	6%	€ 630,83	€ 9,46-	29%
	Conventional	€ 684,02	€ 10,26-	100%	€ 570,74	€ 8,56-	98%	€ 570,74	€ 8,56-	95%	€ 684,02	€ 10,26-	94%	€ 570,74	€ 8,56-	71%

Appendix XVI. Data and model results for short-haul route 2

Short-haul Route 1 from Glasgow to Oslo		Monday			Tuesday			Wednesday			Thursday			Friday		
		Flight	Duration	Fare	Flight	Duration	Fare	Flight	Duration	Fare	Flight	Duration	Fare	Flight	Duration	Fare
Cheapest Self-help hubbing alternative		Glasgow Schiphol Transfer (kiwi) Schiphol Oslo	1,58 5,25 1,75	€ 110,00	Glasgow Dublin Transfer(kiwi) Dublin Oslo	1,00 3,17 2,17	€ 76,00	Glasgow Dublin Transfer(kiwi) Dublin Oslo	1,00 2,75 2,17	€ 80,00	Glasgow Dublin Transfer (self) Dublin Oslo	1,00 3,17 2,17	€ 60,59	Glasgow Gatwick Transfer(self) Gatwick Oslo	1,42 1,58 1,08	€ 127,51
Cheapest Conventional alternative		Glasgow London Heathrow Transfer London Heathrow Oslo	1,50 1,83 2,25	€ 185,00	Glasgow London Heathrow Transfer London Heathrow Oslo	1,50 1,17 2,25	€ 185,00	Glasgow London Heathrow Transfer London Heathrow Oslo	1,50 1,17 2,25	€ 185,00	Glasgow London Heathrow Transfer London Heathrow Oslo	1,50 1,83 2,25	€ 185,00	Glasgow London Heathrow Transfer London Heathrow Oslo	1,50 1,17 2,25	€ 185,00
		Generalized Costs	Utility	Choice Probability	Generalized Costs	Utility	Choice Probability	Generalized Costs	Utility	Choice Probability	Generalized Costs	Utility	Choice Probability	Generalized Costs	Utility	Choice Probability
Millennial	Self-help Hubbing	€ 372,80	€ 5,59-	21%	€ 266,02	€ 3,99-	49%	€ 255,63	€ 3,83-	32%	€ 301,61	€ 4,52-	44%	€ 308,17	€ 4,62-	33%
	Conventional	€ 284,80	€ 4,27-	79%	€ 262,15	€ 3,93-	51%	€ 262,15	€ 3,93-	68%	€ 284,80	€ 4,27-	56%	€ 262,15	€ 3,93-	67%
Leisure	Self-help Hubbing	€ 586,60	€ 8,80-	5%	€ 407,05	€ 6,11-	27%	€ 382,26	€ 5,73-	34%	€ 442,02	€ 6,64-	30%	€ 388,84	€ 5,83-	32%
	Conventional	€ 384,61	€ 5,77-	95%	€ 339,30	€ 5,09-	73%	€ 339,30	€ 5,09-	66%	€ 384,61	€ 5,77-	70%	€ 339,30	€ 5,09-	68%
Business	Self-help Hubbing	€ 1.228,01	€ 18,42-	0%	€ 830,08	€ 12,45-	2%	€ 762,14	€ 11,43-	5%	€ 865,67	€ 12,99-	6%	€ 630,83	€ 9,46-	29%
	Conventional	€ 684,02	€ 10,26-	100%	€ 570,74	€ 8,56-	98%	€ 570,74	€ 8,56-	95%	€ 684,02	€ 10,26-	94%	€ 570,74	€ 8,56-	71%