

Expanding Airport Capacity under Constraints in Large Urban Areas: The German Experience

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1. INTRODUCTION

Expanding airports is a topic which can easily make it to the first page of the national press. But this is highly unlikely as “bad news” is “good news” and most often failures and scandals make it to the front page. Berlin airport or the on-going failure to open up a nearly-complete new airport has been the front runner in this regard and gained so much international attention that the association of engineers fears that the world wide renowned reputation of German engineering might be seriously damaged.

Adding airport capacity is also a topic which goes beyond technical aspects. After all, at some time, in the short or long run, the airport Berlin Brandenburg „Willy Brandt“ will be in operation, but it will then be the economist to ask at what price. This will be difficult to assess not only for Berlin, but also for other major airport infrastructure projects of which some were actually built and some not. Fraport opened its new runway on 21 October 2011. In contrast, Munich Airport’s plan to build a third runway was voted down by a referendum on June 17 2012. Düsseldorf has two runways, but is only allowed to operate at single runway capacity due to environmental restrictions. In the 90’s, the city state of Hamburg resisted the proposal of the Chamber of Commerce to shift all charter traffic to Hannover airport and instead has expanded airport capacity at the inner city airport in Fuhlsbüttel. Plans for a central Northern German Airport never materialised.

In this paper I like to address the following questions:

1. How have German airports extended capacity? Has capacity been expanded on an optimal scale and time?
2. What are the key problems of airport investment?
3. How have investment decision been assessed? By what methods?
4. What are the strength and weaknesses of the German decision process?
5. What can be learned?

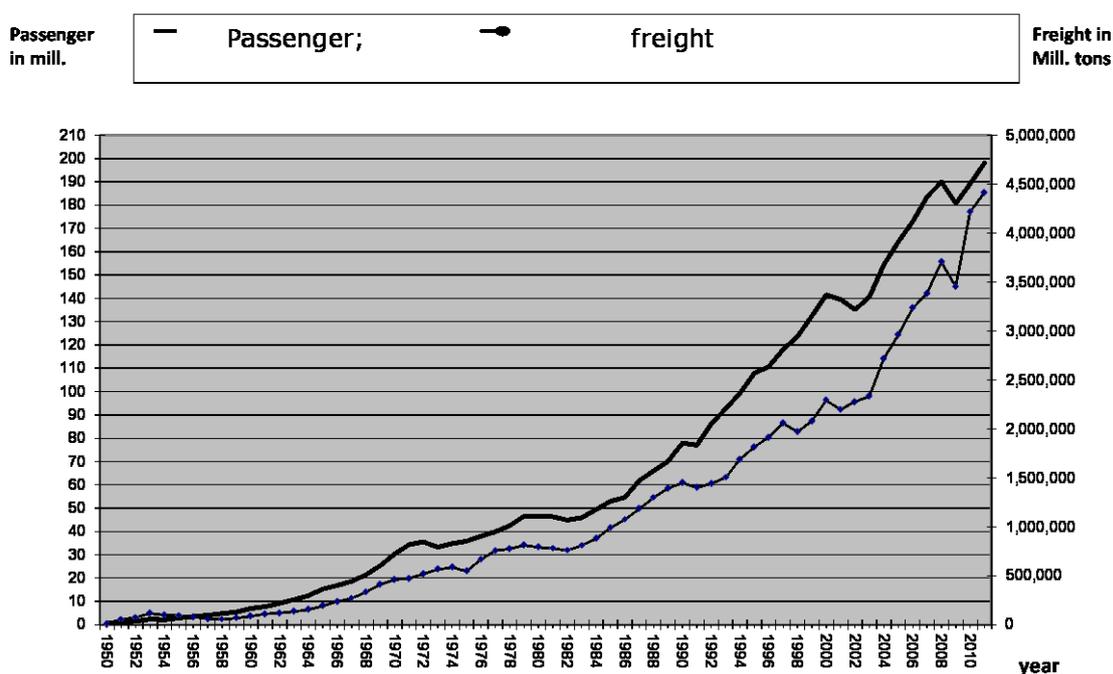
This paper draws together the available evidence and literature. Unfortunately, due to data problems and lack of vigorous studies, it is only possible to shed some light on these problems.

The paper is organized as follows: Chapter II and III describe and analyse how German airports have extended capacity by providing a historical overview and by presenting some case studies. Chapter IV analyses theoretically the major problems of airport investment. This gives some guidance to analyse how investment decisions have been assessed in public planning processes, which will be outlined in chapter IV. Chapter V analyses further strength and weaknesses of these public planning processes. Thereafter, the results are summarized

2. INVESTMENT OF GERMAN AIRPORTS – OVERVIEW

The map of Germany is full of airports and airfields. This is also the result of the Second World War and the cold war. After the war German airports were rebuilt. Typically, runways were extended to handle turbo prop and later on, in the early sixties, the new generation of jet aircraft. Air traffic grew steadily (see fig.1). In the early 60's a number of German federal states and municipalities discussed plans to close down existing airports and built new larger airports for intercontinental flights instead. It is worthwhile to recall that even at that time such plans were blocked by opponents that would have been negatively affected. Noise and in particular the noise of the first jet generation was feared by rural farmers and lead to strong protests which were so effective that, for example, the conservative government of Baden-Wurtemberg decided against building a new airport in Stuttgart in 1973. Frankfurt, Munich and Zurich Airport were seen as sufficient to absorb the local demand for intercontinental traffic of the Stuttgart region (Lang, 1969, Bischoff, 1973).

In the seventies and eighties utilization of capacity at German airports increased, but unevenly and capacity became scarce only at a few airports. In 1965, Frankfurt airport started to apply for public approval for a new runway west. This process turned into long-lasting political protests and lead to concerns in the eighties and nineties that airport extension was nearly impossible to achieve or only at substantial cost and time (see below). These concerns were also fuelled by the failure to extend Düsseldorf airport. The airport applied for approval of a second parallel runway in 1969. 14 years later, in 1983, the runway was finally approved and another ten years later, in 1993, the construction was finished, but the use of the two runways was limited to the capacity of one runway (see below).

Figure 1. **Passenger and freight of German airports**

Source: Arbeitsgemeinschaft Deutscher Verkehrsflughäfen

Given these problems, the allocation of scarce resource became a topic in the nineties after the liberalization of intra-EU air traffic and forecasts of capacity crises. In the nineties, the widely shared view was that a further expansion of Frankfurt airport and Düsseldorf was impossible and that - given the long planning processes of Munich airport - capacity would become increasingly scarce because a distribution of traffic to other airports and other transport modes was seen as difficult (Knieps 1990). It came, therefore, as a surprise that Frankfurt attempted to build a new runway in 1997 and even more that it succeeded in 2011. Even with new capacity, the allocation of capacity remains a problem currently and in the future. Düsseldorf is full at most times of the day, and the new Munich airport which began operating in spring 1992, and has since become the second hub of Lufthansa, has grown faster than originally forecasted (see below). In the future, demand might reach capacity limits at Munich airport as a further expansion has been ruled out by local politics following the referendum in 2012

The allocation of scarce airport capacity to users (=airlines) will remain an issue in the future. Up to now, scarce capacity has been allocated by the EU slot allocation rules which keeps down congestion more effectively than queuing, but creates nevertheless welfare losses (Forsyth and Niemeier, 2012). Unlike the UK, secondary trading has not been (officially) practised at German airports. The number of coordinated movements had been increased even at Frankfurt - and here even before new runway has been opened. Peak and congestion pricing has never been practised by airports with scarce

capacity that is Frankfurt and Düsseldorf¹ with excess demand for all day and Tegel, Munic and Stuttgart for excess peak demand (Niemeier, 2004).

In the post-1990 years, the growth of decentralised charter traffic and later Low Cost Carriers has led to an increased interest in small regional airports. Municipalities saw this as an opportunity for their regions and have entered the market for airports with commercial flights. From 1995 onwards, ten airports have been opened up in Germany (see figure 2 below), but market entry has hardly reduced excess demand at busy airports as entry occurred in region with excess supply (Mueller-Rostin et al. 2010 and Niemeier, 2012) and as new markets were developed (LCC city trips etc.) rather than existing flights shifted from large to small airports. The newest and probably most contested market entry is the "new" regional airport of Kassel Calden which will open up 4 April 2013. The airport is located in North Hessen, a relatively structurally weak region which is already close to three regional airports (Paderborn/Lippstadt (88km), Dortmund (153km) and Erfurt (185km)) and also well connected by highway and high speed rail to the international airports of Frankfurt (1:38hrs by train) und Hannover (1:30 hrs by train). Critics among them, Lufthansa and neighbours, argue that the airport should not have been built in the first place and operations will only be feasible if subsidized. Building the airport is supposed to have cost 271 Mio € which is actually 40 per cent more than planned. The project is financially supported by EU funds and from the federal state of Hessen. The management plans to break even in 2018 (Schmidt, 2011; Bamberg, 2013). The extent and degree to which smaller German airports are subsidized is not clear, but remains an issue² in particular as the EU Commission has begun to investigate in whether the city of Lübeck has subsidized Infratil, Ryanair, Wizz Air and other airlines (EU COM, 2012).

