

Jun 25th, 9:00 AM

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Euiyoung Kim
Technical University of Delft

Sara Beckman
University of California, Berkeley

Ki-Hun Kim
Pusan National University

Sicco Santema
Technical University of Delft

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Citation

Kim, E., Beckman, S., Kim, K., and Santema, S. (2022) Designing for dynamic stability in an uncertain world: A media content study of the aviation industry, in Lockton, D., Lenzi, S., Hekkert, P., Oak, A., Sádaba, J., Lloyd, P. (eds.), *DRS2022: Bilbao*, 25 June - 3 July, Bilbao, Spain. <https://doi.org/10.21606/drs.2022.376>

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Designing for dynamic stability in an uncertain world: A media content study of the aviation industry

Euiyoung Kim^{a,*}, Sara L. Beckman^b, Ki-Hun Kim^c, Sicco Santema^a

^aDelft University of Technology, The Netherlands

^bUniversity of California, Berkeley, USA

^cPusan National University, South Korea

*corresponding e-mail: e.y.kim@tudelft.nl

doi.org/10.21606/drs.2022.376

Abstract: The Covid-19 pandemic has caused radical restructuring of many industries including the aviation industry. Seeking a deeper understanding of how organizations are responding to this disruption, we use media content analysis of 331 news articles to extract approaches used in the aviation industry in response to Covid-19 and clustered them in six categories: research, reframe, repurpose, reimagine, redesign and resile (be resilient). We suggest that, taken collectively, these six approaches may provide a framework that companies might leverage to achieve dynamic stability – the ability of a system to arrive at a steady (previous or new) state after a significant disturbance – as the ecosystems in which they operate continue to change and evolve. The framework provides guidance for developing resilience in the face of both short- and long-term change.

Keywords: designing for dynamic stability; design innovation; design strategy; resilience

1. Introduction

When riding a bicycle, choices must be made regarding the ultimate destination, the route to be taken, and the enabling technology. Steering the bicycle, metaphorically, requires identifying that destination and appropriate paths to get there. Pedaling (and associated technologies that power the bicycle) determines how fast one gets to the ultimate destination. This entails selecting appropriate technologies, enabling an appropriate balance of radical and incremental innovation, and building basic infrastructure. While riding, the cyclist constantly adjusts balance, through steering and adapting the power. In fact there is dynamism and balance at the same time. This metaphor explains Dynamic Stability, the core of this research.

Navigating today's VUCA business environment (Bennett and Lemoine, 2014; Millar et al., 2018), including the Covid pandemic, requires achieving dynamic stability to overcome the



disturbances. COVID-19 has presented a particular challenge to the dynamic stability of organizations beyond individuals and there has been an associated flood of academic papers prescribing means of coping (Killgore et al., 2020; Nembhard et al., 2020) In general, the pandemic provides reasons for companies to engage in entrepreneurial action and innovation, with particular attention to unconventional opportunities for business model innovation and value creation (Namatovu and Larsen, 2021). Design thinking can help organizations react and balance disruptions (Sheppard et al., 2018) and further explore growing VUCA situations (Pitsis et al., 2020; Wrigley et al., 2020).

Existing studies have rarely suggested comprehensive approaches addressing VUCA in the aviation industry. In this paper, we explore how aviation organizations have sought dynamic stability in the face of the extreme volatility, uncertainty, complexity, and ambiguity (VUCA) associated with the COVID-19 pandemic (Maier et al., 2016) to propose a set of design capabilities to arrive at dynamic stability in these situations. Using media content analysis, we examine the aviation industry and its reactions to COVID-19-induced challenges and disruptions. Through that analysis, we surface a basic understanding of the means aviation organizations use to stabilize short-term and long-term changes. To explore this, we investigated the following research questions in this work:

- What actions were organizations in the aviation industry taken to respond and survive in the face of an unprecedented market situation, COVID-19?
- What new design capabilities does this suggest might be developed by design innovators to create dynamic stability in the face of VUCA (volatile, uncertain, complex, and ambiguous) market environments?

2. Related work

In this section, we review related work on dynamic stability, designing and innovating for dynamic stability and its application in the aviation context.

