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AI-Governed Digital Premium Experience in Airlines: The DPX-G360 Architecture for Trustworthy Customer Value and Operational Resilience

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Abstract

Airlines are increasingly deploying artificial intelligence, cloud platforms, biometric identity, modern retailing, customer data systems, enterprise resource planning, and predictive operational intelligence to improve passenger experience and competitiveness. However, many digital transformation initiatives remain fragmented across commercial, customer experience, operations, maintenance, finance, cybersecurity, and governance functions. This article develops DPX-G360 as a design-science architecture for governing digital premium experience in airlines through accountable artificial intelligence, trusted data, integrated systems, and KPI-based execution. The study uses design-science reasoning supported by documentary multiple-case synthesis to connect front-stage passenger touchpoints, offer/order orchestration, and back-stage operational systems. The proposed architecture identifies six interdependent capability layers: digital journey orchestration, personalized retailing, operational intelligence, enterprise digital core, trust and cyber-resilience, and KPI-governed execution. The article argues that premium airline experience is not produced by customer-facing technologies alone; it depends on the governed integration of AI, data quality, identity, retailing, operational recovery, cybersecurity, and measurable decision accountability. DPX-G360 contributes to AI governance and aviation management by reframing premium experience as an auditable socio-technical capability rather than a marketing outcome. The framework provides airline executives, CIOs, CDOs, COOs, CCOs, and regulators with a structured architecture for aligning AI-enabled customer value with operational resilience, trust, and performance governance.

Key words: Artificial intelligence governance; airline digital transformation; premium passenger experience; trustworthy AI; KPI architecture; operational resilience; digital aviation

1. Introduction

Airlines increasingly compete through their ability to orchestrate a reliable, personalized, secure and recoverable passenger journey rather than through fleet scale, route breadth, pricing architecture or brand promise alone. The premium passenger experience now extends across search, booking, payment, identity, check-in, baggage, lounge, boarding, inflight service, disruption recovery, loyalty, refunds, claims and post-flight engagement. In this setting, premium experience is not reducible to luxury or cabin quality; it is the passenger's

experienced combination of recognition, speed, confidence, operational reliability, service recovery and trust.

The strategic urgency is intensified by the industry movement toward Modern Airline Retailing. IATA positions airline retailing as a shift toward a more customer-oriented offer and order environment [1]. New Distribution Capability supports offer and order data exchange processes [2], while ONE Order is intended to simplify fulfilment by moving airline servicing toward order-based logic [3]. Why now: legacy passenger service, distribution and back-office architectures are being pressured simultaneously by passenger expectations for personalization, operational disruption volatility, cybersecurity exposure, AI-enabled service automation and the need to convert data investments into auditable decisions.

Digital transformation literature explains how digital technologies alter business processes, operating models and value creation [4], and how digital transformation generates cross-functional organizational implications rather than isolated IT upgrades [5]. In the airline sector, however, the critical question is not whether digital tools exist but whether the airline can govern the relationships among digital touchpoints, data flows, operational systems and accountable decisions. Customer experience research emphasizes journey-based value formation [9], while service-quality traditions stress reliability, responsiveness, assurance, empathy and tangibles [10]. The experience-economy perspective further shows that economic value is shaped by memorable, staged and differentiated experience [11]. For airlines, these insights must be integrated with safety-sensitive, operations-heavy and cyber-exposed aviation systems.

Many airline digital programs remain technology-led rather than value-led. Mobile applications, chatbots, biometric gates, loyalty platforms, retailing engines, enterprise resource planning modernization and predictive analytics may be justified as modernization initiatives without a clear architecture linking them to measurable passenger outcomes, operational resilience, financial discipline and risk governance. The result is a recurring gap between digital investment and experienced customer value. A premium digital channel cannot compensate for weak rebooking, inconsistent baggage recovery, poor disruption communication, slow refunds, fragmented customer identity, unreliable aircraft availability or data-quality defects.

