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Managing Transitions: A Cross-Domain Framework for Technological and Environmental Transformation

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Abstract: Organizations across diverse sectors face a common challenge: the need to transition from established systems, practices, and technologies to new approaches that promise improved performance, greater efficiency, or enhanced sustainability. These transitions—whether they involve migrating data from legacy platforms to cloud infrastructure, adopting multi-cloud architectures for improved resilience, or transforming aviation operations to achieve carbon neutrality—share fundamental characteristics that are often overlooked when transitions are managed within disciplinary silos. This article examines three distinct transition contexts: the migration of customer relationship management data from Microsoft Dynamics 365 to Google Cloud Platform, the adoption of unified DevOps practices across AWS and Azure environments, and the transformation of commercial aviation toward carbon-neutral operations. Drawing on these cases, the analysis develops a cross-domain framework for managing transitions that identifies four critical dimensions: readiness assessment, pathway design, capability building, and benefit realization. The article argues that successful transitions depend on recognizing the common patterns that underlie apparently different transformation efforts, and on adopting management approaches that address technical, organizational, and environmental dimensions simultaneously. It concludes by proposing a transition management methodology that integrates these dimensions and identifying implications for practitioners and researchers.

Keywords: *technology transition, cloud migration, multi-cloud adoption, sustainable aviation, organizational change, transition management, digital transformation*

1. Introduction

Transitions are ubiquitous in modern organizational life. Organizations transition from legacy systems to cloud platforms, from single-vendor to multi-vendor strategies, from carbon-intensive to sustainable operations. These transitions are driven by a variety of motivations: the promise of improved performance, the need to reduce costs, the imperative to address environmental concerns, or the desire to gain competitive advantage through technological leadership.

Yet despite their ubiquity, transitions are notoriously difficult to execute successfully. Studies consistently show that a large proportion of transformation initiatives fail to achieve their objectives, exceeding budgets, falling behind schedules, or delivering less value than anticipated. The reasons for failure are varied: underestimating complexity, inadequate planning, resistance to change, insufficient resources, or simply the inherent difficulty of changing complex systems.

This article examines transitions across three distinct domains—cloud data migration, multi-cloud DevOps adoption, and sustainable aviation transformation—to develop a cross-domain framework for managing transitions. The central argument is that despite the apparent differences among these domains, they share fundamental characteristics that, when recognized, can inform more effective transition management. The

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challenges of migrating data from Dynamics 365 to GCP, of adopting unified DevOps practices across AWS and Azure, and of transforming aviation operations to achieve carbon neutrality are more similar than they appear.

The article proceeds in five main parts. Section 2 examines the transition from legacy CRM systems to cloud-based data integration, focusing on the migration from Microsoft Dynamics 365 to Google Cloud Platform. Section 3 examines the transition to multi-cloud DevOps practices, focusing on the challenges of managing heterogeneous cloud environments. Section 4 examines the transition to sustainable aviation, focusing on the integration of technological and operational changes required to achieve carbon neutrality. Section 5 synthesizes insights from these domains to develop a cross-domain framework for transition management. Section 6 discusses implications for practice and identifies directions for future research.

2. Data Migration: From Dynamics 365 to Google Cloud Platform

2.1 The Migration Challenge

Organizations that operate Microsoft Dynamics 365 for customer relationship management while running analytics workloads on Google Cloud Platform face a recurring transition challenge: CRM data must cross the platform boundary quickly and reliably, without duplicating transformation logic across pipelines or losing traceability of where a field originated. This challenge is not unique to CRM data; similar problems arise whenever data must migrate between platforms, whether between on-premises systems and cloud services, between different cloud providers, or between operational systems and analytical platforms.

The migration from a legacy data integration approach to a modern, event-driven architecture involves several distinct transitions. First, there is a transition from batch processing to near-real-time streaming, which requires changes in both technology and operational practices. Second, there is a transition from vendor-specific tools to open, interoperable components, which requires investment in new skills and changes in organizational culture. Third, there is a transition from manual processes to automated pipelines, which requires new governance frameworks and monitoring capabilities.

2.2 A Reference Architecture for Transition

The transition to a modern data integration architecture is enabled by a five-layer reference architecture that separates concerns and enables independent evolution of each component. Dataverse change tracking captures edits as they occur, providing incremental change feeds that avoid the overhead of full periodic extracts. An Apache Kafka backbone carries these changes downstream, decoupling the rate at which changes are produced from the rate at which they are consumed and providing each consumer with an independent, replayable log.