2.1 *Dynamic stability*

The notion of dynamic stability is used in the literature from a wide range of disciplines. The engineering literature, for example, uses rigid-body dynamics equations to show how – in theory – a bicycle moving at the right speed maintains self-stability (Whipple, 1899). For our purposes, literature on organizational design describes a dynamically stable organization as one that can serve the widest range of customers and changing product demands while also building long-term process capabilities and the collective knowledge of the organization (Boynton, 1993). Achieving dynamic stability in an organization requires managers who are capable of building long-term, flexible responses in uncertain and fast-changing market environments. Under conditions of rapid market change, a firm's focus should be to satisfy (unknown) future customer demands (Boynton and Victor, 1991). A parallel literature on the notion of resilience identifies three required capacities (Wong et al., 2020; Francis and Bekera, 2014): absorptive capacity describes the degree to which a system or organization

can absorb the impacts of disruption and minimize the associated consequences; adaptive capacity describes the ability of a system to adjust to undesirable situations (e.g., adverse impacts, if absorptive capacity has been exceeded) by undergoing changes; and restorative capacity describes the ability to recover or bounce back and quickly return to normal -- or improved -- operating conditions. Burnard and Bhamra (2011) present a framework that conceptualizes organizational adaptation and resilience during disruptive events and turbulent periods; through this conceptual framework, it is proposed that adaptive capabilities lead to a new system's stability when there is always about the future (Waters, 2011). At the same time, the resilience strategies model: resistance, reliability, redundancy, and flexibility proposes a conceptual framework to build improved organizational resiliency (Gibson and Tarrant, 2010).

Similarly, the dynamic capabilities literature provides guidance as to how firms might gain and retain a competitive advantage in rapidly shifting market conditions (Teece et al., 1997). It suggests three fundamental capabilities necessary for innovation: sensing, seizing, and transforming. These capabilities, respectively, facilitate understanding changing market dynamics, identifying associated opportunities and then taking advantage of those opportunities through the creation of new competencies and the possible disposition of competencies that are no longer relevant thus allowing the organization to be dynamically stable (Teece, 2018; Helfat and Winter, 2011; Leonard-Barton, 1992). The development of sensing, seizing, and transforming capabilities has a meaningful parallel with the management and implementation of design capabilities and frameworks as does the creation of flexible processes that increase organizational adaptability (e.g., Boynton and Victor, 1991). These are complemented by the development of strategies and organizational structures that collectively allow an organization to be responsive when market variability is high (Eisenhardt and Martin, 2000; Teece et al., 1997; Seetharaman, 2020).

2.2 Designing and innovating for dynamic stability

Designing and innovating processes are inherently responsive to market uncertainty as evidenced by the design squiggle (Damien, n.d.) used to depict its path. During the "fuzzy front end" work of design (Koen et al., 2001) design teams research, uncover insights, generate creative concepts, and test them iteratively as they seek an ultimate direction forward. Numerous versions of this process have been introduced by scholars and practitioners over recent decades (e.g., Brown and Katz, 2011; Cooper et al., 2009; Martin, 2009; Rowe, 1987; Tschimmel, 2012). Owen (1998) asserted that innovation processes employ both analytic phases (e.g., finding and discovery) and synthetic elements (e.g., invention and making). Norman and Verganti (2014) speak to the integration of design and technology, suggesting that they must be aligned and balanced to trigger meaningful long-term change (Verganti, 2009; 2006). Recently, design thinking has been integrated with lean product development methodologies in hybrid forms. Design thinking, used to determine what should be built to best serve customers and users, is complemented by lean processes to develop offerings cost- and time-efficiently (Grashiller et al., 2017). This integration allows

organizations to construct meaningful customer experiences that fulfill unanswered customer and user needs (Beckman et al., 2018; Kim et al., 2018; Kim et al., 2016), address rapidly changing market requirements (Teece et al., 1997) and ultimately reform organizational culture (Buchanan, 2015).

The advent of Covid-19 has indeed shown a need for a deeper understanding of approaches that can be quickly adapted, tested, and iterated to tackle complex, systemic challenges (Seetharaman, 2020). The COVID-19 pandemic and the VUCA conditions it has created (Goel et al., 2020; Tooze, 2020) have caused particular firms (e.g., air travel, service, and cultural industry sectors) to further rethink existing innovation models and traditionally accepted innovation methods as the market demand continues to respond to ever-changing conditions. Firms are pushed to be more agile and promptly develop the core capabilities needed to sustain (or shift) their business models in response to changing environments (Seetharaman, 2020).