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1. It should be noted that Düsseldorf airport has introduced digressive landing fees, i.e. small aircraft pay more (per weight unit) than larger aircraft, but not a fixed movement charge (Forsyth and Niemeier, 2008)
 2. For example, subsidies for airports are difficult to assess as - otherwise comparable - airports might be completely differently financed. If airport investments are financed by loans taken by the operator, cost of capital and interest rates will be transparently included in the profit-loss-account. If an airport which is financed this way does not generate enough revenues to pay for all costs - operating and capital - resulting losses usually have to be compensated by the owners / state - which is then often regarded as subsidies. In other cases, however, parts of the airport infrastructure are directly - from the start - being paid for by the owners / state and "handed over" to the airport operator for free. In this case, capital costs tend of course to be lower, which makes it easier for the airport operator to generate an annual surplus

Figure 2 **Market entry and exit of German airport from 1995 to 2012**



Source: Niemeier (2012)

The situation in Germany is in many respects similar to Europe. As Button and Reynolds-Feighan (1999) showed for Europe, there has been abundant capacity in areas with lack of demand and underinvestment in those with excess demand. This unbalance has persisted at least over the last twenty years. Scarce capacity could have been better priced and pricing could have been linked to investment. At busy airports, capacity has been slowly increased. Frankfurt (in 2011) and Munich (in 1992), as well as the airports of Amsterdam, Barcelona, Manchester, Madrid, Paris-Charles de Gaulle have built new runways eliminating excess demand. The same could happen in Berlin if the new airport was built in the right size. But some busy airports like Düsseldorf and Paris-Orly could not be expanded in the past and will most likely not be significantly expanded in future. Stuttgart and perhaps even Hamburg might grow into this situation in the long run and make efficient demand management necessary.

At non busy airports there is evidence for German airports and other EU airports to have wasted resources in building runways for intercontinental traffic. According to Martens (2009 and 2010) the investment was not profitable for at least about 74 of the 113 secondary³ airports with a runway length of more than 2700 meters. Almost 50 per cent of airports had no long distance flights at all in 2007. Compared to the European

3. The airports of Amsterdam, Frankfurt, London, Heathrow, Madrid, Munich, Paris Charles de Gaulle, Rome FCO, Vienna and Zurich are regarded as major hubs and thus excluded.

average, Germany has overbuilt capacity for this market segment on a similar scale. It has performed better than Spain, but worse than UK (see table 1 below). These scores might change if plans to build an intercontinental runway in Münster-Osnabrück is materialised. In the mid-90's Münster-Osnabrück airport (an airport with then less than 2 million passengers) applied for public approval to extend the runway from 2,170 m to 3,600 meters. Permission was granted in 2004, but the decision was opposed legally in the courts by neighbours and environmental groups who argued that the extension would damage a biotope. After more than five years, the administrative appeals tribunal in Munster eventually ruled against the extension because the public interest for intercontinental flights was doubtful and could not outweigh the environmental costs. In 2011, the parties agreed on a runway extension of 3,000 meter which could be realized without any damages to the biotope. Currently, the airport handles about 1 Mio passengers only which is half of what it had in the late nineties (Reichmuth et. al., 2011, Ries, 2012).

Table 1. **Profitability of Long haul runways at secondary European Airports 2007**

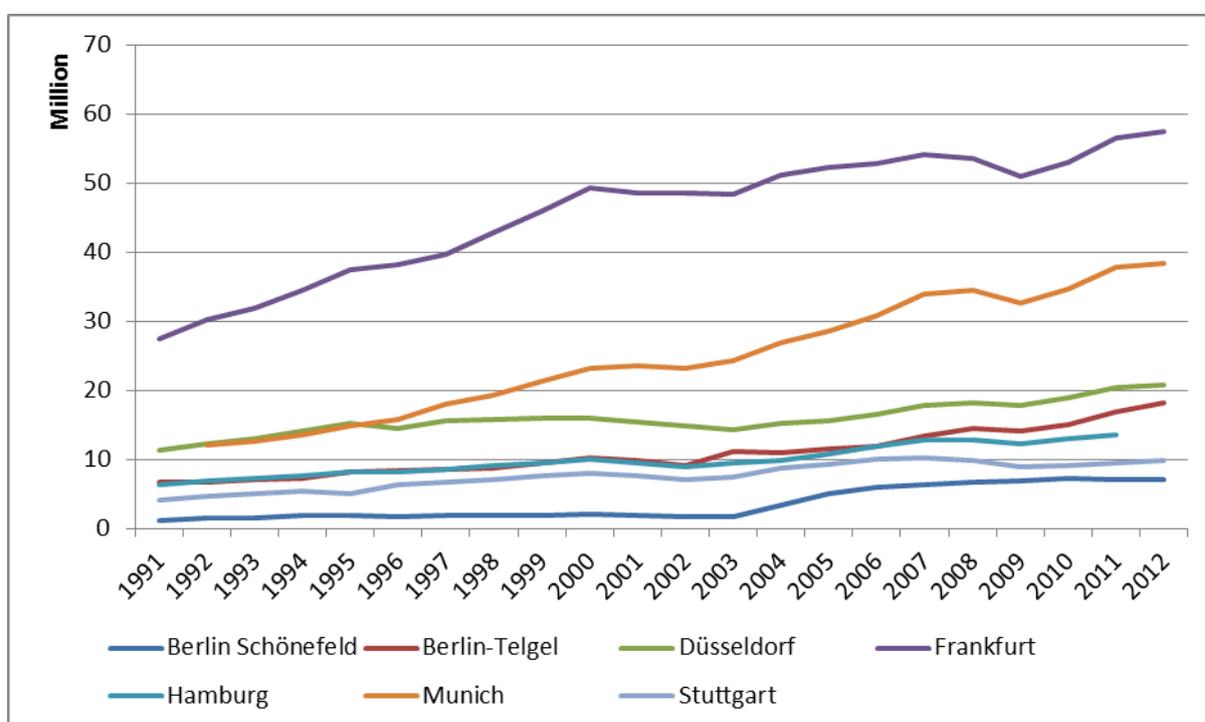
	Germany	Spain	UK	EU
Potentially profitable	30%	19	71.4%	26%
Unprofitable	50%	19	14.3%	27%
No long haul flights at all	20%	62	14.3%	48%
Number of Airports	10	16	7	113

Source: Based on Maertens (2009 and 2010)

3. CASE STUDIES OF CAPACITY EXPANSION AT SIX GERMAN AIRPORTS

In this section I will review in detail the capacity extension of the six largest German airports measured in terms of passenger throughput (see figure 3). The expansion of airports in Berlin, Düsseldorf, Frankfurt, Hamburg, Munich and Stuttgart has in common that in all cases expansion were heavily debated in politics and were contested in courts. After the analysis of these cases I attempt to draw some stylize facts about capacity expansion at German airports

Figure 3. **Passenger growth for large German airports from 1991 to 2012**



Source: Arbeitsgemeinschaft Deutscher Verkehrsflughäfen

3.1. Berlin Brandenburg International Airport "Willy Brandt"

After the German reunification, Berlin had three airports, namely Tegel and Tempelhof in former West Berlin and Schönefeld in East Berlin. Soon afterwards, the plans for a new hub Berlin Brandenburg International Airport (BBI) were started (Bickenbach et al., 2005, p. 71). This hub airport was planned to become the first private airport in Germany. In August 1992, the commission "Air transport of Brandenburg" presented the results of a study on the best location of a new hub. They recommended the area of Jüteborg Ost and Jüteborg West, but not the later chosen location of Schönefeld. A year later in July 1993, a mediation process was officially started to discuss with all

stakeholders alternative locations. Parallel to this, the public planning process started with spatial planning on larger scale (Raumordnungsverfahren) followed by a more detailed approval procedure (Planfeststellungsverfahren). In November 1994, regional planning favored the location of Sperenberg, but again not Schönefeld. What happened then was a political decision by the minister of transport of the federal state. The investment bank Barclays de Zoete Wit which was supposed to privatize BBI recommended Schönefeld as Sperenberg would cause additional costs of 750 000 million €. The management of the Berlin airports did not support Schönefeld, but was overruled by the agreement between the Prime Minister of Brandenburg, the Mayor of Berlin and the federal Minister of Transport in June 1996 to build the new airport in Schönefeld. In September 1996 mediation was stopped as Berlin airports refused to cover the cost for the dialog with citizens. In December 1999 the more detailed planning for the extension of Schönefeld began. In June 2002, the two Länder Berlin and Brandenburg decided to close the airports of Tegel and Tempelhof and concentrate all traffic at BBI in Schönefeld. In August 2004 the planning approval was given. This was half a year later as planned so that the opening had to be postponed from 2007 to 2008 (ibid, p. 74). In August 2004 it was announced to start building in 2006 and to open BBI with the winter flight schedule of 2010. However, as is widely known this was not the last postponement (Janssen, 2013):

- On 14 June 2010 the opening had to be postponed from October 2011 to 3 June 2012.
- On 8 May 2012, the opening date was postponed again (due to technical problems with the fire safety and smoke exhaust systems) to 17 March 2013.
- In early September 2012 the opening date was postponed to 27 October 2013.
- On 6 January 2013, it was declared that BBI would be even further delayed, without given a definite new opening date.

The initial construction costs of 2.83 billion Euro could easily double. While the mismanagement with rising costs and postponements dominated the political discussion in the last year the environmental problems remain. Civil groups demand a stricter night curfew (10 pm to 6 am), oppose a future third runway and criticize the planned flight path (Aktionsbündnis ABB, 2013).

