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MSc. in Innovation, Knowledge and Entrepreneurial/Economic Dynamics

TAKE OFF IN INNOVATION – CASE STUDY OF AALBORG AIRPORT

Master thesis

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ABSTRACT

Small airports are struggling financially, despite a steady yearly industry growth and their high importance and influence in the local economy. The key to growth and being profitable is innovation, which is not prioritized at small airports due to political influence, public-utility mentality and lack of pecuniary resources. Notwithstanding, Aalborg Airport, a small regional airport in Northern Jutland, Denmark, has been a successful innovator, even a self-proclaimed world's first in RFID based baggage sorting technology. The airports innovation management was gauged through interviews with past and current management, thereafter the airport's innovation activities and management were contrasted against the theories to see if there is anything novel and/or replicable in their approach. Findings were that despite not having a well-defined and codified innovation management system, the airport follows innovation management theory closely, having adopted an open innovation paradigm and an opportunistic innovator strategy. It was discovered that Aalborg Airport lacked an evaluation tool, therefore data was collected, and a quantitative tool devised. This thesis serves as a proof of concept that innovation performance can be measured by a modified gravity model with loglinear OLS with innovation activity as an explanatory variable and its coefficient can be interpreted as the quantitative measurement of the performance of the innovation activity.

ACKNOWLEDGEMENTS

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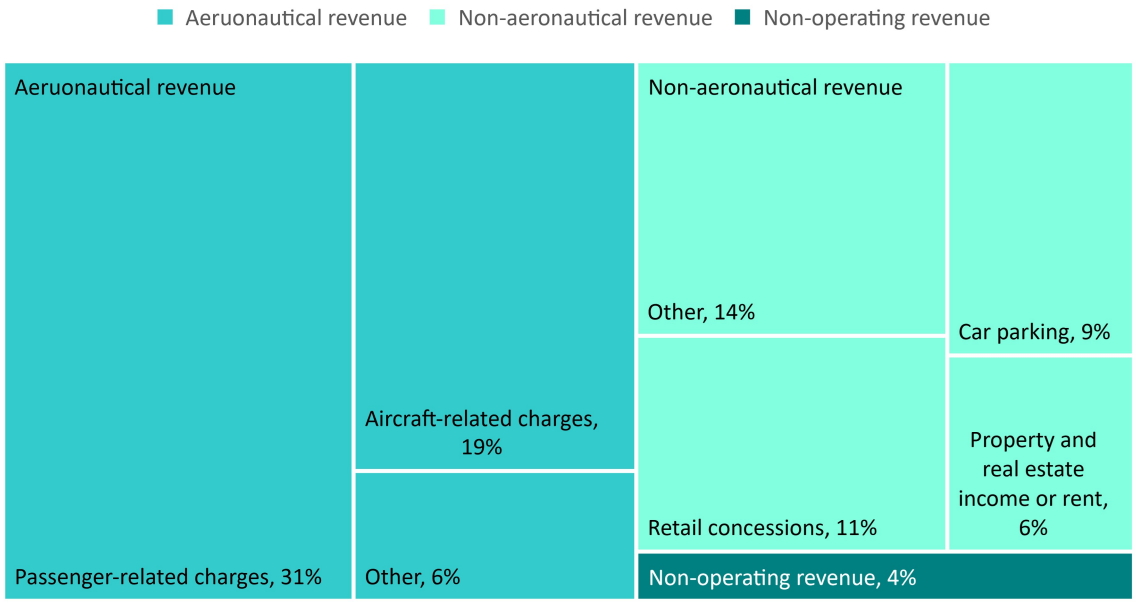
1. INTRODUCTION

1.1. RELEVANCE OF THE SUBJECT

Airports are the subject of keen interest in the business and economics scientific community, as they possess many facets that are worth pursuing in academia. They are large, influential organisations in their community, they serve a public good, they serve as transportation and connection hubs, they are part of key infrastructure, they can be a part of the local innovation system, the list goes on and on.

Airports used to be built and operated by the state, as they first started out serving the military and to this day, they require immense capital investment and maintaining them demands very specified knowledge and is costly. In the early days of flying, travelling, and shipping by air was done by necessity or out of luxury – it was expensive to operate, but corporations were willing to pay a premium. In addition, in the US, up until the Airline Deregulation Act of 1978, prices were set by the federal government, guaranteeing decent profit margins. (Kasper & Lee, 2017)

Figure 1 Revenue structure of an average airport



Source: data from (ACI, 2015) combined, reorganized and visualized by the author

As aviation opened up to competition, between 1990 and 2016, US domestic price per mile decreased by 36%, despite of fuel prices increasing 110% since 1998. (Garcia, 2017) Based on an analysis on airline industry competition by (Kasper & Lee, 2017), this is mostly

due to operational effectiveness and robust competition by low-cost carriers such as Southwest.[1] This resulted in traffic growing significantly over the decades, airports transforming from catering to the privileged elite to being part of the life of the masses. Therefore, airports became businesses in the traditional sense (evidenced by privatization), which means that seeking financial success, not being guaranteed by state set prices, became an important part of the equation.

Logically, airports' revenue can be categorized into three: aeronautical revenue (everything that is necessary for safe aeronautical operations), non-aeronautical revenue[2] and non-operating revenue, for distribution, see Figure 1. Non-aeronautical revenues are nearly half of the revenue, reinforcing the fact that airports rely on these rent streams to survive (40% of all revenue, as per Figure 1).

Moreover, the global airport revenue per passenger was 20.96 USD, divided into 11.88 USD as aeronautical and 8.14 USD non-aeronautical in 2015. However, the total cost per passenger amounts to 16.96 USD, which means that airports require non-aeronautical income to just break even serving each passenger. Furthermore, retail revenue varies significantly – Heathrow can earn up to 13.32 USD, while Washington Dulles received a cut of only 5.68 USD per passenger. (ACI, 2015)

According to (ACI, 2015), as much as 69% of airports operated at a net loss all over the globe, despite global industry revenue year-over-year growth at 5.5% with revenue per passenger growth of 2.2% and an industry net profit margin of 16%, because *"[m]ost of these airports have fewer than one million passengers per annum. Smaller airports have neither sufficient traffic to achieve economies of scale nor to generate significant aeronautical or non-aeronautical revenue."*

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[1] Low-cost carriers cut operational costs by operating one single type of aircraft (slashing costs of maintenance and crew training), benefiting heavily from unification and offering 'bare bone' transport, without amenities (which people might be able to purchase for extra). Some low-cost airlines also prefer less popular airports (e.g. London Stansted vs. Heathrow), where they can leverage the airport into sharing profits of non-aeronautical income such as duty-free shop purchases and parking fees.

[2] Definition from (ICAO, 2012): "*Any revenues received by an airport in consideration for the various commercial arrangements it makes in relation to the granting of concessions, the rental or leasing of premises and land, and "free-zone" operations, even though such arrangements may in fact apply to activities that may themselves be considered to be of an aeronautical character (for example, concessions granted to oil companies to supply aviation fuel and lubricants and the rental of terminal building space or premises to aircraft operators). Also intended to be included are the gross revenues, less any sales tax or other taxes, earned by shops or services operated by the airport itself."* This definition defers from ACI's, where the data is sourced from, however, not to an extent that it would deem the analysis unfounded.

Since the seminal work of Schumpeter (Schumpeter, 1911), it is understood that innovation is the mechanism through which economic growth is achieved. (Nelson & Winter, 1982) Based on the above industry numbers, over ⅔ of airports are in the red, and it is not enough to simply increase the amount of planes/passengers landing, they must be able to capture non-aeronautical revenue to not operate at a loss, which requires innovation. One could argue that simply a bigger throughput would help, as statistically passengers would spend equally more for parking and retail, but this does not take into account that airports are limited physically by how many airplanes and passengers they can serve with their current facilities. There is definitely some wiggle room and this kind of efficiency could be maxed out, but this would reduce flexibility and would increase costs by increased depreciation of assets and possibly needing extra staff for the increased volume. Based on this reasoning, the author argues that the focus of innovation has to cover all areas of revenue in order to maximize profit.

As airports are so vital for the social and economic development of their respective community, it is understood that their growth is directly connected to the prosperity of their area of influence and vice versa, as the surroundings of the airport directly influence their prospects in passenger flow. I argue therefore, that airport innovation activity is worth studying, because an airport's success literally translates to an influx of more money through passengers, whether they are tourists or businesspeople, that will have a ripple effect throughout the region. What makes introducing innovation at airports difficult?

Airports are in a peculiar position: they constantly require to invest back into their own infrastructure for safety reasons, their revenues (and most of their profit) come from passenger traffic (if we exclude aerodromes that specifically cater to cargo) which they have no influence over, as it is the airlines and tour operators that decide whether they want to launch a route or not. Stepping further back, it is decided by demand from people that want to visit the area. Important to note that some civil aerodromes could survive without the increase of significant passenger demand, e.g. Faro, Portugal, which is a popular fuel stop destination by airlines due to its geographical location.[3] However, these outliers are an extreme minority and not even they can sustain themselves without passengers.

In summary, airports are not in the best position with constant high expenses and no direct influence on demand for their services, as they could provide incentives

[3] Faro lies in the south of Portugal, making it a great fuel stop before continuing the journey towards Africa from Europe.

to airlines for launching routes by offering lower fees (which might be deemed unethical practice, if not offered to every airline), but it still would not make it profitable for the airlines without passengers wishing to fly the routes.

This leads to the conclusion that airports need to build demand if they want to be successful. In most cases, passengers choose their destination based on many factors, but the airport is not one of them (one contra example could be London, where passengers do choose airline tickets based on which airport serves as the destination and/or departure point, but the vast majority of aerodromes are not this close to each other). Understandably, not many will choose to fly to Berlin instead of Copenhagen, just because they prefer Schönefeld over Kastrup, and then take a train ride to Copenhagen. This proves the age-old mantra of real estate, that the three most important factors regarding a property is location, location and location.

Obviously, no airport can change its location.[4] It was shown previously that logically, passenger demand can be increased by innovation and investment from the region into itself to attract more people, making launching routes lucrative for airlines. However, the airport is not doomed to be a passive actor in passenger flow management, waiting for the region to invest and for airlines to notice and act upon it.

As mentioned before, increasing revenues can be through passengers[5], who generally choose the area of their visit, then the airport best deemed to serve it, not the other way around. However, most aerodromes do not exist in isolation – ones that do benefit from this fact anyhow. Those that do not, they will compete with airports for the potential passengers that live between them. This means that people might decide to fly out of or to an airport because of conveniences – after maximized exploitation of the immediate area, airports can increase their demand by focusing on these opportunistic passengers as well as increasing the amount of transit passengers.

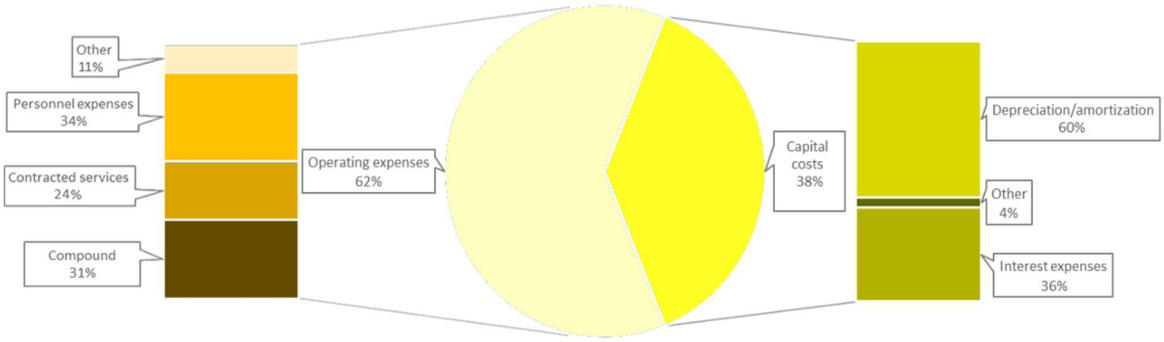
In addition, revenues can be increased not just by increasing the number of items or services sold, but by price. As highlighted before, most airports enjoy a kind of monopoly in their catchment area, but competition does not need to come directly from another airport. Most airports charge for parking (based on Figure 1, amounting to 8.89% of total revenue), if they raised pricing on e.g. parking, they would generate more income, however, if pricing

[4] Airports are very expensive to build, so even in the case of a new airport being built close to an existing one, the new airport would receive new designators and codes, making it a new airport, unless the old aerodrome is completely decommissioned and demolished. These rare cases are out of scope.

[5] Airports can offer services to airlines, like hangar space, maintenance crew, office spaces etc., but they are all contingent on high enough passenger flow.

becomes too high, it will make alternatives such as taxis more affordable and attractive. Overall, prices need to stay competitive, therefore the more lucrative route is increasing the number of items sold. This could be done by increasing the amount one person buys (e.g. deals or add-ons, bundles etc.) or the amount of people purchasing items. This could be done either by increasing throughput or achieving a better conversion rate from travellers to buyers. This identifies two types of innovation avenues – increase of passenger flow and conversion from passenger to buyer.

Figure 2 Cost distribution at airports



Source: data from (ACI, 2015) combined, reorganized and visualized by the author

From the other perspective, instead of increasing rents, an airport can aim to innovate to lower their expenses, increasing profitability that way. To gauge the viability of this route, it is worth noting the cost structure of an airport, see Figure 2. It is assumed that capital costs are optimized and not a major source of innovative activity at small airports, which rather befalls on operations, that amounts to 62% of the expenses. The biggest expense are personnel with 34%, followed by compound (insurance, claims and settlements 2%; materials, equipment and supplies 4%; lease, rent, concession and fee payments 5%; maintenance (excluding contracted services) 5%; general and administration expenses 7%; communications, utilities, energy and waste 8%), contracted services are responsible for close to a quarter of the costs and other costs amount to 11%.

As visible, there are numerous aspects of operations that an airport can decide to pursue to improve upon, nonetheless, aviation, as an industry, is highly and globally regulated. Uniformity is essential in basic management, so flight operations can be conducted safely, which acts as a barrier to innovative activity, not to mention

the costs involved with introducing new equipment, e.g. self-check-in counters or new aeronautical guidance systems. This results in stakes being high and further underscores the need for airports to be able to successfully measure their innovation performance and have a reliable innovation management.

Succinctly, airports are important for multiple reasons and their survival is of interest to many actors. Based on the above, airports need to innovate to be able to stay alive, especially smaller airports. Following the previous reasoning, in this section I posit that due to the highlighted importance of innovation at airports, it is worthwhile pursuing a study of how airports manage their innovation activity, especially the smaller ones that struggle more. *"[…] [T]he main proposition deduced […] is that an airport's ability to innovate is the key for future success."* (Scheler, 2013, p.104)

1.2. PROBLEM STATEMENT AND RESEARCH QUESTION

In summary, airports need to innovate, because it is a necessity for their survival, but are heavily restricted by regulations and pressure for uniformity for operations. This translates into hardships with both managing and evaluating impact of innovation activity. This provides a basis for inquiry into airport innovation activity, which has not enjoyed the attention it deserves. Since its conception, the Journal of Airport Management had 15 volumes, four issues a year with on average 8-10 papers, out of which six dealt with innovation as a topic in total. Using these rough numbers, this comes to ~1% of all research published in this journal concentrated on this topic. This thesis aims to expand on the shared knowledge of airport innovation management, highlighting its importance and hopefully enticing the academic community to focus efforts on this area of study.

1.2.1. Innovation management at airports

The practice of innovation management at airports is explored, to provide an outline of the current state and for the sake of highlighting the importance of this research and how it fills the gap in the current literature.

As mentioned in (Price, Wrigley, Dreiling, & Bucolo, 2013), aviation, as an industry, has an internalized aversion to risks, while (Duman, 2019) refers to airports as zero-risk environments. Innovation, by its very nature, includes taking risks – depending on the type, less or more, but change is intrinsically risky. Innovation management is the tool

that companies can learn to use in order to be able to survive challenges imposed by changing conditions. (Porter, 1990)

This chapter aims to provide an overview of how airports tend to manage their innovation activity, what the main challenges and popular solutions are, including possible tools used by the airports. The literature has been surveyed and presented below with the selection criteria in mind that this paper aims to analyse Aalborg Airport and by extension, serve as a baseline for smaller airports. Therefore, insights gathered from studies not geared towards small airports are either generally applicable to all aerodromes or are utilizable for airports of all sizes.[6]

Based on the Future-Fitness-Portfolio approach, airports are considered to be model/trend based in their corporate foresight, paired with a hybrid innovation management (mixing up technology and demand based management). (Heiko, Vennemann, & Darkow, 2010) This seems to fit well with expectations, as most innovation avenues rely on technology, but they rely on growing demand, as the point of innovating is to provide a better, faster service to more people at once or doing it cheaper.

Barriers to innovation are identified as the pressure to continue to provide the same quality and quantity of service even while innovating, which puts undue stress both on financial resources and organizational culture. One solution to this is a design led innovation approach, which allows for collaboration with customers and service providers and for building internal design capability. This can mostly be done by giving a voice to middle management, who are able to maximize their knowledge of the company as well as their relationship with the customers. (Price et al., 2013) Top-down, hierarchical tradition of management is also a barrier, not allowing a culture that fosters innovation to develop. (Tarry, 2000)

Marketing performance at airports are significantly impacted by market innovation, but market focus, namely traditional or leisure, bears no impact. (Halpern, 2010) It is also agreed upon that the innovation activity comes from the non-core business aspects, namely revenue increase and innovativeness describes the business of the airports not related to aviation itself. (Rho, Sohn, Yang, & Lee, 2015)

[6] Scientific research is not currently focused on the challenges faced by small airports alone, as is the argument made in this chapter, thus some literature that deal with e.g. airport management companies that specialize in managing a number of airports simultaneously, are deemed out of scope, as smaller airports tend not be a part of such a network and tend to be publicly owned. (ACI, 2015)

"More precisely, there are five drivers facilitating the airports' ability to innovate: (1) Monitoring of environment and competitors, (2) Institutionalization of interaction and exchange, (3) Systematic approach, (4) Top management commitment, and (5) Environmental pressure." (Scheler, 2013, p. 106) Scheler further identified three main categories of innovation activity barriers in her study: lack of organizational priority, innovation opponents and limitations in space.

Lack of organizational priority can be explained by the public-utility mentality of airports and innovation opponents can be airlines themselves, as their vested interest is in increasing the flow of passengers or decreasing their costs at the airport and to oppose anything that does not guarantee these. (Tarry, 2000)

In a case study of a small Chinese airport, (Wei & Xu, 2013) found that managers found the lack of communication and coordination between decision-makers and performers (35,34%) the biggest challenge in implementing (formal) innovation management, closely followed by lack of structured policies (30,3%). To a smaller extent, lack of awareness of creating new things (21,67%) and lack of experience (15,15%) also posed a challenge.

(Hoback, 2018) found through the case study of Pittsburgh Airport that innovation is best fostered by management transparency and innovation fostering culture. Front-line workers and middle management offered many of the new ideas and process improvements that helped the airport to achieve growth after multiple years of decline. Culture had to foster risk acceptance and quick pivots.

It is also possible that regulation itself stands in the way, such as single till models[7], where any profit above a predefined level must be used to lower charges of the airport. This does not only decrease the drive and will of management to invest in innovation, but makes the airport a less desirable candidate for privatization, since higher rates of return cannot be enjoyed by the entrepreneur. (Niemeier, 2002) Other financial regulatory constraint could be not allowing the airport to spend on fringe ideas, that would benefit the public and the travellers, but it is not core business related, such as better railway

[7] Single till refers to the idea that all revenue comes into a single airport till, including revenues generated by retail or property management, and airport charges only need to cover the 'missing piece' to hold the airport above water.

connection. (Tarry, 2000) The idea of independently administered airports being more innovative is also supported by a questionnaire-based survey. (Halpern, 2010)

(Tarry, 2000, p. 6) investigated the administration and innovation capability of five public airports in America and concluded that: *"increased autonomy for airport administrators will substantially improve the likelihood of innovation and its beneficial impact on productivity and service quality."* From his wide-ranging survey, he learned the following lessons. First, airports should be aware of their political and socio-economic environment and match their prospects and strategies accordingly. Second, airports should not try to innovate in isolation, they should be inspired by others in the industry as well as borrowing ideas from other industries and use new technology. Third, by hiring the right people, airports should aim to create a dedicated and pro-innovation management, who in turn can foster the right culture. Fourth, public relations must be top priority, as the general public and even the media reporting does not know enough about the highly regulated aviation industry. Fifth, airlines must be treated as business partners and airports need to convince them that despite (mostly) being a publicly owned entity, the aerodrome is willing to operate as a business and involve the airlines in the major decisions. Sixth, airport management should receive bigger autonomy from the politicians, so they can focus on innovation. Based on these lessons, (Tarry, 2000) has three recommendations: increase autonomy, measure performance and management transparency.

A study of airport innovativeness shows that geographical location is more important than size when it comes to the innovativeness of an airport. They found that European airports were quicker to adopt new technology, regardless of size.[8] (Martin-Domingo & Martín, 2016) Most likely the key to this is not geography, but different organizational culture and appropriability regimes. Nonetheless, geography does influence the possibilities of business model innovation. Based on the study of 20 airports of five different basic business models (primary and secondary hub, business, cargo and low cost), there were three main restrictions: geographical (location, proximity to other airports and big cities), institutional (private or public ownership, policy, laws and contract types) and financial (partnerships and sources). (Kalakou & Macário, 2013) Public ownership hinders innovation by not implementing adequate reward and recognition programs;

[8] Worth to note that this study only had medium to large airports as datapoints.

innovators are less likely to take the risks if there is too high organizational inertia and there is no support from senior management and/or if their extra work and risk is not rewarded monetarily and with promotions. (Tarry, 2000)

There are several innovation dimension aspects of airport enterprises including safety, comfort, reliability and convenience. (van Hagen & Bron, 2014) This focus is further divided into even smaller areas of focus, due to airports being providers of a wide variety of services to qualified clients, be it handling cargo or offering parking services to passengers. (De Neufville, 2003) This might erode focus for innovation and hinder the formation of formalized innovation management.

(Bowyer & Chapman, 2014) argues that airports should move towards an open innovation model, embracing a more collaborative innovation stance rather than a client-provider dynamic. They also claim that, based on the case study of Sydney Airport, privatisation had a positive effect on growth through innovation, as stakeholders were more engaged and interest in profit fuelled investments. This is supported by (Chapman & Zakrzewski, 2008) as well, who showed through qualitative analysis that the performance growth of Sydney Airport before and after privatisation was significant. Citing innovation as the ingredient for success, using Schiphol Airport as a point of reference, there are more researchers in agreement that innovation is what sets apart struggling and thriving aerodromes. (Nijhuis, 2012)

It is visible that most research on airport innovation management is stuck at the level of justification for needing innovation and innovation management. When measuring airport performance, measuring innovation activity is not a top priority. (Humphreys & Francis, 2002) There is also more focus on bigger airports, especially privatized ones, possibly because they are easier to study, due to more data and higher willingness to participate in studies or simply because they can afford to fund research. However, as argued before, most struggling airports have less than one million passengers per year and are much less likely to be owned privately, meaning that their barriers to innovate will include political issues and they will more likely suffer from lack of funds. Therefore, this thesis aims to fuel the budding scientific discussion around the innovation management at smaller airports.

1.2.2. Research question

In this paper, Aalborg Airport is used as a case study, as they managed to over double their number of total passengers (exceeding the limitational one million passengers per year) in seven years and had a compound average growth rate of 5,6% of passengers, which proves that their efforts bore fruit. Aalborg Airport is also at the forefront of innovation, having been the world's first in developing and introducing a complex RFID (Radio Frequency Identification) based baggage tracking and sorting system. This makes this case unique and has the possibility of yielding valuable insights for other airports trying to imitate the success of Aalborg Airport. This paper also extends on (Tarry, 2000), where five airports were studied in regards to their innovation management, with the smallest airport having 300 000 annual passengers, the second smallest being 6.5 million, meaning that this case study elaborates further on an airport right around the threshold of critical passenger number for profitability (see Figure 3, Aalborg Airport has approximately 1.5 million passengers per year).

Their average growth rate is basically the same as the growth rate of the industry – how do we know that their success is attributable to their innovation and its management and not to the natural development and expansion of air travel? The airport does not have an innovation activity evaluation system at present. (Bermann & Holst, 2020) It is argued that for a small airport like Aalborg Airport to have the same growth rate as the industry is rare and uncharacteristic of an airport this size, therefore worth studying. (Tarry, 2000) advocates for the need of measuring the performance of innovation efforts, to identify what works and what does not and where can improvements be made.

It is argued that innovation at the airport is quintessential for the financial success of an airport. In order for the airport to be able to identify the best avenue for innovation, it has to manage its innovation activity and it requires a data driven tool that can quantify and measure the impact of said innovation activity and management.

Hence, the following research question is posited:

How does Aalborg Airport conduct its innovation management and how can Aalborg Airport measure the performance of its innovation activity?

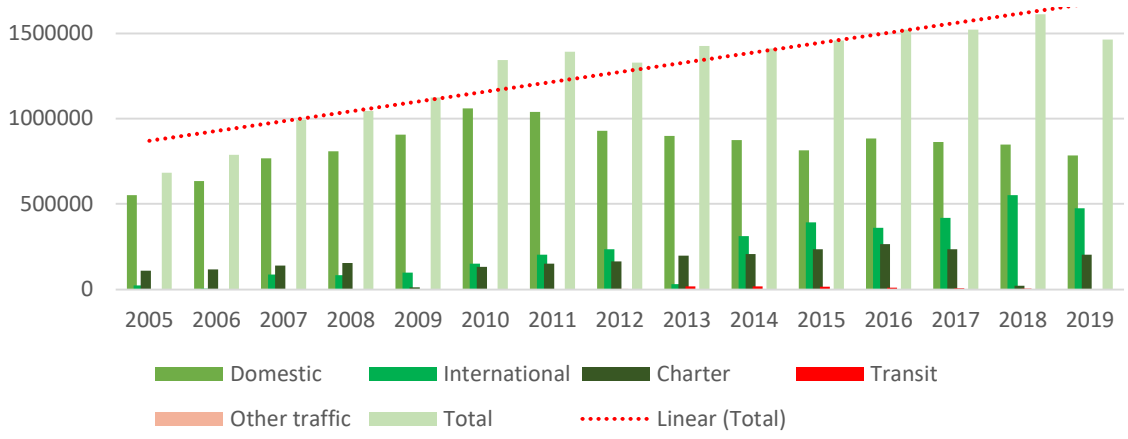
1.3. SHORT OVERVIEW OF AALBORG AIRPORT

Aalborg Airport was founded 82 years ago in 1938. Less than two years later, on 9 April 1940 German forces took over the airport with grass landing field and built the longest runway in Europe at the time out of bitumen along with expanding it into a gigantic military base. This was necessary due to Aalborg's geographical importance – German planes could not fly directly to Norway without refuelling; hence they built an airport to serve as a base for them in northern Europe. The airport is dual use to this day, with a civil and a military side. In this research, only the civil side is under review. Their values are being expansive, holistic, solution oriented and energetic, and in this chapter, it is shown that they live up to their values.

