Seoul inter-noise 2020 23 - 26 AUGUST

The case for a design-led, end-user focused airport noise management process.

Graeme Heyes[1]
Manchester Metropolitan University.
Ecology and Environment Research Centre, Department of Natural Sciences, Manchester Metropolitan University, Manchester, M1 5GD, United Kingdom.

Jack Shepperd[2]
A Good Design Studio.
3 Fencegate Avenue, Stockport, SK4 5EP, United Kingdom.

ABSTRACT

This paper explores concept of 'design thinking' in the context of airport noise management, to inform on strategies and actions that can achieve targeted, impactful and evaluated outcomes benefitting local residents, and by extension, airports. In so doing, the we summarise the noise management challenge and the requirement for an effective ideation and implementation framework, and introduce the design thinking process as a potential means with which to do this. We suggest that design processes have the potential to play a significant role in noise management, but that significant research is required to overcome a number of barriers, to demonstrate the potential effectiveness of the approach through case study research, and for the process itself to be developed further, ideally through co-creative processes with airport noise stakeholders.

1. THE AVIATION NOISE CHALLENGE

The effective management of airport noise requires that noise managers address complex, varied and multi-scale challenges linked to noise induced health outcomes, including annoyance [1,2]. This is accomplished through noise management strategies and actions that fall under four categories of the ICAO Balanced Approach [3], that may, for instance, seek to: reduce noise footprints or change the temporal or spatial distribution of noise (operational procedures); redistribute populations exposed to noise (land-use planning); and, protect people from noise (i.e. through insulation and noise zoning). More recently, researchers have identified a range of non-acoustic factors known to play a role in noise impact [4,5], and have stated that comprehensive approaches to noise management should aim to address such factors directly, through communication and engagement initiatives [6], exemplified by public participation [7].

The implementation of such management actions must be tailored to the specific and diverse needs of different airports, which can differ significantly depending on a range of characteristics [1]. Such flexibility is at the core of the ICAO Balanced Approach [3], and the Environmental Noise Directive [8], which requires airports of over 50,000 movements to produce strategic noise maps and develop

[1] G.heyes@mmu.ac.uk
[2] jack@madebyshepperd.com

noise action plans. A range of guidance exists to aid noise managers in developing noise management strategies and individual actions associated with the balanced approach (International Civil Aviation Organization, 2004). This includes guidance at the national level (Department for Transport, 2017), however this is not always the case and the different characteristics of airports and the challenges that they face may mean that national guidance cannot be directly transposable between nations [1]. Moreover, although such guidance is useful, they do not provide any sort of step-framework in terms of guiding an airport through the development of solutions to noise management challenges in a holistic manner [11]. Nor do they embed the emerging concepts of communication and engagement as means to influence non-acoustic factors in the development of noise management actions [6]. This is a particular challenge for small but rapidly growing airports that can quickly fall under legal requirements for noise management actions, but who may lack experience in their implementation. The danger is that they may seek 'copy-out' transpositions of what has worked elsewhere, rather than what may be most appropriate in their own setting. This approach is understandable and may be effective at demonstrating action in the short-term, it may also lead to sub-optimal outcomes. This is particularly the case seeing how lead-edge airports are constantly developing and redefining their own noise strategies in response to the maturing noise management landscape.

Recent research conducted in the H2020 ANIMA (Airport Noise Impact Management through Novel Approaches) research project highlighted that no best practice solution to noise management challenges exists in terms of implementing specific solutions to specific problems. Rather, best practice to noise management is a process that guides airports from the identification of a need to make a change, the design of a range of management actions, the selection of the most appropriate action, and its implementation and subsequent on-going evaluation [11]. Beyond some example questions that may be asked at each phase however, no additional support was provided as to what such a process might look like.

This suggests that the industry may benefit from a noise management design process that is able to guide airports in designing and implementing responses to noise management challenges, as appropriate to their own circumstances. Is illustrated in

Figure *1*, such a process must produce outcomes that are:

- *Viable* in terms of complex factors such as safety, security, environmental interdependencies and legislative compliance;
- *Desirable* to industry and community stakeholders;
- *Feasible* in terms of airport capabilities; and,
- *Compliant* with a suite of fundamental noise management principles, for example the nuances between reducing absolute levels of noise, noise impact, and the capacity to influence non-acoustic factors.