2.3 Re-typologies

Various forms of re-typologies are proposed and implemented in the design and innovation research fields. For instance, research entails sensing emerging macro, meso, and micro trends as well as changing customer and user needs. Human-centered design research involves connecting with customers, users, and other stakeholders using a variety of methods that help to understand context, decision-making, and human behaviors (Roschuni et al, 2015). Research may also involve literature reviews, contextual inquiry, and in-depth interviews and rely on basic capabilities in observing and noticing (Beckman and Barry, 2007). Reframing requires bringing alternative perspectives to the table and thus seeing opportunities differently (Paton and Dorst, 2011). In fast-changing environments, it is crucial to promptly sense the external environment to reconfigure the firm's organizational structure and its assets (Amit and Schoemaker, 1993; Teece et al., 1997). Repurposing in the context of dynamic market conditions goes beyond material upcycling to involve the construction of new designs to fulfill temporal needs in a reframed business model. To repurpose something is to change it slightly to make it suitable for a new or different application. Conventional usage of the term focused on extending the longevity of products by intentionally designing features or details that facilitate repurposing (Aguirre, 2010). In the aviation industry, for instance, KLM once repurposed airline seat materials for reinventing or upcycling passenger comfort accessories (Green, 2015). Redesigning may traditionally apply to products to improve their quality or reduce production cycle times (Smith et al., 2012) or processes involving physical transformation or repatterning of assets and activities (Mitchell and Zmud, 1999). To reimagine is to imagine again or anew or form a new conception of design (Dictionary, 2020). The term "reimagining" has been commonly used to address larger-scale challenges such as city planning, designing processes, designing systems or platforms, or rebuilding jobs (Taylor and Hall, 2013; Ferretti et al., 2018; Suzor, 2020; Fine et al., 2020). The act of being resilient in the organization broadly supports plans to be more environmentally sustainable. The pandemic has required resilient engineering to

keep the economy open (Goel et al., 2020; Allen et al., 2020). This research brings together literature on these re-typologies to understand when and how these can be beneficial in coping with unprecedented external events and dynamic market environments.

3. Research methods

3.1 Case selection

It is known that, historically, the aviation industry has shown limited resilience, risk, and vulnerability structurally and economically (Gössling, 2020). In the aviation industry, multiple ecosystems stakeholders are engaged in executing any type of innovation, from product to service (Ciampa and Nagel, 2021) to system (Glas and Ziemer, 2009) to organization (Price et al., 2019). The aviation industry faced a significant change in passenger behavior, competition, and technologies before the Covid-19 outbreak, which accelerated the need for change (Taneja, 2016a; Woltjer et al., 2015). Due to the pandemic, the industry has seen a host of both internally generated and externally imposed changes including in-flight service changes, a high number of flight cancellations, the need for emergency financial support, and industry restructuring through shutdowns, mergers, and acquisitions (Forsyth et al., 2020; Adrienne et al., 2020). In response, the industry sought to minimize the erosion of long-developed knowledge, market capabilities, route networks, airport access, and trust relationships with customers (Amankwah-Amoah, 2020).

The aviation industry is familiar with disruption, whether from aircraft accidents, extreme weather events, volcano eruptions, demand disruptions, cybersecurity-related information technology failures, or economic downturns (Wong et al., 2020; Brown and Kline, 2020), and there has been research over the years on the response to such disruptions. There has also been research related explicitly to pandemic management on health screening strategies, airport management, and preventive measures for passengers (Tanriverdi et al., 2020). However, much of this research has focused on the specific actions (e.g., temperature checking) that might be taken. Less is focused on the design approaches that might be employed. In the face of both disruption and expected growth in air travel, the aviation industry must identify novel approaches for understanding and potentially reducing the impacts of disruption on their operations, and thus reassure passengers so they will return (Wong et al., 2020; Budd et al., 2020).

Previous research has addressed strategies for changing the nature of the air-travel economy (Taneja, 2016b). A systematic perspective is needed to ensure a fast response to new challenges in this industry. This involves guiding innovators and decision-makers to be capable of responding to complex system-level problems similar to those offered by climate change and other social issues (Papa et al., 2015). A pandemic resilience roadmap, for example, explicates possible responses and depicts the aspirations of society after COVID-19 with clear steps to follow (Allen et al., 2020). Similarly, scholars have made several efforts in the aviation industry to unlock unexploited innovation opportunities with design-driven approaches (Kim et al., 2020). Our research identifies and categorizes approaches used in

the aviation industry to respond to the unprecedented challenges associated with the Covid-19 pandemic.