This article therefore addresses an AI-governance and value-realization problem: how can passenger airlines govern digital transformation as an integrated capability for creating trustworthy premium passenger experience, operational resilience and sustainable competitive advantage? In response, the article develops DPX-G360 as a design-science architecture for AI-governed digital premium experience in airlines.

The article contributes by developing DPX-G360 as a design-science artefact, operationalizing digital premium experience through a six-layer capability architecture, and linking the artefact to KPI-governed execution. The unit of analysis is the passenger airline as a digitally governed service-operating system. The article does not claim causal measurement of passenger satisfaction, does not rank the case airlines, and does not assert regulatory compliance by any airline. Its contribution is conceptual, methodological and executive: it converts a fragmented digital-transformation agenda into a governable architecture that can be tested empirically in future work.

2. Literature Review and Theoretical Positioning

The literature supporting DPX-G360 is best read as an integrative and design-science-oriented body of evidence rather than as a conventional author-by-author review. Digital

transformation studies establish that technology alters organizational processes, value propositions and operating models [4][5]. Airline-specific research links digital transformation to distribution, operations, customer service and efficiency [15]. Strategic airline transformation work adds that digitization requires digital mindsets, organizational redesign, integrated platforms and new measures of success [6][7][8]. This literature supports a shift from digital-tool adoption toward governed capability integration.

Dynamic capabilities theory provides the primary theoretical lens. Airlines must sense passenger expectations and technology shifts, seize them through investment and operating-model redesign, and transform legacy systems to sustain advantage [12]. Service-dominant logic is a complementary lens because airline value is co-created among passengers, airline staff, airports, technology vendors, distribution partners, loyalty ecosystems, regulators and service-recovery actors [13]. Digital business strategy adds that digital technologies are strategic resources that reshape competitive positioning rather than simply automate existing routines [14]. Together, these lenses justify a framework that connects digital assets with governance, orchestration and measurable value.

Premium passenger experience is a journey-based and socio-technical phenomenon. It includes conventional service-quality dimensions, but it now also depends on real-time information, self-service usability, accessibility, personalization, omnichannel consistency, data privacy, identity assurance, payment convenience and disruption recovery [9][10]. The HCI and UX literature in aviation highlights that airline systems must be intuitive, inclusive and reliable across diverse users and operational contexts [37]. This is important because premium experience is often lost not through a single service failure but through interface friction, contradictory information, inaccessible workflows, or inconsistent interaction between human staff and digital systems.

Modern airline retailing strengthens the commercial basis for premium experience. NDC and ONE Order support richer offers, order-based servicing and more coherent fulfilment [1][2][3]. Taneja's re-platforming thesis reinforces the idea that airlines must move from transport-only logic toward total mobility and customer-centric platforms [7]. The design implication is that retailing should not be separated from operational readiness. The right offer at the wrong operational moment can damage trust; conversely, a well-governed order architecture can integrate passenger value, revenue integrity, service recovery and lifecycle accountability.

AI and data analytics literature shows that airlines can use predictive analytics, resource optimization, personalization, maintenance intelligence and disruption prediction to improve efficiency and customer engagement [16]. Recent aviation-tourism literature also frames AI, machine learning, blockchain, contactless travel and scalable digital ecosystems as drivers of resilience, personalization and sustainable competitiveness [17][18][19]. Digital performance optimization work further connects automation, IoT and predictive analytics with operational efficiency and passenger-experience improvement [20]. The gap is that these insights often remain use-case oriented. DPX-G360 converts them into governance layers and decision routines.

Operational resilience literature and airline logistics work make the back-stage dimension unavoidable. Airline logistics research emphasizes AI-driven predictive analytics, IoT, RFID and blockchain for visibility, lead-time reduction, stock-out reduction and cost discipline [18][38]. Digital twin, blockchain and AI work likewise associates intelligent aviation systems with planning, scheduling, capacity management, risk management, predictive maintenance and control optimization [21]. These streams show that passenger experience

depends on operational intelligence. A passenger-facing digital promise is fragile when OCC, DCS, AODB, MRO, ERP, finance, procurement and baggage data are inconsistent or inaccessible.