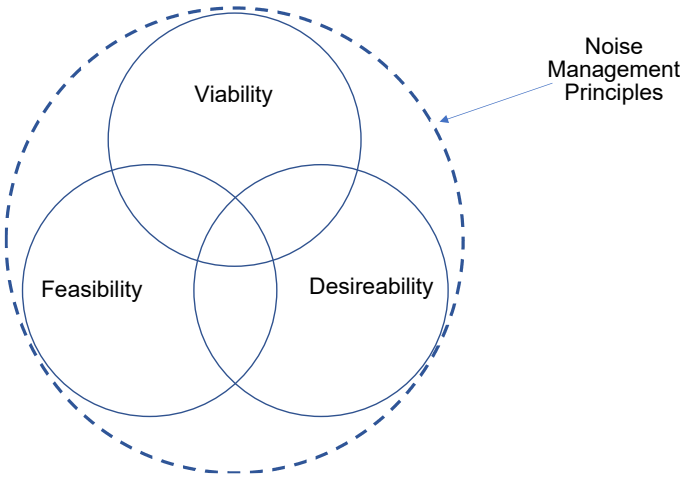

Figure 1: Noise management action requirements.

Such a process must also consider the complex multi-stakeholder nature of noise management and the fact that noise management actions ultimately exist to benefit the lives of residents. This further implies that such a process should be:

- *Collaborative*, to enable cross-stakeholder input and consultation.
- *Iterative*, *yet flexible*, to help develop solutions to unique challenges.
- *Human-Centric and End-user focused*, to produce outcomes that benefit residents in such a way that is empathetic of their perspectives.
- *Impactful,* reflecting the need for management actions that can deliver targeted and evaluated outcomes that aim to address the core issues behind noise problems.

Seeing that noise management actions are 'services' that are 'designed' by airport managers, with the ultimate aim of benefiting local residents, we believe that the design community, with several decades experience of designing products and services for end-users, has the potential to inform on such a process. We explore this further below.

2. DESIGN THINKING

Design thinking is a human-centred [12] and iterative approach to problem-solving that emulates the ways in which designers think and work [13]. It is based on the idea that problems faced by organisations are complex, involve a range of stakeholders, and there may exist several layers of understanding required to comprehend and solve, the core design challenge. Through an iterative processes it is possible to move from a hypothetical starting question that they don't know the answer to, towards, solutions that are empathetic to the needs of end-users and that are able to address the root cause of the problem at hand. There is no formal agreed upon definition of design thinking, and the concept has been critiqued for the fact that it was developed by innovation firm IDEO [14] without proper academic grounding [15], however the concept has nonetheless become widely adopted by the design community, businesses and increasingly by researchers, who have been attracted to its ability to drive innovation and business success [16–19]. Redante *et al.,*[19] went as far as suggesting that design thinking can be used as an alternative to approach to stakeholder engagement.

The design process, as described through design thinking, does not provide a hard and fast set of rules and actions. Rather, it is about creating a sequence of spaces in which different types of activities take place [20,21], notably need-seeking, brainstorming, and prototyping [22], or as Brown [20] defines them: inspiration, ideation and implementation. The processes also embeds concepts of collaboration (reflecting the fact that organisations and their challenges are complex and involve a range of stakeholders), iterative (reflecting the fact that innovation requires phases of research, exploration and ideation), and end-user focused (accounting for the fact that products and services exist to serve the needs of those who use them, or are affected by them). A number of versions of the design thinking process exist, however all essentially follow the fundamental process outlined in the 'Double Diamond', described below and illustrated in *Figure 2*.

The first two phases (discovery and define) of the diamond describe the aim of 'doing the right thing', by getting to the bottom of the problem and identifying what needs to change in order for the problem to be solved, and hence what kind of solutions might be appropriate. This is important as what may appear to be the problem at a superficial level may have its roots in a range of other factors that need to be addressed in order for the problem to be solved. The final two phases describe the aim of 'doing things the right way' in that they explore a range of suitable approaches to solve the problem faced, and through iterative exploratory processes identify the best possible way to develop and deliver a solution to the original problem. The phases are typically described as diverging or converging. During a diverging phase, the design team aims to be as creative and open minded as possible, with the aim of maximising the potential to get to the bottom of the challenges investigated,

or to identify their potential solutions. In converging phases, the focus shifts to condensing and narrowing findings or ideas to provide focus, and ultimately, effective and implementable outcomes.