3.2 Data collection

We collected data from the aviation industry because it is difficult to react to disruptions (Tuchen et al., 2020) due to its considerable ecosystem complexity and inflexibility. We focused on two major participants in the Dutch aviation industry: the Royal Schiphol Group, the largest airport in the Netherlands and AFKLM, the Royal Dutch airline for convenience sampling reasons.

To be specific, we selected articles by searching the names of the case companies on major news outlets on Google News (between Feb. 2020 and Feb. 2021) with the advanced search options. News articles were selected if the following criteria were met:

- The article was accompanied by an action taken by a case company in response to the Covid-19 pandemic.
- The article was written in English.
- The article was published after the outbreak of Covid-19 impacted the Dutch aviation industry (Feb. 2020-Feb. 2021).

The initial search yielded 331 articles, 151 about KLM and 180 about Schiphol. If different news channels covered the same topic, they were counted as one article. Articles written in Dutch (94 about KLM, 74 about Schiphol) were excluded, leaving 168 written in English. Articles that clearly were not related to our research focus (e.g., an article updating airline flight schedules or the release of a quarterly annual report) were also excluded. After this review, we ended up with 13 articles about reactions to disruptions by KLM and 27 about Schiphol in the analysis. All articles were compiled manually in a single text corpus data sets in an excel file including date of article publication; name of publisher; main subject covered; representative stories related to our topic; types of innovation entities addressed (i.e., abstract vs. concrete) to be assembled for the content analysis.

3.3 Data analysis

We used media content analysis (Neuendorf, 2017; Schreier, 2012; Mayring, 2000; Holsti, 1969; Stemler, 2000; Berelson; 1952) to examine the documents. The text corpus data sets are created with the aim of generating the most trustworthy data for the content analysis (Krippendorff, 1980). It is known that the written text of this sort is regarded as more objective than interviews or fieldnotes and can thus be meaningfully used as a primary data source to examine emergent trends and patterns (Charmaz, 2014; Stemler and Bebell, 1998). We performed a priori coding-based content analysis of these documents to surface the primary types of actions taken in response to the pandemic (Weber, 1990).

To be specific, we analyzed the data set by seeking the action verbs associated with shaping responses or new solutions to Covid-19 induced challenges. Once we had identified all of the action verbs, we clustered and then aggregated verb themes with similar meanings or

connotations all starting with the ‘re’ prefix as it was notable that the types of actions taken by the organizations explicitly addressed re-typologies.

4. Results

Our media content analysis and text-mining suggested six primary design principles for coping with radical disruption in a market environment to dynamically stabilize the path through the VUCA disruptions, so to say. The six “re-verb” typologies —research, reframe, repurpose, redesign, reimagine, and resilie (be resilient) —were salient and went beyond conventional design thinking frameworks to encompass a broader set of approaches that organizations might leverage to innovate in VUCA conditions.

4.1 6R typologies

We clustered the re-verb aggregated typologies throughout the content analysis and summarised the re-verbs and our definitions for each re-verb along with the representative verb examples, the frequency of articles using each typology as the core message can be found in Table 1.

Table 1. Our definitions for each 6R typology along with representative verb example.

Re-verb aggregated typology	Definition	Verb examples	Frequency of articles using each typology (KLM, Schiphol)
Research	Sense emerging macro, meso and micro trends as well as changing customer and user needs	Research; move along (with customer needs)	3 (1, 2)
Repurpose	Reconstruct a new motive of design to fulfil emergent/temporay needs	Repurpose; reuse; recycle;	4 (4, 0)
Reframe	Reformulate/shift a design boundary, scope, direction to meet researched market trends	Reframe; redeploy; act fast; collaborate; cooperate; expand; rebuild	6 (3, 3)
Redesign	Construct a new motive of design to fulfil sustained user needs within one of innovation levels: product, service, and system	Redesign; expand; build on; innovate	8 (1, 7)
Reimagine	Reform a new conception of solution in multi levels of innovation: producy, service, and system	Reimagine; replace; work together; reorganize; restructure; revise; orchestrate; co-create	8 (4, 4)
Resilie (Be resilient)	Create a resilient solutions that are more sustainable, long-term, inclusive	Be resilient; be sustainable; reduce; shift	11 (0, 11)

The most dominant aggregated form of the re-verb typology is *resile* (be resilient) (29% or 11 out of 40 papers). It is important to acknowledge that *resile* (be resilient) is the most-taken action by the two organizations according to the number of articles addressing it as the core effort to cope with the recent Covid-19 challenges.

