Summary

Schiphol as an aviation icon (next to KLM and Fokker) is a symbol of long aviation history that started before World War II. Schiphol as an icon and, as a collective construct, reflects a complex world that both accommodates and connects very many people, organisations, companies, processes, techniques and industries. Being an aviation nation, Dutch society is strongly interwoven with this icon.

“Schiphol outmeasures the Netherlands”, the title of this doctoral research has been chosen due to the fact that this small country has an extremely large airport. The “large” or “larger” ideas are based on the many views from which one can observe this complex world. Schiphol’s volume expressed as the number of flight movements, passengers and freight is the first obvious conclusion seen from this perspective. Schiphol took the fourth position in Europe in 2007 (after London, Paris and Frankfurt) in view of the above volume. Schiphol as a mainport (read: hub of major transport routes) is dependent on its transfer position, which is based on the transfer of passengers. Aside from this, Schiphol offered a network of connections linking 256 cities worldwide (Frankfurt had 286 in the same year) with the Netherlands in 2007. To a significant extent, KLM is responsible for this network of connections.

Schiphol, on the other hand, causes noise pollution and safety risks as a result of its key activity, flying, mostly in the vicinity of its home base in addition to offering many major economic benefits and, consequently, this is one of the causes of the spatial planning restrictions in the surrounding area. But the opposite also applies: through environmental legislation and measures in the field of spatial planning the surrounding area imposes restrictions that reduces Schiphol’s growing potential and impeding its operational opportunities.

These various elements (e.g. economic growth, but also a decrease or increase in noise pollution) can be given a specific value applicable to the relevant element so that any increase or decrease can be registered. The increase or decrease of these values is considered equivalent to and also denominated as productivity growth or decline of the Netherlands aviation sector in this thesis. They are compared with the various regions (both in Europe and worldwide) over the past 50 years. Relatively speaking, this growth is remarkably substantial. Now the question is: How can this have happened and what is the growth founded on? Were there specific factors that achieved this? Did overall aviation grow fast or was Schiphol part of a regional development which in itself can be earmarked as the cause of the development of Schiphol?

This research does not focus on the elements on which the worldwide growth in aviation is founded on. It is obvious that economic growth and increasingly interwoven economies are major reasons for aviation growth. This research does not focus either on the enormous technological progress in aviation manufacturing and aircraft operations that took place over the years. International aviation characterised by an enormous cost reduction due to the formation of alliances and consolidation resulting in air transport as a commodity, is not an area explored in this thesis. The effects these parameters have had on productivity are considered to be exogenous factors.

This doctoral research does focus on the steering aspects of the above questions and assumptions. Key issue is the hypothesis to be examined that the above development of the Dutch aviation sector would not have been possible if there had not been a unique, extraordinarily productive form of cooperation between the parties involved. This implies that we can, for now, assume that there was targeted manipulation by people having a certain common goal.
Therefore, this doctoral research is a study of the management of the Dutch aviation sector where socio-scientific research techniques are used. So the questions asked from a historic perspective will be answered from a management (steerage) viewpoint.

• What relevant parties or organisations were involved?
• Did critical success factors exist and how was success defined?
• When did the crucial moments occur with regard to this success?
• Was it a matter of steering centrally or did parties join out of recognised self-interest?
• How did this steering develop over the years?

The objective of this doctoral research is to analyse the events leading to this productivity growth and to draw lessons for the future. The doctoral research verifies the research propositions developed from literature and interviews based on cases.

Research set-up and data gathering and analysis
The research draft contains the translation of the research question where the key constructs of the research question (the Dutch aviation sector, productivity and steering) are defined and supplemented with deduced constructs that form the basis of the research propositions to be verified.

The Dutch aviation sector is defined as a network of aviation-related organisations that are components of (sub)production chains. The organisations are linked through steering relations covered by views. The productivity of the Netherlands aviation network is considered to be the product of perceived effectiveness and efficiency. The effectiveness and efficiency are dependent on the targets set by the aviation network. The steering of the Netherlands aviation network is defined as the integral view-based manipulation of the steering relations between the relevant productivity-oriented organisations. Within the research there are ten steering relations (e.g. Target Congruence and Confidence) covered by five views, which relate to perceived productivity through making a reference to steering.

\[ P = \{\text{steering relation}\}. \]

A first set of research propositions (basic research propositions) provides views on the dependence of the steering relation and productivity. A second set of research propositions (pattern research propositions) provides views on the dependence of the steering relations. The third set of research propositions (interview research propositions) has been developed from the 160 interviews with managing directors, administrators, politicians and policy officials of public and private organisations in and around the Dutch aviation sector. The interview research propositions provide views on the structure of the aviation network, patterns of the steering relations, type of organisations and steering relations in the course of time.