In 1997, the seven municipalities surrounding the airport (Aalborg, Jammerbugt, Rebild, Brønderslev, Frederikshavn and Vesthimmerland) took the ownership over from the state. (Overgaard, 2013) The airport operates as a non-profit company, being responsible for their own finances and development, but decisions are made with the understanding that serving the population of these municipalities comes first. (Bermann & Holst, 2020)

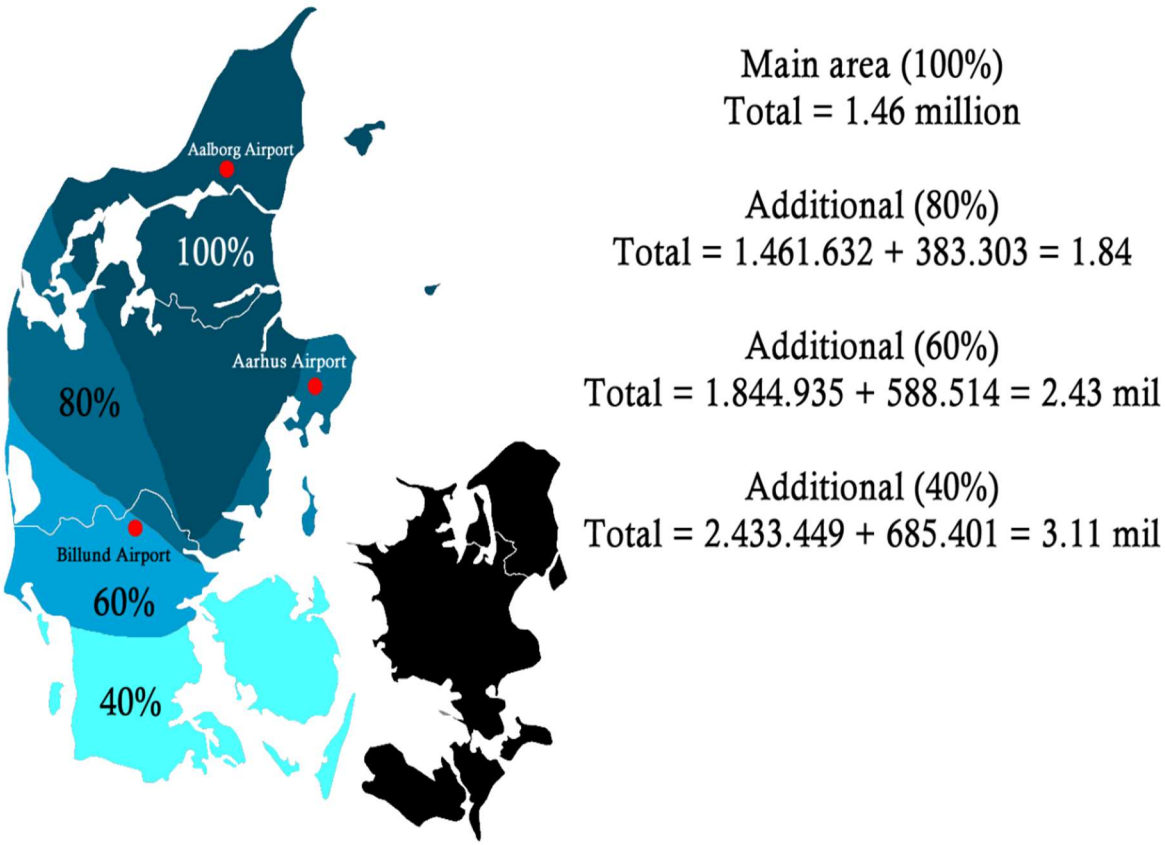
Ever since its inception, the main route was between Aalborg-Copenhagen which reigns supreme to this day, having 1,5 times the passengers than international routes, however, the gap is closing, which means that next to constant growth, the popularity of international routes grows faster than Aalborg – Copenhagen. This can be seen on Figure 3, as well as that the domestic passenger flow has been decreasing since 2009, while both charter and international routes enjoyed a steady growth in numbers.

Figure 3 Number of passengers annually at Aalborg Airport (2005-2019)



Source: (Aalborg Airport, 2019), redesigned

Figure 4 Airport preference/catchment area within Jutland, DK



Source: (Aalborg Airport, 2019), redesigned with map from (FreeVectorMaps.com, 2020)

This most likely means that the Aalborg – Copenhagen route has reached its potential, hovering around 850 000 passengers a year. Between 2008 and 2018, international passenger numbers grew from under 100 000 to over 550 000 a year. Expectations for the future is that passenger numbers will exceed two million per year in the next three to five years.[9]

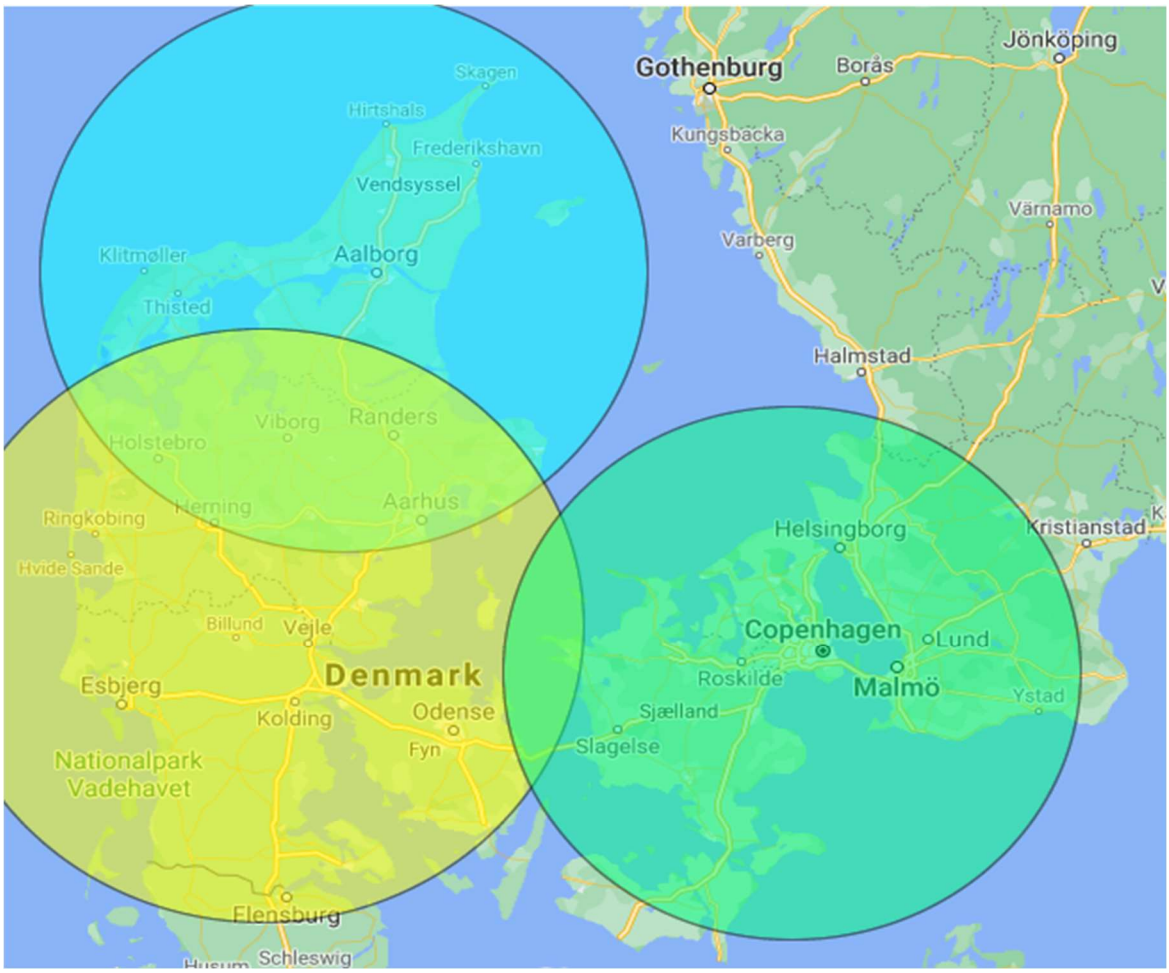
Management's view is that their impressive growth is thanks to offering free parking and easy accessibility[10], serving north-mid Jutland primarily, secondarily southern Jutland. In order to be more accessible to mid and southern Jutland, Aalborg Airport used its influence to convince the municipalities to extend the railway to the airport, making it the second airport in Denmark to be connected with a direct train line, after Copenhagen.

[9] These projections were made in 2018.
[10] The two major competitors, Billund an Aarhus, were also placed strategically from a military point of view, instead of commercial use. Both are harder to reach via public transport and neither offer free parking.

The connection is expected to be finished in 2020 (plans were made in 2010). At the same time, as free parking is one of the main attractions of the airport, they also lobbied successfully to extend E45, the highway that is now reachable with a ten minute drive from the airport, to have a direct exit to the terminal, meanwhile circumnavigating Aalborg city, making the drive shorter as well. (Aalborg Airport, 2019)

As visible on Figure 4, with the expansion of rail and highway, it is estimated that the airport's reach will cover 3.11 million Danes – this is a significant step up from the 587 335 people living in the North Jutland area. (European Comission, 2020) This figure also highlights the competition with Billund airport – which is better visualized on Figure 5. Despite Billund being an obvious choice for southerners, the airport reports an increase of people driving up all the way from the German border to travel out of Aalborg. (Aalborg Airport, 2019)

Figure 5 Catchment area of Aalborg Airport



Source: (Aalborg Airport, 2019), redesigned using Google Maps

The map also shows that the circle of influence extends over Denmark – it is reported that over 10 000 Norwegians chose to ferry over from Norway and fly out of AAL instead of flying out of Oslo (and pay for parking). (Aalborg Airport, 2019)

Management's view, as described by themselves, is unique in the sense that they see the passengers as their customers, not the airlines. (Bermann & Holst, 2020) This seems logical, as passengers are the end consumers, but as is the case in many areas, interests between passengers and airlines do not always overlap. A good example is free parking – some airlines negotiate with the airport for kickbacks from e.g. parking fees, but Aalborg Airport stands firm on offering parking for free for everybody, despite possible pressure from airlines.

However, airlines are still strategic partners, allies and customers and their needs cannot be left unserved. In an attempt to attract airlines, the airport offers marketing support, including help with the marketing plan, a joint marketing effort for advertising new destinations and/or departures, various marketing solutions (print media, banners at the terminal, radio, events etc.). (Aalborg Airport, 2019) They, however, refuse to raise one airline over the other – Ryanair, after successfully launching routes out of Billund and Copenhagen, approached Aalborg to launch routes, but they wanted to avoid paying the same fees that even the airport's biggest client, SAS, had to pay. Management decided to pass up on the offer of Ryanair so as to not anger their loyal partner. (Overgaard, 2013) In the end, Ryanair offered scheduled flights between Aalborg and London Stansted, paying the same dues until 2020.

In a conscious effort to appeal to airlines, AAL has not increased its airport charges for many years, this means that they are the cheapest airport in Denmark (there is about 55 DKK difference compared to Copenhagen per passenger).[11] Admittedly, these charges do not actually cover the expenses of the airport for aeronautical services, but as it was shown earlier, it is common practice to cover some of the costs from other revenue streams. Aalborg also prides itself on being the 9th most punctual airport in Europe as well as having won the Best Service Award from Brand House in 2018 out of 280 businesses. (Aalborg Airport, 2019)

[11] This is important because most airlines use dynamic pricing and they determine the price levels by demand, not mostly based on costs. This means that lower airport fees (that, by regulation, have to be included in the advertised prices) equal more money in the airlines pocket.

Currently the terminal is 7000 m^2 with a 500 m^2 duty free shopping area and a capacity to service 2,3 million passengers[12] annually with 11 gates and 9 parking spots for aircrafts. The duty-free area also includes lounge facilities; revenues from this segment have doubled under five years from inauguration in 2013 to 2018. There are 350 employees in total, including the areas of service that were taken over by the airport from previous suppliers.

The current vision of management is turning the airport into a hub – as their work horse, the reliable route between the city and the capital plateaued out and they have only so many people wanting to visit Aalborg, it is a natural step to increase traffic by increasing transit passengers. One of their innovations in this direction was the equipment and supply hangar, built in 2017, which allows them to offer more services to airlines. They also built a new airplane hangar, unveiled on 1 August 2019, which was already put to use by the newly formed airline Great Dane Airlines that is headquartered in the airport with their three Embraer 195 aircrafts.

Another investment was the new security flow, both by design and by build, which was the innovation of the airport. They introduced another technology as first in Denmark, namely that electronical devices can now stay in the luggage through the scanning process. As part of the new flow, they also invested in a new type of scanner to increase security.

From the aeronautical side, at the end of May 2020, a new Category III ILS (Instrument Landing System) will be introduced – this will allow airlines to land in weather where they could not before, up to zero meters of visibility. This will make diversions and delays due to weather much less frequent.[13] They also invested in new technology, a powerstow (allowing loading and unloading of luggage from airplanes safer and faster) and a push back vehicle that is faster and can handle heavier aircrafts.[14]

After six years of SAS being responsible for passenger handling, the airport took over in 2014, taking over the employees and expanding on quantity and quality of this service. In 2016, the airport took over the food and beverage service from contractors within the secured area and revenue has been increasing from this area steadily. This is done in order to provide the same quality of service in all areas of the airport and also to maintain

[12] This capacity is not expected to be outgrown in the next five years.
[13] Denmark, and specifically the northern parts are prone to fog formation, which limits visibility, a key measurement to gauge whether a landing attempt is viable.
[14] A push back vehicle pushes an aircraft back from the gate

employment – as mentioned before, the airport has a duty to the people of the municipalities and providing employment is one of these. Since their innovations are generally aimed at automation (partially due to the high salaries, compared to e.g. Eastern-Europe), the freed up workforce is then redistributed to a newly absorbed area. (Bermann & Holst, 2020) This approach has worked in their favour so far; satisfaction at the airport is quite high – based on their own survey, 94% of the passengers would choose the airport again for their next travel.

2. METHODOLOGY

2.1. PHILOSOPHY OF SCIENCE

"[…] [M]odern science is a discovery as well as an invention. It was a discovery that nature generally acts regularly enough to be described by laws and even by mathematics; and required invention to devise the techniques, abstractions, apparatus, and organization for exhibiting the regularities and securing their law-like descriptions." (Heilbron, 2003, p. VII) The word science comes from the Latin word 'scientia', which is translated as knowledge. (Harper, 2020) This means that the pursuit of science is the pursuit of knowledge, including its creation.

Creating knowledge is a noble, but difficult challenge to take on. It is important that scientists consciously investigate their preconceived notions about reality, because their philosophical positions influence how they formulate the research questions, what methods they choose to investigate etc. Without consistency between philosophy of science and theoretical and observational findings (Rosenberg, 2018), the created knowledge becomes questionable and possibly takes us even further from the truth.

Apropos truth, it is the first question scientists differ on – what reality is (ontology) and how can it be studied (epistemology). (Blaikie, 2007; Carter & Little, 2007; Meehl, 1954; Wann, 1964) Concerning ontology, on one end of the spectrum, objectivism declares that knowledge has to be acquired through replicable methods and facts that are observable and things like intentions and reasoning can only be studied based on their connections

and interference with measurable phenomena. (Bergmann & Spence, 1941; Kantor, 1958; Nagel, 1961) On the other end, subjectivists argue that social science has to have humans in its focus, as behaviour is affected by characteristics of the human psyche and the uniqueness of the subject matter cannot be ignored in order to produce valuable insight. (Easton & Charlesworth, 1962; Mischel, 1964; Rose, 1954)

This duality, according to (Diesing, 1966), has been surpassed by modern methods and research designs and only exists on the philosophical level. He argues that with the combination and dual application of both types of methods, research can be deemed scientifically rigorous in the eyes of both schools of thought.

Following this argument, the data gathered in this paper are both qualitative and quantitative, therefore the methods used to gather and analyse them also share the dichotomy. However, since the basic underlying question is aimed at what can entice people to fly from one city to another, which is ultimately a subjective decision, it seems appropriate that the analysis and overall conclusions are drawn from a subjectivist point of view.

In this fashion, following (O'Driscoll Jr & Rizzo, 1985), human decision making cannot be described simply by external factors, individuality and creativity will also be a determining factor. Nonetheless, research still can create valuable 'general' knowledge, as evidenced by the intersubjectionalist approach, where it is argued that despite each individual having a unique set of experiences and point of view, we share many common perceptions about the surrounding reality. (Diesing, 1966)

It is deemed that a suitable maxim to follow is pragmatism, due to the paper combining multiple types of methods, but generally following a subjectivist analytical approach. As it is eloquently formulated by (Peirce & Hetzel, 1878, 2nd paragraph): *"Consider the practical effects of the objects of your conception. Then, your conception of those effects is the whole of your conception of the object."*

Inquiry is structured as follows: first, problem is found, second, problem is formulated in multiple ways to find the one most practical, third, create plans to solve the problem, fourth, evaluate the plans based on consequences and finally, take the necessary actions based on the above. (Dewey, 1916)

2.2. DATA GATHERING

Primary data was obtained through semi-structured personal interviews with members of the management team at Great Dane Airlines (namely Stinne Hjorth Dalsø, previous Safety Manager of Aalborg Airport and current Chief Operating Officer and Thomas Hugo Møller, previous Compliance Manager of the airport and founder and Chief Executive Officer of Great Dane Airlines) by exploiting preferential access gained through the job to key personnel at the airport. Interviews were conducted in a manner to ensure objectivity and a satisfactory data saturation level. Transcripts of these interviews are not included as an appendix to this paper due to confidentiality issues and sensitive company data, but they are available upon request. Another interview was conducted with Kirstin Holst, Manager of the Airport Office and Kim Bermann, Chief Operating Officer at Aalborg Airport; see transcript as Appendix A. Data for the statistical analysis was obtained partially by the airport (passenger figures and data for innovations, including number of parking places). For a detailed account, see Chapter 4.1 about the sources of the rest of the data used in the regression.

2.3. METHODS

As argued earlier, a combination of both quantitative and qualitative methods is used to answer the research question. Qualitative methods include semi structured interviews and their analysis, literature review, analysis and critique. Quantitative methods are described in depth, as the statistical model and its testing is included here. In addition, insight and experience is used by the author that she gained working for an airline for 2 years, both in terms of informing analysis and aiding in drawing practical conclusions from the results. This chapter is divided into three, research design, qualitative and quantitative methods. Under research design, considerations regarding this case study and this research design's limitations are presented, under qualitative methods, the method of semi-structured interviews and desk research is explained. Under qualitative methods, a set of guiding principles are set forth to shed light on the process of choosing the appropriate method, then the evolution of the method is explored, finishing with econometric considerations.

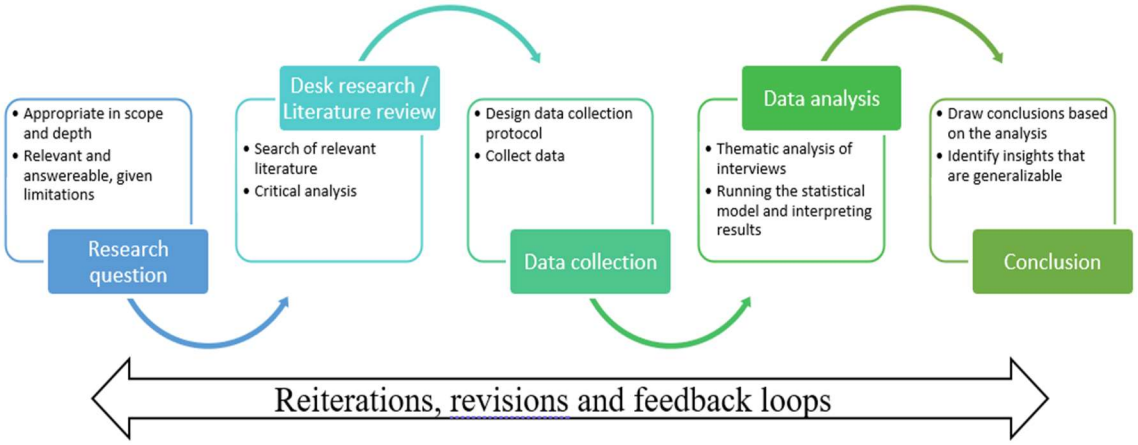
2.3.1. Research design

Taking into account the restrictions imposed by time and access to data due to the pandemic caused by the novel coronavirus (CoVid-19), a case study is chosen as research design due to it being accommodating to mixed methods and is appropriate, as the data originates and describes a single entity, Aalborg Airport. The case study design also fits well with the philosophy of science, as it assumes a subjectivist approach (Stake, 1995; Yin, 2003) and one of its strength is gaining credibility by using multiple perspectives (Russell et al., 2005), which is well aligned with the chosen pragmatist maxim. As by typology, this current case study is an intrinsic and instrumental observational study. (Baxter & Jack, 2008) It also has history of application for the study of innovation management at airports. (Langedahl, 1999)

Figure 6 shows the steps that were taken by the author while conducting the research at hand. The research design is following best practices taught and adopted throughout the curriculum of the master's programme. It is important to note the importance of the feedback loops, as no research is conducted in a linear format, new data and insights should be in constant connection with the research question. This is a hallmark of case study design, data collection and its analysis running concurrently. (Baxter & Jack, 2008)

In the following, it will be argued how a case study is applied and some common objections to its use will be answered, however, this debate is of no central interest in this

Figure 6 Research design



Source: author's own design

paper, thus this section is not meant as a systematic overview or exhaustive list of reasons for raison d'être of the case study research design.

Many have criticised case studies for only providing context dependent knowledge (Flyvbjerg, 2006), some going as far as claiming that any insight gained is unscientific and unsuitable as an inquiry. (Campbell & Stanley, 1966) Generally, this disdain partially stems from the favouritism shown to generalized theory, however, it is easy to see that without case studies, no theory can be further refined, as studying cases that are contradicting current knowledge is how our common understanding grows on any subject. In addition, historically, case studies were also used to debunk reigning theories, even as big as Aristotle's law of gravity that dominated for two millennia were redefined by Galileo Galilei. (Flyvbjerg, 2006)

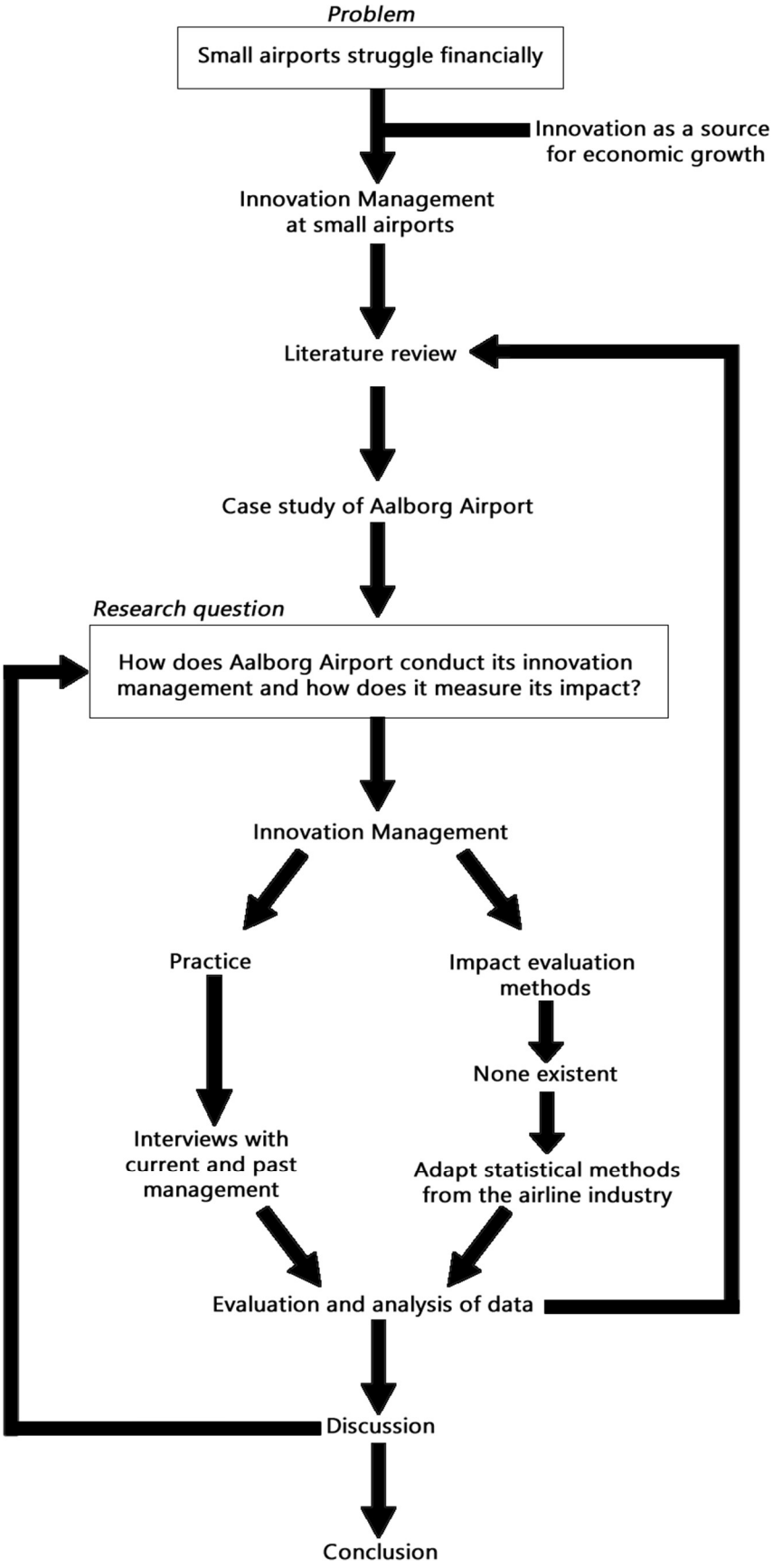
Especially in economics, as (Blaug, 1980) argued, despite preaching hypothetico-deductive approaches in research design, actual research often falls short, as practice shows a bigger array of research designs in practice. Social sciences need to have their own methods, as the adoption of statistical measures although beneficial, cannot grasp all the nuances that contribute to complex phenomena.