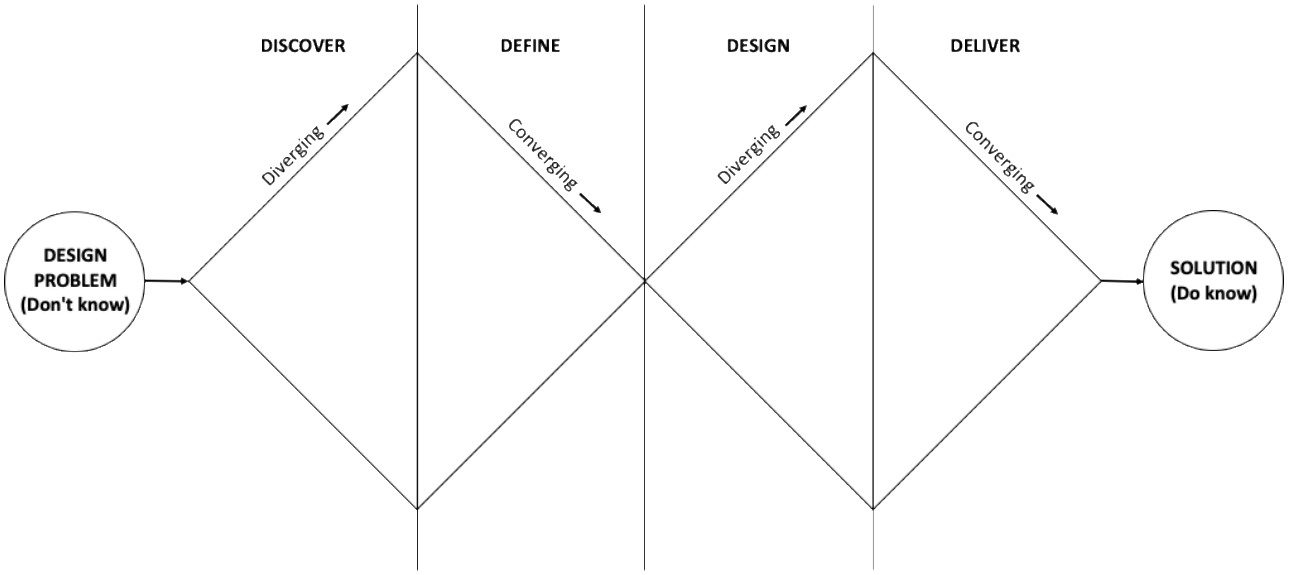

Figure 2: The 'Double Diamond' design process. Authors own, design inspired by Design Council (2020) and Nessler [23]

The process is typically led through a multi-stakeholder design team, which convenes to participate in, and drive the design process. The nature of this team can be flexible to the particular setting, however it is essential that the team comprises all stakeholders with the capacity to be impacted by the design problem. An on-going design team can be beneficial in that it acts as an ongoing group that aims to work together over time to address challenges as they arise. In so doing the team is able to develop long term relationships amongst members and thus establish trust between each other, in the design process, and in their own creative capacity. The convening of the design team begins with what is termed the 'point of departure', which should include a review of the initial hypothesis, or design problem, to be addressed, followed by the establishment of design thinking principles that are necessary for the process to be successful. These include establishing roles and responsibilities, available resources and deadlines, the requirement for open two-way dialogues through which held expertise can be challenge, and the development of success and failure criteria.

2.1. Discover

The discovery phase sees the design team define the overarching challenge and through the acquisition of primary or secondary research data, look to provide additional insight into the question. Research often includes a strong qualitative element to reflect the empathetic, human-centeredness of design thinking. The process typically begins by evaluating the design problem by questioning every aspect of it to identify areas a range of elements, characteristics and areas of interest that can be explored. The findings from this activity can then be clustered into topics that provide an overview of the problem and areas that require investigation.