3.2. Düsseldorf Airport

Düsseldorf Airport is the largest airport of North Rhine Westphalia (NRW). The location was chosen by the city council of Düsseldorf and approved by the transport minister in Berlin in 1925. In 1952 the runway was extended to 2475 meters and in 1969 up to 3000 meter. In the year 1969 the airport management sought public approval for a parallel runway system. The permission was given in 1983 and the runway was built in 1993 for 61 million €. The use of the runway is restricted to the capacity of one runway due to the so called and this goes back to the so called "Angerlandvergleich", a contract between a number of municipalities, the NRW transport ministry and the airport company signed in 1965 (Historikerbuero, n.d.). This contract initially limited the number of movement in the six months with the most traffic of a year to 78.240 movements. The airport management and the transport ministry attempted to increase this movement cap in 1976 to 91,000 slots and to 91,000 movements with a maximum 34 hourly slots in 1983. Later on it attempted to change the movement cap to a noise cap which would have

increased the maximum number of movements which was prohibited by court in 1999. In 2003 a court decided that the Angerlandvergleich allows for some flexibility. Currently the airport is allowed to serve 131.000 movements for the six peak months and a maximum of 43 slots in peak times (Düsseldorf Airport, 2012).

3.3. Frankfurt Airport

Frankfurt Airport is the main hub of Lufthansa and the largest airport in Germany. It is located in Hessen. The location was chosen by the Nazi government in 1936 and the new airport opened in 8 Juli 1936. The northern runway was extended to the length of 3.300 meters on 28 October 1957. Two years later it was further extended to 3900 Meter and the South Runway was prolonged to 3000 meters in 1960. In 1965 the airport handed in the planning documents for extensions of existing runways and for the New Run Way West (Rucht and Sauer, 1984). After public hearing the permission was given in 1968, but the decision was contested successfully in the courts. In December 1971 the Ministry of Economic Affairs and Transport approved the new plans. The content off the approval was identical with the first one. What follows was an 11 year lasting battle in court with demonstrations. The conflict was initially about noise and later on about an area of protected trees in the Frankfurt City Forest. This area was occupied by protestors who erected a camp. As the police began to force the protestors to leave the forest on the 2 Nov 1981 violence escalated to such a level that observers compared it with a civil war. Two weeks later about 100000 people demonstrated in the capitol of Hessen and 220000 citizens voted for a referendum, which later on was turned down by parliament because the federal state of Germany and not the Land Hessen was responsible for air transport infrastructure. The protest movement did not succeed and in the end violent protestors abused the protest by killing two policemen on 2 Nov 1987 (FAZ, 2010). In 1982 the construction of the Runway West begun and on 12 April 1984 the runway was opened (Bickenbach et al. 2005).

Although the social democratic president of Hessen declared after the completion of the Runway West that no further expansion will happed about ten years later in 1997 the discussion of further expansion of the airport began (ibid). The social democratic government of Hessen proposed an open mediation process without any predetermined results in July 1998. In August 1998 the mediation process began and ended in January 2000 (see below). The mediators recommended a package of five measures which should not be broken up. Besides optimization of existing capacity, active and passive noise reduction program, and a regional forum for dialog it was recommended to build a new runway to increase capacity up to 120 movements per hour and to implement a strict night curfew from 11 pm to 5 am. The three parties in parliament unanimously supported the stricter night restrictions and the conservative president of Hessen Roland Koch put it in the phrase: "No expansion without night curfew – no night curfew without expansion" (Handelsblatt, 2003).

In September 2001 Fraport applied for public approval and on 18 December 2007 the Ministry for Economic Affairs and Transport approved a new 2800 meter long runway. For legal reasons it approved not the strict night curfew but allowed for 17 night flights. In 2011 the court decided against this decision and ordered a strict night curfew – a decision which was not well received by airlines. In the approval process the risks of the chemical plant Celanese were assessed. The plant was relocated and Fraport bought the area for 750 million €. Construction of the fourth runway began in May 2009 and finished on 20 Oct 2011. The capacity will be increased stepwise from initially 82 to 120 movements per hour.

Building the runway has not stopped the protest. The local citizen action groups have allied (Bündnis der Bürgerinitiativen, 2013) and for more than a year once a week citizens gather in a terminal of Frankfurt airport and protest against “excessive airport expansion” and demand among others “a ban on night-flights between 10:00pm and 6:00 am” (BI Flörsheim-Hochheim, 2012).

3.4. Hamburg Airport

Hamburg airport opened in January 1911. It is the oldest operating airport in the world. It was initially a private investment and then taken over by the state. The crossed runway system was stepwise extended in 1935, 1950, 1955, 1956, 1961, and 1964. It is currently 3 250m and 3 666 long. While it was built initially at the outskirts of Hamburg in Fuhlsbüttel it has become today an inner-city airport.

In the sixties, plans were developed to close down Fuhlsbüttel and build a central Northern German International Airport. Alternative locations were discussed and finally Kaltenkirchen an area 40 km north of Hamburg was selected. Hamburg Airport even acquired land. However, these plans were stopped in the 70 ties (Die ZEIT, 1976), but have been constantly discussed in periods of strong growth and growing noise emissions. In the beginning of the nineties liberalization of air transport together with strong long term economic growth expectations due to unification of Germany came together with a period of increasing noise emissions. The influential studies of William, Cutler Pickering (1991) and SRI (1991) forecasted an increase from 6.8 million passengers in 1990 to 17 million passengers in 2010. Total movements should rise from 141 000 to 280 000 and commercial from 113 000 to 230 000. The Chamber of Commerce suggested shifting all charter and leisure traffic to Hannover. The Mayor of Hamburg suggested Parchim airport, a former military field between Berlin and Hamburg, as an option for a common international airport of North Germany and the Berlin region. However, the northern German conference of Ministers of Economic Affairs in 1995 saw this not as a realistic option and recommended in the guidelines for a common northern German air transport policy no further planning until 2010. Instead of building megaprojects the existing airports should become less noisy through more effective market based environmental pricing including noise and emission budgets (Niemeier, 1998)

In the mid-nineties, privatization of Hamburg airport began and the airport management applied for public approval to extend the apron, which constrained the airport to 42 movements per hour. In the application the airport forecasts an increase of commercial movements of 195,000 commercial movements in 2010 which would have increased noise and which would have contradicted the guidelines. Therefore Hamburg policy intervened and implemented a noise budget set on the level of noise emissions of 1997 (see below). The apron was completed in and increased the slot constrain to 51 movements – a level which up to now has not been reached.

Compared to the eighties and nineties Hamburg airport has gained acceptance but of course environmental concerns have remained a key issue for the further development. The neighbors are affected and organized in groups. There is one peculiarity. While at most other airports the noise affected citizens live in the city or in neighboring communities within the same federal state this is not the case with Hamburg. Communities in Schleswig-Holstein are also affected. This is similar to Berlin and leads to political conflicts and cooperation among federal states.

3.5. Munich Airport

Munich Airport "Franz Josef Strauß" is located 28,5 kilometers north east of Munich. On 17 Dec 1960 an aircraft crashed in a tramp killing 52 persons (Kretschmer, 1984). This led to demands for a new airport located in the rural area and far enough from the city. Planning started in 1963, different locations were assessed and in the regional planning commission selected the current location at Erdinger Moos on 5 August 1969. Initially four parallel runways (two with 4.000 meter and two with 2.500 meters length) were planned. In 1974 the number of runways was reduced to three and in 1981 to two parallel 4000 meter long runways. This downsizing reflects environmental pressure with appeals to courts, but also the expectation that traffic will grow slower than expected. The planning approval of 1979 forecasted 12 million passengers for 2000. In 1984 this was reduced to 10,8 million. After more than 7 years of construction with stops due to court decisions the airport opened on 17 May 1992.

Traffic grew faster than forecasted and reached in 2000 a level of 23 million passengers almost double than expected. Munich airport reacted by planning a third runway and spatial planning started July 2005. The plans were approved by the government of Upper Bavaria in early 2007 so that the public inquiry could start in August 2007. On 26 July 2011 the government of Upper Bavaria approved the third runway and ordered immediate implementation. The airport management promised not to use this right and wait for final decisions by courts (Süddeutsche Zeitung, 2012).

On 17 June 2012 the extensions plans were stopped by a public vote of the citizens of Munich. 54,3 % voted against it and 32,8 per cent participated in the vote (Spiegel Online, 2012). The outcome of this referendum is interesting as the city of Munich is virtually unaffected by aircraft noise, due to the remote location of the airport.

3.6. Stuttgart

Stuttgart airport is the airport of Stuttgart, the capitol of Baden Württemberg, located in the area of the cities Leinfelden-Echterdingen und Filderstadt. The location was chosen in 1936 and the airport started to operate in 1939. The runway was extended stepwise in 1951 and 1961. The master plan of 1967 proposed to build a large international airport with three runways in the range of 2700 to 4300 meters. This immediately caused strong protests from neighbors (Abel, 1984). The first German Initiative against aircraft noise was established within half a year and gained rapidly members (5000 in autumn 1968). The protest was so strong that alternative locations were analyzed which raised protest there as well. In 1973 the prime minister of Baden Württemberg gave up these plans because people of this area travelled via Frankfurt, Munich and Zurich to their intercontinental destinations so that there was no need for a large international airport. However, an extension of the airport remained on the political agenda as intercontinental flights could not fully operate. On 24 June 1996, after three years of construction, the runway could be refigured and extended to 3345 m. Given the strong growth of traffic a second runway was demanded by the airport management in 2000. But these plans were not only opposed by the neighbors but also by the Minister President Ernst Teufel who promised to keep the promise of no further expansion. His follower, Günther Oettinger did not feel to be bound on this promise and decided to assess the pro and cons of a second runway in 2006 by independent experts (Siegel and Visintin, 2007). After two years in 25 June 2008 his conservative government came to the conclusion that no second runway will be built in future. This promise is limited for the next period of 8–12 years (Stuttgarter Zeitung, 2008). In order to cope with the expected growth of passenger demand from 9.2 million in 2010 to 19.5 million in 2025 the apron should be

extended otherwise with current peak capacity of 53 movements per hour only 15,9 million passengers could be handled (Landtag von Baden-Württemberg, 2011).

