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Aviation's role in society

Globalisation and economic growth have led to aviation's deep incorporation into our society. People and goods can be transported almost anywhere on the globe in a relatively short time and at relatively low prices. The rate of growth in air traffic demand has for decades been higher than that of the world economy. As world population increases, economic growth and ongoing globalisation are expected to continue fuelling air traffic's explosive growth (Walker et al, 2008). As a result the large aircraft manufacturers in the world, Airbus and Boeing, specify in their market forecast annual growth percentages of around 5 to 6%. Since late 2008, the economic crisis has significantly reduced the demand for aviation (IATA, 2008; 2009). However, most authors consider this slowdown to be but temporary. In many occasions in the past, aviation demand growth curbed but growth figures always relatively quickly recovered picking up the growth lines followed before the crisis. The latest occasion has been the recovery in 2004 from the period of stagnation following the attacks on the World Trade Centre in New York City in 2001. In the majority of designed future scenarios for air traffic, the increasing demand for air traffic is expected to continue. This continuing growth will have some valuable effects, but also some drawbacks.

A desired outcome is that the growth of the aviation sector will create additional employment opportunities in and around the sector and continues to be a stimulus for local (regional) and (inter-)national economies. Aviation, in particular, has acted as an important supporting force for the globalisation of industry and business, as well as for long-distance tourism. Given the deregulation and privatization in the sector, a steady drop in ticket prices makes aviation accessible for many more people in society. The more recent rise of low cost carriers has taken this availability a step further.

In addition to the benefits, aviation has some serious drawbacks as well, these high growth factors will only increase them further if nothing is being done about them. Most authors identify as various negative effects on society and the environment noise nuisance, external unsafety, usage of finite resources, and local and global air pollution. Increasing growth of the sector will also lead to more congestion and thus delays, both in the air and on the routes from and to the airports on the ground.

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As aviation is a strongly internationally focussed business, coordinated action is needed to solve the dilemma of keeping the benefits of aviation while mitigating the undesired effects. Making the system more sustainable, that is, striking a balance between People, Planet and Profit issues, is very necessary. However, making policy in such a complex and multi actor system is not an easy job; let alone making policy in an international context requiring coordination. In addition, decision making now leads to implementations that should still function in 30, 40 or even 50 years from now. In aviation, the time frames are very long. Aircraft stay in service for many years - up to 30 or more. Starting a certain change through the selection of a new aircraft design today will have spread over the entire system only decades from now. This makes policy making and decision making in aviation also very strategic in nature.

This special issue of EJTIR focuses on the task of making policies for a more sustainable aviation system both in the short and the long term. We focus on both evaluation of certain potential policies, as on designing specific solutions. Evaluation and innovation in the aviation system: that is the topic. First, we address the issue of policy making, before presenting how the authors of the papers in this special issue address both evaluation and innovation.

Policy making for more sustainable aviation: a complex multi-actor challange

Policy making today, in general, is rarely top-down decision making anymore. Policymaking is no longer characterized by the choice of the policymaker (Rosenhead, 1989; Bennett et al., 1989; Geurts and Joldersma, 2001). The power and resources needed to formulate and implement any policy, are now more likely to be spread among multiple actors, each with their own interests, values and perceptions of the policy space (Van de Riet, 2003). Examples of relevant actors are airport operators, airlines, surface transport operators, airport users, the local population in the vicinity of an airport, and the national, regional and local authorities, and, not to forget, the traveller. In short, designing and successfully implementing policy nowadays requires the collaboration of many different stakeholders with many different interests. Proposed solutions by one actor often interact and conflict with interests of others (see e.g. Miser and Quade 1985, Dunn 1994, Walker 2000, De Haan 2007).

As a consequence, policymaking has to address in one or other way the different stakeholders' interests, values and perceptions. Otherwise, policies risk being delayed or even never implemented. The situation is worsened when actors feel that they have been by-passed in the policy process. Opposition may extend beyond decision making to affect the policy preparation and implementation processes. Opposition in policy preparation can result in counter proposals in which each of the actors initiates their own study from their own perspective, resulting in contested reports. This can lead to political deadlock (Edelenbos et al., 2000, p. 227). Opposition at the implementation stage can become manifest in situations where actors in charge of implementation go their own way, implementing the policy differently from what was proposed (Van Twist and Mayer, 2000). Actions undertaken by opponents may also delay or prevent implementation; for example, opponents buy land that is needed for other's idea to expand infrastructure (Van de Riet, 2003).

As if policy making alone is not already difficult enough, the aviation system and the need to make it more sustainable, increase the policy making task substantially. In the past, aviation policy making was focused merely on providing sufficient capacity with respect to future traffic demand. Currently, however, aviation policymaking also addresses the negative effects, like environmental and external safety issues. As a result of, among others, aviation growth, environmental issues have become a major factor for society. In turn, this has resulted in an increasing societal demand for sustainability; trying to balance the economic, environmental and

social interests. From single issue decision making, aviation policy making has now become multiple criteria decision making.

In this special issue we would like to give arguments why the aviation sector can only become sustainable if an integrative approach is taken. With an integrative approach we mean that all stakeholders' interests, values and perceptions must be considered and an integral policy must be devised that combines things such as innovative aircraft technologies, advanced air traffic management, and the smart spatial planning of airports.

In order to have techniques and methods come to such an integrative approach we present these techniques and methods in two categories. One is the category of evaluation: what is the expected effect of different policies when compared to each other is important input for choosing for one of these policies? The second category is about innovation: how can we start to design or identify potentially good solutions that could become part of a policy? We consider both categories as complementary.