The verification of the research propositions is based on case research in which various cases are used for the analysis of the relation between the steering relations and productivity. The case research is essential to show the crucial moments (in the steering relation and productivity) in a case. The cases must, therefore, have an equal or comparable form to enable this verification research. Comparable in this context means that each case denominates the various crucial moments of highly fluctuating productivity. This is the relative contribution of the case to the productivity of the Dutch aviation sector as a whole (see figure S.1). This, therefore, means that the perceived productivity of the Dutch aviation sector depends on the perceived contribution of the various cases.
Through a survey, the case research focuses on the combination of steering relations and perceived productivity (over the years). This survey has been conducted among the relevant managing directors, administrators, politicians and policy officials who have been asked about their perception with regard to the contribution to productivity and steering relations of a case. A set of potential cases has been drawn up and assessed for workability (lifespan, size, number of actors and productivity fluctuations) for the research based on an interview. This assessment resulted in the cases of the Fifth Runway Construction (in combination with the Dutch Aviation Act), Bilateral Treaties (Open Skies and Japan) and the Privatisation of Schiphol.

In the first instance, data gathering relates to the case research describing the various events in the above cases. The crucial times with regard to productivity, sector parties and relevant politicians and managing directors as well as (semi-finished) steering products are mapped. In the second instance, the survey, is described that is the same in each case and at each crucial time. The questions are answered depending on the period in which the interviewee was employed in the relevant network.

The research data has been analysed in such a way that the research question can be answered. Through analysis, the various cases and their outcomes led to the verification of the b, p and i research propositions. The assessment used a set of statistical analysis techniques (such as factor analysis and multi-dimensional scaling) for the various research propositions.
The analysis of the research propositions provided three renewed views and eight steering relations of varying significance for productivity.

- Cooperation (combination of Target Congruence, Confidence and Power);
- Product match (Product fit);
- Knowledge Management (combination of Knowledge Availability, Knowledge Complementarity, Information Timeliness and Information Workability).

The equation below represents the relation of these independent views with productivity.

\[ P = -0.18 + 0.2b_{\text{Product Match}} + 0.68b_{\text{Cooperation}} + 0.02b_{\text{Knowledge Management}} \]

With regard to the “cooperation” view the “product match” and “knowledge management” views are not significant. The new steering aspects or views as a result of the analysis are independent now, but considering the significances and coefficients it is only the “cooperation” view that is predictive for productivity. In the productivity equation below additional analysis only has a result for the “cooperation” view.

\[ P = -0.14 + 0.84b_{\text{Cooperation}} \]

The analysis of the propositions did not provide any interdependences of significant importance to productivity. The results of the verification of the research propositions are an integral part of the conclusion in the summary below of the Report Phase.

**Conclusion**

Why are certain periods in the Dutch aviation sector marked by a strong growth or decline in productivity? The answer to this research question is substantiated by defining the steering relations, views and productivity in terms of time. The perceived increase in productivity down the years and the cases were considered integrally and set alongside the actually realised productivity for this purpose. It has been
investigated whether the perception of the aviation network relates to the actual productivity within this context. This statement makes it possible to focus on the main steering relations over the years.
The productivity of the Dutch aviation network has been defined as the product of perceived effectiveness and efficiency. The effectiveness and efficiency are dependent on the targets set by the Dutch aviation sector and the included lower aggregated (sub)production chains. Hence, this is a matter of lower aggregated productivity based on lower aggregated (sub)targets. This implies that, depending on what target an individual organisation pursues, a certain degree of productivity is realised. The productivity of the Dutch aviation sector at meso and macro levels is stated in (business) economic, ecological and social targets. Figure S.2 sets part of the (business) economic targets (passengers, freight and flight movements) alongside the perceived productivity across the various cases.