3.7. Some stylized facts about German airport expansion

The case studies show that with the exception of Berlin and Munich the location of major airports has been usually chosen before the Second World War very often under non democratic regimes (see table 2 below). At that time the economic potential and environmental impact of air transport was not and could not have been foreseen. Given the changes in technology and demand, the public airports reacted in the fifties and sixties with an extension of their runways. With the growth of cities conflicts emerged. Space was needed for housing and the noise around airports increased with stepwise extensions, growing number of movements and the increased noise of the first jet generation.

These conflicts accelerated at all airports from the seventies onwards, caused even violent protest in the eighties and lead to long planning processes with court decisions and demonstrations. The length is an indicator how complicated the processes are and how difficult it is to gain acceptance and democratic decisions on major airport extensions. A consensus was not achieved as some groups still oppose extensions.

Mediation as part of the public planning and approval process was practiced at two out of the six extensions. While it was of limited use in Berlin, it played a major role in Frankfurt. Mediation reflects also the uneasiness with the traditional planning process. The total length from planning to building is also an indicator of the complexity which easily might lead to additional costs as with the new BBI airport.

While capacity could not be increased as fast and as much as from airport management initially planned capacity has been increased at all busy airports. Peak capacity has been increased since 1992 at all airports in the range from 20 to 80 per cent. Conflicts will remain in the future, but in different degrees: the situation in Frankfurt and Stuttgart is more intense than in Hamburg.

Table 2. **Airport Expansion in Germany**

Airport	Berlin Brandenburg	Düsseldorf	Hamburg	Frankfurt	Munich	Stuttgart
Locational choice/opening	1996/ no official date given, but expectations not before 2015	1914/1927	/1911	1934/1936	1969/1992	1936/1939
Runway extensions and changes (year and meters)	N.A	In 1952 up to 2475 m, in 1969 up to 3000m.	Stepwise in 1935, 1950, 1955, 1956,1961, 1964 of crossed runways to 3,250m and 3,666 plus extension of apron.	In 1957 north runway up to 3300 m and in 1959 up to 3900 m. South runway 1960 up to 3000 m	NA	1951 up to 1800 m, 1961 to 2250, in 1996 to 3345m
New Runway	Two runways 3600 m and 4000 m	Second parallel runway in 1993	No	Runway west in 1984 Fourth runway in 2011	Third runway for peak capacity of 120 slots voted down in 2012	Promise to build no new way up to 2016 to 2020.
Length of public planning and construction for capacity extensions	At least 19 years	24 years for second runway	3 years for apron extension	22 years for runway West 10 years for fourth runway	13 years	NA
Mediation	Yes	No	No	Yes	No	No
Increase in peak capacity Movements per hour	NA	From 34 in 1983 to 43	From 42 in 1992 to 51	From 55 in 1975 via 82 to 90 to stepwise 120	From 68 in 1992 to 90	From 24 in 1972 to 42
Increase from 1992 to 2012	NA	34 to 43 = 26,5 %	42 to 51 = 21,4 %	66 to 91 = 37,8 %	68 to 90 = 32,3 %	24 to 42 = 81,8 %

4. KEY PROBLEMS OF AIRPORT INVESTMENT

In this section I draw together problems of airport investment from different strands of economics and politics. This is not an exhaustive overview and important insights might be left out. Nevertheless I hope that it serves the purpose to offer some guidance to understand the complexities of airport investment.

4.1. Transaction cost perspective

Williamson (1985) and others have developed the New Institutional Economics⁴ and Wolf (2003) and others⁵ have applied it to airports. In this view, major airports are long term relationship specific investments with externalities and with imperfect information. Such good characteristics create problems for pure market solutions as in the real world of densely populated areas no complete contracts can be drawn among the stakeholders. Hold-up problems and opportunistic behaviour easily rise to such a scale that the transaction costs are probably prohibitive for private provision. This also means that no first best solution is possible and policy makers have to choose between feasible second and third best solutions in order to minimize transaction costs. Public planning is necessary. It is part of the solution and it is as well part of the problem in case public planning does not minimize transaction costs and opportunistic behaviour leads to hold up problems and under investment:

- Private and also public airport owners have invested in a relationship specific asset with its users. This relationship is subject to opportunistic behaviour if airlines do not keep their promises, if for example, the state implements stricter and perhaps prohibiting environmental rules or passes laws preventing market access through restrictive bilateral air service agreements.
- Large hub-and-spoke airlines have erected a base or even a hub which they cannot easily redeploy. They are subject to opportunistic behaviour if for example a stricter night curfew is imposed or other restrictions are increased. However, this does not refer to the new generation of LCC which can easily shift aircraft from one base to another, all of Europe.
- Neighbours might have invested in houses and have built up a neighbourhood with friends which they cannot build up easily at other places. They might be subject to opportunistic behaviour if promises by airport managers and politicians to prevent capacity extensions are not kept.
- Industry has based its locational decisions on the development of an airport. They may find it difficult to switch and might be locked in.

4. For an overview see Menard and Shirley (2005) and for public utilities in particular Gomez-Ibanez (2003)

5. See Biggar and for infrastructure provision Bickenbach et al. (2005 and 2007)

- Airport politics is also open to opportunistic behaviour. The long term nature of airport planning and organization is in conflict with the limited time period politicians are elected. Governments cannot easily bind future governments to keep promises.

Expansion of airport in densely populated areas creates external costs and benefits. These costs and benefits are unevenly distributed in space which in turn might lead to high transaction costs and even to complete blockages of airport enlargements. The negative effects of a new airport or an expansion are generally confined to the neighbourhood of the airport. This is in particular noise and in some cases other emissions. The neighbours have to bear these costs and have typically only benefits which do not outweigh these costs. The avoidance of noise is a public good and might also lead to free riding (Bickenbach et al. 2005 and 2007, Richman and Boerner, 2007).

The positive effects in from of better connectivity and additional production and income are distributed in the wider region of the airport. For a project with a positive benefit cost ratio the benefits outweigh the costs largely born by the neighbourhood. Neighbours might find generally an airport a good thing, but oppose the project which makes them worse off. Their reaction can be described as NIMBY (Not In My Backyard) and airports are typical NIMBY goods. Furthermore, airports might lead to a complete negative reaction of the neighbourhood and other parts of the population. This is called BANANA: Build Absolutely Nothing Anywhere Near Anything/Anybody These rational reactions have to be addressed in the public planning process and the institutional settings which have to be designed in such a way to minimize transaction costs. Such institutional contracts have to decide besides the scale and time of expansion and what conditions and restrictions the new capacity is utilized and how the capacity has to be adjusted for technical and economic developments. In particular the contract has to define who is paying what in order to compensate negatively affected neighbours (Bickenbach et al. 2005 and 2007)⁶.

4.2. Airport Economics and Regulation

Pricing and investment of airports have been intensively studied by economists. From this literature⁷ it emerges that airport investment faces some serious problems compared to a normal industry, in which through the Marshallian adjustment process capacity is increased through investment and market entry until the optimal long term equilibrium is reached. Such a process is guided through short run marginal cost pricing and market clearing price mechanism. Compared to such a well behaved dynamic process the dynamics of the airports do work very differently:

- The EU Slot distribution system leads to scarcity rents for airlines and the slot is not given to the airline with the highest willing to pay (Starkie, 1998).
- Slots and also regulation break the mechanism of short run marginal cost pricing and investment. Prices do not signal to invest at what time and on which scale (Niemeier, 2004).

6. For a review on Nimby goods see Richman and Boerner (2007) and Schively (2007).

7. For an overview see Button (2005), Forsyth et al. (2004), Czerny et. al. (2008) and Czerny and Zhang (2012)

- The investment decision might be dominated by strategic behaviour. Airport and airlines might collude not to expand and share the scarcity rent (Forsyth and Niemeier, 2012).
- Cost based regulation which dominates in Germany leads to an inefficient choice of inputs resulting in the Averch Johnson effect, gold plating and cost padding and an inefficient price structure resulting in a lack of peak and congestion pricing. Both might lead to costly excessive airport capacity which is badly management (Niemeier, 2004)
- Price cap Regulation only practised at Hamburg and temporarily in some from at other German airports might lead to hold up problems and underinvestment. The regulator must creditable signal that it will not behave opportunistically (Helm, 2009).
- The lack of independent regulators sets incentives for regulatory capture. Airports might erect barriers to entry by planning restrictions to prevent the opening of a competing airport (Niemeier, 2009).