Some of the great thinkers, including Lord Francis Bacon, saw an intrinsic problem with case studies, namely that people have inherent biases towards affirmations to their hypotheses (Bacon, 1853), which is certainly easier to do when the researcher has the power to – unknowingly and unmaliciously – manipulate data by choosing just the right people to interview or drawing bigger conclusions from fringe cases than it is warranted. These concerns are best dismissed by (Campbell, 1975, p. 181):

"Experiences of social scientists confirm this. Even in a single qualitative case study the conscientious social scientist often finds no explanation that seems satisfactory. Such an outcome would be impossible if the caricature of the single case study as presented in these three quotations were correct-there would instead be a surfeit of subjectively compelling explanations."

In addition, Figure 7 shows the conceptual framework governing the thesis. It should be highlighted that the feedback loops help streamline the efforts, helping to better crystalize the conclusion.

Figure 7 Conceptual framework of the thesis



Source: author's own design

2.3.2. Overview of qualitative methods

The surveying of the relevant literature was done through desk research. It aims to be a survey of the current level and extent of the knowledge about the fields discussed, identify possible gaps, and help position this current paper within the field.

2.3.2.1. Semi-structured interviews

The primary qualitative data collection was done through semi-structured interviews. As their name suggests, semi-structured interviews exist on the spectrum of structured and unstructured interviews, where either the interviewer leads with a standardised and strict list of questions or the interviewee takes the lead, e.g. by telling stories, respectively. Semi-structured interviews are chosen due to their informal tone and allowing people to swerve the topic to what they think might be relevant, but control remains in the hand of the researcher to keep the dialogue on topic.

The following questions served as the skeleton of every interview:

Table 1 Interview questions sorted by focus

Focus/Topic	Question
Importance of innovation	1. In your opinion, is it important for an airport to innovate? 2. Is it harder to innovate as a smaller airport? 3. Is there formal innovation management, e.g. dedicated managers and/or funds? Is there a key person responsible?
Tools	4. How does Aalborg Airport decide in which area to innovate in? 5. Are there any specific tools used to determine which way to go when faced with two mutually exclusive ideas? 6. Are there any specific tools used to evaluate innovation activity?
Idea sourcing	7. How does the airport source ideas for innovation? Can anybody in the organization propose ideas? 8. Do you have a concrete idea about something that could be changed for the better at Aalborg Airport? Who would you first turn to in order to discuss it? 9. Is the airport inspired by other airports?

Focus/Topic	Question
Formal innovation management	Question 3 and 4 are also applicable here 10. Is innovation generally geared towards attracting more business or increasing efficiency?
Appropriability regime	11. Is the airport concerned with other airports copying their innovation? 12. Has the airport considered collaborating with other airports?
Shortcomings	13. Do you think Aalborg Airport is a successful innovator? 14. Where do you think Aalborg Airport's strategy is lacking? 15. Is there anything you would like to add?

Source: created by the author

Selection of interviewees were based on availability and presumed knowledge and experience of the topic at hand.

2.3.3. Overview of quantitative methods

As set out in the problem statement, small airports require a data driven tool to aid their innovation activity management. This paper will utilize the gravity model, modifying it to suit the research question at hand, but first, an overview of the methods used before will be provided with arguments on why they were not chosen.

Guiding principles of the author were when choosing a method:

1. Data availability – reliable data must be readily available or obtainable by the airport to be used in the analysis.
2. Simplicity – the method chosen must be relatively simple to use and analyse by professionals of any background, no econometrician training should be required, albeit scientific rigor should not be compromised.
3. Validity & Reliability – the method must have robustness, so the insights gained can be trusted. Preferably a history of application within the aviation industry.
4. Adaptability & adoptability – as different airports face different problems, the method must be amendable and modifiable to reflect the issues at hand.[15]

[15] Refer to the guiding principle of simplicity, management has to be able to not just run the analysis and interpret results but modify the method to their unique circumstances.

Naturally, it is posited that the gravity model fits all of the above principles. As elaborated later on, the method is boiled down to a log linear multivariate OLS (Ordinary Least Squares) quantitative analysis, one of – if not the – most used quantitative analysis methods, partially due to its simplicity. The equation can be refined and adapted by new datasets easily and as being a popular approach, there is a vast literature for robustness checks.

Table 2 Properties of selected previously estimated gravity models within aviation

Study	*Factors*	*Obs.*	R^2
(Doganis, 1966)	Observed passenger number at airports, distance	22	0.740[a]
(Brown & Watkins, 1968)	Income, sales competition, average fare per mile, journey time per mile, number of stops, distance, phone calls, international passengers on domestic flight, competition index	300	0.870
(Verleger Jr, 1972)	Income, price, phone calls, distance, flying time	441	0.720[b]
(Moore & Soliman, 1981)	Population on city-level, income, economy fare	69	0.370
	Population of airport catchment regions, income, airport catchment, economy fare	58	0.810
(Fotheringham, 1983b)	Attractiveness/population, traffic outflow of origin, distance	9900	0.730; 0.760[c]
(Rengaraju & Arasan, 1992)	Population, percentage of employees, university degree holders, bigcity proximity factor, travel time ratio (travel time by rail divided by travel time by air), distance, frequency of service	40	0.952
(Russon & Riley, 1993)	Income, population, highway miles distance, number of jet/propeller nonstop/connection flights, driving time minus connection flight time, distance to competing airports, political state boundary	391	0.992
(O'Kelly, Song, & Shen, 1995)	Nodal attraction, distance	294	0.850[d]
(Jorge-Calderón, 1997)	Population, income, proximity of hub airport, hub airport, distance, existence of body of water between cities	339	0.371

Study	*Factors*	*Obs.*	R^2
	Additional variables: tourism destination, frequency, aircraft size, economy fare (not/moderately/highly discounted restricted)	339	0.722
(Shen, 2004)	Nodal attraction, impedance	600	0.568[e]
(Doganis, 2002)	Scheduled passenger traffic at airports, economy fare, frequency	47	0.941

[a] This value is the ‘‘rank coefficient’’. The city-pairs are ranked according to the actual and estimated passenger volumes and the correlation between the ranks yields the rank coefficient.

[b] The study is based on the model from (Brown and Watkins, 1968).

[c] The model with the higher R2 includes the ‘‘accessibility’’ of a destination to all other destinations of an origin’’ as an additional variable to consider the effects of spatial structure

[d] Different methods for a reverse calibration of the gravity model were used.

[e] The focus is on an algebraic approach for reverse-fitting of the gravity model. Therefore, the nodal attraction is estimated endogenously from exogenous spatial interaction and impedance.

Source: (Grosche, Rothlauf, & Heinzl, 2007), redesigned

Regarding its history of application, airlines have long used modified gravity models for passenger demand forecasts. For an overview of the history within the literature, see Table 2. The author posits that the gravity model is a suitable method, both by fitting the guiding principles set out and by legacy rights obtained through popularity within the field to model demand of passenger flow within aviation. The next two subchapters will provide further insight into the gravity model and the econometric considerations.

2.3.4. Gravity model

The gravity model has been dubbed the biggest finding of econometrics (Anderson & Van Wincoop, 2004; Leamer & Levinsohn, 1995), yet despite efforts from scholars, it is still treated as an orphan within academia, as our theoretical understanding why the model works is deemed inadequate. (Anderson, 2011)

The gravity model, pioneered by (Tinbergen, 1962), inheriting its name from Newton’s law, is a rather simple concept to grasp. It explains that the trade flow (F) between two countries (i and j) are subject to the supply (S) provided by country i and the mass of demand (D) at country j, the flow being reduced by the distance (d) in between.

$$F_{ij} = \frac{S_i \cdot D_j}{d_{ij}^2} \quad (1)$$

Since its inception, the gravity model has received much attention in an effort to account for the multiple nuances of trade. In the following, these additions will be reviewed and contrasted against the goal set out in Chapter 1.2, in order to arrive at an equation that is reflective of the challenges faced by the industry, more closely, Aalborg Airport.

The gravity model has been used for, more recently migration (Beine, Docquier, & Ozden, 2009; Borjas, Grogger, & Hanson, 2008), transportation (Khadaroo & Seetanah, 2008), foreign direct investment (Bergstrand & Egger, 2007; Helpman, Melitz, & Yeaple, 2004), remote services trade (Head, Mayer, & Ries, 2009), intra-firm trade (Keller & Yeaple, 2009), international portfolio investment (Portes & Rey, 2005) and many more. This provides further proof of the robustness of the model.

(Eilat & Einav, 2004, p. 1319, italics in original shown here as regular) argues the following in their paper: *"Yet, the use of gravity equations seems here* [in tourism literature] *less founded, since* a priori *there is no reason to believe a country should attract and export tourists in proportion to its GDP."* As tourism, especially international tourism, is not a necessity and is still a privilege for many, especially if one accepts a Pareto distribution[16] for wealth modelling, it seems to be a logical conclusion that wealthier nations (proxied by GDP) can afford to be tourists. Mirrored, it also holds true that wealthier nations generally have more to offer tourists and due to infrastructure development, they are much more accessible, not considering prestige of tourist hot spots. One can also confidently posit that when GDP is aggregated on the regional level, it will encapsulate the interest sparked by businesspeople as well as tourism and will hold explanatory power over why some regions are more visited than others.[17]

As the gravity equation was used to explain trade of goods between countries, many of the theoretical work on its extension was done from this point of view. One prominent difference is that generally, when considering production, consumption and trade,

[16] (Pareto, 1964) described a power law on the distribution of wealth, stating that 80% of all wealth in a society is held by only 20% of the population (and further, the 80% of the 80% of all wealth is held by the 20% of the top 20% richest people, and so forth).

[17] This might not hold true for islands living off tourism (e.g. Cape Verde), as the nominal GDP might be low, despite tourism accounting for a vast portion of it. However, as the point of departure of this paper is to aid the airports that struggle with reaching profitability due to not attracting enough passengers per annum, this shortcoming is disregarded from the purview.

one has to account for the countries' ability to produce as many goods as they consume, as if that equilibrium is broken, it is seen as the driving force for trade between countries. (Helpman, Melitz, & Rubinstein, 2008) However, when looking at tourism, even more closely at air transport, understandably this logic is misaligned, as countries cannot produce the same attractions. Certainly, there is inland air tourism as well, which this model intends to account for, but since the level of aggregation is on city level, this is not considered an issue. On top of it, producers of services, in these cases the airlines providing transport, are more often than not multinational corporations that have established routes and hubs, making domestic and foreign producers nigh indistinguishable. Based on this argument, concerns regarding markups and profitability for home producers are not pursued further. This is further underscored by the freedoms of the air. (see Chapter 3.3.1).

Zeroes are considered an issue in gravity modelling, as they represent inactive bilateral trade flows, which might not be inactive, depending on the aggregation level of the data.[18] There are scholars who allow zeroes for demand, considering choke prices, which establish a price level that serves all demand. (Novy, 2010) Another explanation for zeroes considers too high fixed costs for export, which means that firms cannot profitably export their goods and services, resulting in no flow. (Helpman et al., 2008) This concern is not of interest on the level of airports, as zeroes can be explained by many factors, e.g. proximity, superior alternative modes of transport such as high-speed trains or due to political differences etc, therefore they do not pose the same threat of misguiding the analysis.

Further refinement came in the form of the iceberg melting model, introduced by (Samuelson, 1952). It is regarding trade costs, where costs proportionally grow based on the shipped volume, similarly to how an iceberg's melted parts reflect the volume of the iceberg in a linear fashion. As fuel is one of the biggest and only variable basic cost for any trip, roughly following a linear path for additional nautical miles flown, therefore it is deemed appropriate for this research at hand, as it will reflect the price increase of a lengthier route. Following (Anderson, 2011) it is also understood that the common proxies used for trade costs (see Table 6 for the ones used in this model) include and reflect home bias. Home bias is mostly understood as the preference for locally produced goods, however, the idea is easily translatable to aviation in the sense that people prefer to visit countries where they feel safe and feel able to navigate, which is much easier with a shared

[18] This is not considering issues such as war or political opposition.

common language or through familiarity based on contiguity. Based on (Chaney, 2008), distance can be considered a proxy for both variable and some of the fixed costs.

Elaborating further on trade costs, their elasticity is of high interest for academia and serves as a topic of intense debate. The dominant scholars of the gravity equation in the past decade have relied on constant elasticity of substitution (CES) to describe demand, implicating constant markups. (Novy, 2010) This is a direct result of CES being homothetic, which means that the utility function is homogenous of degree one. The implication is that any change affecting trade costs, e.g. a free trade agreement, lower tariffs or cheaper transportation will have the same proportionate effect despite the original landscape. This holds true depending on how the supply side is characterized (Anderson & Van Wincoop, 2003; Chaney, 2008; Eaton & Kortum, 2002), but it has been argued that the data shows otherwise. (Feenstra & Weinstein, 2010) Theoretically, it is logical to see that by lowering barriers, competition can increase, resulting in non-constant markups. (Melitz & Ottaviano, 2008) This is also supported by consumer theory literature. (Almås & Kjelsrud, 2017; Muellbauer, 1974) In (Lo, 1990), a translog approach is used to model consumer spatial shopping preferences, arguing against the inherent CES assumption of the traditional gravity models. It is worth noting however, that her work is also based on the inner logic of substitutional goods, which does apply to tourism, however, the author holds the position that this is better gauged through the proxies used for trade costs. It is also argued that substitutions in the industry at hand are more rigid when it comes to characteristics of the destination, as reasons for attracting travellers are not easily substitutable.

Regarding trade cost elasticity, it is intended to measure the impact of macroeconomic changes on demand, such as joining a common currency union or becoming a member of WTO. As these events do not influence the demand of passengers so significantly, it is deemed out of scope for the research at hand and is not modelled.

2.3.5. Estimation

Empirically, the gravity model is quantifying trade barriers through different trade costs. (Silva & Tenreyro, 2006) argues against a log linear Ordinary Least Squares (OLS), preferring a Poisson Pseudo-Maximum-Likelihood (PPML) estimation technique, basing it on their Monte Carlo simulations ran on trade data. Their critique of OLS is that based on their data, it significantly exaggerates the effects of certain trade costs, which they attribute to present heteroskedasticity in the data, that violates OLS conditions. It is argued

in this thesis, that it is a moot point arguing that the applicability of an empirical tool is inadequate when the assumptions of its use are not respected. Furthermore, (Anderson & Van Wincoop, 2004) advocates that heteroskedasticity can be remedied by size-adjusting the dependent variable.

(Anderson & Yotov, 2010) also shows that despite using different techniques (PPML, OLS or HMR[19]), their results are identical due to coefficients being 'almost perfectly correlated'.

In addition, in this present research, the perfect exactness of the coefficients holds no strategic value, as it is meant as a proof of concept for future refinement. Certainly, skewed findings makes any insight derived questionable, but as argued by (Anderson, 2011; Martin & Pham, 2008), controlled heteroskedasticity greatly decreases these concerns.

(Anderson, 2011) raises two concerns with the traditional log linear method of estimation. First is the aggregation of GDP on a country level, which is not a concern in this paper, as regional GDP is used, therefore any concern regarding sectoral variable elasticities is negated. Second is the lack of representation of multilateral resistance, which he defines as: *"[…] multilateral resistance measure average buyers and sellers incidence of trade costs respectively"* (Anderson, 2011, p. 15) He himself argues however, that the inclusion of encompassing variables such as GDP and population size will include some of the explanatory power of multilateral resistance.

Based on the above, OLS is deemed an appropriate estimator tool for the task at hand. The basic theoretical equations are as follows:

$$Y = \alpha X_1^{\beta_1} X_2^{\beta_2} X_3^{\beta_3} X_4^{\beta_4} X_5^{\beta_5} \cdots \quad (2)$$

$$LogY = \beta_0 + \beta_1 LogX_1 + \beta_2 LogX_2 + \beta_3 LogX_3 + \beta_4 LogX_4 + \beta_5 LogX_5 + \cdots \quad (3)$$

$$where\ \beta_0 = Log\alpha \quad (4)$$

2.4. VALIDITY AND RELIABILITY

Reliability can be defined as *"*[…] *The extent to which results are consistent over time and an accurate representation of the total population under study is referred to as reliability and if the results of a study can be reproduced under a similar methodology, then the research instrument is considered to be reliable."* (Joppe, 2000, p. 1), in contrast

[19] Named after Helpman, E., Melitz, M., & Rubinstein, Y. (2008)

"Validity determines whether the research truly measures that which it was intended to measure or how truthful the research results are. In other words, does the research instrument allow you to hit "the bull's eye" of your research object?" (Joppe, 2000, p. 1)

Validity and reliability are understood and measured/tested differently in qualitative and a quantitative research design. (Golafshani, 2003) However, some biases may influence each of them, e.g. success bias. Aalborg Airport was chosen as a case study due to its success – however, success depends on many exogenous factors, one of them being luck, which cannot be translated to a lesson for other airports. As it is accepted in the literature, innovation and industries operate on an evolutionary theory (Audretsch, 1995), meaning that survival is for the fittest to the current environment, not the overall best by any other metric. This could result in making recommendations based on this study that will not work for other airports, that are in the process of adapting to their own environment. This bias can be accounted for by replicating this study at other airports in the future.

As argued by (Patton, 1990), triangulation is a great tool to strengthen every research, improving on generalizability, therefore usability. Triangulation can be defined as *"* […] *to use multiple methods, data sources, and researchers to enhance the validity of research findings."* (Mathison, 1988, p. 13) This thesis uses a mixed research design, both qualitative and quantitative, thus triangulation, in order to enhance validity.

Multiple researchers are not available, but on the qualitative side, interviews were done in a semi-structured way with both past and current management. Semi-structured interviews allow for replicability, as the questions asked were the same across each interviewee and by interviewing multiple people, both past and present management, data can be cross validated over time and perception as well. All possible issues with interviews apply, personal biases on both sides, questions of truthfulness etc. These concerns are mitigated by the fact that the author herself works in aviation, thus deception is not so easily achieved. The interviewees also have vested interest in the success of this paper, as they will gain valuable insight from it, hence there is no reason to assume malice or conscious distortion of the truth as they know it. Since all interviewees came from different departments, it is reasonable to assume that agreements between them is not due to bias or loyalty to their own department but can be generalized to the whole organisation.

Sadly, access to quantitative data was not as simple and straightforward as to the interviewees. The regression suffers from lack of data and due to confidentiality, the quality of the data is also not the best possible (as the numbers received from the airport

do not reflect the actual number of passengers flown, but the available seats annually). Three other airports were also approached, Billund, Aarhus and Copenhagen, but they refused to provide passenger data, which would have helped to perform robustness checks and increase the amount of datapoints, thus a better datapoint-variable ratio.

As with any research, there is always a risk that some of the core assumptions are wrong or due to oversimplification of the issue, insights are not applicable in general. This risk is mitigated by transparency of the research design and methods of the case at hand, so any result is contextualized by them.

The methods used also have their limitations, the reasons for accepting the simplification of the gravity model can be found in Chapter 2.3.5 and statistical tests and validity/reliability concerns can be found in Chapter 4.1. It can also be that due to inexperience, the interviews were not conducted in the best manner – the transcript is therefore provided in the appendix.[20]

3. LITERATURE REVIEW

This chapter is divided into three main parts, starting with a non-exhaustive overview of innovation management literature, highlighting theories that provide the foundation for the analysis of the innovation management later on; followed by a summary of innovation management at airports in order to establish a baseline with innovation management within the aviation industry and lastly, demand forecast by airlines is explored briefly, providing an overview of the use of the gravity model and variables and their justification.

3.1. INNOVATION MANAGEMENT

In order to understand how airports innovate and to be able to analyse the data gathered, it is beneficial to first establish what we know so far in order to create a common understanding. This chapter is built around innovation as a topic, first innovation is defined and reasons are identified why companies innovate, then it is explored how companies innovate and how they organize for innovation, then who innovates (small, medium or big firms?), lastly some theories are explained that can influence innovation activity

[20] Transcript with past management is not available, see explanation later.

practices, such as appropriability regimes or open innovation. This overview is by no means exhaustive and is not aimed to provide a systematic overview of innovation studies (for such attempts, see (Fagerberg, 2013)) or for any of the topics covered, it is meant to aid the understanding of the analysis later on as well as provide an overview to the less initiated to innovation literature.

3.1.1. Innovation

First of all, it is important to shed light on what innovation is. There are numerous definitions, even within innovation studies. *"An innovation in the economic sense is accomplished only with the first commercial transaction involving the new product, process system or device, although the word is used also to describe the whole process."* (Freeman & Soete, 1997, p. 6) Another definition, developed for measuring and analysing the statistics of innovation surveys in the Oslo Manual (OECD & Communities, 2005, p. 46).

The definition: *"An innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations.* […] *The minimum requirement for an innovation is that the product, process, marketing method or organizational method must be new (or significantly improved) to the firm."*

In this paper, the author adopts the view that innovation includes the process through which inventions become innovations, as the focus of this project is the management of said process, and newness must be measured on the firm level.

There is one key attribute of innovations that distinguish them from inventions, and that is denoted as 'implementation' in the definition. Innovations are implemented inventions, e.g. think of a new technology that is in the drawer of an inventor. Until it is not produced on a large(r) scale, marketed and sold, it is not considered an innovation. Another way innovation, as per definition, differs than how people might use innovation in casual conversation is the focus on newness to the firm. In non-academic circles, people generally think of innovation as this once-in-the-history-of-mankind event, adoption is only imitation. However, in innovation studies, if an American firm adopts new procedures from an Asian firm or vice versa, it is considered innovation to the firm that adopted and implemented something new into their organisation. This is measured on the degree of novelty, lowest of which is the firm, then market and finally, to the world.

According to the Oslo Manual, there are four types of innovations: product, process, marketing and organizational innovations. As these are quite self-explanatory, it is worth shedding more light on the groupings of innovations based on their impact and nature. Following the father of innovation studies, Schumpeter's legacy, one possible categorization is radical and marginal/incremental. (Freeman & Soete, 1997) The invention and marketing of the printer can be classified as a radical innovation, in contrast, marginal innovation would be, for example, a printer that could print the same page with 5% less ink. This dichotomy continues throughout innovation studies, e.g. continuous and discontinuous (referring to the leaps it bridged by new technology, e.g. automobiles or PCs) (Veryzer Jr, 1998) or sustaining and disruptive (Bower & Christensen, 1995). As the method described in Chapter 4.1 will not be able to disaggregate innovation directions to this level, nor to the degree of their novelty, thus further expansion of grouping innovations and degree of novelty will not be explored. Nonetheless, it is not enough to simply define what innovation is; there has to be an answer on *how to* innovate.

3.1.2. Innovation activities

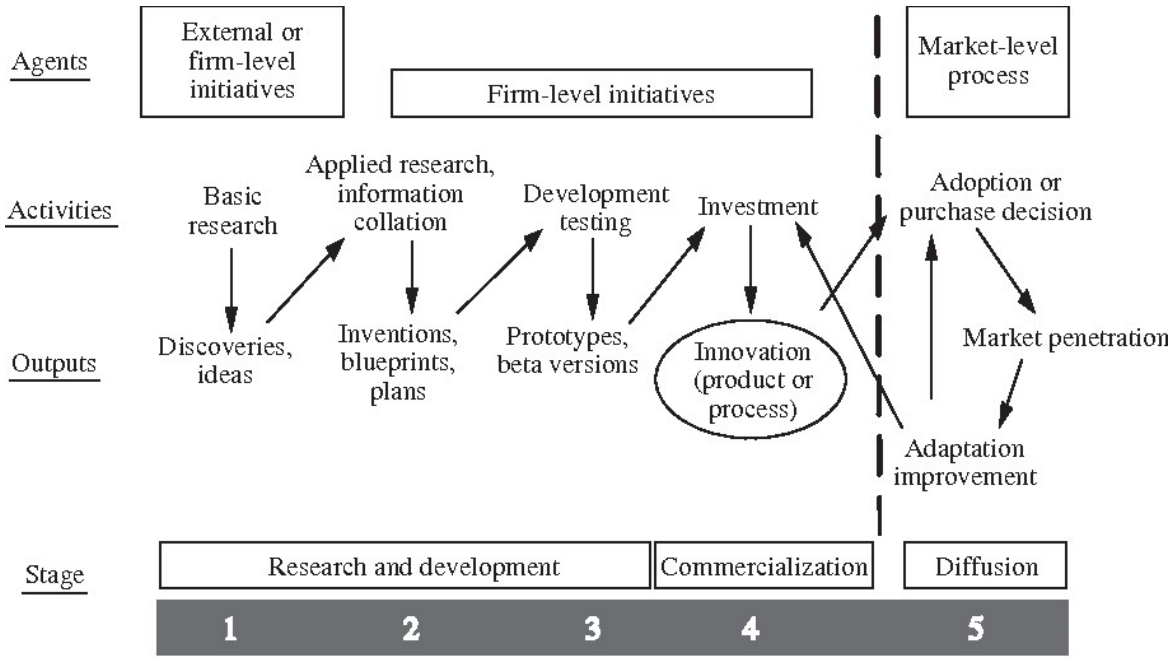
"Innovation activities are all scientific, technological, organizational, financial and commercial steps which actually, or are intended to, lead to the implementation of innovations. Innovation activities also include R&D that is not directly related to the development of a specific innovation." (OECD & Communities, 2005, p. 47)

Certainly, innovation activities are complex and challenging and based on how many departments are involved in the successful implementation of innovation, these activities need to be managed by a dedicated team.

Figure 8 shows a simplified process from basic research all the way to marketing/ adopting a new product or process. (Greenhalgh & Rogers, 2010) divide it into five steps, which are then grouped into research and development, commercialization and then diffusion. Taking a closer look at the activities within the firm, one can see that innovating is a process where the entirety of the firm needs to work in harmony, because each step is necessary for success.