It is obvious that these productivity indicators follow similar curves as those of the perceived productivity. This correlation is shown (in correlation coefficients) for the (business) economic, ecological and social targets in table S.1.

It should be noted with regard to figure S.2 that the first derivative of the absolute growth is shown for the productivity figures of movements, passengers and freight since, as asked in the interviews, in essence the perceived productivity is also a first derivative. The various correlations can be considered high although there are a number of exceptions. The correlation for serious noise pollution is highly negative. This indicates that the traffic volume has increased and serious noise pollution has decreased in a similar way. This does not imply though that there is a causal connection (“when air traffic grows, noise pollution will decline”). The correlations for accessibility of the Netherlands must be considered coherently. This means that the average correlation for network development (including the number of connections, destinations and seating capacity) is 0.49.

In addition to the periods of productivity, growth and decline have been mapped. In conclusion, we can say that the perceived productivity is linked to the actual productivity. From this conclusion we focus...
on the perceived productivity and the most significant Cooperation view (with the Target Congruence, Confidence and Power steering relations) that has been set alongside time below (see figure S.3).

The analysis of the research data shows that there is a strong connection between perceived productivity and the Target Congruence steering relation. The connection between productivity and the Power and Confidence steering relations is of a lower ranking. The relation between the three steering relations and productivity is as follows:

\[ P = -0.16 + 0.19b_{\text{confidence}} + 0.10b_{\text{power}} + 0.56b_{\text{Target Congruence}} \]

The analysis of the Target Congruence steering relation (as the main factor for perceived productivity) shows that there has been a shift with regard to the target over the years. This is a matter of two distinctive periods (the period until the mid-1990s and the period that followed). These are shown in figure S.4 where the targets are shown with regard to the different years. The accent of a particular year is shown in the relative position with regard to the targets. Initially, the accent in the 1960s was on the survival of the Dutch aviation sector. In two to three decades (see the left green field) this shifted to (business) economic targets (including increase in capacity, market expansion and more connections out of Schiphol). This transition was marked by an enormous volume growth for Schiphol as an infrastructure. The Open Skies and Japan cases prove that the then successful application for landing rights realised this volume growth. These cases are not individual cases, but they are exemplary and serve as models for the various bilateral treaties resulting from the above transition.

From the mid-1990s the (business) economic targets changed into more economic and ecological targets at a national or macro level (see the right green field). During the 1990s, these economic and ecological targets increasingly focused on the quality of the network, safety and reduction of noise pollution. Schiphol’s infrastructural significance is shown in terms of national interests such as accessibility, liberty, affluence and contribution to GDP. It has been in particular the political targets that have played
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a role in the value network during the last few years. The various targets differ in nature, structure and origin. Schiphol has increasingly been the issue of political debate at a macro level. This is particularly the case under the influence of the construction of the fifth runway in which the contrast between economy and ecology has centre stage. The privatisation of Schiphol shows the combinations of all targets. The periods defined in figure S.4 show this shift of target as the result of all cases combined.

Therefore, additional and new targets for the steering of the Dutch aviation network have been created. The environment or context (read macro level or society) within which this aviation network is to operate competitively sets sustainable targets in ecological and social fields. Hence, ecological and social targets affect the productivity of the network in addition to economic targets and they are not related on the basis of quantitative economic principles.

These targets (developed from the macro level) in combination with the growing number of related organisations make the demarcation of the aviation-related network complex. Subsequently, the latter affects the productivity traditionally pursued by the Dutch aviation sector. This means that the set of quaternary organisations and parties compiling these targets affect the complexity of steering to a great extent.

When we look more specifically at the type of organisations in the value network of the Dutch aviation sector, a number of things are obvious. We have a withdrawing government on the basis of a lower target congruence that is comparably lower for all organisations involved (from primary to quaternary). The internal coherence as well as the network coherence of the Dutch aviation sector has declined over the years. Consequently, the organisation clusters to be distinguished in the various cases grew into a lower coherence (read: a lower Cooperation or internal coherence) over the years. In addition, the overall value
network lost part of its correlation or coherence. Table S.2 sums up the various primary and secondary clusters in the value networks for the various cases. The primary cluster is the cluster with the strongest internal coherence in the value network. The most central organisation is the organisation that has the strongest steering relations within the cluster concerned.