The governance literature also requires risk controls. The NIST AI Risk Management Framework stresses trustworthiness across AI design, development, use and evaluation [23]. EASA's AI Roadmap 2.0 frames aviation AI through human-centric, safety-oriented and ethical considerations [24]. Cybersecurity guidance stresses enterprise risk management, workforce governance and operational resilience [25][26]. European AI and data-protection regulation further intensify the need for lawful, accountable and explainable automation in contexts where profiling or automated decisions may have significant effects [27][28]. Therefore, airline digital premium experience must be governed through consent, privacy, security, model-risk control, human oversight, data lineage, incident response and auditability.

The user's uploaded prior works add three relevant streams to this literature base. First, airline customer experience and AI-passenger-experience work positions KPIs as instruments for translating AI-enabled personalization into measurable customer outcomes [34][35]. Second, Industry 5.0 and human-centric AI work emphasizes human-machine collaboration, workforce resilience and the need to balance efficiency with skill retention [36][39]. Third, KPI, data analytics, cybersecurity and IT-solution studies emphasize performance architecture, data-driven decision-making, risk control and strategic alignment across airline functions [40][41][42][44]. The article builds on these streams but narrows the contribution to premium-experience governance rather than general airline digital transformation.

3. Methodology

The article uses design-science research logic to develop a practical and theoretically grounded artefact for a real organizational problem: the fragmentation of digital transformation, premium experience, operational resilience and KPI governance in passenger airlines. Design-science is appropriate because the intended output is not a causal estimate or ethnographic account but a prescriptive governance architecture that can guide executive decision-making and be validated in later empirical work.

The study combines design-science reasoning with documentary multiple-case analysis. The cases are not selected to rank airlines or infer statistical generalization. They are selected as illustrative modernization pathways that represent different components of the DPX-G360 architecture: Singapore Airlines as an AI-enabled customer and operational efficiency pathway [29]; Emirates as a contactless and biometric journey pathway [30][31]; ANA as an enterprise digital-core modernization pathway using ERP transformation [32]; and Thai Airways as a digital MRO transformation pathway supported by Trax and Aerostrat [33]. The cases are treated as archetypal evidence for design requirements, not as complete organizational audits.

The documentary evidence base consists of the uploaded draft manuscript, the uploaded literature-review file, the uploaded reference list, and the uploaded past works on airline digital transformation, HCI/UX in aviation, logistics, Industry 5.0, human-centric AI, KPI-driven strategic excellence and data analytics. No web browsing was used. Consequently, the article avoids live claims about current company status, real-time implementation maturity, financial performance or regulatory compliance. Source-integrity verification of URLs, DOIs and official pages remains a final pre-submission task if browsing is later approved.

The design procedure followed an evidence-gated loop. First, the problem was reframed from a technology-adoption issue to a governance and value-realization issue. Second, central constructs were bounded: digital premium experience, journey orchestration, offer/order orchestration, operational intelligence, enterprise digital core, trust and cyber-resilience, and KPI-governed execution. Third, literature streams were mapped to these constructs. Fourth, case evidence was used to derive architecture requirements. Fifth, unsupported causal or statistical claims were removed or reframed as conceptual, documentary or illustrative findings. Sixth, the visual model was redesigned to improve clarity, flow, cognitive load, UX logic and executive readability.

The method has explicit boundaries. The study does not include passenger survey data, internal airline KPIs, confidential implementation records, interviews, experimental testing or longitudinal performance measurement. It cannot claim that DPX-G360 has been empirically validated across airlines. It can safely claim that DPX-G360 is a theoretically informed and evidence-bounded design artefact that synthesizes literature and documentary case evidence into a governance framework ready for empirical testing.