This special issue of EJTIR

The four papers published in this issue are (in order of appearance):

1. "The sustainability of airports", by Milan Janic;

2. "Insufficient scope in current airplane technology developments", by Alexander De Haan;

3. "Adaptive Airport Strategic Planning", by Jan Kwakkel, and;

4. "An operational design for transition experiments" by Mark De Bruijne, Odette van der Riet, Alexander de Haan and Joop Koppenjan.

The first two papers focus on the category of evaluation, while the third paper is a mix of both evaluation and innovation. The fourth paper focusess on innovation.

Evaluation

Policy analysis aims to facilitate the policy making process by producing policy relevant *information* that can be utilized to resolve problems in specific political settings. Helping people in deciding and finding solutions to problems is thus the core of policy analysis (Dunn, 1981, p. 2, 62, and 84). Policy analysis provides a systematic approach to identifying, exploring, and assessing policy strategies (Walker, 2000). Policy analysis methodology draws from and integrates elements of many scientific disciplines, including operations research, economics, statistics, political science, sociology and psychology. In terms of scope and discipline, policy analysis has changed dramatically over time. The first policy analyses were based primarily on operations research (Edelenbos et al., 2003), with optimization and utility playing an important role. Later, the economic perspective and economic norms and values were introduced. Cost-benefit analyses and cost-effectiveness analyses were used to inform decision-makers.

Evaluation explores how current and alternative airport policies affect the full range of outcomes of interest, while also comparing their estimated impacts. This evaluation usually uses a system model and is usually performed for each of several future scenarios. These activities generate knowledge about the effects that the alternative policies have in the various scenarios, while also produce insights into the tradeoffs that will have to be made regarding the effects. Evaluation can also involve monitoring how a current aviation system functions and analysing the consequences of previously adopted strategies (Walker, 2008).

The paper authored by Janic provides an indicator system that can be used for policy evaluation (Janic, 2010). The indicator system comprises an integrative set of indicators for evaluating the

sustainability of airport policy. The indicators and the related measures reflect the airport's operational, economic, social, environmental and institutional performance.

Some actors in the aviation system claim that the future efficiency gains deriving from developments in aircraft technology will fully compensate for any negative effects stemming from aviation's continued growth, and that thus there is no need for concern about the expected growth in aviation. The paper authored by De Haan challenges this claim by using a policy analysis evaluative approach (De Haan, 2010). The paper's conclusions contradict the stated claim: the technological innovations currently in development will lead to only about (ideally) 20% reductions in some of the negative effects, while aviation is expected to at least triple between now and the year 2050. Hence the conclusion is that much more than mere efficiency gains are needed to compensate for the expected continuing growth of aviation.

Innovation

Coping with the negative externalities of aviation is a major sustainability challenge. Transport innovation is needed to deal with these complex and persistent problems. Transport innovation has been defined as "new ways to manage transport systems and new technologies", which includes new policy instruments (Feitelson and Salomon, 2004, p. 12).

Identifying promising solutions to problems, starts with problem formulation and future analysis. During problem formulation the goals, constraints and criteria are identified. Next, policy options are designed and analyzed according to the indentified outcomes of interest. Futures analysis is required, because the future external developments that cause changes in the development of airports and aviation are highly uncertain. Typically, scenarios are the analytical tools used to represent and deal with these uncertainties. Each scenario is a description of one plausible future state of the external environment of a system (Walker, 2008). Another problem facing airport planners is that the contextual settings in which airports operate are no longer as stable as in the past. This is due to a variety of recent developments that affect the functioning of the airports, including globalisation, privatisation, deregulation, liberalisation, and rising fuel prices. Given the increased uncertainty about what the future will bring, there is a need to revisit the way airports deal with uncertainties. Most uncertainties cannot be eliminated; instead, they must be accepted, understood and managed. As a consequence, policy design increasingly requires the development of flexible, adaptive policies that can be adjusted as new information becomes available (Kwakkel, Walker and Marchau, 2007; Walker, 2008).

The paper authored by Kwakkel et al deals with this adaptivity challenge for airport planning (Kwakkel, Walker and Marchau, 2010). The paper discusses three adaptive alternatives: dynamic strategic planning (which includes real options), adaptive policy making (which includes the identification of vulnerabilities and signposts), and flexible strategic planning (which includes pro-active planning).

In addition to identification of potential solutions, experiments also greatly contribute to reaching innovations. The path from experiment to the implementation of an innovation is a long and difficult one, however. Creating a development path requires more than just one experiment or field test. Before an innovative idea or concept can be adopted by the regime, more learning is often required. Small experiments eventually affect a wider policy process and contribute to a transition. In this a distinction is made between three levels:

- Micro-level (where the experiments occur; this level is occupied by the niche players: the actors that operate on a relatively small scale and that are active outside the scope of the establishment;

- Meso-level (where the policy processes occur and which is occupied by the regime players);

- Macro-level (where the transition processes occur).

The actors that comprise the regime formulate the mainstream transport policies and strive to maintain the regime policies that suit their particular core policy beliefs. To up-scale a policy instrument, the niche and regime levels should be aligned. A condition for up-scaling is that the effects of an experiment should be monitored and evaluated, and that learning should occur (Loorbach, 2007). However, few practical guidelines have been developed for how to manage experiments in ways that ensure learning does in fact occur.

The paper authored by De Bruijne et al aims to fill this knowledge gap (De Bruijne et al, 2010). The paper provides an operational design for transition experiments: practical guidelines for the experiments intended to stimulate learning and strengthen the transition character of the experiments. The design builds on the transition management literature, while offering insights derived from the process and network management literature and notions from innovation studies.

By providing new insights both about evaluating policies and identifying potential innovations, we think this special issue is of major interest to people interested in creating more sustainability in the aviation sector. The papers are written such that they will fit the needs of an academic audience, but for sure will provide practitioners in the field and policy makers in both the industry and the government with fruitful new ideas.

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