4.3. Mega project cost economics

Flyberg et al. (2003) and others⁸ have analysed the economics of mega projects. Mega projects are loosely defined as projects which cost at least a hundred million dollar and have the following characteristics that they are long term risky capital intensive projects, technology is new or has to be adapted, stakeholders are locked in at an early stage, the scope of the project changes and risk is neglected (Flyberg 2009, p 345). These factors cause a) "misinformation about costs, benefits and risks is the norm throughout project development and decision-making" (ibid) and b) "cost overrun and/or benefit shortfalls" (ibid.). Despite these problems mega projects are increasingly planned and implemented. This phenomena is called the "megaproject paradox" by Flyberg et al. (2003, p 137).

Flyberg et al. (2003) show that the distorted estimates of cost and benefits "make projects look good in cost-benefit analysis and environmental assessments" (p. 138) which leads then to the "survival of the unfittest" a term coined by Flyberg (2009). Furthermore, demand forecasts were far too optimistic (by more than + - 20 per cent). This holds for a period of 30 years and shows that improvements in forecasting have not been implemented in practice. Flyberg (2009) shows further that these forecast errors are not caused by lack of technical expertise like data problems, limit knowledge of future events and low quality of models. Optimism bias⁹ also cannot explain the systematic forecasting errors, but "political-economic explanations and strategic misrepresentations" (Flyberg, 2009, p. 351). In short, "lying pays off" because the governance does not make the project promoters accountable. This is due to the fact that "(i) public-sector accountability through transparency and public control; and (ii) private-sector accountability via competition and the market competition" (ibid. 359) do not work effectively. Regarding the first factor Flyberg et al. (2003) show that no trade-off between democracy and efficiency exist. Instead they recommend more and effective democratic control. Local grants from the federal government should not be project

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8. For an overview see Sanderson (2011). To my knowledge the authors on mega projects seem not to be influenced by transaction cost literature.
 9. Managers are too optimistic and involuntary ignore risks and overestimate the benefits. This theory was developed by Kahneman, Tversky and Lovallo. For an overview see Lovallo and Kahnemann (2003)

related. CBA and forecasts should be made by independent organizations and be peer reviewed and lying should be prosecuted by criminal law. Regarding the second way Flybert et. al. (2003) recommend an explicitly formulated "regulatory regime and the involvement of risk capital" of more than a third of the total capital costs.

It should be noted that the economics of mega projects rest on large data base including many rail and road projects, but only a few airports. These projects are subject to CBA which is not necessarily the case with airports (see below). Flyberg et. al. (2003) point out that in projects with CBA also economic impact analysis plays an important role. Major projects are supposed to bring the wider benefits of jobs and growth to regions and even the whole economy. Flyberg et al. (2003) show that these claims "are not well founded, the main reason being that in modern economies, transport costs constitute a marginal part of the final pricing of most goods and services" (p. 72).

5. ASSESSMENT OF DECISIONS ON CAPACITY EXPANSION OF AIRPORTS

Decisions on investments in additional capacity have been assessed by public planning and in recent years also by mediation. In this section I discuss firstly the rationality of both decision processes. Thereafter I discuss how benefits and costs which are created by the investment are assessed in this institutional setting.

5.1. Public Planning

All airport expansion have to go a public planning process which consists of regional planning (Raumordnungsverfahren), an approval in terms of air law and a public approval process (Planfeststellungsverfahren) (Zaß, 2008)¹⁰. The regional planning process evaluates different locations and recommends a location. The recommendation is not binding. This part of the public planning process is an internal planning process of the administration. Citizens cannot directly participate but through their elected representatives in municipalities. The air law approval evaluates also under public interest considerations including noise and safety and security. This part of the process is done by the administration of Land in which the airport is located and in cooperation with the federal state. The public approval process evaluates in detail the planned airport expansion in terms of public interest which includes environmental effects and also negative effects on neighbours. The public approval authority is a body of the Länder. The body is usually part of the Ministry of Economic Affairs and given a quasi-independent status as the minister cannot directly intervene. The approval process is public and all stakeholders are invited to public hearings. Very often the permission is given with conditions and restrictions the airport has to meet in building and operating the added capacity. The planning approval can be challenged in the court which has happened with all airport extensions.

Bickenbach et al. (2005) have evaluated the German planning process and have raised in particular the following criticism:

1. *Lack of full compensation.* The planning process limits itself to active and passive noise measures, but does compensate those directly negatively affected. Therefore it is rational for neighbours to take all legal and political action to get compensation (ibid. 56).
2. *Lack of independent planning authority.* The quasi-independency is not accepted by citizens in the planning process. They see the planning authority as a party¹¹ and fear that the facts and arguments are not objectively assessed. They fear that the narrow economics interests of the airport managers and owners influences the decision. The public and partial privatised form of airport ownership conflicts with regulator function in planning processes. This leads all parties overestimate the

10. For legal details see Ronellenfitsch (2006)

11. According to Gohl and Meiste (2012, p. 87) the planning authority helped intensively Fraport to improve their planning application.

effects in order to get public opinion on their side in order to influence politics (ibid. 57).

3. *Lack of long term commitment.* The planning process is limited to the specific capacity enhancing project. Promises to add no further capacity lack credibility. This leads to longer and very often emotional discussions (ibid.).

Together with other factors the weaknesses of the planning process lead to avoidable polarizing and to policy gaming so that transaction costs increase substantially and might lead to blockage of welfare enhancing investments.

5.2. Mediation

As the planning process with the legal conflicts seem to have some weaknesses politicians have added mediation (Gohl and Meister, 2012). The mediator can certainly be more independent than the quasi-independent planning authority, but the mediation results are not legally binding and cannot compensate the lack of long term commitment (Bickenbach et al., 2005, p.82. This also leads to strategic behaviour of the parties as they might either not chose to participate at all like several local citizen action groups in Frankfurt or they might participate only to such a degree that their legal position will not be negatively affected (ibid and Gohl and Meister, 2012, p 84).

The quality of mediation can be diverse. Mediation in Berlin could hardly be called as a serious discourse with citizens and stakeholders. The discussions did not play any role in the locational choice. Location was chosen by the federal minister following the advice of the investment bank for privatisation of BBI (Bickenbach et al., 2005, p. 73). Compared to Berlin mediation in Frankfurt was better designed, but still has serious flaws (see below). According to Thießen (2000) relevant questions such as external effects were completely left out, time was artificially limited and independent reports for example on the reaction of hub decision by airlines were conducted on behalf of stakeholders.

5.3. The role of CBA and the role of Impact Analysis

The rationality of the planning process and the mediation process depends crucially how the investment is evaluated. The peculiar method of assessment becomes obvious in the well documented mediation process for Frankfurt airport (Forum Flughafen und Region, 2013). The objective of mediation was to find out "under which circumstances Frankfurt Airport can help to keep up permanently and enhance the competitiveness of the Rhine-main region with respect to employment and economic structure, without neglecting the ecological costs imposed on the region" (quoted from Hujer and Kokot, 2001, p. 112).

On behalf of the three mediators and the supporting mediation group, studies about the economic, ecological, and social consequences were conducted¹². Five scenarios were defined, ranging from the status quo, a reduction of aircraft movements to a full-scale expansion. The results of the Input-Output study (Bulwien et al.,1999) were crucial for the final recommendation. The result is, while currently 142,000 jobs directly or indirectly depend on the airport in the State of Hessen, a full-scale expansion would create another 57,000 jobs. For each of the scenarios an input-output model was used to quantify the results. Then the mediation group weighed the different scenarios and came to the

12. Interestingly Hujer and Kokot (2001) report that in the mediation group it was unanimously agreed that a study on the economic significance should be conducted as the supporters based their study on an outdated study.

conclusion to recommend the full-scale expansion, because of the economic importance of the project for the region, i.e. because of the 57,000 new jobs. Due to the overwhelming economic effects the citizens have to accept the ecological costs.

The mediation group obviously followed the “logic of jobs versus the environment” and decided pro jobs and in favour of a stricter night curfew and better active and passive noise protection.

The mediation logic of jobs versus environment is not conclusive and indeed misleading:

1. Assume that there are two airport projects with the same amount of passengers and freight, but with differences in labour productivity, wages, efficiency, investment costs, and geographical distribution of suppliers. *Ceteris paribus*, the project with lower productivity and lower wages will be selected because more labour is necessary in the production of the direct and the indirect product. In addition, as workers with lower wages tend to have a higher marginal propensity to consume, the induced effects would be higher as well. If the decision were between a new ‘gold plated’ traditional terminal and cost efficient innovative terminal, IO-analysis would favour the first one because the direct and indirect effects are *ceteris paribus* higher as the production needs more resources. If the first project uses only locally produced goods, while the latter uses all the resources of a globalized world economy, IO -analysis would produce greater indirect effects for the first. Obviously, taking IO-analysis as guidance leads to unproductive and inefficient airports.
2. The induced effects are roughly a third of the total effects for the German economy and a fifth of the total effects for the economy of Hessen in each scenario. The induced effect will only occur if excess capacity as well as resources are available for multiplier effects to come into effect. Furthermore, the induced effects are independent of the decision to extend Frankfurt airport. They would also occur if passenger demand which could not be serviced at Frankfurt airport shifts to other airports or a similar amount of income is spend on other projects.

In short, airports might be expanded because job figures which only exist in models not designed to evaluate investment decisions and might create an infrastructure of the “unfittest” that is with negative cost benefit ratios and with long-term ecological damaging effects. As decisions on airport extensions which inevitably will include environmental externalities would be better based on a CBA which needs to made subject to an open ex-ante and ex-post evaluation. The danger is that this will not happen with future investment projects into airports as airports managers and owners have adopted the logic of “jobs versus environment” and mislead the public discourse (see box 1). Such logic might backfire because there is growing evidence that local citizen action groups do not belief in these figures anymore and will find out that they have been intentionally mislead. This will not improve an already highly political question.