With the key topics identified, research takes place to provide insight into the reality of the design problem. In terms of primary research, this may result in the generation of empirical and qualitative data. The latter often being important in revealing the core aspects of the design challenge that need to be addressed.

2.2. Define

Next the design team converge into a defining or interpretive stage with the aim of assessing the collected information to form insights that may provide additional clarity or perspectives on the design problem. This can take place in a workshop setting where those responsible for each phase of the research feedback their raw findings with the rest of the team. Creativity can be useful here to help bring the research to light, for example by synthesising data to 'tell stories' about the experiences of different stakeholders and to illustrate the important information uncovered, what was surprising, what were motivations and frustrations, what are the relationships that exist. Doing so is useful in building empathy for stakeholders to ensure that ideated solutions designed to help them have their needs at heart.

Following this session, the results can be reviewed and clustered into themes of relevance as part of a 'search for meaning' so that insights from them can be drawn. The aim is to uncover the hidden truths that may (or may not) exist regarding the situation and can be particularly useful when considering human issues, such as people's frustrations, wishes, or perceptions regarding a specific topic. From this, opportunity areas can be identified that can be adapted into headline statements that can subsequently lead to the development of 'How Might We' questions designed to inspire the design process by acting as a tangible statement of what needs to be accomplished for the design problem to be.

2.3. Develop

With the actual design problem uncovered and defined, it is now possible to begin to look at solutions in a further workshop environment where the design team comes together to identify and evaluate solutions. The workshop can be broadly split into two sessions, the first being to brainstorm solutions related to the redefined design problem. It is important that this stage is approached with a creative and open mind with no judging or evaluation taking place as this can constrain thinking and the ability to think of potentially unique and powerful solutions. After the ideation phase an evaluation phase takes place to appraise ideas and identify those with the most potential to solve the defined problem the group is attempting to solve. This is typically accomplished by placing the generated ideas on a matrix of impact and feasibility.

2.4. Deliver

In the delivery phase, the identified solutions see the design team converge once more to prototype, test, and refine selected option, or options deemed to hold most potential, in order to determine which is the most appropriate, and how it can be implemented. A key concept at this stage is the idea of 'minimal viable products'(MVPs) – simple representations of proposed solutions that can be tested as fast as possible by offering just enough for initial feedback to be obtained. These MVPs can then be developed and refined over time as they move closer and closer to becoming final products.

3. DESIGN THINKING FOR NOISE MANAGEMENT?

Whilst there is no evidence of design thinking being applied in a noise management context, design and design thinking have been used to solve a range of environmental challenges [13,24–33]. Similar iterative processes that take an initial research problem and creatively generate solutions and pathways to implementation have also been used extensively in management fields [34–38]. Importantly, design thinking principles have also previously been used to solve a range of aviation industry challenges, related to issues such as safety, air cabin design, and digital services, by organisations such as airlines, the military, and NASA [39–44].

Considering the noise management challenges and requirements outlined at the start of this article, and the characteristics of design thinking introduced above, the case for design processes to guide noise managers in solving noise problems is compelling. Design thinking provides an iterative yet

flexible process which can help to guide noise managers not through a set of hard and fast steps, but by providing space through which appropriate good practice can emerge through deep and collaborative exploration of noise problems, in a human-centric fashion [12], that is able to produce outcomes that seek to benefit residents in such a way that is empathetic of their perspectives, and that is viable, feasible, and impactful in terms of delivering targeted and evaluable outcomes. This is illustrated through *Table **1*** which describes the core characteristics of design thinking as defined by Shapira *et al.* [31], to which we have supplemented with noise management requirements in order to demonstrate the synergies between the two.

Table 1: the core requirements of airport noise impact management and synergies with design thinking

Design Thinking (Shapira et al., [31])	**Airport Noise Management Requirements**
Human-centredness, placing end-users at the centre of the design process.	Consider resident needs, i.e. the ultimate beneficiaries to whom noise management actions are designed to help [6].
Research-based to understand users' needs, drivers, and challenges.	Consider relevant acoustic and non-acoustic data [4].
Surrounding context enables the wider research setting to be considered in the design process.	Noise challenges (and solutions) are specific to each individual airport and a range of external factors (operations, environmental interdependencies, socio-economic benefits of the airport) [1].
There is a fundamental belief that anyone can create or inform on change.	Noise management research has shown that communities have the potential to provide valuable insight to noise management, by being experts on the areas where they live [11].
Strong focus on experimentation, and refinement over time.	Noise management actions should be trialled, modifiable, and evaluable in terms of their ability to deliver on pre-determined and relevant outcomes [11].