4. DPX-G360 Framework and Findings

The central finding is that digital premium experience is not a front-end property of mobile apps, biometric gates or digital service channels. It is a cross-functional capability that emerges when passenger-facing touchpoints, offer/order systems and back-stage operating systems are governed as one value architecture. DPX-G360 therefore organizes premium experience into three connected stages and six capability layers. Figure 1 presents the revised architecture.

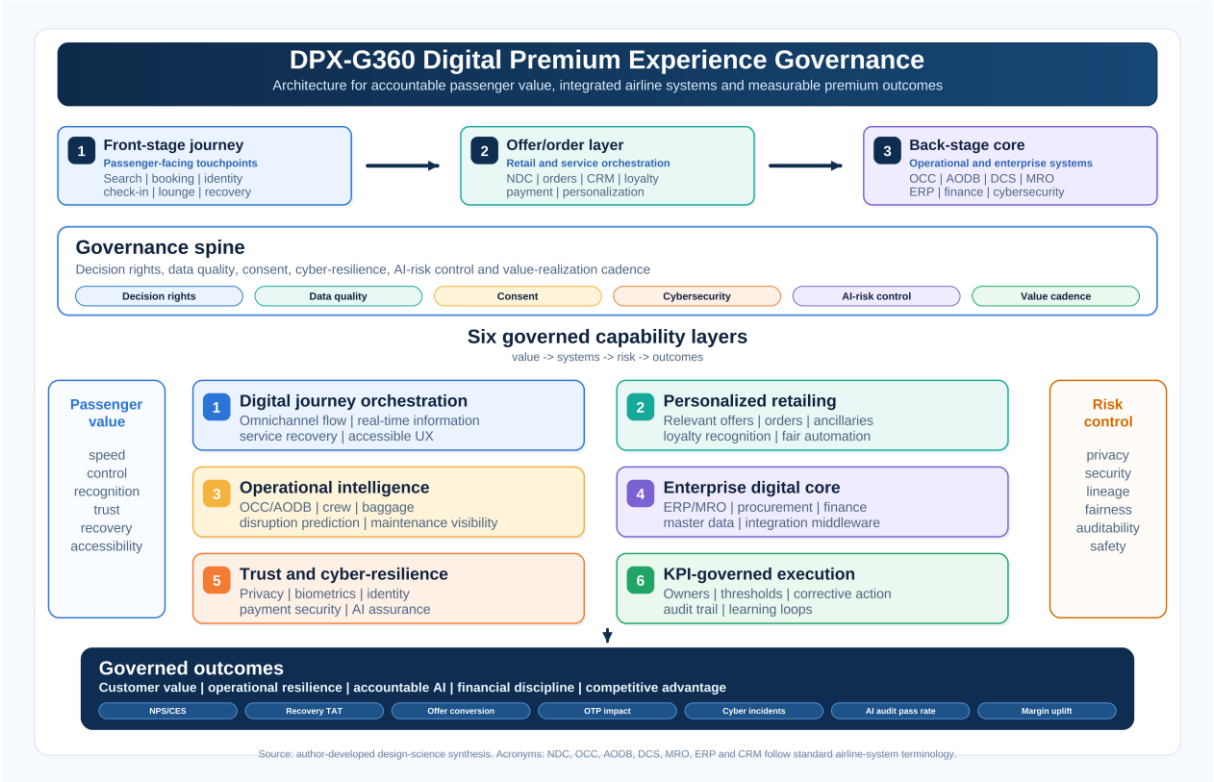

Figure 1. DPX-G360 digital premium experience governance architecture.

The first stage is the front-stage journey. This includes the passenger-visible flow from search and booking to identity, check-in, baggage, lounge access, boarding, inflight service, disruption recovery and post-flight engagement. The governance objective is to reduce friction while increasing control, recognition, accessibility and trust. UX governance is essential here because poor interface design can create anxiety, delay, service failure or exclusion even when the underlying technology is sophisticated [37].