However, reimagining and redesigning actions accounted for 20%, respectively, meaning that while the uncertainty has long been recognized as a risk in running their business, the attempt to sustain longer-term innovation and its vision appears to be seen as core innovation capabilities over the covid-19 disruptions. Additionally, it is notable to acknowledge that KLM discusses repurposing (tie with reimagining) as the most actions taken whereas there is an absence of repurposing action in Schiphol. We thus observe a difference in applying different design approaches between the two organizations, but the sample size is small.

4.2 6R typology cases

The following describes each of the identified “re-verb” clusters in Table 1, connecting them to the instances of their use in the aviation industry as described in the articles analyzed and to the academic literature associated with those “re-verbs.”

Research

The COVID-19 outbreak dramatically impacted the air travel experience. Governments and air-travel associations continued to announce new measures, instructions, and resources to keep air-travel experiences healthy and safe (e.g., International Air Transport Association, 2020; Transportation Security Administration, 2020). As one of the major touchpoints along the air-travel journey, airports were severely affected (Adrienne et al., 2020; Brown and Kline, 2020; Tanriverdi et al., 2020). At the Royal Schiphol Airport in Amsterdam, all travelers were required to wear masks, follow new air travel and COVID-19 measures issued by the Dutch government (Government of the Netherlands, 2020), and submit temperature checks at the gate before departure. With air travel down 60% (Heeb, 2021), airports across the world had to adjust. Research became a primary focus, as much of what airports understood about their users and the travel context before the pandemic had changed. Rather than a “nice-to-have” as it might have been before the pandemic, research was an absolute requirement for these organizations to find their way in a radically changed landscape. It enhances the argument that the role of research in our society should be reconsidered to cope with societal grand challenges (Howard-Grenville, 2021).

Reframe

Amsterdam Airport Schiphol saw an opportunity in the reduced number of aircraft movements at its facilities to test the potential benefit of drone technologies for activities such as structure inspection and performing various operational processes. “There is currently 85 percent less air traffic at Schiphol compared to the same period last year [2019]. This is extremely unpleasant for airlines and many travelers but also gives us the opportunity

to carry out a test like [drones]”. Reframing is the act of shifting one’s mental models to see a situation or problem in a different way (Beckman, 2020). The resultant reframe allows an organization to create an alternative story about itself, and thus evolve, innovate and change (Kannan-Narasimhan and Lawrence, 2018). Research led to reframing as participants in the aviation industry found other means of seeing the situation they were in due to the pandemic.

Repurpose

During the pandemic, major global airline companies repurposed empty passenger seats into cargo spaces, reconfiguring the cabin space to carry urgent medical supplies and, more generally replacing underutilized passenger seats with cargo spaces to meet the firm’s reframed business objective (KLM Introduces Cargo-In-Cabin, 2020). It is admired that creating a contactless travel journey is key to restoring customer confidence and accelerating recovery from the pandemic (Collins Aerospace, 2020). Instead of waiting until contactless travel is ready through the adoption of new technology, so people are back to air travel, some airline companies began to pivot their business models and convert the customer experience. For example, they repurposed inflight meals by selling them on the ground (e.g., restarting their kitchens to offer airline meals to the general public), thus providing a comforting experience for those who miss the inflight meals they used to have. Repurposing has proven to be a cost-effective way of executing new frames, including new business models. These findings reinforce that there has been a number of fast innovation repurposing initiatives to cope with the pandemic (Von Krogh et al., 2020), including the repurposing of drugs for Covid-19 treatment (Goel et al., 2020).

Redesign

Schiphol has recently redesigned the food ordering service experience from physical to digital using a mobile app so that travelers can now have a safer, contactless, and seamless travel experience. Similarly, they plan to redesign the passport check experience by eliminating physical passport controls, so travelers are not required to remove their passports or travel documents from their pockets. These two examples of redesigning the travel journey via digital transformation to secure travelers’ safety and reinforce their overall experience.

On a larger scale, a consortium of stakeholders in the aviation ecosystem, TU Delft, Airbus, and KLM, convened to redesign aircraft by creating the Flying-V, a V-shaped airplane that would increase fuel efficiency and create a better passenger experience. Even bigger redesign efforts, such as Air New Zealand’s redesign of coach seating to accommodate families, have been associated with thinking about the segmentation of travel use cases and how their differential needs might be met.