Box 1. On the Abuse of Impact Analysis for Airports¹³

"Public airports must *compete* for funds with other governmental activities. They are scrutinized during budget preparation and may be subject of public debate, particularly if major improvements or *new constructions* are anticipated. They may *even be the target* of proposed restrictions aimed at *limiting aircraft noise levels*. It is important that the public and their representatives appreciate the economic significance of airport if they are to continue to support them. This report is designed to assist analysis of the economic importance of airports. It is *not intended* for use in financial feasibility studies or *cost/benefit analysis*," writes the US-DOT in its guidelines for the use of Impact study developed in 1986 and updated in 1992 (USDOT, 2002, p. 1, italics added).

This quotation clearly indicates that

1. IO-analysis is used for the purpose of supporting airport extensions and for overcoming environmental restrictions in public debate.
2. The authority is aware that these purposes belong to the question how to allocate scarce resources.
3. Instead of guiding the public discourse by a cost benefit analysis, the authority intentionally recommends IO-analysis to analyse problems of efficient allocation including the internalization of externalities.

AACI-Europe developed similar guidelines for their members in 1992 and published further material in 1998 (York Consulting, 1998). This led to a widespread use of impact studies with a clear strategy: The US-DOT, AACI-Europe and many of its members such as Frankfurt Airport all used IO-Analysis intentionally to discuss publicly the pro and cons airport extensions and environmental measures in a framework, which is logically not suited for this purpose and which misleads the general public.

13. Based on Niemeier (2001)

6. STRENGTHS AND WEAKNESSES OF THE GERMAN DECISION PROCESS

In this section I discuss further weaknesses and strengths of the institutional setting in Germany. The list is not complete, but is hopefully provides a comprehensive overview. The points raised are of different nature – some are technical and others are more political. I start with the strength and continue with a rather long list of weaknesses.

6.1. Strengths

The strengths of the German decision process becomes obvious in the light of popular claims that the approval decision takes too long and should be as short as in China in order to enhance investment to stay competitive in global competition. So far less have this quite influential view has not changed the democratic nature the planning process. The democratic legitimation is one of the basic assets of the planning process. Furthermore, it addresses the key problem of such investments, namely the conflict of interest and with approval decision controlled by the court it give all stakeholders the necessary planning security to invest in long term relation specific object (Bickenbach et al. 2005). Nevertheless, the planning process as such and the actual practice has a number of shortcomings.

6.2. Weaknesses

In addition to the weaknesses discussed in section III I will point out further problems, namely doubtful demand forecasts, airport investment and airport competition, pricing of externalities, public acceptance and the question of too many hubs.

6.2.1. *Doubtful Demand Forecasts*

The quality of forecasts is central for the assessments of benefits and costs of an airport expansion. The economics of mega projects show that there is a tendency to be too optimistic. This raises the question whether this might be also the case for airports.

The quality of demand forecasts for airport investment is difficult to assess and opens up an interesting topic for future research. By its nature the forecasts are long term of 10 to 20 years. This sometimes leads to the view that such forecasts are not possible or useless because of the time length. However, this view overlooks that short term forecasts might be even more difficult than long term forecasts (Tichy, 1994). The exchange rate of the Euro to the US Dollar on May 4th 2013 is certainly harder to predict than the population of Europe in 2015. Another example is the recent economic crisis in 2007, an event which some economists even think of being impossible to predict. A simple comparison of the forecasts with the results does not say much as forecasting assumes certain factors like population and GDP growth, intensity of competition to be constant or of a certain magnitude and value. But these factors might unexpectedly change over time leading, for example, to the result that a forecast predicts exactly the number of passengers because other factors have caused the result and not those of the model. What the planning processes lack is a vigorous ex-ante and ex-post evaluation of forecasts. I will show below how misleading the forecast for the public planning approval

for Hamburg was and that it was driven by an ideology of forecasting as much as possible and a narrow view on economics benefits ignoring environmental aspects of welfare (see box 2).

Very often this is less and more difficult to detect. There is some evidence that the forecasts for other airports are also of low quality (Thießen, 2000). The ex-ante evaluation is certainly difficult and should be done by a peer review process of independent scientific experts as Flyberg suggests. The complete model and the results should be open for the public. The ex-post evaluation should also be done by scientific experts. But the long term nature causes the specific problem that forecaster might rationally not care to deliver wrong and even intentionally misleading forecasts as it takes a long time to falsify results.

Box 2. **Case study on demand forecasting for Hamburg airport**¹⁴

Hamburg airport seek permission through a process of public inquiry for expanding the apron in 1996 (Flughafen Hamburg GmbH, 1996). This was based on a forecast of passenger demand and movements. In parallel the Ministry of Economic Affairs of Hamburg had commissioned a forecast by MKmetric (Mandel, 1997). In the Ministry both forecasts were compared. Both forecasts expect similarly strong growth of passenger demand in a range between 13 (MKmetric) to 13.85 million passengers (Hamburg airport) in 2010, but the forecasts largely diverge on the commercial movements. Hamburg airport forecasts 195,000 commercial movements in 2010 while MKmetric forecasts 155,000 and 172,000 at maximum.

Also the methods are different. Hamburg airport extrapolates a trend of commercial movements independently from the passenger forecasts while MKmetric derives the number of commercial movements from passenger demand. Given the supply of aircraft orders and the tendency towards rising load factors at the point of forecasting in 1995/6, MKmetric forecasts a relationship of 77 to 86 passengers per commercial movement in the year 2010 while Hamburg airport's method resulted in a marginal rise from 68 to 71 passengers per commercial movement.

Given the orders of aircrafts the latter could have had only happen if the airlines reversed their former decisions and order smaller aircraft and/or reversed their policy of increasing load factors. Neither explanation was realistic at that time when liberalization lead to a strong growth of leisure traffic. The high numbers of movements showed the inconsistency between the number of movements and the passengers and thereby the inconsistency of the forecast.

Viewed from today the forecast of MKmetric is more in line with actual figures of 2010 (12.962.917 mill passengers and 137.290 commercial movements), but as argued above many of the given factors developed differently as for example economic growth and the rise of Low Cost Carrier with its intense competition.

The airport management insisted on the validity of its forecast and based the airport expansion on this over- optimistic forecast. It seemed to follow the logic of predicting and demanding as much growth as possible with the hope that politics will follow the expertise of the airport neglecting environmental concerns and provide permission for the expansion.

Furthermore, this strategy increased the risk of losing the acceptance of the airport in the adjacent neighbourhoods. Noise emissions, based on the movement forecast of the airport, were rising dramatically. The policy in Hamburg reacted by accepting the forecast of MKmetric and implemented a noise budget (see below).

14. Based on Niemeier, 2003 and 2004

6.2.2. Airport Expansion and Airport Competition

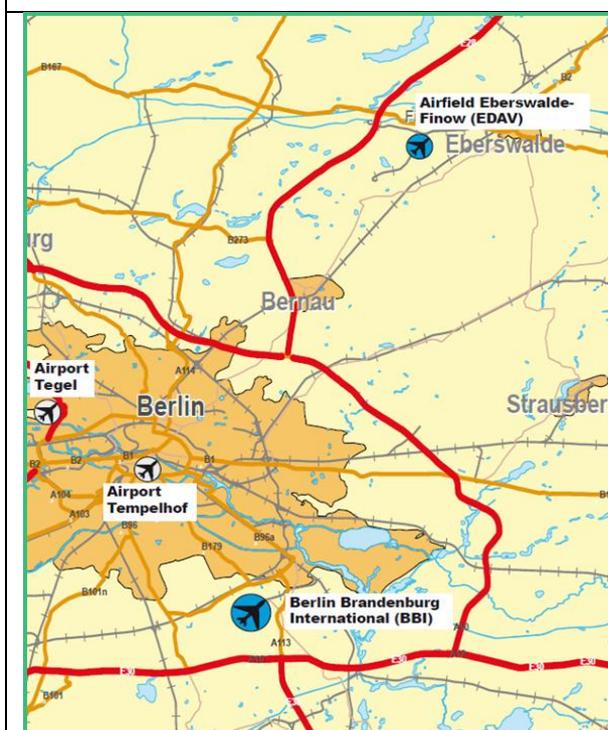
The conflict between airport expansion and airport competition can be illustrated at best with the case of the new Berlin airport. The old airport system consisted of three airports Tegel, Schönefeld, and Tempelhof. Together they offered as much capacity as the new BBI airport:

- Tegel airport currently serves 18 million passengers, is slot coordinated and has peak problems.
- Schönefeld is a non-busy airport and can handle more than the current 7 million passengers
- Tempelhof could handle up to 5 Mio. It had 4.7 M in 1973 and 1 mill in the nineties where it was used by regional jets.