Design thinking may have potential application when looking to design an already determined noise management action, for instance deciding how to distribute flight paths using performance-based navigation (PBN). However, the design process' ability to explore problems in detail, and uncover hidden meaning and perspectives held by stakeholders means that it is likely to have particular value when addressing higher-order problems in which there are many unknowns, for example:

- There has been an increase in resident complaints.
- People are campaigning against a particular flight path.
- The airport wants to explore opportunities to increase capacity.
- There is uncertainty regarding how to spend resources aimed to enhance the quality of life of local residents.

In this sense the adoption of design thinking to noise management may hold most potential for small but rapidly growing airports who may otherwise be tempted to 'copy-out' noise management actions conducted previously at larger airports, which may lead to sub-optimal outcomes, considering that such airports have made mistakes in reaching current practice that may need to be avoided, and that they are evolving their own practices as the noise management field continues to mature.

As an exploratory article, we acknowledge that we may present more questions than we are able to answer in this paper. Notably, we recognise that there are a number of barriers to design process being adopted by noise managers, for instance:

- The process needs time and commitment, as well as the acquisition of new skills to either lead the design thinking process, or to work through the process with a practitioner in a creative, collaborative and open manner.
- The collaborative nature of design thinking means potentially giving away control to other stakeholders, which can be a daunting proposition for airport management – although the establishment of noise management principles into the process, and hence influencing the perceived feasibility and impact of developed solutions in the design phase, should ensure that proposed solutions are viable and lead to desirable outcomes.
- Design thinking is best performed with expert facilitation, which can come at a cost that may be challenging for smaller airports.
- Noise stakeholders can differ significantly and gaining representation from all necessary parties may be challenging.
- In some cases, there may not be a perfect solution to a noise problem and obtaining a consensus agreement between the design team may be difficult and require some participants to cede on certain issues. This can be a particular challenge when the development of a noise solution may result in 'winners' and 'losers' from, for instance, deciding where a flight path may be best situated in densely populated areas.
- Integrating community members in to a design team may be challenging in terms of recruitment and facilitation. Those likely to volunteer to a design thinking process are likely to be from the 'vocal minority' of community voices who complain and campaign about noise. Such individuals are typically more distrustful of airport activity and obtaining their buy-in to the design process could be difficult.
- Much of design thinking can take place in a small number of workshops, however the research and delivery phases can be time intensive, meaning that a full design thinking process may not be suitable when a rapid response is required.

Despite these barriers, we believe that the track record of design thinking at solving complex issues, and the synergies between the design process and the requirements for a noise management framework, mean that there is potential for design processes to inform on the development of a flexible yet structured and iterative approach to thinking about, and solving noise challenges. We call for the research community to contribute to understanding and overcoming these barriers through case study research with airports. Such research should seek to gain expert input into the potential development of a tailored design-led noise management process that can be tested in a real setting and to identify what barriers exist, and how they can be overcome. Doing so should assess how the phases of design thinking described in this article may need to be adapted, or if alternative models away from the double diamond may be more suitable. We also call for research into how elements of competence can be embedded into the design process, following recommendations made in recent research regarding effective public participation in noise management [6]. This should inherently come through in the discovery phase of the design process, however the complexities of noise management may require the addition of a preliminary 'noise literacy' phase so that participants who

do not come from a noise or aviation industry background are better able to take part in more technical discussions.

4. POINT OF DEPARTURE

Effective noise management is not dictated by specific noise management interventions conducted in a consistent manner. Rather, good practice is defined by the system through which airports design noise management strategies that are suitable for their own circumstances, and the characteristics of the challenges they face. Design thinking provides a space in which this can take place, by ensuring that those circumstances and characteristics are understood, and that appropriate solutions can be developed.