Reimagine

In a reimagine effort spurred by the pandemic, Airport Schiphol reimaged its airport from air travel only to a multi-modal hub that would embrace other emerging transportation modalities such as a hyperloop (a high-speed rail in an underground tube with low air pressure for the travel of passengers or freight) that replaces short-haul flights to neighboring airports (Hyperloop Can Play Major Role in Schiphol, 2020). Such ambitious reimaging of existing business models has helped the aviation industry survive and continue to evolve.

Resile (be resilient)

The example of the ‘hyperloop’ at Schiphol, which aimed at substituting short-haul air travel, may ultimately reduce the airport’s environmental footprint. It is essential to make sustainable, long-term, inclusive, and societal impacts part of our society and nature, *“Now is the best time for the Dutch government [to] begin to shift its infrastructural focus from promoting growth to ensuring the quality of life and meeting sustainability goals in the aviation industry,”* said *NL Times*. It also creates an opportunity to reconsider the fundamentals of the aviation system and its impacts on business, individuals, and society (Gössling, 2020). As the Head of Innovation at Royal Schiphol Group says, *“The aviation industry has found itself in an unprecedented situation. The recovery will take years but continuing to invest in innovation and sustainability has great significance”*. Our research reinforces that being resilient requires an action to return something to its original state after being disturbed and is an important capability to adapt and thrive in uncertain conditions (Carey, 2020).

5. Discussion

This paper explores the notion of dynamic stability and how it might be achieved in the face of significantly disruptive change such as that triggered by the Covid-19 pandemic. It uses media content analysis to extract from articles about the aviation industry in the public domain and understand how organizations in that industry have responded to the pandemic. That work led us to identify six approaches (5.1) to creating a dynamically stable organization and prolonging the development of adequate design strategies in light of uncertain environments. Overall discussions are presented in 5.2, followed by validation in progress and future research in 5.3.

5.1 Maintaining dynamic stability in turbulent times

Research (observing and noticing) needs to be conducted continually to maintain full awareness of market and ecosystem dynamics and changing customer and user needs. *Reframing* uses research to reformulate project boundaries and scope in the short-term (e.g., shifting the core business from passengers to cargo), while *reimagining* will use research in the reformation of concepts for the longer term (e.g., reconfiguring airports to

multi-modal transport hubs). *Repurposing* becomes a means of executing inside a reframe (e.g., converting passenger seats to cargo space) while *redesigning* may be undertaken in support of a reimagined future (e.g., the V-shaped aircraft). The ultimate goal in the adoption of new innovation approaches is to gain *resilience* that allows the organization to respond quickly to future curve balls – such as Covid-19 – that may be thrown their way. We synthesize these six approaches in Figure 1 to show when (short-term vs. long-term) and where (concrete vs. abstract) they are applied.