The second stage is middle-stage offer/order orchestration. This stage connects NDC-enabled offers, order management, customer relationship management, loyalty, payments, ancillaries, servicing and disruption logic [1][2][3]. It is where commercial personalization becomes either a value proposition or a trust risk. DPX-G360 therefore requires airlines to govern personalization accuracy, offer transparency, channel consistency, revenue integrity, consent and serviceability. A premium offer is not merely a more profitable bundle; it is an offer that the airline can fulfil, explain, service and recover.

The third stage is the back-stage operating core. This includes OCC, AODB, DCS, MRO, ERP, procurement, finance, cloud, data platform, cybersecurity and integration middleware. These systems are often invisible to passengers, yet they determine whether the passenger receives accurate information, timely recovery, correct refund processing, baggage visibility and operational reliability. Prior airline logistics and digital core research shows that predictive analytics, asset visibility, blockchain, ERP and data governance can improve operational transparency and resilience when integrated properly [18][32][38].

The six DPX-G360 capability layers translate these stages into executive governance. Digital journey orchestration governs the end-to-end travel flow and service recovery. Personalized retailing governs offers, orders, loyalty recognition, payment and servicing. Operational intelligence governs disruption prediction, OCC integration, crew/baggage visibility and maintenance intelligence. Enterprise digital core governs ERP, MRO, procurement, finance, master data, cloud and integration. Trust and cyber-resilience governs privacy, biometrics, identity, AI risk, cybersecurity, incident response and human oversight. KPI-governed execution governs ownership, thresholds, escalation, corrective action, audit trails and learning.

The framework converts these layers into decisions through KPI architecture. Passenger-value KPIs include digital task completion, first-contact resolution, disruption recovery time, rebooking success, refund cycle time, baggage status visibility, personalization relevance and digital accessibility. Operational-resilience KPIs include on-time performance recovery, aircraft availability, maintenance turnaround time, baggage mishandling rate, AOG recovery time, OCC decision latency and system availability. Trust and governance KPIs include consent capture quality, model exception rate, cybersecurity incident response time, data-quality SLA adherence, lineage completeness, biometric failure handling, complaint escalation closure and human-override effectiveness. Financial KPIs include digital conversion, ancillary attach rate, servicing cost per passenger, disruption cost per affected passenger and value-realization variance against business case.

The governance implication is that each KPI must have an owner, threshold, escalation path, decision cadence and corrective-action mechanism. A dashboard without decision rights is not governance. DPX-G360 therefore distinguishes KPI display from KPI execution. The board and executive committee should govern strategic value, risk appetite and investment sequencing. The CIO and CDO should govern platform integration, data architecture and AI/data controls. The CCO should govern offer relevance, loyalty value and customer-recovery design. The COO should govern operational resilience, OCC integration and

disruption recovery. The CISO and data protection function should govern cybersecurity, privacy and incident response. Finance should govern value realization, cost-to-serve, investment discipline and auditability.

5. Discussion

DPX-G360 reframes premium airline experience as a governed operating capability. This reframing matters theoretically because it connects customer-experience research with dynamic capabilities, digital business strategy, service-dominant logic and AI/cyber governance. The passenger's premium experience is not only a perception formed at the service interface; it is an emergent property of the airline's ability to coordinate data, systems, people, risk controls and decisions across the full service-operating system.

The framework also extends airline digital-transformation literature by making the back-stage visible. Many digital-transformation narratives focus on apps, personalization, biometrics, retailing or analytics. DPX-G360 shows that these technologies create premium value only when connected to order management, OCC, DCS, AODB, MRO, ERP, finance, procurement and cybersecurity. This is particularly important in disruption. A seamless booking journey may be insufficient if disruption recovery fails. Conversely, strong operational intelligence may become a premium differentiator when it enables proactive recovery, transparent communication and accountable compensation.