It is obvious that in practically all the cases KLM played a leading role, but that NVLS or AAS have also taken a central position in the various cases. Apart from these primary clusters, the Dutch Ministry of Transport, Public Works and Water Management and the then Dutch Department of Civil Aviation played a central role initiated by the government in the various cases.

The Cooperation analysis shows that the internal coherence (and, to a lesser extent, the network coherence) is highly correlated to the perceived productivity of the value network. Hence, for the ultimate productivity of the value network, the Cooperation of the primary cluster is always important. All the cases proved that success (read: high perceived productivity) always depended primarily on the internal coherence and secondarily on the network coherence. When we consider the primary clusters over the years, KLM, NVLS and the Dutch Ministry of Transport, Public Works and Water Management have always played a prominent part. This means that for a high productivity of the Dutch aviation sector, a strong coherence (with regard to the Cooperation view) is conditional for these organisations.

The analysis of the Cooperation view shows a multi-actor prisoner’s dilemma. The lack of confidence in each other leads to the power-based pursuit of purely individual targets. This dilemma results in stra-
tactic behaviour on part of the actors (with individual targets) in the value network. As a consequence of this dilemma the Dutch aviation sector realises suboptimal productivity.

The productivity growth the Dutch aviation sector underwent resulted in the shift from a meso to a macro level. The contribution from the meso level of the Dutch aviation sector as a value network increasingly affected the affluence of the national economy. On the basis of competitive power, a meso level value network should ensure a lasting contribution to the affluence of the national economy. Cooperation between the meso and macro levels based on the aforementioned Target Congruence and Endogenous Tie steering aspects is of crucial importance to the development opportunities within the value chain itself and from here for its contribution to the national economy. This cannot reduce the development and growth of the Dutch aviation sector as a value network to the development of an effective and efficient production system in itself. The (social) system around this production system largely affects the success of the Dutch aviation sector. As a consequence, additional targets for the Dutch aviation network were developed over the years. Apart from the (business) economic targets, the environment or context (read: macro level or society) in which the Dutch aviation sector is to operate competitively, set sustainable targets in ecological and social fields. Hence, ecological and social targets affect the network’s productivity in addition to the economic targets.

This makes it obvious that the Dutch aviation sector was and is a major issue of political debate due to the productivity growth in the 1990s. Though in the past there was an undisputed consensus between a (limited) group of government parties and the parties directly involved in aviation on the significance of the growth of the aviation sector as well as the share in the Dutch economy, from the 1990s other aspects have been demanding attention. The aspects that began to attract a great deal of attention in this debate are, for example, quality of life, noise pollution, safety, employment, land use, sustainability etc. and these aspects did not always run analogously with the target of economic growth. Over the years the significance and number of these aspects have increased and they run synchronously with the number of organisations reflecting these aspects or interests. The success of the Dutch aviation sector also depends on the participation of government bodies and coordinating organisations representing these contiguous interests. All organisations related to the success of these interdependent organisations (primary or quaternary) belong to the Dutch aviation sector within this context. The number of (government or quaternary) organisations involved in this value chain and the various interests they represent leads to the macro level being affected automatically. The decline in the view of Cooperation including the Target Congruence, Confidence and Power steering relations of government organisations is in line with this.

Figure S.5 represents the above conclusions in a highly abstracted graphic form. The curve indicates the various periods and runs alongside the spirit of the times of Dutch society that the Dutch aviation sector has been part of (over the past 50 years).