That makes us arrive at the next inquiry, what is innovation management? How can a company manage its creativity? The organisation itself, its structure and culture must be open to foster innovative creativity. This supportive context is necessary to inspire key individuals, allowing sharing of knowledge and shared learning, keeping up motivation, providing organized teamwork etc. (Ekvall, 1996; Ismail, 2005)

Figure 8 The stages of the innovation process



Source: (Greenhalgh & Rogers, 2010, p. 7)

Since the seminal work of (Cohen & Levinthal, 1990), it is understood that due to the complexity of knowledge bases and to their increasing breadth, regardless of firm size, all firms depend on external sources to spark creativity and recombine with newly absorbed knowledge. They dubbed this a company's '*absorptive capacity'*, referring to *"the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends is critical to its innovative capabilities."* (Cohen & Levinthal, 1990, p. 130) In the same paper, they highlight that – as with the case of many other social capability – the sum of the absorptive capacity of individual employees does not equal the organisation's capacity, as it is greater than the sum of its parts, due to diversity in expertise providing a more holistic view, increasing the level of understanding of every member. Based on (Østergaard, Timmermans, & Kristinsson, 2011), other social diversity also has a positive effect on innovation. It is not just true for intrafirm effects, but holds regarding outside links as well by increased external sourcing and a bigger variety in the breadth of networks. (Jackson, Joshi, & Erhardt, 2003)

Moreover, companies need to consciously organize for innovation. It is not enough that employees are able to learn and utilize new knowledge, they require systematic support, which is much easier said than done. Since (Schumpeter, 1911), we understand *creative destruction*, which explains how the status quo has to be destroyed first, before new

can be built up from the ashes, very similarly how an old building has to be demolished before something new can be built in its place. This logic is applicable on multiple levels of the economy, be it on project level or the entire economy of a country. Now that what and how have been covered – the next question is: who innovates?

3.1.3. Innovators

In the literature, following (Malerba & Orsenigo, 1995; Nelson & Winter, 1982) – there are two reigning ideologies dubbed as Schumpeter Mark I and II. Schumpeter Mark I was articulated in '*The theory of economic development'* (Schumpeter, 1934), arguing that creative destruction meant the demise of the big incumbent by the small, innovative and entrepreneurial firm, meanwhile creating something new. He wrote that incumbents were exploiting existing technologies and regimes (mostly focusing on incremental innovations); today it is further elaborated that incumbents usually suffer from organisational inertia (Hannan & Freeman, 1984) and their highly structured routines (Nelson & Winter, 1982) also impede their ability to pursue innovation.

However, in '*Capitalism, socialism and democracy',* (Schumpeter, 1942) focused on the big firms that were in the forefront of innovation in their respective industries. He theorized that the monopolistic stance achieved by these incumbents allowed them to possess *creative accumulation*, which aims to describe the wealth of knowledge and prowess to conduct innovation in sizeable R&D laboratories. (Malerba & Orsenigo, 1995) classified it as widening and deepening, respectively. In Mark I, the market and the innovation space within is widened by the entrepreneurs, eroding the monopoly of incumbents. In Mark II, concentration of innovation activity at larger companies allows for the cumulation of knowledge and therefore, dominance, discouraging new entrants by raising entry barriers high (e.g. pharmaceutical industry).

The reconciliation between these two phenomena came through the lens of industry life cycles. (Audretsch & Feldman, 1996; Klepper, 1997; Utterback & Abernathy, 1975) An emerging industry is, by its very nature, populated by small, entrepreneurial firms that have just created this industry. This stage is spent on finding a *dominant design*, solidifying and unifying the product (e.g. airplane designs, vast majority of modern aircrafts resemble a cross like shape, however, new innovations like flap free designs that resemble a triangle are in the works). Dominant designs might not be the technologically most advanced or most aesthetically pleasing, in true fashion of evolutionary theory, they are simply the fittest. A classic example is the triumph of VHS over Betamax

in the home videocassette recorder segment. Betamax lost despite being first entrant and accumulating sales before VHS hit the market, and the decrowning happened due to strategic manoeuvring by JVC (producer of VHS), not superior performance or craftsmanship. (Cusumano, Mylonadis, & Rosenbloom, 1992)

After the dominant design solidifies, new entrants try to challenge the incumbent by differentiating enough to be unique, but similar enough for people to still buy the product. This is the growth phase; competitors are flooding into an industry where profit margins are still high and competition is still not cutthroat enough. There is, unavoidably, a saturation point and shakeout happens, decreasing the amount of companies within the field. As time goes on, maturity dawns on the industry, reaching Schumpeter Mark II. Just like any lifecycle, eventuality is decline and death. (Utterback & Abernathy, 1975)

3.1.4. Innovation management theories

3.1.4.1. Disruptive innovation

However, industries can be reborn, meaning their lifecycles are set back to day one – possibly by a disruptive innovation event. (Bower & Christensen, 1995; Christensen, Raynor, & McDonald, 2015)

As explained in (Christensen, 2013), the book on the innovator's dilemma aims to shed light on how these incumbents fall asleep at the wheel, unaware of the storm of disruption on the way. Based on this theory, incumbents are listening to their biggest customers, who are heavily invested in their products or services. As is logical from the customer's point of view, they will entice the company to focus on sustaining innovations. To honour the origins, let us see it through the lens of the disk drive industry. Companies in need of disk drives that use it for industrial purposes are interested in better disk drives. It does not matter if it is bulkier or needs extra cooling if its processing power is greater. By listening to the big spenders, manufacturers will invest in these incremental innovations, while newcomer companies, not having to cater to these customers, meaning their innovation focus and their production capacity is not preoccupied by serving them, can target people who are satisfied with products that are of worse quality, but in this case, possess a preferable attribute: being small. As time progresses and the small companies grow and shift to incremental innovations, slowly but steadily they are closing the gap

in the attributes they were lacking, being able to provide the same processing power, but in a smaller drive, thus creating disruption.

Apropos disruptive innovation, co-author of the ground-breaking paper from 1995, Bower has articulated earlier that ideas for new opportunities are stemming from lower managerial levels (Bower, 1970) (as disruption theory argues the same on a mesoeconomic level). However, strategy is not decided on lower levels, so it is worth taking a look at how companies position themselves in regard to their philosophy.

3.1.4.2. Explorative and exploitative businesses

One can follow (Galbraith, 1982), who described how designing an innovative organisation should go. Before jumping into it, it is essential to understand the cognitive dissonance it causes a firm to try to be explorative and exploitative simultaneously. Explorative refers to trying to explore new knowledge, new ways of combining existing knowledge, new avenues etc. This requires work and as it is intrinsic to exploration, it is not guaranteed that something will be found or what is found is economically fruitful. This means that explorative efforts are expensive, they need to be funded, which usually comes from exploitation of existing avenues of profit. When taking into account organizational learning as well, it is essential to keep the balance between these two activities to achieve long term survival. (March, 1991)

This balance needs to be struck on multiple levels. On an organizational level, operative and innovative tasks need to each have their dedicated resources and attention, which will result in a good exploration vs. exploitation dynamic. Without this, the organisation will be facing torque in everyday business, as innovation is usually resisted due to its destructive nature to established groups. (Galbraith, 1982) On a strategic level, the company must pursue a viable strategy between sharing resources, e.g. one way to classify it would be by the strategic aggressiveness theory (see next subchapter).

As explained by organisational slack, defined as the difference between the resources currently available and those required (Cyert & March, 1963), companies generate slack when successful (e.g. extra capacity by hiring more people or having more revenue), which in turn can be used to fund exploration or absorb shocks by, for example, a disruption event, very similarly to the logic of portfolio management, where the loss of some investments are balanced out by the success of others, providing overall favourable returns.

Table 3 Differences between exploitative and exploratory business

Alignment of	*Exploitative business*	*Exploratory business*
Strategic intent	Cost, profit	Innovation, growth
Critical tasks	Operations, efficiency, incremental innovation	Adaptability, new products, breakthrough innovation
Competencies	Operational	Entrepreneurial
Structure	Formal, mechanistic	Adaptive, loose
Controls, rewards	Margins, productivity	Milestones, growth
Culture	Efficiency, low risk, quality, customers	Risk taking, speed, flexibility, experimentation
Leadership role	Authoritative, top down	Visionary, involved

Source: (O'Reilly 3rd & Tushman, 2004), redesigned

See Table 3 for an overview of the difference between exploitative and exploratory business. One can see how these strategies are antithetical to each other, and as resources are finite even in the most roaring businesses, managers need to make decisions where to deploy them. Senior management can then invoke dynamic capabilities theory to help them organize for change if their current model is challenged by external events.

3.1.4.3. Innovation strategies

To understand how companies deal with the challenges faced by them during the different phases of the life cycle (and with their personal role within, as a company could be an incumbent in one and a newcomer in another industry), many turn to the theory of strategic aggressiveness: "*Specifically, the framework has two major elements: (a) a general model of the process of adaptation which specifies the major decisions needed by the organization to maintain an effective alignment with its environment, and (b) an organizational typology which portrays different patterns of adaptive behaviour used by organizations within a given industry or other grouping."* (Miles, Snow, Meyer, & Coleman Jr, 1978, p. 547) They clustered behaviour into four generic types: prospector, analyzer, defender and reactor, out of which reactor is a non-viable passive strategy that is not maintainable on the long run.

(Miles et al., 1978) characterize Prospectors as the perfect explorer, its main concern is to exploit opportunities and new markets through constant innovation. This behaviour obviously results in generally smaller size overall (Smith, Guthrie, & Chen, 1989), as the Prospector will abandon an industry for new prospects when its organizational flexibility[21] becomes too big a hindrance, due to the antithetical nature of flexibility and efficiency.

The opposite of a Prospector is a Defender, which aims to reign by economies of scale in a segment of an industry, concentrating on incremental process innovation and achieving higher levels of efficiency of production. It grows to a size where it can maintain close to monopolistic powers over its domain.

Surely, there is a middle ground on this spectrum, and these are the Analyzers, aiming to combine the best of both worlds. By size, they are closer to Defenders, as they have built out their capacity to produce, but their strategy to explore new avenues and their general interest to enter new segments makes them unique and more similar to Prospectors in this regard. Analyzers can be labelled opportunistic in the sense that they are usually close seconds on the tails of Prospectors on new ideas which, due to their R&D activity, they are able to exploit (i.e. well-developed absorptive capacity) and due to their production facilities, they can provide better pricing and possibly better quality.

A different way to categorize strategies was developed by (Freeman & Soete, 1997). They specifically developed this grouping (Table 4) to give an overview to different innovation strategies.

Table 4 Strategies of the firm

Strategy	Inhouse scientific and technical functions within the firm									
	Fundamental research	Applied research	Experimental development	Design engineering	Production engineering quality control	Technical services	Patents	Scientific and technical information	Education and training	Long-range forecasting and product planning
Offensive	4	5	5	5	4	5	5	4	5	5
Defensive	2	3	5	5	4	4	4	5	4	4
Imitative	1	2	3	4	5	3	2	5	3	3
Dependent	1	1	2	3	5	2	1	3	3	2
Traditional	1	1	1	1	5	1	1	1	1	1
Opportunist	1	1	1	1	1	2	1	5	1	5

Source: (Freeman & Soete, 1997, p. 267), redesigned

[21] *"Flexibility means being capable of multiple responses to the firm's environment."* (Phillips & Tuladhar, 2000, p. 23)

A company pursuing an offensive strategy is generally big and has a certain mix of advantages such as state-of-the-art R&D, quicker exploitation, better absorptive capacity, so they can stay ahead of the competition. It is argued in their paper that the reluctance of incumbents to pursue an offensive strategy paves the way for smaller, innovative firms to break into the industry. It might not be due to lack of initiative – an offensive strategy is extremely hard to maintain over an extended period of time, as it requires success (due to the monetary burden this strategy entails). Some would-be offensive strategy might turn into a defensive strategy by simply being outpaced by a more successful firm. One can see that this fits well with a Schumpeter Mark II company with a Prospector strategic aggressiveness.

Defensive strategy resonates well with the Defender strategic aggressiveness. They are characterized as big, established companies with a solid market base who mainly survives on perfecting their existing products by incremental innovations. An important keystone of this strategy is that defensive strategists are not simply imitators – they are usually not the first to come up with the revolutionary idea, but they might be the one perfecting it, edging it closer to an Analyzer from (Miles et al., 1978). This is understandable, as these are idealized strategies based on behavioural clusters, no two company will behave completely identically, and many will exist on a spectrum in between.

In contrast, following an imitative strategy allows savings on the costs of innovation, depending on how far the lag is behind the innovators, by either not having to pay for the patents or only having to pay for it (not the associated costs with developing it), which allows them to precisely plan if it is financially worthwhile. Imitators usually have an advantage that is hard to copy, e.g. preferential political treatment (protectionist countries), natural advantage (breaking into producing the raw material for their already big demand on the end product), superior production and economies of scale and many others.

Taking imitation one step further are dependent firms. They are best described as subcontractors or daughter companies that mainly cater to the mother company. These satellite firms usually enjoy steady, but low income and somewhat limited independence. It varies how exploitative or cooperative their relationship is, but as the name suggests, dependant firms do not take any sort of initiative when it comes to innovation, but have the means of changing the output based on input.

The ability to change to a great degree is what differentiates between a dependent and a traditional strategy. Traditionalists usually depend on their mostly unchanged product, hence the tradition they rely on. Understandably, these companies are mostly situated in industries where technical prowess and technological advancement is not of the greatest concern, products and/or services rely more on skills, e.g. restaurants or art.

Finally, an opportunist strategy is denoting the reliance on imaginative entrepreneurship; these firms will find a niche or opportunity that other have not thought of and move in quickly to exploit it. This strategy usually does not require extensive research or great technological prowess, but is dependent on a scarce resource, entrepreneurial creativity.

3.1.4.4. Dynamic capabilities and ambidextrous organisations

Dynamic capabilities are *"the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments"* (Teece, Pisano, & Shuen, 1997, p. 516) Despite praise and widespread acknowledgement of the dynamic capabilities theory, there are scholars calling for further refinement, calling it vague and tautological. (Priem & Butler, 2001; Wang & Ahmed, 2007; Wheeler, 2002; Williamson, 1999) However, as argued by (Eisenhardt & Martin, 2000), dynamic capabilities can be understood as 'best practice' processes in moderately dynamic markets and can be defined and are more generic (meaning substitutional between firms). The basic ideology rests on the notion that firms that possess dynamic capabilities can combine internal knowledge and capabilities with external ones, providing the opportunity to respond to exogenous shifts in the market in a more appropriate way.

It is easy to see the parallel between dynamic capabilities theory and disruptive innovation theory, are they are dealing with the same duality – how can a firm concentrate on old and new business at once? Organisations have chosen to pursue two different avenues simultaneously, when both operational leverage and strategic importance were high; these companies are dubbed ambidextrous. (O'Reilly 3rd & Tushman, 2004) This connection was made by the authors' of organizational ambidexterity, calling ambidexterity the dynamic capability that solves the innovator's dilemma. (O'Reilly

III & Tushman, 2008) Ambidexterity usually refers to the ability of being equally dominant with both hands, but in business studies, ambidextrous organizations are firms that manage to create a divide within the organization, tasking one with exploiting, the other exploring.

3.1.5. Appropriability regimes

Through hard work, the company finally has a viable, innovative product it decides to market. It sounds quite straightforward – task the marketing department with organizing the launch, assign budget, source materials and produce the product. Sadly, turning a profit is more complicated than that when it comes to innovation.

It has been discussed throughout this chapter that there are many types of innovations and they are usually costly. To stay within the industry, let us say that one airline redesigns its website, allowing partners such as hotels or car rental companies to advertise throughout the booking flow, so people will book them at the same time. This innovative idea could increase sales and revenue many times over – but it is very easy to copy and one month later, many competitors will have adopted this new method of upselling and this small advantage got devalued.

Because of this reason, innovation studies address appropriability regimes – in layman terms, how easy it is to profit off one's innovation. Many innovations are considered to be intellectual properties – that is the reason why intellectual property rights (IPR) were born, to protect these ideas from copying. Without this, firms will be reluctant to innovate, as it is a risky and expensive endeavour and without the chance to recoup the costs and offset the risks, there is no incentive to invest.

On one hand, there are formal and institutionalized IPR protections, such as trademarks, registered designs, patents and copyright, which grant temporary monopoly to the inventor. It allows actors to trade their IPR and to prevent others from unlawfully obtaining it. Disadvantages include cost and some inventions are not compatible with this system.

On the other hand, companies can decide to not reveal their ideas and instead keeping trade secrets, using non-disclosure agreements or use the advantage of being a first mover, trying to exploit the idea and gain recognition before mimics enter the scene.

As an oversimplification, the regime under which a company can profit off of its invention and innovation is tight, one where legal protection is lacking is considered weak. (Teece, 1986) In Europe, the regime is tight, IPR are fiercely protected by the fullest extent of the law and in general, stealing of IP is frowned upon in the business culture.

3.1.6. Open innovation

Figure 9 Closed and open innovation principles

Closed Innovation Principles	Open Innovation Principles
The smart people in our field work for us.	Not all of the smart people work for us so we must find and tap into the knowledge and expertise of bright individuals outside our company.
To profit from R&D, we must discover, develop and ship it.	External R&D can create significant value; internal R&D is needed to ourselves. claim some portion of that value.
If we discover it ourselves, we will get it to market first.	We do not have to originate the research in order to profit from it.
If we are the first to commercialize an innovation, we will win.	Building a better business model is better than getting to market first.
If we create the most and best ideas in the industry, we will win.	If we make the best use of internal and external ideas, we will win.
We should control our intellectual property (IP) so that our competitors do not profit from our ideas.	We should profit from others' use of our IP, and we should buy others' IP whenever it advances our own business model.

Source: (Chesbrough, 2006, p. 38), redesigned

One way to be less concerned about appropriability is by adopting an open innovation paradigm. As (Chesbrough, 2006) explains, closed innovation is the thought process of the firm having to have a strong R&D lab where they make discoveries, which they then commercialize and market and reap the benefits. In contrast, open innovation does not limit itself to internal sources of inspiration and ideas – the goal is not to develop it alone and be the first mover but to be the most successful marketer.

This overview is by no way exhausting, innovation management literature is much richer and topics such as measuring innovation or actual techniques of innovation activity have not been explored. This review is meant to provide a basic understanding of the theoretical foundation the later analysis will be built on.

In the next subchapter, the inspiration and previous operationalization of the gravity model in the aviation industry is explored further, so as to provide the same basis for the model created as the literature overview does for the analysis of the innovation management at the airport under purview.

3.2. DEMAND FORECASTING BY AIRLINES

As mentioned in Chapter 1, airports are subject to airline route planning in terms of passenger flow. As shown, increasing passenger flow is the only viable long-term way of sustainable growth, as increasing prices will increase competition and profit comes solely from non-aeronautical revenues. This means that it is important to understand what airlines consider when deciding between possible routes.

The chapter is built up as follows: a brief explanation of the laws and basic regulations that govern route planning, followed by a brief overview of the science of demand forecasting and lastly, common variables are discussed that were considered for the model at hand.

3.2.1. Five freedoms of the air

Before submerging in the topic of airline route planning, it is important to have a succinct overview of the general rights of airlines, so as to understand competition between them as well as airports.

The Convention on International Civil Aviation, often referred to as the Chicago Convention, established ICAO (International Civil Aviation Organization) as a special

agency of the United Nation responsible for air travel across the globe. (ICAO, 2020) The ICAO have grounded the rights or freedoms of the air for scheduled international air services as follows (ICAO, 2020):

1. To fly across its territory without landing.
2. To land in its territory for non-traffic purposes.
3. To put down traffic in a different State coming from the home State of the carrier.
4. To take on traffic in a different State destined for the home State of the carrier.
5. To put down or to take on traffic in a different state coming from or destined to a third State.

These freedoms are officially recognized in the treaty, but there are four more that exist and are either granted together or not granted; they basically allow cabotage[22]. As Aalborg Airport is part of the European Common Aviation Area, which is a single aviation market, it is the author's judgement that traffic is not hindered by lack of competition or overzealous red tape, however, it is important to note that this limitation might influence other airports and needs to be addressed critically, as most countries do not grant cabotage rights to each other. (Commission of the European Communities, 2001)

3.2.2. Demand forecasting

As this paper is not attempting to analyse and model the entire process of airline route planning, this subchapter's main focus is to highlight the considerations airlines take that are exogenous and non-operational[23]. Therefore, issues such as fleet management, crew scheduling, operations control etc are not taken into account. In tandem with this approach, operational limitations at airports will also be deemed out of scope, e.g. not enough slots to allocate, handling companies not having capacity, opening hours etc. This is justified by the focus on the small, financially struggling airports that have all of the above in abundance.

As set out in Chapter 1.1, everything starts with passenger demand; people must want to travel from point A to point B. Certainly, this is the alpha, but it is far from being omega. Demand elasticity plays a big role in the economics of launching a route.

[22] Cabotage is the transport of passengers or goods within a country by an operator registered in a different country.

[23] Airplanes have operational performance limitations and minimum requirements for landing and taking off at airports, i.e. not all airplanes can land at all airports. It is assumed by the author that most commercial aerodromes are capable of accepting the majority of commercially used aircraft types, therefore this limitation is excluded from consideration.

This is easy to understand by simply considering how many of us would choose to fly to the Canary Islands, were it to cost 50 EUR, all other costs being equal. Question arises, how do airlines decide which routes to pick and how to price them?

Operational concerns were excluded, but strategy of an airline's route planning is worth exploring further. Presumably, routes that will generate profit should automatically get a green light from any airline. However, it is not that simple. Airlines evaluate the profitability of each route, but it is their best interest to be profitable at the end of the year over their entire route system, and routes are not created equal. To understand how routes are evaluated and chosen, it is important to see what influences the airlines' decisions.

First, there are two main categories of airlines: legacy carriers and low-cost airlines in commercial aviation. Legacy carriers are big and have been around for some time, they are also usually flag carriers, e.g. KLM, SAS, British Airways. They are also usually part of airline alliances[24], have extensive network of routes, offer more premium service, have segmented cabins[25] etc. They are competitors of each other, but since the rise and disruptive innovation of Southwest (one of the classical examples of (Bower & Christensen, 1995)), there is a completely new type of threat by low-cost carriers. They turned the luxury of travelling by air into an everyday commodity, stripping away the amenities and offering a barebone service of taking people from point A to point B. They could do this by greatly simplifying their own business model by using one type of aircraft only (cutting costs on maintenance and crew training costs), greatly segmenting passengers based on price, flying alternative airports[26] etc. Their routing also greatly differs, while carriers generally built out a hub and spoke system[27] (Camilleri, 2018), low-cost airlines also cut costs on flying direct routes between cities, called point-to-point flying.

Second, airlines can earn well on longer flights. There are multiple reasons for this, one is aircraft depreciation. Aircrafts are certified for a certain number of flight hours

[24] There are three major alliances, vis á vis Star Alliance, SkyTeam and Oneworld. It is a cooperation agreement between airlines to share aircrafts (code sharing) on routes and generally have a united front towards passengers. Revenue passenger miles generally can be redeemed throughout the continuous route system of the entire alliance.

[25] As in physical first class, business class and economy class.

[26] Taking London as an example, instead of flying Heathrow, Ryanair is flying London Stansted, which is further from the city and holds less prestige. For some airports, it is even worth giving a cut to low-cost carriers from non-aeronautical revenue, because they are so dependent on them for passengers.

[27] It might be a combination of hub and spoke, triangular and/or linear, but the basic logic does not differ. Airlines fly to the most destinations from the hubs and syphon passengers from the spokes, e.g. KLM's route from Aalborg to Amsterdam is an example of a spoke routing, through which passengers can fly out from the hub.

and cycles; both are counted from block off time to the next block on.[28] This means that it counts as one cycle, whether the aircraft is in the air for one or for ten hours. Cycles are generally more limiting, as taking off and landing are the times when forces take their toll on the fuselage of the airplane. Another is price competition, on short flights, if margins are too high, people will consider taking public transportation or a car, but on long-haul flights, especially over bodies of water, this is not an option. There is also a psychological bias at play, that people are more accepting of a higher price, because it is an expensive and unique experience overall to travel further from home. One set of crew can also be used, as it is standard rule that crew can either spend more hours in the air or can perform more landings and take off, making longer flights better with crew utilization. Lastly, airlines also profit off of in-flight services, be it food and drinks or perfume and skin care products and there is much more time to shop on longer flights.

Logically, it is in the airlines' best interest to fill up their long-haul flights and to launch as many of them as possible. Nonetheless, irrespective of where their hub is located, not enough people will want to fly out daily to New York, Dubai or Tokyo, they need more passengers that want to fly to the long-haul destinations than what the local region of the hub airport can provide. This is where the spoke routes come into play. They are often called feeder lines, as they serve traffic into the hub's other routes. Feeder routes can be offered at below cost, if the profit margin on the long flights can offset the costs, and the entire routing is still profitable. The hub and spoke system also helps streamline passengers and maximize load factors, as the end routing is irrelevant, from one region, everybody will take the same feeder line to the hub. In contrast, low-cost carriers are much more geared towards direct routes, as this is a way of competing with the legacy carriers with non-well-serviced routings. Strategic route planning, such as launching a route at or below cost to choke a competitor or to scare them away and prestige routes, e.g. keeping the same frequency of flights over the low season as in the high season to remain a preferred choice will not be considered here on out.

How does the above factor into the research at hand? Due to the different business models and competition, low-cost airlines and legacy carriers have a different approach to route planning. Low-cost carriers prefer point-to-point flying instead of building a hub and spoke system, they are also more likely to use smaller, alternative airports.

[28] Block off time starts when the aircraft gets pushed back from the gate and block on is when the aircraft returns to the gate.

These different approaches result in differing reasons why a route is launched, but Aalborg Airport has both types of carriers as customers, therefore it makes sense to try and account for it.

Aalborg Airport is not a hub by any metric currently, which means that any connection it has with other airports are either a spoke route or a point-to-point one. Due to this, by including the hub characteristic in the analysis, the model will be able to better explain why a route leading to a hub is more popular than a route leading to a tourist attraction. For further elaboration on how airlines choose routes, see the next subchapter.

Another question was price: how do they decide pricing? As it will be elaborated later, as intuitive as it would be to include average price as a variable, it has endogeneity issues with the dependent variable and is therefore excluded and is circumvented with instrumental variables. Demand elasticity was mentioned before, as it greatly influences planning. Airlines make use of this, segmenting passengers based on dynamic pricing and when determining whether a route is economically viable. However, to keep the analysis to minimum complexity, it is assumed that airline ticket demand elasticity is sufficiently inelastic to make routes viable. (Pindyck & Rubinfeld, 2001)

3.2.3. Commonly used variables considered

Following the previous thought, airlines can use numerous variables in their quest to find the best route map, they have access to significantly more personal data to profile their passengers and follow their path if they take multiple planes to reach their destinations. In this section the possible variables will be considered for the gravity model analysis based on the demand forecasting of airlines. This operationalization and adaptation of the theory will be utilized in Chapter 4.1.

