Chapter 49
Innovation for Sustainability in Aviation:
World Challenges and Visions

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ABSTRACT

In this chapter, the shared visions and the latest activities for sustainability in the aviation sector are presented and perspectives on the innovations that this sector should achieve are discussed. To do this, the latest experts' talks are collected from four international meetings for aviation and the environment held around the world between September 2009 and May 2010, which invited experts and researchers from Japan, Europe, and North America. The expansion of networks between agents of the sector, which is considered to be essential for the success of innovation transition, is found in the latest projects for aviation sustainability. To smooth the transition of innovation from sector's initiatives including radical change such as low-carbon alternative fuels, we emphasize the need for more discussion about new economic measurements. Finally, we discuss directions for future research, using multi-level perspectives for a transition management of aviation innovation for sustainability.

INTRODUCTION

Some environmentalists believe that air transportation is evil because it is energy consuming, extravagant, and polluting. Aircrafts fly using fossil fuels, which emits various problems such as "sustainability," however air travel also allows people to meet their friends and families living on other continents, and the chance to buy local products of another hemisphere in their own towns. The aviation and a "sustainable" future is very complicated issue socially and economically. Furthermore, aviation connects countries. No single country has full control of international

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flights, which indicates that the management of aviation in the future cannot be achieved without international negotiations and challenges.

In this chapter, we investigate how the sector is going to control the flight for sustainability in such a difficult weather. Over a hundred years after the Wright brothers flights, aviation has achieved countless technological and system innovations in the area of fuel efficiency, noise, air quality, speed and safety. The main agents of the aviation sector are listed as follows: airlines, aircraft manufacturers, engine manufacturers, research institutes, researchers, air control services, airports, and governmental and non-governmental organizations. Geel (2006) pointed out that the networks within the socio-technical system for aviation were one of the keys to success in precedent innovations. With successful experience in innovations, the aviation sector is now tightening and widening the networks between various agents to challenge the climate-change issue. Last year, for example, the sector produced the first globally harmonized agreement on reducing the sector's impact on climate change (ICAO, 2009), the details of which will be described in the next section.

This chapter is organized as follows: the second section explains the theory we use for the analysis of experts' talks and the background of the aviation and the environment issues. The third section presents the data sources which the analysis is based on, and the sector's shared visions toward aviation for sustainability. The fourth section discusses the technological and system innovation trends, network expansions of agents of the aviation sector and perspectives for achieving the sector's responsibility toward a carbon-neutral society. The fifth section proposes future innovation management directions. And the sixth section concludes our findings.

Finally, in this chapter, we treat CO_2 emission reduction as the main solution for aviation impact reduction for climate change, while the balance of NO_x effects to ozone production and methane reduction and the potentially grave effect of contrails are still uncertain (Szodruch, 2009).

BACKGROUND

Research into Innovation and Sustainable Development

Recent social science research into innovation and sustainable development can be classified into two groups: cleaner technology and systems innovation (Smith, 2006). The latter is important since cleaner technologies are often not adopted without some transformation of socio-technical systems (ex. technology, policy, users, industry structure, markets, culture, infrastructure, science) (Weber et al., 1999). Researchers of systems innovation have been developing many theories and tools to promote the transitions required to make it possible to move innovations from laboratories to market.

One prominent school of thought in recent systems innovation debates is called Strategic Niche Management (SNM). Here niche is used to describe an emerging and innovative technology or system, and is vulnerable at the infancy. Studying the history of technology innovations, SNM scholars have analyzed processes to try to determine what is the best for successful development of niche. They have identified some strategic factors; broad and deep social networks, robust expectation shared between actors of a niche, and learning processes at multiple stages where the actors related to the niche learn about the design, user needs, cultural and political acceptability, and other aspects of the niche (Schot & Rip, 1996, Hoogma et al., 2002).

SNM researchers have taken a lot of case studies of the transition mechanism of various domains; products such as organic food, eco-efficient house etc., or public services such as biogas energy plant, waste water plants and so on (e.g. Smith, 2006; Raven & Geel, 2010; Dries et al., 2007). There are a few studies about aviation (Haan & Mulder, 2002; Kivits et al., 2010). More studies are expected to accelerate both the SNM research and the aviation sustainability, because systems innovation in the aviation sector is very difficult due