Should design thinking prove as useful to the industry as we believe, the potential for noise management to be enhanced across the globe is great. We are exploring opportunities to further explore research in the field and call for other researchers interested in enhancing airport noise management to consider how design thinking can be implemented by airports, in such a way that its advantages can be exploited, and barriers to implementation can be circumvented. We also call for noise managers begin to think more like designers, by approaching noise management problems with creativity, collaboration, and human-centred empathy to their stakeholders.

5. REFERENCES

1. Heyes G, Dimitriu D, Hooper P. ANIMA D2.1 - Pan-European overview of Existing Knowledge and Implementation of Noise Reduction Strategies. 2018;
2. Hudson R, Rajé F, Kranjec N, Jeram S, Schreckenberg D, Kuhlman J, et al. ANIMA D2.3 - Recommendations on noise and health. 2019;
3. European Union. Regulation (EU) No 598/2014 of the European Parliament and of the Council of 16 April 2014 on the establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Union airports within a Balanced Approach and repealing Directive 2002/30/EC. 2014.
4. COMOTI, Manchester Metropolitan University, Zeus. ANIMA D2.4 - Recommendations on annoyance mitigation and implications for communication and engagement. 2019;
5. Vader R. D/R&D 07/026 Noise Annoyance Mitigation at Airports by Non-Acoustic Measures. 2007.
6. Heyes G, Hooper P, Raje F, Dimitriu D, Burtea N, Galatioto F. Exemplar Case Studies of Aviation Noise Mitigation Strategies in the European Union: A Review of the communication and engagement state of the art. 2020.
7. Gasco L, Asensio C, de Arcas G. Communicating airport noise emission data to the general public. Sci. Total Environ.2017;
8. European Union. DIRECTIVE 2002/49/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 June 2002 relating to the assessment and management of environmental noise. 2002.
9. International Civil Aviation Organization. Guidance on the Balanced Approach to Aircraft Noise Management (Doc 9829). 2004;
10. Department for Transport. UK Airspace Policy: A framework for balanced decisions: on the design and use of airspace: Moving Britain Ahead [Internet]. 2017 [cited 2020 Jun 9]. Available from: www.gov.uk/government/publications
11. Heyes G, Galatioto F. ANIMA D2.5 - Critical review of Balanced Approach Implementation across EU Member States. 2019;
12. van der Bijl-Brouwer M, Dorst K. Advancing the strategic impact of human-centred design. Des. Stud. [Internet] 2017;53:1–23. Available from: https://doi.org/10.1016/j.destud.2017.06.003
13. Hoolohan C, Browne AL. Design thinking for practice-based intervention: Co-producing the change points toolkit to unlock (un)sustainable practices. Des. Stud. 2020;67:102–32.