The first variable that comes to mind is ticket price. Certainly, one of the biggest factors in deciding whether someone will take a certain flight is the cost. Demand is heavily influenced by price; a survey of passengers in Germany showed that 52% of them would have chosen not to travel, were it not for the available cheap seats at low costs airlines. (Grosche, 2009; Tacke & Schleusener, 2003) However, in this project, ticket prices will not be taken into account for various reasons. Firstly, a price variable would be highly correlated with numerous other variables, secondly, price can be considered an exogenous factor due to high competition (Jorge-Calderón, 1997) and lastly, data availability is scarce for airports and it would diminish the usability of the model. (O'Connor, 2001) Strategic pricing notwithstanding, some of the price variable can be captured via a distance

variable, since as discussed before, longer flights are generally pricier both due to costs (fuel burn) and the acceptance of higher prices by passengers due to psychological bias.

Nonetheless, travel in and by itself is expensive, especially considering the associated costs, e.g. hotel accommodation, tourist attractions etc. Hence it is necessary to control for the disposable income inequality and the general difference in strength of the economies. This can be modelled by the buying power index (Grosche, 2009), but as this statistic might not be widely available, purchasing power parity is used in this study. Economic strength is measured by GDP (Asri & Sugie, 2003; Grosche et al., 2007; Suryani, Chou, & Chen, 2010) aggregated at the catchment level.

Another intuitive variable is population, as it conveniently gauges both the relative size of demand and market, as there are more people who will find it convenient to depart from that airport and it is also more likely that more populated areas have more to offer both to tourists and businessmen alike, hence this variable is considered for the model.

Catchment area is an often-used variable to gauge the importance of the airport. (Grosche, 2009; Grosche et al., 2007; Moore & Soliman, 1981) In this paper, however, instead of introducing catchment as a single variable, other variables are collected and summarized on the catchment area level. This ensures that variables like population also reflect reality better, e.g. taking surrounding municipalities into consideration for bigger airports like Amsterdam.

Apropos surroundings, airports have competition from surrounding airports, e.g. Rotterdam to Amsterdam. Clearly, if one can fly to Rotterdam instead of Amsterdam and just take an hour-long train ride to reach Amsterdam, and the above costs significantly less than a direct ticket, Amsterdam Airport will lose passengers. Alternatively, simply by having routes, Rotterdam Airport prevents airlines from launching flights to Amsterdam from the same city, as it would decrease their load factors. Therefore, a dummy variable is created to measure the effect of an alternate airport on the passenger flow.

As discussed earlier, a dummy variable is also included for hubs, to control for the complexity of demand for the feeder routes. In addition, a dummy variable for capital helps control for the bigger interest in capitals, due to both cultural and business-related reasons. A continuous variable aims to measure the popularity of the destinations, proxied by the number of beds offered to tourists named tourism infrastructure. Last but not least, a dummy variable is introduced to include cultural closeness and explain why airports

are more connected than they should be based on importance and traffic connections. This is proxied by common language.

Rejected variables include contiguity, which was not considered because the only airport contiguous was Copenhagen, duplicating it as a variable. Other variables used in the literature include perceived accessibility of the airport (Fotheringham, 1983a), average income level (Khadaroo & Seetanah, 2008; Yang & Wong, 2012), travel time (Asri & Sugie, 2003; Wirasinghe & Kumarage, 1998), employment (Alam & Karim, 1998; Carson, Cenesizoglu, & Parker, 2011), frequency of service (Alam & Karim, 1998; Asri & Sugie, 2003) etc. These are not used in this study, because the number of datapoints cannot justify further variables and/or they are not widely available, therefore not applicable for use for airport management. (See number one of the method's guiding principles.)

4. DATA GATHERING, RESULTS AND ANALYSIS

This chapter is divided into two main sections, qualitative and quantitative. In the quantitative section, the gravitational model is presented and explained, and the regression results are shown and interpreted, while in the qualitative section, the interviews conducted by the author will be presented and analysed.

4.1. QUANTITATIVE

As emphasized by (Tarry, 2000), measuring the performance of the innovation is of utmost importance, yet Aalborg Airport has no system for this. Benchmarking does not go further than monitoring the already existing benchmarks, e.g. enplaned passengers, revenue from concessions etc. This, however, does not allow to measure the impact of the innovation activity and distinguish them from other efforts or projects that also might influence these numbers.

Therefore, a gravity model approach has been developed below. This subchapter is built up as follows: first, the data gathering and cleaning process is explained, followed by the descriptive statistics of the collected data and a list and explanation of the reason for the excluded variables from the model, finished by the regression and its analysis.

In Table 4, all considered variables (cf. Chapter 3.2.3.) have been collected and described, despite the fact that some had to be removed from the final model due to different issues discussed in the next subchapter.

As a quick recap, ticket prices are not included due to endogeneity concerns and also due to lack of data availability, which would violate the guiding principles set out earlier. GDP, purchasing power parity (PPP) and population aims to capture the socioeconomic reality of the destinations, proxying the wealth and size differences and some of the demand.

Distance and the tourism infrastructure capture some of the variability in price, as longer flights cost more, and the tourism infrastructure helps channelling the perceived importance of the destination, influencing both price and demand.

The common language and capital variables are stand ins for cultural proximity and importance, while the other dichotomous variables, commercial alternate and hub, hope to account for the relative importance of the airports in route planning.

Finally, the chosen innovation from the airport were the number of free parking spaces offered each year. The chosen dependent variable was the number of seats offered annually.

4.1.1. Data gathering and cleaning

In this subchapter the data gathering for the statistical analysis will be explained, including methods of dealing with missing datapoints and reasons for simplifying and limitations imposed by purifying of data and simplifying it. A list of the variables and short descriptions can be found in Table 5.

Due to the continuous variables being on vastly different scales, all of them were standardized, making the results insensitive to the scales of the variables. As per (Anderson & Van Wincoop, 2004), size-adjusting helps with heteroskedasticity concerns as well. First differences were considered, but it is unlikely that changes in the independent variables would so rapidly translate in the passenger figures, these effects are much more likely delayed. It would also have meant losing datapoints, and the dataset is already very limited.

Some variables (see Table 5) were collected on the catchment area level. The catchment area was determined by the author, as there is no general guidance, just empirical judgement. The author's judgement is deemed as acceptable due to the experience in the Operations Control Centre of an airline. The area was based on NUTS3 areas for ease of use for statistical data gathering. As seen on Figure 4, many airports consider distance as a diminishing factor and take a certain percentage of people the further they are (in agreement with the gravity model). However, as the true catchment area can only be really determined by the airports, since they have the passenger information data, in order to simplify the case at hand, the whole NUTS3 region was considered at 100%.

Table 5 Description of all considered variables

VARIABLE	MEASURE	TYPE	DESCRIPTION	DATA SOURCE	REFERENCES
PAX	Number of passengers	Continuous	Number of seats offered per annum	Aalborg Airport	
GDP	Income of destination region	Continuous	Average real income per capita in the catchment area	Eurostat – NUTS[29] 3 level[30]	(Abed, Ba-Fail, & Jasimuddin, 2001; Grosche et al., 2007; Song, Wong, & Chon, 2003)
PPP	Relative prices	Continuous	PPP of the destination airport's country with exchange rate adjustment	Eurostat – Purchasing power parities (PPPs), price level indices and real expenditures for ESA 2010 aggregates	(Abed et al., 2001; Scheler, 2013)
DIST	Distance	Continuous	Great circle distance between two airports in NM	https://www.airmilescalculator.com/	(Bhadra, 2002; Yang & Wong, 2012)
TOURINF	Tourism infrastructure	Continuous	Number of establishments, bedrooms and bed-places by NUTS 3 regions	Eurostat – NUTS 2&3 level[31]	(Khadaroo & Seetanah, 2008; Park & Jang, 2014)
POPUL	Population	Continuous	Population within area of influence	Eurostat – NUTS 3 level	(Bhadra, 2002; Yang & Wong, 2012)
LANG	Common language	Dummy	Equals 1 if there is a shared common national language	Author's judgement	(Khadaroo & Seetanah, 2008; Martinez-Zarzoso, 2003)
ALTN	Alternates	Dummy	Equals 1 if there is a viable commercial alternate airport within 150 NM. Only includes commercially available airports.	Author's judgement	(Fotheringham, 1983a; Rengaraju & Arasan, 1992)
CAPITAL	Capital of a country	Dichotomous	Equals 1 if the airport is situated in the capital of its country	Eurostat	(Khadaroo & Seetanah, 2008; Yang & Wong, 2012)
HUB	Airline hub	Dichotomous	Equals 1 if the airport is a hub	Author's judgement	(Jorge-Calderón, 1997)
PARK	Parking spaces	Continuous	Amount of free parking spaces available	Aalborg Airport	

Source: made by the autho

[29] Nomenclature des unite's territoriales statistiques (NUTS) are levels of territory, grouped by approximately the same population size that provide the basis for regional statistics for the EU.

[30] NUTS3 borders might not match the catchment area perfectly, but as they are socioeconomically somewhat homogenous, it is deemed acceptable. Some of the skewing is mitigated by combining NUTS3 regions if the area of influence matches multiple of them better. It is the author's judgement what constitutes catchment area.

[31] In order to cover the entire decade of data supplied by Aalborg Airport, some of the data had to be sourced from NUTS2 level and some from NUTS3 level, but they are interchangeable in the cases where NUTS2 is used, therefore it will not bear any effect on the regression.

This certainly skews the data in favour of higher numbers but is somewhat controlled by not including regions further away, that would still fall into the influential area. The fact that not the real number of passengers are regressed on, but an aggregate of the number of seats offered, helps with more closely representing the true relationship, as the simplifications both skew to higher numbers.

PAX data was obtained from Aalborg Airport. Due to confidentiality, actual pax numbers could not be provided, as this would allow insight into the load factors of certain routes, as many routes were only flown by one airline. Numbers therefore reflect the number of seats offered, calculated by the number of seats of the airplane multiplied by amount of departures. This means that actual data is certainly lower, as a 100% load factor on each and every flight is unrealistic over a decade long period, but it is assumed that airlines would cease flights or reduce them if load factor was not satisfactory. Some of this is thus accounted for, as the frequency is included in the data.

Due to having switched to a different system in 2010, data does not go further back than that and due to the pandemic and time of year, 2020 is excluded as non-representative. This means that there are only a decade's worth of data and innovations and improvements have been introduced in almost every year, resulting in a failure of establishing a baseline of growth before innovations. In total, 53 destinations were listed in the data packet, but most were patchy – numerous airports were only flown to seldomly only a couple years in the period under review. Therefore, five airports were chosen, four of which had all ten datapoints and AMS, which had nine. AMS only had 103 seats offered in 2010, 2011 was missing and 2012 had 75271. It is assumed that the reason for 103 seats was due to KLM launching the route late December of 2010, therefore 2011 was calculated from 2012 by deduction of the amount of growth from 2012 to 2013.

GDP was sourced from Eurostat on NUTS3 levels. It was decided by the author which regions to include in the area of influence based on geographical proximity, popularity of the airport, distance to other airports and their level of network and the author's professional opinion as a flight operations assistant. (Anderson, 2011) argued that GDP will encompass some of the explanatory power of multilateral resistance.

PPP was sourced on a country level, as it is assumed that tourists do not visit a different city in the same country than the one they originally wanted solely because hotel prices are higher – other than accommodation, it is assumed that tourists are able to source

food and entertainment on their desired price level. Business travellers have a lower demand elasticity, so they do not influence the decision of the aggregation level of PPP.

DIST denotes the distance between the airports and Aalborg Airport in nautical miles. It is calculated on the great circle – the shortest distance – even though operationally, airlines might choose different routes to circumnavigate congested airways to avoid delays or choose to fly over different countries to optimize overflight surcharges. Due to distances being so short, these considerations are not expected to skew results in any significant manner.

TOURINF shows the number of establishments, bedrooms and bed-places by NUTS 3 regions. In the case of Málaga, where many Danes have holiday homes and cities where AirBnB is more prevalent, this data might not reflect reality. However, it is assumed that Danes with foreign property are not the majority of tourists and that despite not taking AirBnBs and other alternative housing options into account, the difference between destinations is represented. Missing datapoints were calculated from a calculated compound annual growth rate from the existing data.

POPUL corresponds to the population of the catchment area. As NUTS 3 level territories differ in size and population density is not stagnant within, the data does skew in favour of allocating more people to each destination. This distortion is not assumed to be significant, however, as all airports included in the regression either enjoy monopoly, such as Palma de Mallorca or a capital or in case of Málaga, a popular tourist destination. Missing datapoints were calculated from a calculated compound annual growth rate from the existing data. (Anderson, 2011) argued that population size will include some of the explanatory power of multilateral resistance.

LANG is a dummy variable which takes on 1 if there is a shared common national language. Due to how close Norwegian is to Danish (language distance is very low) (Gooskens, 2007), Copenhagen and Oslo both are 1.

ALTN is a dummy variable, aiming to capture competition between destinations.

CAPITAL is a dummy variable with the purpose of describing higher interest in certain destinations due to their assumed cultural and socioeconomic importance.

HUB is a dummy variable that helps accounting for feeder lines, it is 1 when the airport is the centre of a hub and spoke system.

PARK is the chosen innovation from Aalborg Airport being measured in the regression, it is the number of available free parking spaces at the airport in the given year.

4.1.2. Descriptive statistics and excluded variables

As described in the previous subchapter, all missing datapoints have been calculated, so all five destination airports have a datapoint for every year between 2010-2019. The continuous variables have been standardized – see the descriptive statistics in Table 6.

Table 6 Descriptive statistics

	Mean	*Std. Deviation*	*N*	*Trade cost proxy*
PAX	0.00	1.00	50	
TOURINF	0.00	1.00	50	X
PARK	0.00	1.00	50	X
POPUL	0.00	1.00	50	
PPP	0.00	1.00	50	
GDP	0.00	1.00	50	
ALTN	0.40	0.495	50	X
HUB	0.60	0.495	50	
LANG	0.40	0.495	50	X

Source: based on the regression performed

However, some of the variables had to be excluded from consideration due to multicollinearity, these variables will be listed below. It is argued that these collinearities are not inherent to every airport's own gravity model and should be assessed on an ad hoc basis.

CAPITAL had to be removed because due to the limited data, every capital was a hub and the only hubs were capitals, thereby duplicating the variable. This is simply due to only having a handful of airports as datapoints and the natural bias of there being annual scheduled service to capitals/hubs.

Despite standardization, **GDP** showed medium strong correlation[32] with ALTN and HUB. This is explained by more prosperous countries having higher GDP and having a higher chance of being hubs (thanks to higher disposable income to spend on travel

[32] Pearson correlation coefficient is above 0,75.

and support a hub). Having commercial alternates usually means that demand is high for the area, which ties back to richer areas. Notwithstanding, with a robust enough dataset, it is possible that this connection is faint enough to incorporate all variables, thanks to the incorporation of low-cost carriers' point to point flying schemes and smaller hubs.

The above issue with GDP is only exacerbated in the case of **DIST**, since it has a one-to-one relationship to each destination and there is no variability throughout the years, resulting in medium to high correlation with most variables. In datasets big enough, regressions can be run per annum, eliminating this issue.

Table 7 Correlation matrix for all considered variables

		PAX	TOURINF	PARK	POPUL	PPP	GDP	ALTN	HUB	LANG
PEARSON CORRELATION	PAX	1.000	-0.414	0.090	0.048	-0.656	0.451	0.011	0.690	0.505
	TOURINF	-0.414	1.000	0.142	0.694	0.652	-0.099	-0.207	-0.607	-0.537
	PARK	0.090	0.142	1.000	-0.009	0.094	0.128	0.000	0.000	0.000
	POPUL	0.048	0.694	-0.009	1.000	0.120	0.530	0.236	-0.002	-0.296
	PPP	-0.656	0.652	0.094	0.120	1.000	-0.588	-0.518	-0.947	-0.854
	GDP	0.451	-0.099	0.128	0.530	-0.588	1.000	0.813	0.771	0.180
	ALTN	0.011	-0.207	0.000	0.236	-0.518	0.813	1.000	0.667	0.167
	HUB	0.690	-0.607	0.000	-0.002	-0.947	0.771	0.667	1.000	0.667
	LANG	0.505	-0.537	0.000	-0.296	-0.854	0.180	0.167	0.667	1.000
SIG. (1-TAILED)	PAX		0.001	0.267	0.371	0.000	0.001	0.470	0.000	0.000
	TOURINF	0.001		0.162	0.000	0.000	0.247	0.075	0.000	0.000
	PARK	0.267	0.162		0.476	0.259	0.189	0.500	0.500	0.500
	POPUL	0.371	0.000	0.476		0.203	0.000	0.049	0.495	0.018
	PPP	0.000	0.000	0.259	0.203		0.000	0.000	0.000	0.000
	GDP	0.001	0.247	0.189	0.000	0.000		0.000	0.000	0.105
	ALTN	0.470	0.075	0.500	0.049	0.000	0.000		0.000	0.124
	HUB	0.000	0.000	0.500	0.495	0.000	0.000	0.000		0.000
	LANG	0.000	0.000	0.500	0.018	0.000	0.105	0.124	0.000	

Source: based on the regression performed

PPP shows significant multicollinearity with HUB and LANG, which is most likely due to hub airports being in countries with a stronger economy, which also happens to coincide in this case with language closeness. This is predominantly an issue currently due to the size and variety of the dataset.

Lastly, HUB is eliminated from the model as a variable, due to increasing the VIF (Variance Inflation Factor). It wouldn't need to be eliminated just based on collinearity with another singular variable but having a Pearson correlation coefficient above 0,60 with each and every other variable warrants its exclusion.

Table 8 shows that there is no interference-worthy multicollinearity left in the regression model upon elimination of the variables discussed above. The collinearity diagnostics show that no variable has a variance proportion above 0.9, let alone two in the same model. (Snee, 1983) Thus, the assumption that there is no multicollinearity in the model is accepted.

Table 8 Collinearity diagnostics

Model	Eigen value	Condition Index	Variance Proportions					
			(Constant)	TOURINF	PARK	POPUL	ALTN	LANG
1	2.317	1.000	0.04	0.02	0.00	0.01	0.04	0.06
2	1.702	1.167	0.02	0.05	0.01	0.09	0.03	0.00
3	1.008	1.516	0.00	0.00	0.88	0.01	0.00	0.00
4	0.508	2.136	0.16	0.11	0.03	0.06	0.31	0.05
5	0.348	2.579	0.15	0.01	0.00	0.20	0.12	0.64
6	0.117	4.441	0.63	0.81	0.08	0.64	0.50	0.26

Source: based on the regression performed

In summary, CAPITAL, GDP, HUB, DIST and PPP are excluded from the model. This is expected to affect the fit of the model and its explanatory power in a negative way, however, due to the low N, it is better to use less variables in the model to prevent overfitting.

4.1.3. Regression & Analysis

The final regression model therefore is as follows:

$$LnPAX_{odt} = \alpha + \beta_1 TOURINF_{dt} + \beta_2 POPUL_{dt} + \beta_3 LANG_{od} + \beta_4 ALTN_{dt} + \beta_5 PARK_o + \varepsilon_{odt} \quad (5)$$

where d stands for destination, t is the time variant and o is origin and β_x are the coefficients of the independent variables and α is the intercept.

Hypothesis: The increase in the free parking spaces offered at Aalborg Airport positively influenced the number of passengers enplaned.

Before an OLS regression can be run, the regression's assumptions need to be tested. All assumptions that are not mentioned below are considered to be accepted. See Appendix B and C for figures/tables for the basis for the accepted assumptions.

There is heteroskedasticity in the data, to counteract this, robust errors were used for the regression. The higher the values the bigger the errors, which means that the results are less reliable for more popular destinations.

Table 9 shows the R^2, which shows how well the model fits the data. Adjusted R^2 is close to the R^2, meaning that the data is not overfitted and the value being over 0,64 means that the coefficients have an acceptable level of reliability in terms of model fit, in other words, the model explains over 64% of the variance within the data.

Table 9 Model summary

R	R^2	Adjusted R^2	Std. Error of the Estimate	Durbin-Watson
0.823	0.678	0.641	0.599105506753801	2,354

Source: based on the regression performed

Based on the Durbin-Watson test (see Table 9), a slight, therefore acceptable level of autocorrelation is suspected in the data, as the test result exceeds 2 but is below 2.5. (Vogt & Johnson, 2011)

The regression analysis was statistically significant at the 1% level based on the ANOVA test. This means that the predictors in the model are able to account for a significant amount of variance of the number of passengers flying between the city pairs.

Table 10 ANOVA test

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	33.207	5	6.641	18.504	,000
Residual	15.793	44	0.359		
Total	49.000	49			

Source: based on the regression performed

Table 10 shows the coefficients from the regression. All variables are significant at the 1% level except for TOURINF, including PARK, which denotes the amount of free parking spaces at Aalborg Airport, with a positive coefficient. Due to the standardisation, the interpretation of β in this case would be that a change in one standard deviation of the number of parking spaces is associated with a change of 0,264 in the natural logarithm standard deviation of the number of passengers travelling. Thus, the hypothesis can be accepted, the free parking spaces positively influence the number of passengers travelling to and from Aalborg Airport.

Table 11 Coefficients of the gravity model regression

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	β	Robust Std. Error	Beta			Tolerance	VIF
(Constant)	-2,337	0.147	-2,337	-3,838	0,000		
TOURINF	0,609	0.160	0,609	-0,752	0,456	0.285	3.514
PARK	0,264	0.089	0,264	5,705	0,000	0.928	1.077
POPUL	0,123	0.145	0,123	4,281	0,000	0.348	2.872
ALTN	2,175	0,095	0.512	22,981	0,000	0.667	1.499
LANG	3,895	0,961	0.298	4,055	0,000	0.691	1.447

Source: based on the regression performed

It is worth noting that the unstandardized and standardized coefficient match since the raw data itself was standardized with the exception of the dichotomous variables. Based on the collinearity statistics, both tolerance and VIF are acceptable, as tolerance is above 0.2 and VIF is below 5.0. (Menard, 1995; Myers & Myers, 1990) Robustness check was performed with exchanging the correlating variables – the model was significant, albeit with less explanatory power, but the hypothesis could still be accepted, the number of free parking spaces were a positive influence on the number of seats offered to and from Aalborg Airport.

4.2. QUALITATIVE

4.2.1. Data gathering – conducting interviews

Four people have provided insight through interviews – Stinne Hjorth Dalsø, previous Safety Manager at Aalborg Airport and current COO of Great Dane Airlines, Thomas Hugo Møller, previous Compliance Manager at Aalborg Airport and founder and CEO of Great Dane Airlines, Kim Bermann, current COO of Aalborg Airport and Kirstin Holst, current Manager of Airport Office. Mr Bermann has been working at the airport since 1983, managing operations since 1998, first as assistant manager, and as COO since a promotion in 2009. Ms Holst has been working as a Duty Officer since 2001.

Mr Møller and Mrs Dalsø were interviewed separately, over the course of the whole data gathering period in shorter instances, following the questions built up for the semi structured interview. The goal for interviewing them was to gain an outside perspective of the innovation management at the airport (as they have not worked for the airport for approximately one and a half years), but they still have an intimate knowledge of the inner workings. It was assumed that, as senior members of the only airline based in Aalborg Airport, Great Dane Airlines, they will have a unique view on how the innovative activities of the airport affect airlines. In addition, having flown to over fifteen different destinations since the airline's inception, they have gained enough experience to be able to contrast it against Aalborg Airport. The author has also been part of the airline since its beginning, it is therefore posited that based on long-standing work relationship, the answers gained are as truthful as possible.

The latter two were interviewed together in a semi-structured interview (for the skeleton of questions, see page X.) For a transcript of this interview, see Appendix A.

Originally only Mr Bermann was approached, but he invited Ms Holst to the interview as well, as she is a direct subordinate and therefore quite involved. The interview took place at Mr Bermann's office, keeping social distancing guidelines. With a combined 56 years of experience at the airport between them, it is posited that their knowledge in the area of interest is relevant and current, including historical insight on the development of the business.

4.2.2. Analysis

As the author already had prior knowledge regarding the innovations at the airport, having worked there physically as well as being updated in a professional capacity as a member of the Operational Control Centre of the airline located on the premises, but not much of its management, the interview questions were aimed at innovation management at the airport and evaluation of the innovation activity. In this analysis, the red thread will follow a theory-driven logic – the airport's activities and management will be contrasted against the theories to see if there is anything novel and/or replicable in their approach, and in the interim the identification of potential weaknesses could be beneficial in order to find possible solutions. The overall goal of this analysis is to gain insight into the innovation management of Aalborg Airport and based on it, extract valuable lessons and combination of tools used to be able to generalize the management of innovations to a certain degree that could benefit other small airports.

The following topics have been covered by the prepared questions (question numbers in brackets): importance of innovation (1, 2, 3), tools (4, 5, 6), idea sourcing (7, 8, 9), formal innovation management (3, 4, 10), appropriability regime (11, 12), shortcomings (13, 14, 15). In the following, the analysis will be based around these topics, in respective order.

4.2.2.1. Importance of innovation

Every interviewee agreed that innovation at any airport is *"vital"*. (Dalsø, 2020) There was general consensus on the reason – innovation is the key to staying competitive. Both the airport and the airline mentioned that minimizing costs for airlines is of high importance, as it makes the airport more attractive. (Dalsø, 2020), COO of Great Dane Airlines, also mentioned that as airports get their profit from non-aeronautical revenue, it is imperative that they continue to find new avenues and possibilities to increase income.

Innovating as a small airport has its positives and negatives. (Møller, 2020), previous Compliance Manager, said that *"decision making is quicker, and complexity is less daunting".* (Dalsø, 2020) agreed that agility and flexibility is beneficial for deciding on innovation projects, adding that *"employees are directly employed, making it easier to gain ownership of new ideas and projects amongst the employees."* (Bermann & Holst, 2020) mention that it is definitely harder to innovate as a smaller airport from a financial point of view. This mainly concerns the bigger innovations, since they are costly to develop as well as implement.

It is fair to establish that innovation is regarded as quintessential to Aalborg Airport by the perception of management. There is a dedicated strategic management group consisting of the Sales and Marketing Manager, the CEO and the COO. They are the responsible people both for vision and for operational implementation of new ideas. However, despite how much importance they assign to innovation, there is no well-established innovation management in the systematic sense.

4.2.2.2. Idea sourcing

The first step in the innovation process is research. (See Figure 8.) On one hand, ideas come from external sources, such as network activities of the three members of strategic management. Mr Bermann (COO) goes to the PTE (Passenger Terminal Expo) annually, which is a conference geared specifically towards airports. He also claims to always be on the lookout when travelling, as well as visiting airports with the intention to learn more about their operations (by being shown around behind the scenes in e.g. Dublin). (Bermann & Holst, 2020) mentioned that for the last couple of times, they took representatives from the IT department with them to these excursions. This is clearly increasing their absorptive capacity, as their knowledge base and diversity in expertise allows them to gain more information.