For the Netherlands and Europe, the 1950s and 1960s were dominated by the reconstruction of the country and the airport. Due to far-reaching industrialisation, the Netherlands affluence saw fast growth during the 1950s. The 1970s were characterised by the extent to which fundamental social change could be effected by government policies. The 1980s were marked by an oil crisis, high unemployment, a badly running economy and a high budget deficit resulting in the phasing out of the welfare state. This period was succeeded by the 1990s marked by a new objectivity and an improving economy. Social engineering was partially left behind so that the possibilities for government interference were under dispute.
In the mid-1990s the growth of Schiphol resulted in a shift from a meso level to a macro level. The volume growth (in passengers, freight and flight movements) resulted in a political debate at a macro level which has been going on for two decades now. This debate has been dominated by the benefit of and need of having Schiphol and the incurred social expense (such as land use, noise and emission of harmful substances) and benefits (such as employment and connections). These problems, as such, are unstructured and undefined where the outcome is a solution that cannot be objectified and that has to be acceptable to the actors. This led to the debate being dominated by the question from which standard system the value network problems should be considered. The growing number of organisations involved (see the various network developments in the various cases) reflects the economic, ecological and social interests and targets. Hence, this, in fact, implies that the commitment of more organisations with other normative visions on productivity has resulted in a different steering or another type of coordination. The target congruence declined over the years not only due to the increase in the number of parties, but particularly because these parties brought along their individual and sometimes conflicting additional targets that had to be integrated in the target compilation of the Dutch aviation sector. In the past few years, the (perceived) productivity growth followed a similar levelling trend.

As a matter of course, the conclusions included in figure S.5 show an abstract curve concerning perceived productivity. The levelling off of the curve represents the perceived productivity of individual organisations. The lack of a coordinating target and the mere pursuit of individual targets give a perception of limited productivity.

The development of the different phases of aviation in the past fifty years shows that operating the airport on purely business economic grounds ends in low cooperation and, consequently, a levelling productivity. The macro economic significance of Schiphol is more important than the mere pursuit of business economic targets by individual organisations within the aviation network. The coherence (read: cooperation) within the aviation network, on the one hand, and the surrounding value networks, on the other hand, are of overriding importance for the future of Schiphol. The S curve in figure S.5 representing the development of productivity over the years shows that we are nearing the end of this productivity curve. New forms of cooperation will have to be developed for the future to ensure a new S curve is produced. For this purpose, three (arbitrary) scenarios have been identified in figure S.5.

Scenario 1 represents a fast drop in productivity. The organisations continue to pursue their individual targets in this scenario. These targets are the only ones and are an extension of self-interest. They are pursued through blocking power which ends in a low confidence among the organisations. This causes a deepening of the multi-actor prisoner’s dilemma, due to which the organisations will individually realise a lower productivity leading to Schiphol fast losing ground as an aviation network.

Scenario 2 is a much milder form of scenario 1 in which a levelling productivity involves a growth in the number of targets and organisations. Though new ways are found to come to cooperation, they will be insufficient to reach a new S curve based on competitive benefit compared to the other European aviation sectors. As a consequence, the Dutch aviation network will gradually sink back into a format comparable to the economic hinterland of the Netherlands.

Scenario 3 marks a completely new form of cooperation. As in the past, once again a network of politicians, managing directors, administrators and policy officials of mainly the primary organisations will succeed in reaching a new S curve of productivity on the basis of confidence, productive power and target congruence. This target congruence will be realised by process innovation in which public and private
parties will form new alliances that can define and form a dominating binding target. This new form of interweaving of the government and trade and industry is based on high Cooperation between managing directors and politicians in which authorities show forms of entrepreneurship. Individual organisations have derived targets that are consistent and coherent towards each other and lead to synergetic benefits for the overall value network. Subsequently, this value network with high internal coherence is able to bind other geographically bound value networks. Cooperation with other production chains in the Netherlands leading to cluster formation with synergetic benefits gives substance to this new S curve. This new S curve, which is based on far-reaching Cooperation and is value driven, leads to a shift from a national macro economic level to a European macro economic level. The merger of KLM and Air France as a European carrier will have a follow-up by positioning Schiphol (and the associated value network) as a European (multi-hub) airport: the European Airport Schiphol as icon of European economic activity.

This S curve actually follows on from Porter’s cluster theory (Porter, 1990) that departs from the physical clustering of companies within specialised growth sectors. This clustering functions as a source of regional economic growth in which production chains with companies clustered on a single spot and engaged in activities concentrating on one specific theme will relatively experience more growth. This S curve distinguishes two processes that are conditional for high productivity. On the one hand, it is the above introduced European macro-economic process that is to provide sufficient regional economic activity and, on the other hand, this is the process management that is required for embedding these economic activities in the Dutch environment where a good deal of these processes are taking place.

Harmony with the environment also continues to be a major source of success for the Dutch aviation sector operating at a European level. The two processes are interwoven where cooperation in and between these processes is the basic concept for success.