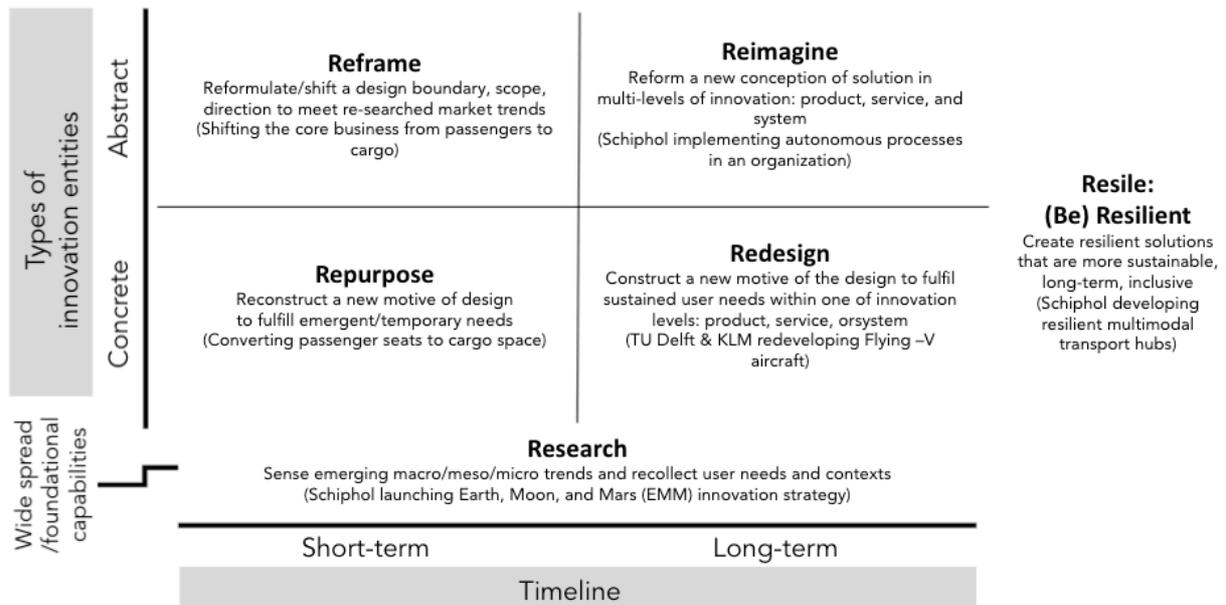


Figure 1. 6R design framework for innovation to keep dynamic stability in an organization.

The framework shows that research is foundational, much as sensemaking is a foundational practice in the design and management literature (Beckman and Slocum, 2020). Research is conducted over the short- and long-term and supports engagement in the repurposing, redesigning, reframing, and reimagining activities. Repurposing and redesigning involve less complexity than do reframing and reimagining. Repurposing and reframing are shorter-term efforts relative to reimagining and redesigning. Resilience can be developed across all types of innovation entities and provides the ongoing capabilities to respond to changing conditions.

This 6R Design Framework may function as an innovation enabler to support the establishment of dynamic stability in highly uncertain market environments. Our contribution lies in highlighting re-action, a strategic act of investigating past and current status to promote a firm’s new and innovative design capabilities to be dynamically stable by providing the audience with a set of practical and actionable 6R framework dimensions (i.e., research, reframe, repurpose, redesign, reimagine, and resilience).

5.2 Overall discussions

The notions of dynamic stability, the 6R design framework, and its typologies that emerged from our analysis of the aviation industry yield recurring themes that provide one view into what this set of approaches might contain.

First, it shows a distinct need to imagine alternative futures that include radical systems redesign. Although future casting, scenario planning, and other strategic foresight methods are sporadically used, our media content analysis identifies several verbs that imply the important connection between envisioning an alternative future and connecting that vision to action in the present: a new service builds on an existing offering [...], the airport expands its service with [...], and reorganization/restructuring plans to [...]. The ability to research the present, then reframe or reimagine the future, and ultimately implement change, including redesigning and repurposing, towards a radically different future state emerges at the heart of the flexibility the aviation industry has shown throughout the pandemic to date.

Second, imagining alternative futures must be soundly grounded in research to develop an understanding of customers', users' and other stakeholders' current experiences and importantly their expectations and aspirations for future experiences. Shifting from product-centricity to customer-centricity (Lee and Day, 2019) will require changing how firms operate from priority setting at senior levels to ways in which data and information about customers are collected, analyzed, and shared. Throughout the pandemic, the aviation industry paid close attention to the passenger experience as they developed and tested programs to support a rapidly evolving set of customer needs. The Schiphol airport installed Sanitizing Service Stations for passengers to disinfect themselves and their personal items. Passengers now pre-order food and beverages before passing through security checkpoints and pick them up afterward in a contactless process. The evolution of these practices requires continued attention to the comfort of passengers, employees, and community members around personal health and safety when traveling.

Finally, it was evident from the research that organizations must become more adept at balancing attention to either or both the short- and long-term: *“Balancing short- and long-term needs is one of the most pressing challenges of product-related decisions compelled by disruptions of such significance”* (Raymond, 2020). The development of adaptive, flexible, and proactive responses to ecosystem changes requires portfolio building, experimentation with alternative future scenarios, and execution across time. Reassessment and adjustment of business strategies will build upon emerging design roadmapping processes (Kim et al., 2018; Kim et al., 2015) and business model shifting (Seetharaman, 2020) and leverage the 6R Framework to create resiliency in organizations.

Implementation of the elements identified in the 6R framework begs the question as to who in the organization might take on this change. Design innovators develop innovative solutions by working closely with other designers, engineers, marketers, and customers (Tschimmel, 2012). They engage in collective, collaborative work at multiple levels in the organization – product, service, system, organizational – to tackle wicked real-world

problems (Buchanan, 1992; Price et al., 2019). In the aviation industry, it seems clear that the pandemic is not the last wicked problem to be faced (Brown and Kline, 2020) and this is likely to be true for other industries as well. Thus, we believe the 6R framework may function as an innovation enabler and aid in the establishment of dynamic stability as it provides possible options for firms to self-evaluate their capabilities for dynamic stability, and serve as a benchmarking template to systematically compare their internal strategies.