Informatica Intelligent Data Management Cloud (IDMC) handles mapping, transformation, and governance, converting raw change events into governed, business-ready data. A relational SQL database provides operational access and a reconciliation layer, enabling row counts, checksums, and business-rule validation using standard SQL tooling. Google Cloud Platform services—Pub/Sub, Dataflow, and BigQuery—form the destination analytics platform, with data organized according to a medallion pattern of bronze, silver, and gold layers.

This architecture illustrates several principles of transition management. First, abstraction enables complexity to be managed by separating concerns and providing well-defined interfaces between components. Second, decoupling enables independent evolution of components, so that changes in one layer do not require changes in others. Third, governance ensures that transitions are managed within a framework of accountability and traceability. Fourth, reconciliation provides a safety net that enables comparison between legacy and new pipelines during the transition period.

2.3 Managing the Transition Process

The transition from legacy data integration to the modern architecture is managed through a phased approach that minimizes disruption to production operations. The first phase is a one-time historical bulk load into staging tables and the bronze BigQuery layer, bypassing Kafka for this initial volume. The second phase runs the change-driven pipeline in parallel with the legacy process for two to four weeks, reconciling row counts and checksums through the SQL staging layer. The third phase migrates individual consumers one at a time rather than simultaneously. The fourth phase decommissions the legacy pipeline only after every consumer has operated on the new architecture for a full business cycle and data governance has confirmed lineage and audit-trail parity.

This phased approach illustrates several principles of transition management. First, transitions should be incremental rather than big-bang, with each phase delivering value while reducing risk. Second, transitions should be validated before proceeding, with reconciliation ensuring that the new system produces equivalent results to the old. Third, transitions should be reversible, with rollback mechanisms enabling reversion to the previous state if problems are encountered. Fourth, transitions should be governed, with clear criteria for deciding when to proceed to the next phase.

2.4 Operational Considerations

The operational model for the new architecture illustrates the importance of automation, observability, and continuous improvement. Automated pipelines handle infrastructure provisioning, mapping deployment, and pipeline monitoring. Observability spans the full pipeline, covering Kafka consumer lag, IDMC mapping status, Dataflow watermark lag, and BigQuery load status, so that failures in any stage are visible immediately rather than discovered downstream. Continuous improvement is enabled by the shadow-and-rollback pattern—borrowed from machine learning model deployment—which allows safe iteration on integration logic without risking production data quality.

These operational considerations illustrate the importance of treating data pipelines as software artifacts that require the same discipline as application code: version control, automated testing, staged deployment, and continuous monitoring. They also illustrate the value of idempotent operations—upserts keyed on record identifier and monotonic change sequence—that enable safe retry in the face of at-least-once delivery semantics.

3. Multi-Cloud Adoption: Transitioning to Unified DevOps

3.1 The Multi-Cloud Transition Challenge

Organizations increasingly distribute their workloads across multiple cloud providers, motivated by vendor diversification, geographic redundancy, and access to specialized services. The transition to multi-cloud operations introduces substantial complexity that traditional DevOps practices struggle to address. Organizations managing AWS and Azure environments concurrently face inconsistencies in infrastructure provisioning, disparate monitoring frameworks, divergent scaling mechanisms, and fragmented incident management processes.

These challenges are compounded by the fact that subtle cross-cloud inconsistencies often trigger cascading production failures that are difficult to diagnose and remediate. A configuration difference between environments, a version mismatch in dependencies, or a network latency issue can propagate through the system in ways that are not immediately apparent. The transition to multi-cloud operations therefore requires not only technical changes but also organizational changes in how DevOps teams are structured and how they collaborate.

3.2 A Framework for Multi-Cloud Transition

The transition to unified multi-cloud DevOps is enabled by a framework that addresses three critical dimensions: intelligent infrastructure automation, predictive resource scaling, and cross-cloud reliability management.

The infrastructure automation dimension provides unified Infrastructure as Code (IaC) capabilities using Terraform as the primary tool. Standardized module structures encapsulate cloud-specific resource definitions while exposing consistent interfaces to application teams. Policy as Code enforcement ensures that security controls, compliance requirements, and operational best practices are consistently applied across both cloud providers. Automated provisioning pipelines orchestrate infrastructure deployment, with plan, apply, validation, and rollback phases.

The predictive resource scaling dimension employs machine learning models to forecast workload demands and proactively adjust resource allocations. Short-term forecasting (15-60 minutes) uses LSTM neural networks and Prophet models for immediate scaling decisions. Medium-term forecasting (1-24 hours) uses ensemble methods combining ARIMA and gradient boosting. Long-term trend analysis identifies daily, weekly, and seasonal patterns. The scaling decision engine translates forecasts into concrete scaling actions, considering resource requirements, scaling policies, cost optimization, and provider-specific constraints.