In total, the old airport system probably was designed at least for more than 30 million passengers. The new airport has been planned for 27 million and there are talks to increase capacity further. This shows how expensive the new airport is. An investment of initially 2.83 billion Euro, which increased to 5 billion Euro, did not add any new capacities and offered less differentiated quality for airlines (Tegel for traditional scheduled airlines, Schönefeld for charter and low cost carrier, Tempelhof for high yield business). But the old system had an important disadvantage. Tegel is an inner-city airport with noise problems. These externalities might tip the benefits and cost in the direction of a new airport in Schönefeld. But such a cost benefit study have never been performed, because the decision for the new BBI airport was decided by the minister for transport based on a study of the investment bank to privatise the new BBI airport. Privatisation did not happen later on, but it is clear that the rent seeking of private owners goes into the direction of creating an airport monopoly. The same is true for the new BBI airport under public ownership. Also, the public owners try to monopolize the market. BBI has less competition than what could have been achieved. This is obvious and gained much publicity with the closure of Tempelhof. Competition, however, from Tempelhof would have been limited to quality competition. What is less obvious and has not been openly discussed in German politics is that the planning process has erected legal barrier for the entry of a low cost carrier airport with ample capacity in Eberswalde-Finnow. This airport has tried to get permission to operate since the mid-nineties. It has neither got it under the regime of privatisation nor under the regime of public ownership (see box 3). The lack of independent planning authorities encourages rent seeking, erects legal barriers of entry, lessens airport competition and leads to expensive and excessive airport infrastructure.

Box 3. Airport Competition in the larger Berlin region

Figure 4. Map of Berlin Airports



Eberswalde-Finnow airport is an airport 55 km south east of Berlin (see Fig 4). It has a runway of 2520 meter length and could technically serve flights of Boeing 737-800. However it is permitted only for flights with a maximum take-off weight of 14 tons. The EU funded project has studied the "potential future role of Eberswalde-Finow airfield/airport against background of upcoming structural changes" (Levsen, 2007, slide, 2) and concluded that the airport "will be the only suitable airport location for the business model of True Low Cost Carriers (TLCs) in Berlin and Brandenburg in 2011" (ibid. slide 4).

The airport company has taken the Land Brandenburg to court. A final decision will be expected within a few years (Döll, 2009).

Source: Levsen (2007)

6.2.3. Airport Expansion and Environmental Policy

As noise and other emissions are key obstacles for the expansion of airports and are prolonging the planning process and lead to tedious court cases, one might expect that German airports with their mixed private and public owners have carefully assessed the benefits and costs in order to design an efficient environmental policy along the lines of Gillen (2000). However, that has generally not happened over the last decades. No doubt, environmental management has improved (Schmidt, 2000) but there is still a tendency towards more or less effective command and control measures combined with ineffective (hardly inefficient) market based instruments¹⁵:

- *Goal setting and noise budgets.* Economist would prefer to minimize noise by balancing the marginal benefits and marginal costs. However, this approach has hardly been possible in the period of German airport expansion. Fichert (1999) doubts that in the nineties a marginal benefit function of noise reduction could have been estimated at a particular airport. To my knowledge, it has generally not

15. I confine myself to a discussion of the most important instruments. For an overview see Conradi et. al. (2013) and Fichert (1999)

happened with the exception of a recent study on Schiphol Airport¹⁶. Lijesen et al. (2010) recommend lessening noise by 3 dB to reach the optimal level of noise reduction. Given this lack of knowledge, environmental quantitative goals for airports are usually not set by politics and very often politics tries to avoid this although it increases the risks for all stakeholders of airports. Even with a willingness to set such quantitative goals, it is difficult to achieve compromises given the limits of knowledge of the future (see box 4). Nevertheless, noise budgets should be the preferred policy option for airport and in turn the lack of effective noise budgets combined with permits (Brechet and Picard, 2010) is a sign of the risks for future airport expansions and the lack of efficient environmental policy.

- *Noise protection programs.* According to ADV (2012), German airports have invested more than 500 Mill Euro in noise protection programs over the last decades. This is, at first sight, an impressive figure, but with about three billion passengers it boils down to less than 20 cents per passenger. During the second phase of airport expansion from 1975 onwards to 1995 the airports had to pay 257 mill German Marks for legally binding noise protection. In addition, they paid voluntarily almost the double sum, namely 408 mill German Marks, which is in total about 30 Pfennig or 15 Euro cents per passenger (Fichert, 1999, p 173). This was due to the fact that a reform of the noise protection law was blocked by the military and airports had to implement voluntarily more effective programs in order to gain public support. The reform of the initial law of 1971 was achieved in 2007, but it has been heavily criticised by environmental groups. ADV (2012) claims that it will have to spend another 400 to 600 million Euro which again easily boils down with 200 million passengers within a few years to less than one Euro per passenger. A full assessment of noise protection programs would analyse the benefits and costs which is beyond the scope of the paper. According to the German Advisory Council on the Environment (2008) the thresholds for noise protection norms have been improved, but no legal binding exposure thresholds (emission limits) have been defined.
- *Night curfew.* The setting of night curfews has always been critical and sensitive issue. This is the case with Frankfurt as well with other airports. Local citizen's initiatives demand a nationwide strict night curfew from 10 pm to 6 am. In Brandenburg they collected 20.000 more signatures than the threshold of 80000 signatures for a petition while in Berlin they failed. Matthias Platzeck, the minister president of Brandenburg, promised to support this initiative although this conflicts with his role as a chairman of the board of BBI.

16. Lijesen et al. writes: "It is surprising to see that such an obvious finding has not yet lead to any practical use of a cost-benefit analysis based approach to noise nuisance near airports (ibid. p. 51).

Table 3. **Night Curfews at German Airports**

Airport	Berlin Brandenburg	Düsseldorf	Hamburg	Frankfurt	Munich	Stuttgart
Night curfew hrs	23:00 to 5:00	24 to 6:00	24 - 6 pm	23:00 - 5:00	24:00- 5.00 Noise and movement budget	24.00 – 6.00.
Restrictions for louder aircrafts	NA	23.00 - 6.00 bonus class,	23:00 -24 delayed Chapter 3 aircrafts		Bonus aircrafts 22 – 24; 5- 6	23.30- 24.00 delayed Chap. 3
Noise surcharge	NA	Yes	yes	yes	yes	yes
Demand of local initiatives	22.00 – 6.00	22:00 - 7:00	22.00 7.00	22-6.00	22-6.00	22.00- 7.00

Source: Boeing data base, Website of local initiatives

There are several problems with the politics and economics of night curfews:

- Nationwide night curfews are inefficient as the local noise externalities and the danger of health risk differ from airport to airport.
- The night curfews for the core time are not flexible and are only efficient if a certain number of movements with the least noisy aircrafts leads to health risks.
- A noise budget would be more appropriate than a night ban. Such a night budget should be efficient or set at a politically acceptable level. Munich Airport has noise budget at night. It has not been utilized up to now. Frankfurt Airport had a noise budget from 2001 to 2009, but no airlines have been penalized.
- The evening and morning time times are subject to restrictions and noise surcharges. The categorization in ICAO chapters has proven to be unacceptable and biased by industry interests. The bonus class has similar problems though to a lesser extent. Therefore, it is reasonable to differentiate noise by classes defined by each airport and make this the basis for time related noise surcharges. Fraport noise surcharges rise for an A 318 from 37,70 Euro to 90,50 € for the time from 22 to 23 and 5 to 6 (B 747-2002 from 1.450 to 4.400 Euro). The effects have not been assessed. The alternatively instrument to noise surcharges has not been tested.

In summary, it remains to be seen whether German airports will implement a politically acceptable noise budget for the time from 10 pm to 6 am which puts an effective price tag on these flights and leads to measurable substitution effects.

- *Ineffective noise surcharges.* Noise charges are a cost efficient way to reduce noise to an optimal level or to the level set by politics. They have been slowly implemented in the eighties and nineties. There were several problems with these

charges (Niemeier 1998 and 2009, Fichert, 2009). First of all, the differentiation was based on a classification by ICAO. These categories were criticised as too broad and biased towards specific interests of air craft producer. Second the charges should not be based on weight but just on noise. Third, the effectiveness on reducing noise by substitution processes was doubted. Around 2000 Frankfurt Airport and Hamburg Airport reformed and implemented their charges based on noise differentiated in five classes. Their effectiveness has not been carefully assessed. Evangelinos et al (2013) found no short term substitution effects for the airport of Zurich which has one of the strongest differentiated charges in Europe. Fichert (2012, p 5)¹⁷ also doubts the effectiveness as "the share of the noise surcharge within the total airport charges is rather small, in most cases significantly below 10 %." The problem with unilateral noise surcharges is that there is an externality which leads to free riding. This might be circumvented partly if a country sets the noise surcharge, but even then other countries might free ride. Another problem is that noise charges are set in a political process. The outcome might not so much be determined by welfare considerations, but reflect a political equilibrium determined by the political powers of the stakeholders (Evangelinos et al, 2013).

Box 4. Noise budget of Hamburg Airport

In the eighties, passenger growth lead a significant rise of noise level measured in the area of an equivalent noise measure. This trend was reserved in the nineties. 50 per cent passenger growth was combined with a 50 per cent reduction in noise due to the fact that the share of Chapter 2 aircraft in total jet movements decreased from 60 % to 10 %. A crucial question in 1997 for the acceptance of Hamburg Airport by the local community was whether the strong expected growth from 9.2 million to 13 million with 50.000 more aircraft movements will eventually increase noise levels again? These questions were debated at election time when the airport was going through a mandatory planning process to obtain permission from the local community to increase apron and terminal capacities.

In the political discussion some parties demanded a freeze on movements at current level in its election program. But such a measure might be inefficient compared to a noise budget combined with effective charges or permits (see table 4).