Ideas are also encouraged to be shared within the company, at all levels. There is a weekly meeting for low to mid management, where they share ideas under one overarching question: *How does this benefit the passenger or our staff?* It is viewed as a collaborative effort between departments, framing every action as something towards a common goal. This resonates well with the idea that both the structure and the culture of the organisation has to be supportive of innovative creativity. All interviewees agreed that the airport, as is the case in most Danish companies, has a flat hierarchical structure, distance between levels is short. Culture is informal – colleagues are on a first name basis

with top level management and as described above, suggestions are welcome from everybody.

Ideas are sourced from every level of the organisation. The airport has gathered all of its employees for meetings, where they were informed about the direction and growth of the airport and then they could write down ideas on sticky notes, which then were categorized for the different department heads, who evaluated and gave feedback openly on why one idea was promoted to be considered on higher levels and why some were incompatible with current operations.

Unknowingly, the airport followed (Bower & Christensen, 1995), who warned that listening and focusing too close on the current customers and their needs – as upper management tends to do so – might result in a company losing touch with the needs of future customers and will become unappealing and will fall behind compared to those who innovated towards future buyers. This is further underscored by the fact that the airport invested in facilities before demand arose for them, e.g. hangars and security check capacity, consciously choosing to invest in the infrastructure in the hopes of attracting the customers that were not in the picture yet. In addition, sourcing ideas from lower levels of management is also something recommended by disruptive innovation theory, as these ideas tend to be less restricted by earlier commitments. However, there is no objective evaluation system in place – even though ideas arise, organizational inertia is still a big force that might suffocate this creativity.

Depending on the budget needed for the idea to be operationalized, the project can get the green light by the head of the department, the COO or the CEO and the board. But how do they decide between competing projects? What tools do they use to measure potential and impact?

4.2.2.3. Tools

There is no formalized and systematic innovation management and there are no specific tools used to evaluate the different ideas at Aalborg Airport. (Dalsø, 2020), previous Safety Manager, mentions the use of market and SWOT analyses as a decision making tools between mutually exclusive ideas, but (Bermann & Holst, 2020) from the airport say that they do not sit down to do different analyses, instead they opt for making a quick managerial decision.

One method described is creating three possible scenarios – if nothing happens, if everything goes wrong and if everything goes right. However, it is mostly used for long-term strategic planning and is not an everyday evaluation tool.

Part of the reason why it seems unnecessary for the airport to have a well-developed toolkit for their innovation management is because politics weighs in heavily on the decisions. The airport is owned by the surrounding municipalities and is a non-profit organization – they have to keep in mind that by playing such a key role in the growth of the area, they are unofficially mandated by the municipalities to prioritize building infrastructure and increasing the level of service to the locals instead of increasing profits – even though the airport has to sustain itself and does not receive any investments or other infusion of pecuniary resources by the municipalities.

An example of this is offering free parking. By charging for parking, they would definitely lose the business of southerners, as it would not make sense to drive up north anymore, however, locals would still use the airport just as frequently, meaning that profits would most likely increase. Nevertheless, the end goal is to increase traffic, even at the expense of losing higher profit margins.

Even if it is accepted that political influence is too heavy on these decisions, resulting in tools such as Cooper's stage gate model not serving their purpose without modifications, it is argued that smaller innovation projects would benefit from more objectivity, as currently it is decided by either the head of department or the COO.

The airport also neglects to evaluate the success of their projects. There are no controls built in to create feedback loops for adaptational improvement or refinement. There is no impact study, projects are not evaluated for their long-term effect and overall performance. It is fair to assume that partially the reason behind this is continuous growth – everything seems to work out well for management, net profits are growing each year, passenger numbers are on the rise, strategic goals such as becoming an international airport succeeded.

Nonetheless, it is argued that evaluation of these innovation activities and asserting better overall control would lead to improvements. Even if it is argued that management uses best judgement to distinguish between the viability of two projects, it is posited that formalizing the project management of innovations would yield, if nothing else, better understanding and management skills, allowing to speed up decision making and implementation. This would also allow the next generation of managers to have a better guideline and procedural blueprint of decision making.

4.2.2.4. Formal innovation management

There is no formal and systematic innovation management – there is no department, there are no people dedicated to this task and there is no deep knowledge present regarding innovation management or innovation studies in general. Despite this, the airport has managed to not only successfully implement and achieve financial success with innovation, but they also came to be at the forefront of innovation for airports, being a world first in a new technology for sorting baggage. Does management at Aalborg Airport do something unique or are they following innovation management theory without knowing it?

Mr Bermann and Ms Holst, COO and Airport Office Manager respectively, spoke about how most of their innovation effort are fuelled by the high salaries they pay their workers – labour is not cheap in a country as rich as Denmark and being situated in North Jutland, it is possible that cheap foreign labour is not as readily available as in e.g. Copenhagen. As labour are their biggest variable expense, it makes sense to automate as much as possible, cutting costs and increasing service quality at the same time. This also fits well with their ars poetica of making everything easier for the passenger.

It has been established earlier that innovation in this thesis is understood as something new to the firm, so adopting infrastructures and technologies from other airports still counts as innovation. However, the reason why Aalborg Airport is so interesting is that they do not just adopt and mimic, they take part in development and they even managed to be the first in the world in technology. How is this possible?

RFID has been mentioned before – it is an acronym for radio frequency identification. In summary, a tag is placed on something to be identified – livestock, pets, baggage to name a few – and this tag contains a unique frequency and can be located and identified based on this. Pros of this is that it does not need visual analysis compared to a barcode and depending on type, it can be used from hundreds of meters away and is less susceptible to be unreadable due to weather.

Using RFID for baggage tracking and sorting was not invented by Aalborg Airport – the CEO of the airport, Søren Svendsen wrote an article about their innovation, highlighting the positives and the reasons they chose this technology, partially because it is supported

by IATA (International Air Transport Association). (Svendsen, 2010) However, they did more than simply purchase something off the shelves.

Mr Bermann, as COO and responsible person for the operational concerns at the airport, sat down their IT provider companies to a table and proposed that they develop a unique baggage sorting and tracing solution. As mentioned earlier, the biggest hardship facing such innovations is the lack of pecuniary resources – the airport could never afford to pay these companies for their services up front. The ingenuity of management was offering to be the guinea pig – they will collaborate with Lyngsoe Systems to perfect the solution and after it is done, Aalborg Airport is fitted with the world's first of its kind all-encompassing solution and the developer has a successful test case to shop around to convince bigger airports about buying a tested, reliable product and service. According to the airport's COO, they were the first in the world where passengers do not need to do more than verify the bag is theirs and put it on the belt and that they were the first to build an RFID reader into the automatic sorting area, decreasing the amount of manual labour needed by scanning each barcode by an employee. This translates into fewer employees dedicated to sorting, less mistakes and an overall faster system allowing more airplanes to be handled at once.

Certainly, the system outperforms the previous in speed, reliability and costs as well, especially taking into account the standard of living in Denmark, which results in high labour costs. But it is important to also think about the benefits for the airlines – higher reliability means less lost baggage, which means substantial savings[33] and happier passengers.

Being a first mover and part of the development phase grants Aalborg Airport more than just bragging rights. RFID technology is backed by IATA, therefore it is safe to assume that airports will adopt this technology, phasing out barcodes. This process is going to be sped up by airlines who themselves have adopted the technology and will want to consolidate procedures all over their route network, as well as benefit from less baggage lost.

[33] Rush bags (baggage that were separated from their owner) need to be transported on flights by other airlines, administration fees need to be paid, etc. Due to pressure for reconciliation, airlines charge multiple hundred DKK per bag, making rush bags expensive and airlines will avoid them as much as possible.

4.2.2.5. Open innovation

Research suggests that an open innovation model would benefit the airport industry. (Bowyer & Chapman, 2014) Adopting an open innovation mindset would help ease some of the concerns regarding appropriability regimes as well, since management would focus on the best adoption and execution of a given idea, not its protection either by keeping it a trade secret or spend top dollar for IPR protection and enforcement.

The COO seems to have adopted an open innovation mindset already. Instead of only focusing on innovative ideas from within the company, he visits yearly expos, tours other airports and allows other airports' management to be inspired by Aalborg Airport. In the words of the COO: *"There have been many airports that have been flying into Aalborg Airport to see what we are doing. I think nearly all Swedish airports have been here and seen what we are doing, so a lot of airports are coming here to see what to do. And of course, in Denmark, Copenhagen airport has been here looking at our sorting area. And Billund has been here. Billund has been here to look at our new security flow. They want the same. And before this Corona, the supplier of the new security flow has asked for a conference to be held here to show our new security flow because it's so fast, and so smooth, and so easy for all the passengers."* (Bermann & Holst, 2020) They also mentioned during the interview that airlines consider them a very innovative airport and that they *"*[…] *share our innovations with almost anybody"* (Bermann & Holst, 2020)

The example of the RFID development is also telling – they never intended it to remain a novelty system unique to them, a selling point in their pitch to the developers was that it can be sold to bigger airports.

Open innovation is also specifically beneficial to smaller airports, because airline route planning will favour lower cost and similarity. Taking the RFID baggage sorting and tracing as an example, if an airline has this system integrated and working with Aalborg but not with Aarhus, they will be more inclined to establish a feeder line or a future hub with the airport that allows for smoother operations.

4.2.2.6. Barriers to innovation

As discussed in Chapter 1.2.1, there are several possible barriers to innovation at an airport. During the interview, the monetary burden of innovation was highlighted by the current leadership. (Bermann & Holst, 2020) This is understandable and most likely shared by most of the small airports. (Price et al., 2013) mentions organizational culture as a barrier and provides design led innovation as an approach. Surprisingly, this exact approach is applied by management, i.e. sourcing ideas from middle management and giving them a voice in the process, allowing for collaboration with partners and customers. *"In every company you have people with an abundance of ideas. We put them together and told them that we wanted all their ideas, and they should write them down. And then we said: "We have been arranging some meetings where all the employees were informed about which direction the airport was going in, and the employee was able to put some sticky notes on a piece of paper and in these different areas of the airport about what sort of ideas they have. After that we put them in smaller groups. All these ideas are for the operation'' and then we considered: ''Is this a good idea or is it not a good idea?'' and all the employees could see our responses to their ideas. So, everybody employed at Aalborg Airport can present their ideas and have it subjected to discussion, and those ideas will be discussed during our meetings."* (Bermann & Holst, 2020)

Their focus of innovation activity, which is non-aeronautical business, is also in agreement with the literature. (Rho et al., 2015) This focus is most likely due to the high pressure for standardization in all aeronautical systems and because increased profits almost exclusively can only be obtained through these channels.

Barriers to innovation at airports, as described in (Scheler, 2013), include lack of organizational priority, innovation opponents and limitations in space. There is high priority assigned to innovation at Aalborg Airport at all levels, all input is welcome, and each gets evaluated. Innovation opponents can come from different areas, both internal and external, this organizational inertia is likely something each company, regardless of industry, has to face to a certain degree. Limitations in space inevitably plagues smaller airports more than bigger ones and it is not easily mitigatable.

The survey from the small Chinese airport (Wei & Xu, 2013) shows similarities with Aalborg with lacking structured policies, which results in hardship with the coordination of the innovation efforts. The establishment of an innovation management department could be tasked with the development of policies and procedures.

It was mentioned earlier that the seven surrounding municipalities own the airport and influence its management to prioritize the betterment of service and this fits well with the notion of public-utility mentality. *"It is influenced by politics. Our owner would say that we do not want to earn that money from parking, because it is more important for us that the airport has the possibility to grow. If we have to increase the passenger numbers, we need the passengers to come from the south."* (Bermann & Holst, 2020)

While this is true, management seemingly was able to adopt this duality in their approach – they slowly insource jobs and tasks from companies to keep providing jobs despite automatization and innovation, creating different types of jobs. (Bermann & Holst, 2020; Dalsø, 2020; Møller, 2020) The point of innovation is long term growth instead of short-term gain for the airport, and playing the long game seems to pay off, since staff is not afraid of being made redundant by new and better ways of doing things, so internal opposition is presumably lower.

5. DISCUSSION

This thesis stemmed out from the curious case of Aalborg Airport – a small airport in the least developed part of the Kingdom of Denmark, in the northern part of Europe with a smaller population density, yet a successful innovator who managed to surpass the critical one million passengers a year, below which most airports are in deficit. Therefore, this research aimed to provide an explanation for this unlikely success by conducting a thorough case study of the aerodrome, hoping to gain insight into what made them successful, in the hopes of other small airports might be inspired by them.

Small airports are in need of theoretical support, as they are struggling, despite their fundamental role in their respective communities. However, due to their lack of financial resources to fund research and seemingly lower importance than major hubs, they are neglected by academia. Why should they be studied separately from big airports? It is due to their differing features – small airports tend to be in the red, therefore publicly owned, as investors will always prefer to privatize profitable businesses, meanwhile the public utility mentality stunts innovation and growth; they tend not to be part of airport management systems (which manage multiple airports at once, benefiting from economies of scale), airlines are less likely to invest in them (e.g. hubs), have significantly less pecuniary resources to innovate, considering the enormous red tape within aviation etc.

It is posited that small airports differ enough in terms of their circumstances and available tools and resources that they require researchers to study them separately.

The research question of this paper was: *"How does Aalborg Airport conduct its innovation management and how can Aalborg Airport measure the performance of its innovation activity?"* The discussion will be separated into two, based on the two parts of the above question. The first section will discuss the innovation management at Aalborg Airport, which was studied and analysed via semi-structured interviews, contrasted against innovation management theory and current airport practice. The second section sets out to discuss the model described and used in Chapter 4.1 and its usability in the future for airport innovation management at Aalborg Airport.

5.1. INNOVATION MANAGEMENT AT AALBORG AIRPORT

Aalborg Airport has no formal innovation management, there is no dedicated person or team, there are no defined processes or budget set aside for innovation activity. Notwithstanding, just because practice is not codified, it does not mean that it does not exist – the airport has a quite successful innovation activity and it manages it, however, without the use of formal management processes.

Basic research and discoveries, ideas come from employees of all levels of the company. Any idea is welcome, and employees are encouraged to share it and they also receive feedback whether their idea was implemented or not and why. This helps create a corporate culture where innovation is part of the daily life of each and every employee, thus allowing for a much bigger net to be cast for future improvement and innovation ideas. This is based on the recollections of both past and current management. This is in line with both the general innovation management literature and with (Tarry, 2000), who found that in Salt Lake City, employee encouragement for taking risks and innovating was a key factor for success. It seems consistent therefore, that engagement from senior management and cultivating a pro-innovation corporate culture is a necessary first step to turn towards innovation. This is partially explained by the generally flat Danish hierarchical corporate structure, which is not common within aviation, as its history is based in the military, resulting in usually stricter chains of command and overly formal exchanges.

Ideas can come from external sources as well – a company must be open to these ideas and has to have the necessary means to acquire and utilize them. This means that there needs to be a certain organizational slack – at Aalborg Airport, the COO says that his subordinates are fully capable of filling in for him, allowing him to have the time and energy to dedicate

to innovation. Another key feature of a company when it comes to sourcing ideas from outside is absorptive capacity, which was increased in this case by including IT personnel on the trips to expos and tours of other airports. This was not done by following the relevant theories, but by instinct, which means that this process could be thought through and formalized, resulting in optimizing absorptive capacity further by e.g. including other experts on these trips. This also supported by open innovation, where the competition is not focused on who came up with the idea, but who operationalized it better.

A usually neglected source of ideas is the anticipation of the needs of future customers. The airport, by putting the customer in the focus of their innovation efforts, side stepped an issue described by (Bower & Christensen, 1995), viz. putting too much focus on current customers and investing in incremental innovation instead of trying to gain new customers. This is evidenced by them building a hangar and expanding the security check area before the needs arose, in the hopes that these facilities will attract airlines that want to establish a hub. This is also supported by the Future-Fitness-Portfolio approach to innovation management (Heiko et al., 2010), however, Aalborg Airport seems to have a more visionary foresight rather than just model/trend based.

Compared to other airports, which tend to have a hybrid innovation management (technology and demand based) (Heiko et al., 2010), Aalborg Airport has openness incorporated into the operationalization of their foresight. This is demonstrated by their open dialogue with all relevant stakeholders, from technology and software developers to airlines to other airports, illustrated well by their cooperation with Lyngsoe Systems, which resulted in the automated RFID based bag collecting and sorting. Internally, they have weekly meetings from low to mid management, where ideas can be discussed. (Bermann & Holst, 2020) Collaborative efforts are extended to the outside of the company, e.g. aiding a Greenlandic airport in launching and optimizing their services. This all stems from the dominant paradigm, which is the belief that the future can be shaped through the interaction with the stakeholders.

The management team seemingly has a natural grasp on the concept of creative destruction. They rebuilt and redesigned their terminal to embody a walkthrough shopping area concept (making passengers spend more time in the shopping area), ‘destroying’ the old terminal in order to literally rebuild it in a creative way. They employed the same concept for the development of the RFID automatic sorting area and its implementation, which was a world’s first according to the COO of the airport.

The benefits of Aalborg Airport by being the first, essentially taking a shot at solidifying a dominant design, is reaching further than just happy customers and airline partners. A thought experiment is suitable to see what can happen to the airport if it succeeds to convince bigger airlines such as KLM, SAS and Norwegian to adopt their system, which in turn will make these airlines ambassadors of this design and will influence their hubs and other aerodromes in their route network to follow suit. This will take years, as Aalborg Airport could only afford this by dedicating time and resources to co-development – other aerodromes will have to purchase the final product, undoubtedly for a significant price, making adoption slow, especially for smaller airports.

Due to being able to afford it and where these airlines have the biggest pull, first adopters will be the big hubs and headquarters these airlines fly to and from the most. Creating hubs creates a lot of benefits – maintenance and crew are concentrated, aircrafts are easy to park and are interchangeable, facilities are available and airline procedures are well known by ground handlers and so forth. Nonetheless, hubs have their own limits, so airlines tend to have multiple of them, and this is where Aalborg Airport can aim to seize an opportunity – if an airline who has already adopted this new technology and starts shopping for a new hub, it will indubitably favour an aerodrome that, other than having satisficing facilities, is already integrated into their baggage handling system. Based on this, it would make sense for Aalborg Airport to actively encourage early adoption by airlines, solidifying this advantage. This could be done by weaving the collaboration effort tighter with Lyngsoe Systems.

Essentially, with the advent of new technology, the baggage handling system solution industry has entered a new level of Mark I cycle and actively is working on solidifying this design, the airport can ride its wave and increase its strategic importance in route network planning.

Management's willingness to co-develop this system, even more so, actively seek out this opportunity, classifies them as an exploratory business, not so common in the aviation industry, as profit margins are so low, exploitation of current assets and maximizing profit is less about greed and more about survival. Being a small airport makes it easier to change procedures, assets cost less to replace, traffic is not so high volume that momentary slowing downs due to newness will cause extreme delays and dissatisfaction, changing back is also a more viable option etc. This provides greater organizational flexibility than those of bigger airports. These characteristics put Aalborg Airport between a Prospector and an Analyzer in terms of strategic aggressiveness.

Possibly by reaching their goal of becoming a hub, this will tilt more towards an Analyzer position.

Their innovation strategy, as categorized by (Freeman & Soete, 1997), is a mixture between imitator and opportunistic: *"If we should innovate and we need some company to help us, because we cannot pay for it, so then we will go to them to ask them for help. After, they will have a product to sell, and that is the appeal to it, however, we will be the first mover. And then we will be a step ahead."* (Bermann & Holst, 2020) The airport can be classified as an imitator due to hard to copy characteristics, such as geographical location and being close to both railway and highway, which grant them advantages when adopting innovations. However, their success is mostly attributable to having one scarce resource, entrepreneurial creativity. This explains how they manage to be successful, even on an international level, despite lacking formalized innovation management. However, this does not mean that they would not benefit from creating procedures and a transparent management system.

In essence, the open, creativity-inspiring culture, flat hierarchy, innovation-seeking behaviour and high absorptive capacity allows the airport to possess dynamic capabilities, that is evidenced by the co-development of the RFID-based baggage drop system. This is further enabled by organizational slack.

Overall, management follows and are in tune with many of the theories presented here, despite not being familiar with them. It is argued that by learning and formalizing innovation activities, the airport could make more conscious decisions and have a better-informed strategy.

(Scheler, 2013) mentions five innovation drivers at airports. Aalborg Airport constantly monitors their environment and competitors (they conducted surveys to see how many people know about the free parking at the airport, they talk directly with the two closest airports, Aarhus and Billund etc), their top management is absolutely committed to innovation and development and they also feel an environmental pressure, since they are aware that they have a natural cap in passenger numbers, if passengers are only using Aalborg Airport as a gateway to Northern Jutland. (Bermann & Holst, 2020) There are two drivers that are missing: institutionalization of interaction and exchange and systematic approach. Therefore, it is further argued that formalized innovation management would benefit the airport, as innovation is what sets apart successful from not successful. (Nijhuis, 2012)

Table 12 serves as a condensation of the theoretical fit of the case of Aalborg Airport to all the innovation management theories that have been discussed in Chapter 3. On the left, the theory is mentioned, in the middle, the operationalization of the theory at the airport is described and lastly, to the right, the applicability and fitness of the theory to Aalborg Airport is judged on a scale of not applicable, weak, good and great.

All but one theory has either a good or a great fit, which is in line with the previous argument, that the airport's innovation management is in line with the general theories, albeit not due to conscious effort. The only not applicable theory is the appropriability regime, which is understandable due to two reasons. On the one hand, the airport adopted an open innovation paradigm, thus it is sensible not to concern themselves with the protection of their IPR. On the other hand, the airport is located in Europe, where corporate culture and laws are already fiercely protecting IPR, giving the airport protection without having to go out of their way with keeping trade secrets.

Based on Table 12, Aalborg Airport's innovation management reflects innovation management theory very well. This means that replicability should not be an issue for other airports, as they already have access to these theories and with this thesis, a guide to successful operationalization as well.

Table 12 Fitness of Aalborg Airport's case to innovation management theory

Theory	Operationalization at Aalborg Airport	Fit
Culture must be pro innovative creativity and lower management should be included	Management is dedicated to innovation and successfully communicates it to the entire organization. Employees of all levels of the company are encouraged to pitch ideas and there is an open and transparent process, where employees receive feedback on why some ideas get adopted, why some do not.	Great
Innovation process	Despite not being formalized, the innovation process at the airport follows the main steps described by (Greenhalgh & Rogers, 2010), but in a less formal way. The negative side of this is that delegation of certain tasks is nigh impossible, if there is no overarching management of the process.	Good

Theory	Operationalization at Aalborg Airport	Fit
Absorptive capacity	By taking a specialist from IT to their idea sourcing events, management increased their absorptive capacity. There is also a history of promoting internally, allowing employees to work their way up, hence having a better understanding and overview of the processes.	Great
Creative destruction	Management does not shy away from reorganizing and abandoning modus operandi.	Great
Organisational slack	The airport strategically builds slack, e.g. expanding the security check area before it was necessary, avoiding a bottleneck for future expansion.	Good
Innovation strategy	Based on (Freeman & Soete, 1997), the airport is following an opportunist strategy, meaning the reliance of imagine entrepreneurship, especially that of the COO. This fits them well, as this does not require the airport to have too much effort invested into research and development of technology, but it also makes them vulnerable, as it relies on a rare resource, entrepreneurial creativity. Based on (Miles et al., 1978), Aalborg Airport fits the best into a Prospector strategy, as they are relatively small and focus on innovation. However, an airport cannot change industries as easily as an average company when threatened by competition, so management must consciously work on exploitation of their innovation activities.	Great
Dynamic capabilities[34]	The airport possesses dynamic capabilities, evidenced by adopting the RFID mechanism and improving on it by integrating it into the sorting belt.	Great
Disruptive innovation	Unknowingly, management follows the teachings from the theory by giving voice to middle management,	Great

[34] Dynamic capabilities are *"the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments"* (Teece et al., 1997, p. 516)

Theory	Operationalization at Aalborg Airport	Fit
	having the passenger as the main customer instead of the airlines and keeping an eye out for other innovators.	
Appropriability regime	Management goes out of its way to share their innovations with other airports, even direct competitors. This is possibly due to their innovation being easily copyable and due to the unique situation of the transport industry, that competitors are part of the same route network, thus adoption of innovation is preferable.	N/A
Open innovation	The airport unconsciously adopted an open innovation approach to their innovation strategy. They share their innovations actively with others, they source ideas externally and build on better absorptive capacity.	Great

Source: made by the author

The airport's management's perception is, that innovation is indispensable for the development and continued success of the airport, the biggest hindrance they experience is the financial burden of exploration. This is in line with what can be expected, smaller airports generally do not possess the means to spend on innovations that have a higher risk component. This fact might discourage smaller airports in general from pursuing innovation, accepting that their fate is to be late adopters. An important lesson is therefore, that smaller airports are capable of innovation, but it is necessary that senior management is dedicated to it and prioritizing the innovative culture.

How do these results fit in with (Tarry, 2000) and his case studies of different sized airports? There are many similarities between them. Miami Airport improved on their service by looking at airlines as business partners, involving them in the innovation process, just like Aalborg Airport. Both Miami and Chattanooga Airport conducted surveys to measure the efficacy of their communication to stakeholders, as did Aalborg Airport. Salt Lake City and Portland increased their absorptive capacity by hiring people from other industries, just like Aalborg Airport did with bringing IT personnel along on scout missions. Aalborg Airport lobbied to have the train extended directly to the airport and to have a direct exit built off of the E45 highway, similarly to Portland, who solved its own ground transport bottleneck.

5.2. INNOVATION PERFORMANCE MEASUREMENT AT AALBORG AIRPORT

This thesis set out to provide a possible way to measure innovation performance quantitatively at smaller airports. It is important to measure the performance because management needs both a predictor and an evaluation tool. Projects need to be assessed and due to finite resources, especially at smaller airports, it is of great importance that possible paths can be evaluated quantitatively, so the right one can be chosen, as well as evaluating any project that is in the works or has been finished.

It has already been argued why the modified gravity model is theoretically suitable in Chapter 2.3.3., thus that is not addressed further. In addition, in Chapter 3.2.3., the commonly used variables were considered, that have a history of applicability for air transport, justified by the demand forecasting tools of airlines. Worth noting that only air transport literature was included in that survey, therefore expanding the research to other modes of transport might yield further insight and help adjust the model with new variables or data sources. Overall, it is posited that the innovation performance can be measured by a modified gravity model with innovation activity as an explanatory variable and its coefficient can be interpreted as the quantitative measurement of the innovation activity.

This subchapter is divided into three main parts, first the guiding principles are contrasted against the model and second, the model's strengths and weaknesses are discussed, finished by discussing the results.