Thus, the future will require design innovators who can maintain stability in an ever-changing ecosystem, setting long-term vision (steering) based on a deep understanding of stakeholder needs and facilitating the choice and implementation of supporting technologies (pedaling). The 6R framework could serve to ensure that design innovators engage with proper/timely design capabilities in various dynamic contexts (abstract vs. concrete or short-term vs. long-term). Academic programs are already educating designers in some of the 6R Framework concepts: resilience is taught in several institutions focused on architecture, landscape design, and community design, and reframing approaches are embedded in curricula at major research universities (Resilient Design Institute, 2020; Beckman et al., 2010; Seelig, 2013; Voûte et al., 2020). However further exploration of how best to develop the design innovators needed in the future is needed.

5.3 Validation in progress and future research

To vindicate the proposed framework in the paper, we expanded our research to involve LDA (Blei et al., 2003), a text-mining approach to validate the findings of the media content analysis. It is important to recognize that content analysis is meaningful and valid when the results are triangulated (Stemler, 2000). Thus, the text-mining began with 2,667 articles from Google news (news.google.com), where we could obtain news articles from various and global news sources containing strategies of airlines or airports across the world to change or adapt their way of working in reaction to uncertain situations resulting from COVID-19. Two annotators independently defined the labels of each topic by inspecting its ten representative keywords and by reviewing its 20 representative articles that had the highest probabilities of corresponding to it, whereby the labels were linked back to a priori codes from the content analysis result. Any disagreement in topic labels was resolved through discussion. The other authors confirmed the final topic labels through the discussion with the two annotators until acceptable interrater reliability (IRR) of 0.85 is achieved. The results of the validation process will be included in our following research articles.

This study leaves open multiple other paths for exploration. How might notions of dynamic stability best be embedded in the educational curriculum? Which of the 6Rs are most suitable for which types of innovation entity—abstract or concrete? For example, is repurposing best used at the concrete innovation level (e.g., product), or might it also operate at the abstract innovation level (e.g., business strategy plan)? What are the interactions among the 6R elements? For example, under what circumstances is it helpful to

reframe before engaging in repurposing? Many questions remain open before the 6R framework can be made useful for designers, engineers, and innovators.

6. Conclusion

Dynamic stability—the ability of a system to adapt to a (previous or new) steady-state after a significant disturbance—has been studied by various disciplines to develop a greater understanding of the behavior of physical structures, human bodies, organizations, and business models. The advent of Covid-19, however, has caused more organizations to seek to understand what it means and how to achieve it. This paper explored dynamic stability through media content analysis of the response to the pandemic of two major players – Royal Schiphol Group and AFKLM airlines – in the Dutch aviation industry (13 articles about KLM and 27 articles about Schiphol of the total 331 news articles) and text-mining to validate the proposed design capabilities. This research yielded six “re-typologies”—research, reframe, repurpose, redesign, reimagine and resile (be resilient)—that provide insight into approaches used in reacting to Covid-19. The significant systems-level changes that have been wrought by the pandemic have forced organizations to think and execute in radically different ways, developing capabilities that will serve them going forward to tackle other large-scale systems problems. Our hope is that the identification of the 6Rs with examples of their application will guide academic explorations of approaches to systems-level change and of companies as they explore options for making themselves more dynamically stable over the different timelines and types of innovation entities.

7. References

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About the Authors:

Dr. Euiyoung Kim is an Assistant Professor in the Faculty of Industrial Design Engineering, TU Delft, NL. His research focus is on design, strategy and mobility. He published in California Management Review, Journal of Mechanical Design, and IEEE Transactions on Engineering Management Journal.

Dr. Sara L. Beckman is Earl F. Cheit Faculty Fellow and Faculty Director of Berkeley Product Management at the Haas School of Business at the University of California, Berkeley, US.

Dr. Ki-Hun Kim is an Assistant Professor in the Department of Industrial Engineering at Pusan National University, South Korea.

Dr. Sicco Santema is a Professor of Marketing and Supply Management in the Design Organization Strategy (DOS) Department at the Faculty of Industrial Design Engineering, Delft University of Technology, the Netherlands.