The framework contributes to KPI scholarship by shifting from indicator selection to decision execution. Traditional airline KPIs such as on-time performance, CASK, RASK, customer satisfaction and NPS remain important, but they are insufficient for digital premium experience governance. Airlines need second-order KPIs that monitor the integration quality of the value system: identity-match accuracy, order-service consistency, data-quality SLA adherence, model-exception rates, digital accessibility failures, incident response maturity, consent lineage and corrective-action closure. These indicators connect measurement to governance rather than merely describing performance [40][44].

The managerial implication is that airline executives should avoid treating premium digital experience as a customer-channel project. It should be governed as an enterprise transformation portfolio with explicit decision rights and investment sequencing. A useful roadmap is to begin with value-stream diagnosis across the passenger journey; map the systems and data objects that determine journey success; define critical service failures and recovery rules; assign KPI owners; prioritize integration of identity, offers, orders, baggage, disruption and finance data; then institutionalize a monthly value-realization and risk-review cadence. This prevents digital transformation from becoming a collection of disconnected pilots.

DPX-G360 also clarifies AI governance. Airlines should not deploy AI personalization, chatbots, disruption automation or predictive maintenance as isolated use cases. They should define which decisions are automated, augmented or human-owned; document model-risk controls; monitor bias and exception rates where relevant; establish human override; protect privacy and identity data; and make AI outputs auditable. Human-centric AI research in airline operations warns that efficiency gains must be balanced against workforce skill retention, communication protocols and accountability [39]. Premium experience depends on this balance because passengers trust airlines when digital systems and human staff act coherently.

The policy implication is that regulators and industry bodies should interpret digital passenger experience as part of broader operational resilience, cybersecurity and consumer-protection

governance. Biometrics, AI profiling, automated offers and digital identity can improve speed and personalization, but they also require safeguards. Airline modernization programs should therefore be evaluated not only by adoption rates but also by recoverability, accessibility, fairness, data protection, incident response and auditability.

6. Conclusion and Future Research

This article developed DPX-G360 as a design-science architecture for governing digital premium experience in passenger airlines. It argued that premium experience is not created by digital channels alone; it emerges from the governed integration of front-stage passenger journeys, middle-stage offer/order orchestration and back-stage operational systems. The six capability layers - digital journey orchestration, personalized retailing, operational intelligence, enterprise digital core, trust and cyber-resilience, and KPI-governed execution - provide a practical architecture for converting digital transformation into measurable customer value, operational resilience and accountable decision execution.

The strongest contribution of the article is the integration of previously fragmented streams. Airline customer experience, digital retailing, AI, HCI/UX, enterprise modernization, MRO/logistics, cybersecurity and KPI governance are usually discussed separately. DPX-G360 integrates them into one executive framework. For airline boards and executive committees, the framework provides a decision architecture: identify where passenger value is created or destroyed, connect it to data and systems, assign owners, govern AI and cyber risk, measure outcomes and institutionalize corrective action.

The study has limitations. It is based on documentary analysis and design-science reasoning, not on proprietary airline datasets, passenger surveys, interviews or longitudinal performance measurement. The four airline cases are illustrative modernization pathways, not audited case studies. References and official-source claims were strengthened using uploaded materials only; live DOI, SSRN and official-source verification remains evidence-blocked until browsing is approved. Therefore, DPX-G360 should be treated as a publishable conceptual and management-framework article ready for empirical validation, not as a completed causal test.

Future research should operationalize DPX-G360 with airline survey instruments, executive interviews, passenger-journey analytics, structural equation modeling, design-science evaluation panels, or longitudinal case studies. Empirical work should test whether higher maturity in DPX-G360 layers predicts improvements in disruption recovery, digital conversion, passenger trust, cost-to-serve, employee adoption and operational resilience. Further research should also examine regulatory variation, cultural differences, airline business models and the governance of AI-enabled offers, biometric identity and digital service recovery.

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