5.2.1. Does the model fit the guiding principles?

As a reminder, the four principles for this method were data availability (airports need unrestricted access, both in terms of ease of access and financial barriers), simplicity (not having to hire new personnel to run or interpret the regression), validity and reliability and finally, adaptability (so different airports with different unique characteristics can adopt and adapt the method).

5.2.1.1. Data availability

All considered variables have been collected and presented in Table 5. Many of the data points are readily available, the airport already has access to the passenger data (at a lower aggregation level than what was used in this analysis, making it possible to have a higher explanatory power) and all Eurostat data used are open source and easy to find and download.

Choosing a catchment area for other airports could prove difficult for variables such as GDP, population et cetera. In this paper the author's judgement was used based on industry experience at an airline, however, an airport has two possible sources for more precise data. On one hand, airlines also have a history of using the modified gravity model (see Chapter 3.2.2), so it is reasonable to assume that they would already have done research, since they are operating said routing. In addition, since airports are business partners rather than competitors, it is in the airlines' best interest to share data and knowledge, as they are considered stakeholders at each airport they operate at.

On the other hand, the airports themselves might also be willing to share their own research into their catchment area, as it is not necessarily sensitive data, and the airport could gain some benefits if the results of the regression are shared with them (as it could tell them how much of their traffic is explained by certain variables).

Other variables where data must be created based on judgement, such as what is considered a commercial alternate or what is considered common language, the airport has two choices: either use their professional opinion or conduct a survey. Some airports collect such data before allowing access to the free Wi-Fi at the terminal or at the automatic check-in counters, allowing the airport to collect primary data on airport preferences and mitigating factors in choosing a routing.

Based on the above, the data availability criterion is deemed fulfilled by the model.

5.2.1.2. Simplicity

Simplicity refers to the entire process of running this model, from data gathering all the way to interpreting the results. The intentions were that small airports should not be forced to hire an econometrician to do this regression, as this would be counter intuitive, since they are already struggling and are in the red, hence they need this tool to help them. This does not mean that no statistical knowledge can be required, but it is safe to assume that economists do work for the airport, who have been trained in this level of statistics. If not, it has already been argued by (Østergaard et al., 2011) that diversity increases the innovativeness of firms, therefore success, so it is recommended to have such skill set in the management of any airport.

Data availability was addressed in the previous subchapter, but cleaning and transforming the data, OLS assumption testing and interpreting the results has not. Data cleaning is an important first step and albeit time consuming, it should not pose

an insurmountable obstacle, as the regression can be run with some missing data or they can also be computed (as they were in this case) and outliers can be omitted.[35] Transformation of the data, if necessary, requires the person running the analysis to be a bit more versed in statistics, as they need to determine whether it is necessary and if yes, what transformation should be applied. It is recommended to standardize the data for this model, considering the expected drastic differences between magnitudes, which is supported by (Anderson & Van Wincoop, 2004), as it also helps remedy heteroskedasticity.

Overall, it is argued that these are still the basics of a simple regression analysis and it should not exceed the expertise of an economist; thus, the requirements of simplicity are fulfilled.

5.2.1.3. Validity and reliability

There are no special concerns with using this type of data for a loglinear multivariate OLS modified gravity model, which means all validity and reliability issues are applicable that apply to a simple OLS regression. It is argued that these concerns should not prevent using this method, considering its wide and frequent application in the aviation industry, which proves that both its validity and reliability is accepted by professionals and academia alike.

It has been mentioned before that the exact values of the regression were not deemed important due to the issues with the data, it is worth noting that not all variables were included in the final regression that were supposed to be trade cost proxies, which might have resulted in some of the variable and fixed costs of trade costs to be excluded. Notwithstanding, the model fit seems to be appropriate, therefore this concern should not invalidate any finding or insight, but this fact should be accounted for when discussing results and possible policy based on the results.

5.2.1.4. Adaptability and adoptability

In this sense, adoptability refers to the ease by which an airport can implement this tool into their innovation management and adaptability refers to the ease by which the tool can

[35] There is debate whether outliers should be omitted from datasets, as it is possible to over sanitize the data, but this debate is not pursued further in this thesis.

account for special characteristics, e.g. a sizeable festival or good public transport access, which could significantly skew the dataset.

It is relatively easy to add and exchange variables in the model, therefore adaptability should not pose an issue, despite the different circumstances and special characteristics of some airports.

Adoptability echoes the need for simplicity and data validity but is mostly understood in the sense of fitness to existing management systems. Since this model builds on the most widely used and simplistic statistical method, an OLS regression, it is argued that any existing innovation management system can be amended to incorporate running and evaluating such a regression. It is worth to note that, as mentioned before, some airports have special circumstances that are hard to account for, for example lucky geographical location for refuelling or one singular attraction for tourists, possibly rendering this tool not applicable.

In summary, the model fulfils all four of the selection criteria set out in Chapter 2.3.3, therefore deemed fit for use for all airports.

5.2.2. Strengths and weaknesses

Every tool has its strengths and weaknesses, and it is important to identify them, so they can be deployed the way the results are the most reliable and closest to reflect reality, while increasing their usability to management and possibly the scientific community.

5.2.2.1. Strengths

The adherence to the guiding principles is considered to reflect some of the strengths of this tool. By being simple, yet adoptable and adaptable, while remaining valid and reliable is a significant feat. This makes this tool universal enough to allow management to make it their own, yet to be able to learn from others and their mistakes, driving down costs, as no specially trained work force is needed, despite how tailored the tool can be.

Another strength is the wide applicability. In this thesis, the regression was used to measure the impact of one certain innovation activity, the offering of increasing number of free sparking spots, on the number of seats offered to passengers, which is a proxy to increased passenger flow. Certainly, each and every airport wants to increase the number of passengers enplaned, however, as it was pointed out before, the average airport actually loses money on serving a passenger that does not spend money at the airport, other than

paying for the airport taxes via the airfare. That means that this tool might be great at showing the effect of an innovation activity on the passenger flow, but this might not translate into higher profitability.

The adaptability of this tool allows to change the dependent variable as well. Instead of regressing on the number of passengers travelling, an analyst can choose to regress on either aggregate total revenue at the airport or individual revenue sources, such as retail concessions or car parking (see Figure 1), allowing management to see exactly what revenue increased by what amount due to their innovation. This could help shape strategy and future policy as well as allow management to treat the airport more like a business and lose some of the public-utility mentality, which holds them back. (Kalakou & Macário, 2013; Tarry, 2000)

This would especially help the smaller airports, that struggle to convince politicians to invest into the airport as well as find it hard to drum up investors. Notwithstanding, this tool can also be used as a selection tool between mutually exclusive projects for the future, allowing both airport management and the investors to have a quantitative analysis of future projects for evaluation, by regressing projected data.

5.2.2.2. Weaknesses

No tool is perfect or entirely universal and it is imperative to know what weaknesses each has. As this model uses a loglinear OLS regression method, all weaknesses of this method are applicable – assumptions need to be met for the results to be reliable, valid, and robust, and not all data will fulfil these conditions. The test itself is sensitive to outliers and it can also be sometimes an oversimplification, which could result in inflating the importance of some variables or effects.

It is conceivable that some variables are hard to quantify, which could result in a lesser model fit and leaving known explanatory power in the error term, but in these special cases it is possible to hire outside help with this specific issue, which is not easy to do for struggling airports.

5.2.3. Results

An adjusted R^2 of 0,641 is a bit surprising, especially considering how many variables had to be omitted for various reasons. The model used is not fit for general applicability to all other small airports – it is expected that as there is no perfect recipe for exploiting the unique advantages of each airport, there also will be no perfect regression

model that captures the motivations of every passenger all around the globe. Some of the explanatory power was lost by omitting variables. Notwithstanding, this R^2 proves that this model can be developed further, and this can be used as a proof of concept for further refinement and research.

It is not surprising that the hypothesis was accepted, it is only logical that free parking entices people to choose Aalborg Airport instead of Billund or Aarhus and this finding is also corroborated by the airport's own primary research of questionnaire survey.

In summary, this tool can be considered as an answer to the call of action from (Tarry, 2000) for measuring airport innovation performance. Thus, the second part of the research question is answered by this tool – Aalborg Airport could measure its innovation management's performance by utilizing this modified gravity model based loglinear OLS regression model.

6. CONCLUSION

Aalborg Airport, despite being small, is successful for multiple reasons, none of which is due to an intrinsic, irreplicable value. This means that their success can be a valuable source of insight into what works for small, regional airports, which can help other aerodromes with similar qualities. These lessons are in no way, shape or form the one and true recipe for success for any airport management team, however, it can serve as an inspiration for improvement. Each airport needs to find their own competitive advantage to exploit, but the mode of exploiting does not have to be unique. It is encouraged that the lessons learned from this paper be contextualized by the local status quo before adaptation.

Their success is attributable to dedication and vision from the entire senior management, but in particular to Kim Bermann, the COO who seems to possess a rare resource, entrepreneurial spirit and who, even though unknowingly, manages the innovation activity as it is recommended by theories and the literature. They benefit from the flat Danish hierarchical structure, that allows for a more informal relationship to develop within the different levels of the company, allowing ideas to flow better and be nurtured. Other than this advantage, Aalborg Airport's innovation management follows innovation management theory very closely. It is argued that by learning and formalizing innovation activities, the airport could make more conscious decisions and have a better-informed strategy.

They have adopted an open innovation paradigm, both concerning their competitors and their partners, most notably Lyngsoe Systems, with whom they co-developed an RFID based baggage sorting system, demonstrating dynamic capabilities. They realised that they would benefit from increasing their absorptive capacity, and they did so by, for example, including their IT department in innovation idea sourcing missions. Management is not afraid of creative destruction, evidenced by their willingness to rebuild their internal concession area in order to increase revenue. All of the above can be adopted and adapted by any business with some necessary modifications. The fact that Aalborg Airport is successful, and they follow the theories, is a positive feedback on the theories and further solidifies them, from yet another branch. It is even more impressive, taking into account all the specificities and regulations that are involved in aviation.

However, something is arguably missing – how do they know that their success is due to the innovation effort, not due to a possibly exogenous circumstances? Aalborg Airport follows the theories, despite not having a formalized and codified innovation management procedure, and this results in them missing an evaluation tool, that could help assessing the performance of each project. It is argued that having a quantitative tool, which can be used for both evaluation of past activity and as a selective measure for evaluating future projects, is useful.

The modified gravity model based loglinear OLS model used in this thesis serves as a proof of concept for further development. It was shown that it can be used to quantitatively evaluate the effect of innovation activity, in this case expanding the number of free parking spaces. Future research can expand on this study by replicating it at other airports, providing robustness and richness to the current findings. The regression model can also be finetuned by applying it to other datasets, possibly introducing new, more general variables to measure innovative activity instead of number of free parking spaces.

The contribution of this paper is two pronged: first, as a qualitative case study of a small, yet successful airport's innovation management and secondly, a proof of concept for a simple, yet versatile quantitative tool that can be a applied both in further research and in practice.

In conclusion, Aalborg Airport manages their innovation activity mostly as it is suggested by theory, however, without formalized processes, which makes it vulnerable to changes in personnel or strategy. They biggest weakness is the lack of measuring of the performance of the innovation activity. As a remedy, a modified gravity model-based regression model was proposed as a possible solution.

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APPENDIX

APPENDIX A

Interview with Kim Bermann (COO) [K.B.] and Kirstine Holst (Airport Office Manager) [K.H.], the interviewer is the author, Dorottya Hrabovszki [D.H.]

D.H.: Do you consent to be recorded during this interview?
K.B.: Yes, that is okay.
K.H.: Yes, it is okay.
D.H.: Thank you. Alright, could you tell me a little bit about the airport? First, a little bit of history?
K.B.: The history of this airport? Where should we start? You know, Hitler-
D.H.: Yes, I know it was founded under the Nazi regime.
K.B.: Then I would prefer to go back to 1997.
D.H.: Why 1997?
K.B.: Because before that, this airport was owned by the state.
D.H.: Hmm, okay.
K.B.: And in 1997 the municipalities took over the airport. Since then, we have had a fast growth and owned our own money.
D.H.: Yeah, but are you still a non-profit?
K.B.: Yeah?
D.H.: Or can you pay out to…
K.H.: No.
K.B.: No, no.
D.H.: Then you are a non-profit.
K.B.: Yeah, okay.
D.H.: Okay, and then how does it differ between the military side and the civil side?
K.B.: The difference?
D.H.: Well-
K.B.: We have some costs we share with the military. You know we have the runway. We share the cost of them, the tower and the rescue staff.
D.H.: Fire fighters?
K.B.: Yeah, yeah.
D.H.: Do you share for general upkeep, like a cleaning lady?
K.B.: No, that's our domestic area.
D.H.: So, everything that has to do with passengers?
K.B.: Yeah.
K.H.: There is a quite clear line between the military side and the civil side of the airport, so we only... We will pay for the fire trucks and anything like that. We share the….
K.B.: Costs for NAVI-AIR.
K.H.: NAVI-AIR, yeah.
K.B.: And for the runway and the rescue staff. The rest is ours.
D.H.: Okay, I thought they would take on a bigger cost.
K.B.: No, no, no, but we pay nearly twenty million to the Danish defence for this part of the rescue staff, for the tower and for the runway.
D.H.: Well, that is a sizeable chunk of change.
K.B.: Mhm.
D.H.: The focus of this interview is your innovation management. How you manage to innovate, because you are a quite innovative airport, and you classify yourself as innovative. So how do you manage all of this? And I have written fifteen questions. This is a semi

structured interview, so I don't need to read up every one of them. It should be a free flow and you should tell me everything you want to tell me on what you think is important for me. Of course you are the expert on the airport, and you are the expert on the innovation management, so everything that is important for me to know, you should say, even if the question doesn't necessarily fit it perfectly.
K.B.: Yeah, okay.
D.H.: So, my first question is: ''In your opinion, is it important for an airport to innovate?''.
K.B.: Yeah!
K.H.: Yeah, absolutely!
D.H.: Why is that so?
K.B.: Because if we don't do that we will fall behind. So we have to be innovative, because when you innovate...You know we have grown nearly, if you go back to 1997, with 200 percent, and for us when we are using new technology we do better and we do things faster, and we do it with less employees. And then we can have a lower cost for the airlines. So that is why we always say: ''Okay, where can we do better. What sort of technology can help us and how to implement and utilize it?" It is something we do every day and talk about every day when we have a meeting and so on. How to do it better and how to use this technology.
D.H.: That is a great service minded outlook.
K.B.: Yeah, because when we don't use money for staff and the building, we can lower the prices for the airlines, so it is done in order to help our customers.
D.H.: So, do you think it is just as important to innovate for a big airport, like Heathrow, as it is for you?
K.B.: Yeah.
D.H.: Just as important, not less, not more?
K.B.: No.
D.H.: The same?
K.B.: The same.
D.H.: Is it harder to innovate as a smaller airport?
K.B.: Yeah.
K.H.: In some aspects.
K.B.: Especially the financial part, because when we have an idea and we don't have that much money to start up with, we nearly always have a dialogue with some companies where we tell them: ''If you help us, you will help yourselves. You will have product you can sell to a bigger airport!''
D.H.: Oh, I see. So, you get companies to develop it for you?
K.B.: Yeah, they help us.
D.H.: So, you are like a test run site?
K.B.: We have been tested on our check in area, baggage drop as one of the first in the world. Technology on the ramp where we use the belt loader.
K.H.: Baggage tracing.
K.B.: Baggage tracing was one instance where we told them that we had a good idea. So, we have two IT suppliers. One on the check-in IT and another in the sorting area, and we had them sitting by this table and told them: ''If we use this technology like so and so, we need less staff on the ramp''. Because now in every other airport, every handling agent is scanning the luggage, and now we do it automatically because we have ID in the tag. So, we have a scanner on the belt loader so we can load the luggage with less staff, and better quality. In all other airports, companies pay for that kind of service, and now they pay a little fee to us, so we do it cheaper, we do it smarter and we do it faster and with a better quality. That is the way we always try to think. If you look at the bag drop down here,

we were the first where the passenger had to do nothing. Just put the luggage on the belt and push a single button. All other airports need to scan a barcode and so on.
D.H.: But how do you do that? Shouldn't they have to scan their ticket? How do you match the bag to the person?
K.H.: RFID tags.
D.H.: But you still need to know who puts in on the belt?
K.H.: Yeah, but they will verify their names or their bags. That's the only thing the passengers need to do at the screening. So as long as you put the bags on the belt and the RFID tag is scanned, all the passenger needs to do is to verify that this is their bag
D.H.: Wow, that's amazing. And you were the world's first to do this?
K.B.: Yeah.
D.H.: That's very impressive. Why don't they copy?
K.B.: They are copying us now.
D.H.: I think it is quite a genuinely great business model that you are a small airport so you don't have a lot of sway with a lot of IT people because you are just not big enough, but that you are willing to be the guinea pig. So why don't other small airports do the same as you do?
K.B.: There have been many airports that have been flying into Aalborg Airport to see what we are doing. I think nearly all Swedish airports have been here and seen what we are doing, so a lot of airports are coming here to see what to do. And of course, in Denmark, Copenhagen airport has been here looking at our sorting area. And Billund has been here. Billund has been here to look at our new security flow. They want the same. And before this Corona, the supplier of the new security flow has asked for a conference to be held here to show our new security flow because it's so fast, and so smooth, and so easy for all the passengers.
D.H.: I heard it is similar in Amsterdam.
K.B.: Yeah, nearly, but we are doing it, if you ask us, a little bit smarter than Schiphol. If you look at the security flow in Schiphol it nearly looks the same, but if you look at how the flow is….when you come to Schiphol as a passenger, all passengers need to go into a security scanner to stay. In Aalborg we have the frame, so if there is no metal in the frame, you don't have to into the body scanner, so you have a better flow.
So, eighty percent of our passengers are not going into the body scanner, so you have a much better flow. So that is the way we are always thinking. When we have meetings we ask: ''Is this good for the staff?'' or ''Is this good for the passenger?'' We nearly always look into these things. If it is good for the passenger then we have to do it. We need the passengers in order to earn money.
D.H.: Who do you consider your customer to be?
K.B.: The passengers. There is another way to look at it. If you go to Billund or other airports and ask: ''Who are your customers?'', they would say: ''The airlines.'' The airlines are a partner, but the passenger is our customer. It is your customer, but it is also our customer.
D.H.: And when it comes to finances, I read some reports and they all say that you need passenger revenue, so non-aeronautical revenue, to generate a profit. Is it also true for Aalborg Airport that you need people to spend money in the duty free for you to be able to turn a profit?
K.B.: It is a part of our…
K.H.: So, our new strategy to gain…
K.B.: We need to earn more money on the non-aviation part.
K.H.: Yeah, but years ago we were only handling the aircraft on the apron and not the non-aviation part. It is only the check in, the security and the ground handling and the fuel.

We didn't have any employees at the food or duty free at that moment or some years ago, but a new strategy was-
K.B.: To overtake this because if we want to have low cost for the airlines we have to earn money on non-aviation, which is why we told the people who are running our duty free and food and beverage that we will take over, because we need to earn money for salaries and rent and so on.
K.B.: If you go back twenty years and look at this airport, we had the highest fee for passengers and the airlines. Now we have the lowest fee in Denmark because we haven't increased the fees in twenty years.
K.H.: The fee has been the same. It has not been touched the entire time.
D.H.: But your costs have risen?
K.B.: Yes.
K.H.: Yes, and that is why we have been insourcing those things.
D.H.: Do you own Aalborg Food? The catering part fully so it is all integrated, and it is not a different company?
K.B.: Yes. We do everything ourselves.
K.H.: But for some airlines we only cater, but they will be delivered by Gate Gourmet [rival airside food catering company ed.], because they have worldwide contracts.
D.H.: Like IFS?
K.B.: Yeah.
K.H.: But the rest we have insourced.
D.H.: Is there formal innovation management? Like when I finish my education, I am going to be an innovation manager as a title, or I could be..
K.B.: No, it is only me and Kirstine. *chuckles*
D.H.: Just the two of you? *chuckles*
K.B.: Due to the fact that we are the type of airport that owns and oversees our own security, our own food and beverage area, our own handling, our own parking area and so forth... And every leader of these departments gathers around this table every week, where we talk about how to do better. Not only how to improve in terms of security, but how to improve the airport as a whole. If the security manager says: ''If we do so and so, things could be better'', then Kirstine says: ''Then perhaps we can help you''. It is a collaborative effort. It is a type of culture of helping each other to do better for the sake of the passengers.
K.H.: The main key is the passengers in every thought and action.
K.B.: That is why we are award winning. *chuckles*
K.H.: The main focus is also how to do better every day and…
K.B.: Doing it smarter, doing it easier.
D.H.: So, if there is an innovation in one area of the airport. Let's say in the food area. Who is the responsible person for that to go through and go smoothly, and that the innovation is implemented as it was meant to be?
K.B.: We'll have this meeting for the operational part, and we have a meeting with Søren and his team of leaders where we discuss how to do better. So, I have all the information about what takes place at the airport, and I bring it into the operational part.
D.H.: And if there is a mistake and something goes wrong, who is responsible?
K.B.: Me, I guess.
K.H.: On the aviation it would be Kim and on the non-aviation side it will be the head of that department or Søren.
K.B.: But if we make some changes in the duty free area, then they come to me and say: ''We will need to make some changes'' and inquire about how to do it, so it is always interconnected.

D.H.: How do you decide what to innovate and when to innovate? For example, there is this table meeting, the weekly meeting, and there are like ten ideas. How do you decide which one to go with?
K.B.: We ask: ‘’Is this good for the passenger?’’
D.H.: In this case all of them are good for the passenger, but you have limited resources. How do you decide which one to go with, because you only have one budget?
K.H.: I think it depends on how big the budget is. On small budgets, the head of the department could make the arrangements by him or herself.
K.B.: We talked before regarding the tracking and that was quite expensive. We used nearly two million Danish kroner. But when we make the decision here that it could be a good idea, I present it to our CEO, and if he approves of it, then we go for it.
D.H.: Are you benefitting from having a smaller hierarchy? Because I think Søren is quite close to you both physically and in terms of hierarchical structure. Does that benefit your innovation that someone can tell you an idea and then you tell Søren?
K.B.: Yes.
D.H.: Let’s say you have two ideas. You have the RFID and you also have a, let’s say a completely new way to guide down airplanes, but you only have the budget for one. Who decides which one and how do you decide?
K.B.: I will. It depends on the need, and of course the price, how it can aid us. Then we will have the discussion: ‘’If we do that, then we can do this and this’’.
D.H.: So, you do a cost-benefit analysis?
K.B.: Yeah, you could say that.
K.H.: It also depends on what the needs are and what are the future choices.
K.B.: We don’t sit down and do a SWOT-analysis. We are quite fast at making the decisions.
D.H.: How do you get your ideas? Can anybody in the organisation propose an innovation, no matter how big or small the idea is?
K.H.: Yeah. The airport has also made some arrangements for all the employees. We have been arranging some meetings where all the employees were informed about which direction the airport was going in, and the employee was able to put some sticky notes on a piece of paper and in these different areas of the airport about what sort of ideas they have.
K.B.: After that we put them in smaller groups. In every company you have people with an abundance of ideas. We put them together and told them that we wanted all their ideas, and they should write them down. And then we said: ‘’All these ideas are for the operation’’ and then we considered: ‘’Is this a good idea, or is it not a good idea?’’ and all the employees could see our responses to their ideas. So, everybody employed at Aalborg Airport can present their ideas and have it subjected to discussion, and those ideas will be discussed during our meetings.
D.H.: Okay, so it is quite an open sourcing way?
K.B.: Yeah.
K.H.: Yeah, absolutely.
D.H.: Do you get ideas from outside?
K.B.: Yeah, yeah.
D.H.: How about that IT thing... Did you approach the IT companies?
K.B.: No, we have our own IT company.
D.H.: No, no I mean, when you had that RFID. So, did you approach them to be a guinea pig?
K.B.: Yeah.
D.H.: So, the RFID was actually an idea coming from Aalborg Airport and then spreading to the world?