Table 4. Noise budget versus movement restrictions

	NOISE BUDGET	MOVEMENT RESTRICTIONS
ADVANTAGE	<ul style="list-style-type: none"> ▪ incentives for <ul style="list-style-type: none"> ➤ less noisy aircraft ➤ higher load factors ▪ planning security 	<ul style="list-style-type: none"> ▪ Incentives for <ul style="list-style-type: none"> ➤ larger aircraft ➤ higher load factors
DISADVANTAGE	<ul style="list-style-type: none"> ▪ minimal operational disadvantages 	<ul style="list-style-type: none"> ▪ no incentives for less noisy aircraft ▪ increase of noise ▪ unnecessary economic loss

17. For further evidence see Ehmer (2010)

Movement restrictions have the advantage that airlines would have to use larger aircraft and utilize the seats effectively, but there are several disadvantages. There are no incentives to use modern less noisy aircraft, nor is there any incentive to utilize noise reduction potentials. In a situation with high excess demand and high noise differences of aircraft fleets movement restrictions might even lead to an increase of overall noise levels.

A noise budget has a number of advantages. First, there are incentives to use larger aircraft combined with higher load factors. Secondly, it has the advantage of promoting the use of less noisy aircraft at minimal operational cost for airlines. Overall, these advantages were seen decisive and from the year 1999 onward the noise level at Hamburg has not been allowed to exceed the level of 1997. This noise budget has improved the acceptance by the neighbours and by politics in general. Local initiatives have positively reacted to the noise budget. According to Hoffmann (2011), Hamburg Airport has substantially improved its acceptance which is also due to better communication.

As of today it has become obvious that setting a noise budget is complicated. It is not enough to fix the noise level for a certain period of time. The several crises of the last ten years lead to a different growth than expected (see above). Movements and also noise are below the expected level. It seems therefore, appropriate to reduce the noise level and combine it with a noise budget for night times.

6.2.5. Single or Multi Hub strategy

In the mediation process for the extension of Frankfurt airport the question was raised whether a dual hub operation is possible and how the competitive position against the hubs of London, Amsterdam and Paris might be affected. Unlike other questions no vigorous study was conducted and the issue was discussed only qualitatively in the expert meeting. Nevertheless, the mediation group reached the conclusion that shifting of traffic to other hubs like Munich will reduce the efficiency to such a degree that the competitive position of Frankfurt would be endangered (Mediationsgruppe Flughafen Frankfurt /Main, 2010, p 22).

While this claim is rather bold, one has to admit that empirics of multi versus single hubs are not well researched (see Wojahn, 2001). As long as there is free capacity, a single hub strategy is preferable as a doubling of destinations multiplies the transfer destination by four. At what stage the network economies run out and diseconomies set in has not been studied to my knowledge. Since the decision of the Mediation group in 2000 Lufthansa and other European alliances have adopted a multi-hub strategy. This might be due to the fact that hubs might face capacity restraints with delays which propagate faster in a single hub system. Airlines might also want to increase their bargaining power. After the expansion of Frankfurt, Lufthansa has now four hubs with ample capacity and it remains to be seen how intense hub competition will be¹⁸.

18. Another reason might be that the airline can reap higher profits from feeder traffic into hubs.

7. SUMMARY AND CONCLUDING RECOMMENDATIONS

This paper analysed how German airports have extended capacity. This process has the following characteristics:

- German airports expanded capacity to the demands of passengers and shippers and to the requirements of new (jet) aircrafts after the second world war.
- Conflicts over the use of land have emerged firstly in the Sixties, accelerated in the Eighties and are expected to remain in the future, particularly in Frankfurt, Berlin, Munich and Stuttgart. These conflicts have led to long planning processes (including mediation), demonstrations and court decisions but remained unresolved for many stakeholders.
- German airports have been utilized differently. Capacity has become scarce only at a few airports. Existing capacity has not been allocated efficiently due to a lack of pricing. There is evidence for excessive investment in intercontinental capacity and in regional airports.
- While capacity has not been increased as fast as initially planned, it has been increased substantially at all busy airports, sometimes at high costs like in Frankfurt with the removal of a chemical plant and in Berlin with cost overruns of more than two billion.

Expanding airport capacity, Germany has faced problems which are deeply rooted in the nature of the industry.

- Airports are long term relationship specific investments plagued with hold up problems, opportunism, externalities and imperfect information. Costs and benefits are unevenly distributed in space and lead to NIMBY reactions in the direct neighbourhood of airports.
- German airports have expanded their capacity under a regime of cost based regulation and slot coordination. Regulation and slots break the link between scarcity and pricing so that prices lose their signalling function for investment. Cost based regulation sets incentives for inefficient pricing and for excessive and too costly investment. The lack of independent regulation might easily lead to regulatory capture and rent seeking.
- Airport investments might turn into mega projects with benefit shortfalls and/or cost overruns. The failure of mega project is due to a lack in public or private sector accountability. Public control and transparency are not implemented or competition does not work effectively. Cost Benefit Analysis and forecasts should be made by independent organizations and be peer reviewed. Private risk capital should be involved in the project.

Airport investments have been subject to the approval by public planning and in some cases to mediation. Public planning has its strengths and weaknesses:

- The planning process is democratically legitimized. It addresses the conflict of interest. The approval decisions are controlled by the courts. It provides stakeholders with planning security to invest in long term relation specific objects.
- The planning process lacks
 - full compensation for those directly negatively affected. It therefore encourages neighbours to take all legal and political action to get compensation.
 - an independent planning authority. The quasi-independency is not accepted by citizens in the planning process.
 - long term commitment. As the planning process is limited to the specific capacity enhancing project, promises to add no further capacity lack credibility.
- Mediation can compensate partly the lack of independency of the planning institution. Its recommendations are not legally binding. The quality of mediation was poor in the case of Berlin Brandenburg airport and better though not of sufficient quality in Frankfurt.
- Investment decisions are not assessed by Cost Benefit Analysis, but by Impact Analysis. The direct and indirect effects of impact analysis are greater the more costly and unproductive an airport is and the induced effect is independent of the investment object. Hereby, impact Analysis creates the wrong image that jobs can only be created if noise and environmental burdens are accepted. Impact Analysis has been misused by airports to legitimize investment and to delude the public.
- The planning process of airports lack a vigorous ex-ante and ex-post evaluation of forecasts.
- The planning process of airport expansion might reduce airport competition as the lack of independent planning authorities encourages rent seeking to erect legal barriers of entry.
- The negative external effects of airport expansion are not efficiently addressed by the planning process and by the environmental policy.
 - Efficient or acceptable noise budgets are not implemented at German airports.
 - Noise protection programs have been implemented in most cases on a voluntary basis. The German law for noise protection has been reformed after 36 years of debate with improved thresholds for noise protection norms, but with no legal binding exposure thresholds.
 - There is a growing tendency to strengthen night bans. Noise budgets set at an efficient or at a politically acceptable level have not been implemented although they seem to be suitable for the time between 22.00 to 24.00 and 5.00 to 7.00 hrs.
 - Noise surcharges have been reformed, though rather late. At most airports they do not lead to any measurable substitution effects.
- The question whether limiting capacity expansion at Frankfurt hub does endanger the competitive position has not been well assessed.

With the expected growth of demand investment in airport, capacity will remain an important issue for Germany. The current planning system has led to avoidable transaction costs and an infrastructure which is too costly, inefficiently used and leading to unnecessary environmental costs. Hence investment in airports has been criticized by a large group of citizens and has not been confined to those living under the flight paths of airports and therefore being directly affected. It is recommended to reform the system along the following lines which involve more than a narrow reform of the planning process:

1. *A clear distinction between tasks and responsibilities of airport management with an independent planning authority separated from the owners of airports* (Bickenbach et al., 2005). The quasi-independency in the current system invites rent seeking by all stakeholders. Rent seeking can be limited by an independent planning authority which should report to parliament. Bickenbach et al. (ibid) additionally demand a complete privatisation of airports, but this not necessary as long as the planning authority is completely independent from the airport management¹⁹.
2. *Open and transparent planning process.* As Flyberg (2009) argued mismanagement does not come from too much democracy. The final decision on the location of the new Berlin airport should not have been made by the transport minister but should be the result of a transparent and not predetermined planning process.
3. *Compensation of directly negative affected citizens.* Compensation should be restricted to those who are seriously affected by noise. Legal binding exposure thresholds should be defined. The planning authority must then assess the damage and determine the compensation (Birkenbach et al. 2005).
4. *Mandatory Cost Benefit Analysis.* It should be mandatory to assess investment decisions by Cost Benefit Analysis and not by Impact Analysis. The quality of forecasts should be carefully scrutinized. Cost Benefit Analysis including passenger forecasts should be subject to ex-ante and ex-post evaluation. Lying of forecasters should be prosecuted.
5. *Market based environmental policy.* Airports should adopt market based instruments like noise budgets with permits or effective noise charges. These instruments should be made effective.
6. *Reforming the organisational structure of the German airport industry.* Instead of monopolizing markets, airport competition should be fostered by prohibiting joint ownership of potentially competing airports. Subsidies for regional airports should be carefully assessed. An independent authority should regulate airports with market power and set incentives for efficiency. Secondary trading of slots combined with an efficient structure of charges should be implemented for a better allocation of given capacity.

19. There are good reasons for full privatisation as partial privatised airports are operational inefficient compared to state-owned or fully privatised airports.

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