14. IDEO. Design Kit: The Human-Centered Design Toolkit | ideo.com [Internet]. 2015 [cited 2020 Jun 11];Available from: https://www.ideo.com/post/design-kit
15. Kimbell L. Rethinking Design Thinking: Part I. Des. Cult. 2011;3:285–306.
16. Dorst K. The core of "design thinking" and its application. Des. Stud. 2011;32:521–32.
17. Glen R, Suciu C, Baughn CC, Anson R. Teaching design thinking in business schools. Int. J. Manag. Educ. 2015;13:182–92.
18. Johansson-Sköldberg U, Woodilla J, Çetinkaya M. Design thinking: Past, present and possible futures. Creat. Innov. Manag. 2013;22:121–46.
19. Redante RC, de Medeiros JF, Vidor G, Cruz CML, Ribeiro JLD. Creative approaches and green product development: Using design thinking to promote stakeholders' engagement. Sustain. Prod. Consum. 2019;19:247–56.
20. Brown T. Design thinking. Harv. Bus. Rev. 2008;
21. Liedtka J. Perspective: Linking Design Thinking with Innovation Outcomes through Cognitive Bias Reduction. J. Prod. Innov. Manag.2015;32:925–38.
22. Seidel VP, Fixson SK. Adopting design thinking in novice multidisciplinary teams: The application and limits of design methods and reflexive practices. J. Prod. Innov. Manag. 2013;30:19–33.
23. Nessler D. How to apply a design thinking, HCD, UX or any creative process from scratch [Internet]. Medium2018 [cited 2020 Jun 23];Available from: https://medium.com/digital-experience-design/how-to-apply-a-design-thinking-hcd-ux-or-any-creative-process-from-scratch-b8786efbf812
24. Prendeville S, Bocken N. Sustainable Business Models through Service Design. Procedia Manuf. 2017;8:292–9.
25. Rocha CS, Antunes P, Partidário P. Design for sustainability models: A multiperspective review. J. Clean. Prod.2019;234:1428–45.
26. Tukker A, Tischner U. Product-services as a research field: past, present and future. Reflections from a decade of research. J. Clean. Prod. 2006;14:1552–6.
27. Braungart M, McDonough W, Bollinger A. Cradle-to-cradle design: creating healthy emissions - a strategy for eco-effective product and system design. J. Clean. Prod. 2007;15:1337–48.
28. Carlsson A, Hjelm O, Baas L, Eklund M, Krook J, Lindahl M, et al. Sustainability Jam Sessions for vision creation and problem solving. J. Clean. Prod. 2015;
29. Fischer A, Pascucci S. Institutional incentives in circular economy transition: The case of material use in the Dutch textile industry. J. Clean. Prod. 2017;155:17–32.
30. Geissdoerfer M, Bocken NMP, Hultink EJ. Design thinking to enhance the sustainable business modelling process – A workshop based on a value mapping process. J. Clean. Prod. 2016;135:1218–32.
31. Shapira H, Ketchie A, Nehe M. The integration of Design Thinking and Strategic Sustainable Development. J. Clean. Prod. 2017;140:277–87.
32. Maher R, Maher M, Mann S, McAlpine CA. Integrating design thinking with sustainability science: a Research through Design approach. Sustain. Sci. 2018;13:1565–87.
33. Buhl A, Schmidt-Keilich M, Muster V, Blazejewski S, Schrader U, Harrach C, et al. Design thinking for sustainability: Why and how design thinking can foster sustainability-oriented innovation development. J. Clean. Prod. 2019;231:1248–57.
34. Boardman A, Shapiro D, Vining A. A framework for comprehensive strategic analysis. J. Strateg. Manag. Educ. 2004;
35. Mendoza JMF, Sharmina M, Gallego-Schmid A, Heyes G, Azapagic A. Integrating Backcasting and Eco-Design for the Circular Economy: The BECE Framework. J. Ind. Ecol. 2017;21:526–44.
36. Heyes G, Sharmina M, Mendoza JMF, Gallego-Schmid A, Azapagic A. Developing and implementing circular economy business models in service-oriented technology companies. J. Clean. Prod. 2018;177:621–32.

37. Heyes G. The potential for sustainable business model innovation: a case study of the airport retail sector. 2016;
38. Broman GI, Robèrt KH. A framework for strategic sustainable development. J. Clean. Prod. 2017;140:17–31.
39. ThisIsDesignThinking.net. Be rebellious! How ANA is Utilizing Design Thinking to Connect its Past with its Future | This is Design Thinking! [Internet]. 2016 [cited 2020 Jun 11];Available from: https://thisisdesignthinking.net/2016/12/ana-design-thinking-japan/
40. Goodheart B. Design Thinking for Aviation Safety. Aviat. Bus. J. 2016;4.
41. Turner Donald EIII. A case study in Design Thinking applied through Aviation Mission Support Tactical Advancements for the Next Generation (TANG) [Internet]. 2017;Available from: https://calhoun.nps.edu/handle/10945/56830
42. Hall A, Mayer T, Wuggetzer I, Childs PRN. Future aircraft cabins and design thinking: optimisation vs. win-win scenarios. Propuls. Power Res. 2013;2:85–95.
43. McGowan AM, Bakula C, Castner R. Lessons learned from applying design thinking in a nasa rapid design study in aeronautics. In: 58th AIAA/ASCE/AHS/ASC Structures, Structural Dynamics, and Materials Conference, 2017. 2017.
44. Design For Europe. Brussels Airlines | Design for Europe [Internet]. 2020 [cited 2020 Jun 11];Available from: http://www.designforeurope.eu/case-study/brussels-airlines