K.B.: Not exactly…
K.H.: The barcode was not invented here. But the main process, where we don't have to scan every single baggage and only need to put on some sensors on the belt, that was something that came from us. [Kim] invited the two companies and asked them: "What about this idea? I think you can earn some money from this! And we would like to be your guinea pig."
D.H.: That is amazing! I did not know that this has originated from here. Very impressive. When you think about innovation - you already mentioned that you are thinking about passengers as your customers... When you are trying to choose between innovative ideas, do you tend to go more for efficiency or for generating more business in general? Because of course, if you are selling something, you can either earn more money by being better at producing it cheaper or by selling more units.
K.B.: Yes, but we are not a product company.
D.H.: No, but you do sell services.
K.B.: Yes, that is right.
K.H.: It depends on the opportunities. We cannot make an aircraft fly here, it depends on the airlines. It is their decision to fly to Málaga. But we try to do everything we can to make sure that they fly to Málaga and that they can do that any weekday, but in the end, it is not our decision. At the same time, in that case, if we have one aircraft departing at 6 AM, a second one at 7 AM and a third one at 8 AM, we are happy. But it is not up to us to make the decision as to what time the departures should be. But we would like to get some staff to handle each aircraft, spreading the work out. But we can't decide, and we will not make any sort of restriction about it.
D.H.: That is understandable, but that is also not where your money comes from, it is duty free.
K.H.: Yes.
K.B.: The thing is, you only get money from duty-free if you have routes that have passengers.
D.H.: That is true. But you can also earn money by having innovation ideas that increase the efficiency of selling goods. I can personally attest that every London airport makes you go through a veeeery long route.
K.B.: Exactly, that is why when we remodelled the terminal the last time around, we created a walk-through duty free. That is something we certainly looked into. We increased the sales by 20% and 80% come from women.
D.H.: 80% come from women? *chuckles* That makes sense, since you have a great selection of perfumes and skin care and makeup...
K.B.: *laughs* Yes-yes.
D.H.: You do not have that big selection for men. Cigarettes and booze?
Laughter from all parties
D.H.: If you had two opposing ideas - one would increase your sales by 20%, but the other would increase 20% of turnarounds - which would be more interesting if you do not know success rates in advance?
K.H.: That would very much depend on different factors.
D.H.: So, there is no one single focus for you.
K.B.: No. There could be a lot of ways where we can earn more money if we would want to. We could take money for parking, but we do not.
D.H.: But why don't you?
K.B.: Because we know that if we have to move passengers from Jutland up to us in the north, we have to do it for free. So, if we take money for parking, they will fly out of Billund,

because they will not have an incentive to drive up here. If you are living in the Aarhus area, you have the nearly same distance to Aalborg as to Billund.
D.H.: What about Aarhus Airport?
K.B.: They are significantly smaller than the two of us. That is why that in our marketing budget, we used nearly 70% from Randers and to the south, because we know that the people who live in our area are using Aalborg Airport. And we know that we can move the passengers from the south if we tell them about free parking.
D.H.: And was the marketing successful?
K.B.: Yes, we have done the analysis. "Do the passengers know about free parking in Aalborg?" And we can see after each campaign, how many know now that there is free parking. That is why we are moving the passengers from the south. If you look at the Málaga route, we have had up to 7 weekly departures. We have been the biggest operator in Jutland to Málaga. Why? Because a lot of Danes have houses and apartments in Málaga, and if we are in Málaga for 3 weeks and you fly out of Billund and have to pay for parking for all three weeks... You will prefer to drive up to Aalborg for the free parking and fly to Málaga out of Aalborg.
D.H.: That does make a lot of sense. But if you were to charge as much as Billund... Of course now you get more people that fly out, but have you done the analysis that if you decided to charge the same as Billund, and naturally, would lose passengers, but you would also get revenue from parking. Have you done this analysis to see which is the more lucrative business model?
K.B.: I think you are right that we would probably earn more if we started charging for parking. Maybe we would drop from the 1,5 million passengers a year down to 1,2 million, but we would earn a lot of money from the parking fees. Our owner, however, is interested that we increase the amount of passengers and that we make a better infrastructure that are living in our area. So that is the whole idea with the airport and our strategy.
D.H.: Okay, so then it becomes important that you are not a private airport, because you want to provide a service to the area.
K.B.: Yes.
K.H.: We fought for the entire network in Aalborg and whole Northern Jutland.
D.H.: Do you have any specific tools to evaluate if some innovation has been beneficial or not? Let's say you could easily do a cost-benefit analysis on your parking - do I earn more money by charging people or do I earn more money by attracting more people? If you have something like the RFID, that is a bit harder to gauge, do you have anything to see if it was actually beneficial to you?
K.H.: A specific tool?
D.H.: Yes.
K.B.: No, not really. It is influenced by politics. Our owner would say that we do not want to earn that money from parking, because it is more important for us that the airport has the possibility to grow. If we have to increase the passenger numbers, we need the passengers to come from the south.
D.H.: But I meant not just about infrastructure. An example is your security flow. Let's say that it wouldn't be a success. There was a mistake and it is not as functional. Do you measure - okay, how much did this flow increase our security? Do you measure it against expectations? Do you consolidate in the end? Or do you just accept the product and rest assured that you did your best?
K.B.: We know that with the old security, how many passengers we could take per hour. We had simulated the new flow on the computer on how many we can. We can process 214. We decided that okay, we will do that and if we build four flows, we will have so many. We said to ourselves, that we should build number four, because in our mind we are always

on the way to grow further. Now we built the number four flow, because it makes sense if we have this mindset that to want to grow, so we are ready. Other airports only start to build up when they have the problem, and it is a bottleneck. So, we try to be one step ahead all the time. “Okay, where are we going?” For nearly ten years ago, Søren, Rikke and me went to a company in Aalborg and we made a decision that we don’t tell anybody what we want, we make 3 possibilities - if nothing happens, if everything goes wrong if everything goes right. We said that we want to take this - and we don’t tell everybody. I have a report in my closet... Our mindset is always about growth, growth, growth! I can remember when we picked this hangar for our next project... Before we started up with this, we took a half year and when I came back from one of these meetings and I turned around the hangar because if one day we have to build out - and we will have to because of growth - I changed it. Now I can build it further. It is in our mindset.
K.H.: The mindset is layered - passengers is one of them. Depending on which layer you are in the airport, the structure, you have several points of view.
K.B.: Can you see the hangar for the planes? We started to build this hangar because we wanted this airport to be a base airport. Before we finished up the hangar, there was already a company called Great Dane headquartered at Aalborg Airport who needed the hangar.
D.H.: Exactly.
K.B.: So, it is about always thinking about growth.
K.H.: There is no specific tool for it. It is only a mindset.
D.H.: You know that this is very impressive. But what if you have built a hangar but there is no Great Dane? What would you have done then?
K.B.: Try to get someone else, because now we have the facility. We cannot tell a company - “Hey, come here to fly” - “Okay, but you have no facilities”. What comes first? If we always try to move further along, we have to prepare. It could mean staffing, building and so on.
D.H.: Does it matter a lot for airlines? I know from Great Dane that we are not going to Málaga Airport because it is great. We plan on going there because our passengers want to go there. Does it make any sense not to concentrate heavily on innovation as an Airport and just do the bare minimum, do incremental innovations, because people want to fly out anyway? Why innovate when you already have a very steady demand, why work hard for it? You do not need to convince people to fly - they most likely need to do it anyway, there is no alternative for locals. Why do you decide to innovate when there is already a demand for you and they would choose to fly out of Aalborg anyway?
K.B.: If we wouldn’t have built a hangar, they would have built it in Aarhus, and they would have provided the infrastructure for a new base company. A company would consider that Aarhus Airport has a hangar and a hotel - everything needed. We are sure that people who want to fly to Málaga would drive to Aarhus.
K.H.: I think that the main key is perhaps is that we secure infrastructure for the communities.
K.B.: That is one of the reasons the train is here.
D.H.: I am hoping that is it going to arrive soon, I would also use it to come to work.
K.B.: But Aalborg Airport is responsible for the new train connection.
D.H.: But you are also owned by the surrounding municipalities…
K.B.: That is the same for Aarhus and Billund. It is the same owner structure.
D.H.: So other than half of Copenhagen that is private, everything else is owned by the surrounding municipalities?
K.B.: Yes.
D.H.: Why does not Billund do the same with convincing the municipalities to invest in a railway connection? They also have the train going from Vejle.

K.B.: That is right. They are trying, but we are the ones who got it.
D.H.: Why are you so much better than Billund?
K.B.: Billund is good too, but if you look at the main railway, it is quite near to the airport in Aalborg, so it was easy to make a line directly to the terminal. But to make a completely new line from Vejle to Billund is quite difficult to do.
K.H.: It was the lowest cost in Aalborg.
K.B.: They need people lobbying for them.
D.H.: Okay, let me look at my questions. We will skip the ones that already got answered. Are you concerned with other airports copying your innovations? For example, Aarhus?
K.B.: Yes, they will always do that. They have been here quite a lot of times, last time was quite recently. We told them that we do not have the time to show you around. It is always a risk, but then you only have to innovate again.
D.H.: But you do show them around?
K.B.: Yes.
K.H.: Sometimes.
D.H.: Do you give tours to non-Danish airports?
K.B.: Yes.
K.H.: Quite a lot.
K.B.: We are quite open to airports that are non-competing with us. That is why a lot of our…
K.H.: Some airlines are also saying to other airports: "I think that you should go and pay a visit to Aalborg Airport!", "Try to go to Aalborg Airport and see how they are doing it!". Some airports are rebuilding the airport and the airlines recommend them to visit us to gain ideas. The airlines also say that they consider us a very innovative airport.
D.H.: In innovation studies, there is a theory about open innovation. If you want a good example, Procter Gamble. They do not innovate themselves; they buy. Other companies come up with ideas and they purchase it. Other companies, like Coca-Cola, they are very secretive, they build on trade secrets. Would you classify yourself as an open innovator?
K.B.: Yes, we share our innovations with almost anybody.
D.H.: Do you visit other airports yourselves?
K.B.: If we should innovate and we need some company to help us, because we cannot pay for it, so then we will go to them to ask them for help. After, they will have a product to sell, and that is the appeal to it, however, we will be the first mover. And then we will be a step ahead.
D.H.: Would it make sense for you to collaborate with other airports that are not that close to you, but close enough in a cultural sense?
K.B.: At the moment we are helping the airport they are building in Greenland. I have been there many times and we have told them to do try doing this or that. Equipment and such... We help them for free. When we do that, I hope that one day they will say - "We have to fly to Aalborg! Because we have good cooperation with Aalborg, and that is better than to fly to Aarhus!"
D.H.: With the RFID chip it would also make sense that the more airports have it, it is easier for you to integrate your IT system and one bag could go through the entire world with one tag.
K.B.: Do you know Delta? [Major American airline - ed.]
D.H.: Yes.
K.B.: Them and KLM are in the process of implementing the chips.
D.H.:RFID should be the future also speeding up shopping, such as the Amazon instant pay stores.
K.B.: Exactly.

K.H.: You can see on the webpage, that as soon as they had a little bit of money, they changed it to a carbon copy of our homepage.
D.H.: Do you visit others?
K.B.: When I am travelling, I am always working! *giggles* My wife keeps telling me: "Kim, come on already!" And then I am going to this PTE every year. It stands for Passenger Terminal Expo. There are a lot of speakers... If you want to know about rescue, if you want to know about bag drop or tarmac, you can go to this expo. All other airports are talking about that, then you can go into a different conference room and listen to something else... I am there every year, because to be inspired and to find something you can use and rebuild... Of course, you need to have some ideas from the outside to say: "Yeah, that could be it, yeah." You can use this little part, but if you take this part, it could be much better and fit into our airport.
D.H.: Is it only you who goes?
K.B.: No, me and our marketing director and last year we also had our IT manager, because IT is more and more important.
D.H.: The more you move towards innovation, the more IT it gets.
K.B.: We have started in my leader group in Operations... We have gone to see Dublin last year. It was part of the plan that every year we take a trip where we can go out and see how Ryanair was operating an airport. The budget right now is quite low, so it will not be this year that we go out again... If we didn't have this CoVid-19, we would be out again, the whole group.
D.H.: I see. How does CoVid-19 affect you, innovation wise?
K.B.: Everything is stopped now, but still... Right now, Kirstine and I have talked about that we have to start up next week with a meeting where we can talk about how can we do better with less staff. To make operation as cheap as possible. Budget is low and where can we help each other and where can we do better with less staff and much lower budget. So that is innovation in another way.
K.H.: But we still have to do the same work. It still needs to be safe and up to standard.
D.H.: Have you thought about diversifying? As you insourced a lot of departments, like food and beverages…
K.B.: I think there is still a possibility for us to go another way. We have a company that is taking care of cleaning outside the terminal and so on. We are not talking about it now, but I am thinking that I might insource this part to keep our stuff in the company, so we will take over where we can, so we can keep our employees. Because when we raise efficiency, we can go another way again.
D.H.: Is that a pattern, that you increase efficiency and then you diversify to keep people?
K.B.: Yeah, yeah.
D.H.: Does that come from management or does that come from you being a non-profit organization that it is important that your staff continues to be employed, because it is important to the surrounding municipalities that you provide job opportunities to the surrounding area?
K.B.: You can say that, but we are still a company and we still have to earn money. We get no money from the municipalities. We have to earn our own money…
D.H.: Do they take any of your profit?
K.B.: No, we can keep what we earn. We cannot receive new money though.
D.H.: I see. What is your end goal in 5-10 years? Where would you like to be in terms for, for example, passenger numbers?
K.B.: You can see it on the board there. Little bit above 2 million. I can send you our presentation.
D.H.: Thank you, that sounds lovely.

K.B.: You are welcome. I am also gifting you this book about the history of Aalborg Airport.
D.H.: Thank you very much, that is so generous of you. What about the parking spaces? You have mentioned earlier that you plan on expanding it. How many more spaces do you plan to build?
K.B.: 6500.
D.H.: That is a lot. What is your occupancy rate, when it is not under a global pandemic?
K.B.: It depends on the time of year, but if you look at the picture behind you from 4 years ago, you can see that every space was occupied in June.
K.H.: We have an employee in the parking area showing people to the free parking spaces.
D.H.: I like the system you have in place, where it shows how many places are still free. Why do you need an employee?
K.H.: Yeah, but many times there were no free spaces.
D.H.: Who gets more out of free parking? Is it people who go to Málaga for 3 weeks or more the business folk?
K.B.: Both, because if you are a businessman, you fly 3-4 times a week. It would add up. And if you have a flat in Málaga and you stay there for 3 weeks, it is also good for them.
K.H.: Or 3 months. We have some of the passengers calling the airport office, because there has been some writing in the newspaper about abandoned cars at the airport. They said: "We are staying in Málaga for the time being, please do not tow our vehicles, we are coming back!" They were away for several months.
D.H.: Yeah, this would not go to Billund for that. *chuckles*
K.H.: No. *chuckles*
K.B.: By the way, Kirstine will send you the presentation and you are free to put the information in your report and your school may also see it. If you have any further questions, please also direct everything to her. She knows everything that I do.
D.H.: Everything?
K.B.: Everything.
D.H.: But then you are redundant - you should not reveal that. *laughs*
K.B.: That is true. *laughs* But this allows me to have the time to innovate.
D.H.: That is a good point.
K.B.: Exactly, because if you are always working, you cannot spend time on innovation. If you are a little bit lazy, you are the right person for the job!
D.H.: But it is working lazy.
K.B.: Always do it the easy, the smart way! That is why men invented the wheel! When the wife said no, the man had to come up with something else.
D.H.: We talked a lot about innovation management. Is there a field where you think you are lacking?
K.H.: No! *giggles*
D.H.: In your strategy perhaps. For example, you are not getting supported by management or the employees are lazy and are unwilling to change their work habits. Or possibly in your actual strategy where you just feel that the airport could do better.
K.B.: Now?
D.H.: Yes.
K.B.: Yes, we need some planes out there.
D.H.: That is not your fault. I meant it is either organizational inertia...
K.B.: I can't see it. *giggles* Of course we can always do better. If money is not an issue. If I had all the money that I could want, there are many things that I would do differently.
D.H.: If you had one pet idea, what would it be? It does not matter what it costs, you married the daughter of Bill Gates and he will finance it for you. What is it?

K.B.: *chuckles* If I had all the money and I could spend it on anything. I don't have a specific idea on the top of my head right now, but it would definitely be geared towards the passengers. How can I make the airport better for the passengers. If I had to do one thing now, I would make a new road to the airport.
D.H.: You mean connecting it to the highway?
K.B.: Yes, I would speed up the connection as we have talke about it for a long time. If you come from the south part of Denmark to Aalborg Airport, this would be a way to increase accessibility.
K.H.: The infrastructure is very important.
K.B.: New ideas and new ways of doing things better is always important. It could be a new hangar, new free parking spaces.
D.H.: Are you afraid that there is a cap to your growth? To me, it seems that there is a natural cap.
K.B.: Of course, in Denmark there is a maximum. If I find my old strategy in the drawer about 10 years ago, and we pretend the pandemic did not happen, where would Aalborg be? A lot of people would be astonished from the amount of parking spots from 10 years ago to now. Now we have a big terminal, a hangar, but have we told anybody 10 years ago? They would have said we were crazy. We had a financial crisis in 2008, where we started up with new ideas. In my little book, I have a wish, that we want to be a hub.
D.H.: You could be a hub for the north.
K.B.: Yes, from Greenland and so on.
D.H.: Would it make more sense for Copenhagen to be that hub.
K.B.: Why?
K.H.: Not necessarily.
D.H.: Because it is a bigger, already existing hub.
K.B.: Yes, but we have the harbour for Greenland too. Right now, we want to be a hub.
D.H.: That is a dream. And is that the only way to grow further, because it does not matter much how much extra parking you offer, there is a limit on how many people are willing to drive up from the German border.
K.B.: Norwegian...
D.H.: You mean the airline or the people?
K.B.: The airline. We have seen flying from Copenhagen to Aalborg to Málaga. One departure we had almost 50% of passengers coming from Copenhagen to Aalborg and continue on to Málaga, because the connection was good, the price was low, the day was the good fit. This is the first little step to be a hub.
K.H.: It is the same for Amsterdam and the Faroe Islands.
K.B.: We have seen that last summer. We will start out as a little hub. Ten years ago we wrote down that we want to be a hub. It is not true for us yet, but we are on the right track for it to become reality.
D.H.: It does not come overnight. Your facilities make more sense now, if you want to end up being a hub, you need to build the facilities first. And even if Great Dane does not come, others might, just to establish a hub, even if not a home base, but a second or third hub. Rather visionary. Have you ever thought of using an airport management companies? Those that manage multiple airports. It would not be you, Kim, it would not be Aalborg Airport management but a bigger entity. Have you ever thought of joining one, being sort of taken over? Efficiency is very high, because everything is done on economies of scale.
K.B.: Someone that would take over the airport?
D.H.: Yes, the management. It is very popular with bigger airports.
K.B.: I would not feel comfortable about that.

K.H.: I think the most keyword here is to be taking care of the passenger, and this would remove our ability to customize the service our passengers receive all the way from the car to the aircraft.
K.B.: We take care of the passenger when they sit in the car til they are in the air. It is our responsibility.
K.H.: Some issues we have with the larger companies is that we are just a small part of them and it takes quite the amount of work to make small changes that would make it more comfortable for the passengers. As long as we have our own management at the airport, we can make those small arrangements. We have also tried working with companies where our IT department is also guiding some of the people there.
K.B.: Now we would be ready... Of course, we do not really have the number of flights right now to Schiphol by KLM, but Aalborg Airport used 3 years to convince KLM to do a bag drop.
K.H.: Our RFID has a major impact on that. But still, it has taken 3 years.
K.B.: When a little airport such as AAL and you look at AAL and their route network... We tell them: “Hey! We have a good idea! Listen!”
D.H.: You are a small fish in the big sea.
K.B.: And then we receive the call: ”We want to pay for this, if we could start up with this soon..”
D.H.: Do you charge them for the bag drop?
K.B.: No, it is for free, you work for Great Dane.
D.H.: Yeah, but I am not in finance. *laughs* I spend Great Dane money, not account for it. *giggles*
K.B. & K.H.: *laughs*
D.H.: I have reached the end of my questions. Thank you very much for your time, it is much appreciated. If you have anything to add, please feel free to say so or e-mail me.
K.B.: I think we have covered the topic.
K.H.: Yes, I think we have exhausted it.
D.H.: Thank you again.

APPENDIX B

Figure 10 Correlation matrix for all considered variables

Correlations

		PAX	TOURINF	PARK	POPUL	PPP	GDP	DIST	ALTN	CAPITAL	HUB	LANG
PAX	Pearson Correlation	1	-,414**	0.090	0.048	-,656**	,451**	-,676**	0.011	,690**	,690**	,505**
	Sig. (2-tailed)		0.003	0.533	0.741	0.000	0.001	0.000	0.939	0.000	0.000	0.000
TOURINF	Pearson Correlation	-,414**	1	0.142	,694**	,652**	-0.099	,732**	-0.207	-,607**	-,607**	-,537**
	Sig. (2-tailed)	0.003		0.325	0.000	0.000	0.494	0.000	0.150	0.000	0.000	0.000
PARK	Pearson Correlation	0.090	0.142	1	-0.009	0.094	0.128	0.000	0.000	0.000	0.000	0.000
	Sig. (2-tailed)	0.533	0.325		0.952	0.518	0.378	1.000	1.000	1.000	1.000	1.000
POPUL	Pearson Correlation	0.048	,694**	-0.009	1	0.120	,530**	0.208	0.236	-0.002	-0.002	-,296*
	Sig. (2-tailed)	0.741	0.000	0.952		0.407	0.000	0.146	0.099	0.989	0.989	0.037
PPP	Pearson Correlation	-,656**	,652**	0.094	0.120	1	-,588**	,963**	-,518**	-,947**	-,947**	-,854**
	Sig. (2-tailed)	0.000	0.000	0.518	0.407		0.000	0.000	0.000	0.000	0.000	0.000
GDP	Pearson Correlation	,451**	-0.099	0.128	,530**	-,588**	1	-,627**	,813**	,771**	,771**	0.180
	Sig. (2-tailed)	0.001	0.494	0.378	0.000	0.000		0.000	0.000	0.000	0.000	0.210
DIST	Pearson Correlation	-,676**	,732**	0.000	0.208	,963**	-,627**	1	-,578**	-,977**	-,977**	-,747**
	Sig. (2-tailed)	0.000	0.000	1.000	0.146	0.000	0.000		0.000	0.000	0.000	0.000
ALTN	Pearson Correlation	0.011	-0.207	0.000	0.236	-,518**	,813**	-,578**	1	,667**	,667**	0.167
	Sig. (2-tailed)	0.939	0.150	1.000	0.099	0.000	0.000	0.000		0.000	0.000	0.247
CAPITAL	Pearson Correlation	,690**	-,607**	0.000	-0.002	-,947**	,771**	-,977**	,667**	1	1,000**	,667**
	Sig. (2-tailed)	0.000	0.000	1.000	0.989	0.000	0.000	0.000	0.000		0.000	0.000
HUB	Pearson Correlation	,690**	-,607**	0.000	-0.002	-,947**	,771**	-,977**	,667**	1,000**	1	,667**
	Sig. (2-tailed)	0.000	0.000	1.000	0.989	0.000	0.000	0.000	0.000	0.000		0.000
LANG	Pearson Correlation	,505**	-,537**	0.000	-,296*	-,854**	0.180	-,747**	0.167	,667**	,667**	1
	Sig. (2-tailed)	0.000	0.000	1.000	0.037	0.000	0.210	0.000	0.247	0.000	0.000	

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

APPENDIX C

All figures and tables were created by the author based on the regression detailed in this thesis.

Figure 11 Normal P-P Plot pf regression standardized residual

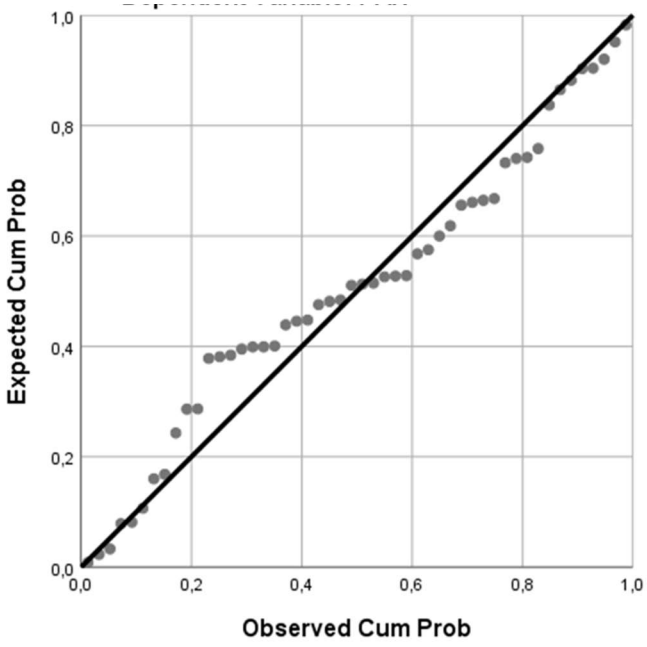

Figure 12 Histogram of regression standardized residual and frequency

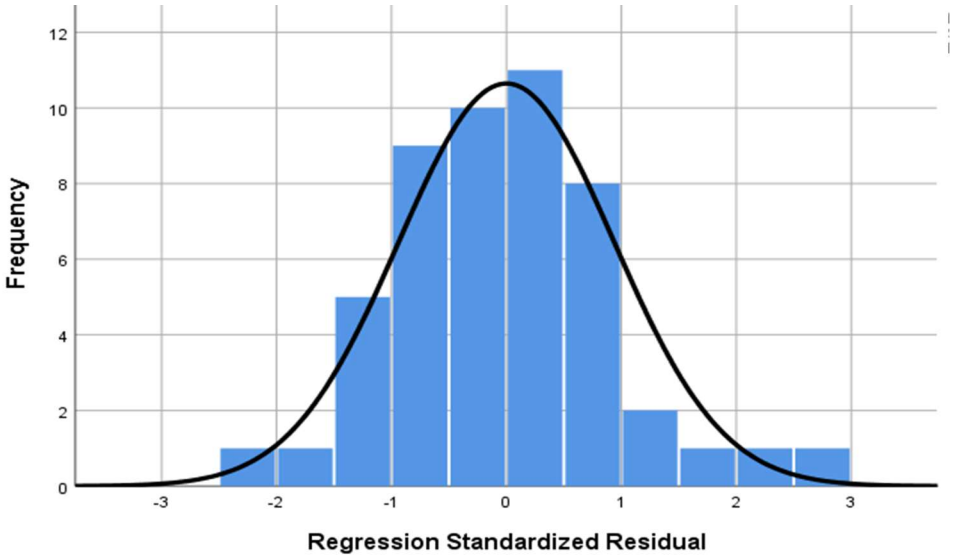

Table 13 Residual statistics

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-1.2168053388	1.7632269859	-0.000000000000001	0.8232240506	50
Residual	-1.7111632823	0.8472936153	0.000000000000000	0.5677166216	50
Std. Predicted Value	-1.478	2.142	0.000	1.000	50
Std. Residual	-2.856	1.414	0.000	0.948	50

Figure 13 Standardized residual and predicated value scatter plot

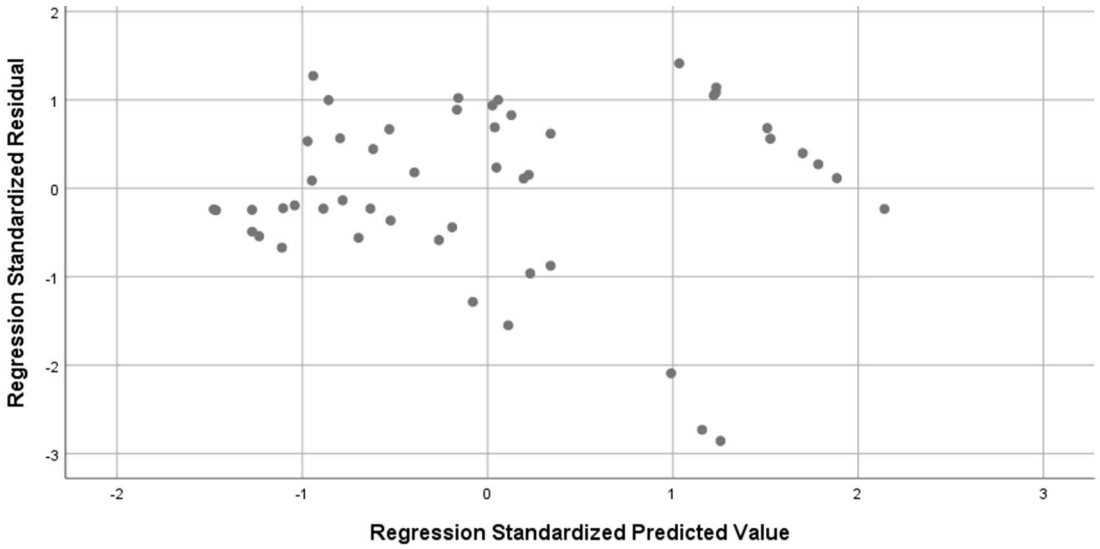

Figure 14 Linearity matrix