

# Some Problems with modern Management and Planning Systems: The technology-environment trade-off for the aviation industry

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## 1 ABSTRACT

While technology is changing the way cities look, it is having a more profound affect on the way city users interact, and by extension, the way planners strategise to accommodate these new interactions. Many of these strategies are system-based in an attempt to capture as many variables as possible, and are often aimed at delivering multiple, and sometimes competing objectives. A prime example is the emerging reliance by planners on environmental management systems (EMS), which are specifically designed to instruct organisations in the management of environmental impacts. Considered by many to be the most valuable tool for building a sustainable future, the EMS is hinged to benchmarked best practice, which is driven in turn by new technology.

The problem for managers and planners though is that new technology tends to have a singular focus, and in many cases can have a detrimental impact on other outcomes. This means that setting benchmarks for an EMS can require complicated calculations to be undertaken so that the metrics established collectively add up to an optimal net gain. This is problematic for the aviation business, which is constrained by the noise issue, which can be offset by design and operational strategies that actually increase fuel burn and carbon and nitrogen emissions. Ways need to be found to balance competing objectives in order to safeguard against appealing to short-term popular demands, which if accommodated, can have implications for climate change and other less obvious issues.

The purpose of this paper is not to deny claims by the aviation industry about the greening of air travel, but to simply point out that the way forward for greener aviation technology is laden with trade-offs. The task here then is to describe what these trade-offs are, and suggest scientifically justifiable ways of objectively measuring the implications of a range of possible scenarios relative to the trade-offs. In this respect, a basic cost benefit analysis is unlikely to capture the nuances associated with the types of trade-offs that the aviation industry faces. A multi-criteria analysis (MCA) informed by closed-system thinking is more equipped to accurately portray the likely outcomes resulting from the actual trade-off pursued.

This analysis will aim to determine, using MCA techniques, whether trade-offs such as those between aviation noise and emissions, can actually be accurately measured, and if so, how can this be represented in an EMS? A relevant sub-question that will need to be addressed is what are the key metrics, and how does knowledge of performance relative to these metrics translate into improved sustainability strategies? It is anticipated that the results will help to determine what are the limits of a cost benefit approach to the problem, and how MCA approaches extend these limits?

Achieving the conflictive goals of reduced fuel burn and noise presents a dilemma for aircraft designers, airport operators and regulators. Whether sanguine or sceptical about the possibility of technology solving the aircraft emission problem, the truth is that the low-hanging fruit in jet engine development has already been picked. It is true that engines are more efficient and quieter than just a decade ago. However, further gains are likely to be more marginal. While there are identifiable solutions for aircraft inefficiencies, there is an inevitable trade-off between noise, fuel economy, and 'wake penalties', which is the pattern of air turbulence trailing behind an aircraft that has serious safety implications.

Accordingly, the article has three objectives. Firstly, to demonstrate that an EMS involves multiple variables that are not always complementary, requiring sophisticated analysis to make sense of them. Second, to emphasise that technological solutions are usually 'linear' in scope and effect, and can have serious implications for disconnected processes and outcomes. Finally, that multi-criteria techniques can be useful for solving trade-off problems between technology and environment.