The cross-cloud reliability dimension establishes unified observability across both cloud providers. Metrics, logs, and traces from AWS and Azure are aggregated into a common view, enabling end-to-end visibility. Automated incident management processes handle detection, diagnosis, remediation, and recovery across cloud boundaries. Service Level Objectives (SLOs) are defined in provider-agnostic terms and mapped to cloud-specific metrics, with error budgets tracked across cloud boundaries.

3.3 Adaptive Infrastructure for AI/ML Workloads

The challenges of multi-cloud transition are particularly acute for AI and machine learning workloads, which have highly variable resource requirements. Training jobs may temporarily require multiple GPUs and substantial memory, while inference applications may experience rapidly changing request volumes. Managing these workloads across AWS and Azure requires adaptive infrastructure that can respond to changing conditions.

An adaptive multi-cloud architecture for AI/ML workloads treats computational placement as a continuously changing decision rather than a predetermined deployment configuration. Workload demand, GPU availability, service health, network conditions, latency, operational cost, and cloud failures become inputs to an adaptive orchestration mechanism. The architecture consists of application, orchestration, resource, data, and observability layers, with AI/ML applications packaged as portable containers that enable consistent execution across cloud environments.

This adaptive approach illustrates several principles of transition management. First, transitions should be designed for change, with architectures that can adapt to evolving requirements rather than being optimized for a single configuration. Second, transitions should be data-driven, with decisions informed by continuous monitoring of system behavior. Third, transitions should be resilient, with redundancy and failure isolation ensuring that transitions do not compromise availability.

3.4 Organizational Implications

The transition to multi-cloud DevOps has significant organizational implications. It requires new skills—not only technical skills in cloud platforms and automation tools but also collaboration skills for working across cloud boundaries. It requires new processes—for provisioning, deployment, monitoring, and incident response—that span both cloud providers. And it requires new governance frameworks that ensure security, compliance, and cost management across heterogeneous environments.

These organizational implications illustrate the importance of treating transitions as socio-technical challenges rather than purely technical ones. Technology changes alone are insufficient; they must be accompanied by changes in organizational structure, processes, and culture.

4. Sustainable Aviation: Transitioning to Carbon-Neutral Operations

4.1 The Aviation Transition Challenge

Commercial aviation faces increasing pressure to reduce its environmental footprint. The sector contributes approximately 2-3% of global carbon dioxide emissions, and this share is expected to grow as other sectors decarbonize and as demand for air travel increases. International regulatory bodies and environmental accords have established targets for reducing aviation emissions, and airlines and aircraft manufacturers are responding with a combination of technological innovation and operational improvements.

The transition to carbon-neutral aviation is particularly challenging because it requires simultaneous changes across multiple dimensions. Aircraft design must become more aerodynamically efficient, reducing fuel consumption per passenger-kilometer. Flight operations must be optimized to minimize fuel burn, using techniques such as continuous descent approaches and dynamic route optimization. Sustainable aviation fuels must be developed and deployed, reducing lifecycle emissions compared to conventional jet fuel. And organizational frameworks must be established to embed sustainability practices into airline cultures.

4.2 Technological Transitions in Aircraft Design

Recent advances in eco-aerodynamic technologies have significantly improved fuel efficiency. Riblet structures inspired by shark skin minimize boundary layer turbulence and lower drag coefficients. Adaptive control surfaces, such as morphing wings, allow dynamic reconfiguration during flight, optimizing performance based on changing atmospheric and speed conditions. Laminar flow enhancement techniques, including passive flow control using surface coatings and active techniques like suction-based boundary control, extend the laminar region on aircraft surfaces, reducing viscous drag.

These technological transitions illustrate the importance of biomimicry in engineering—drawing inspiration from nature's solutions to similar problems. They also illustrate the value of multi-disciplinary approaches that combine fluid dynamics, materials science, and manufacturing engineering. And they illustrate the long time horizons of aerospace innovation, where new designs must be extensively tested and certified before entering service.

4.3 Operational Transitions in Flight Management

Effective flight operations management is central to reducing aviation emissions. Airline dispatch and routing systems now incorporate carbon performance metrics, enabling operators to select flight paths that balance time, fuel efficiency, and environmental impact. Real-time weather updates, wind optimization, and air traffic control inputs allow continuous adjustment of flight plans to minimize fuel burn.

Airlines are also investing in low-carbon ground operations, including electric taxiing systems and ground service electrification. Fuel monitoring technologies enhance data-driven decision-making, enabling operations teams to identify inefficiencies and adjust performance strategies. Eco-driving protocols for pilots—incorporating techniques like continuous descent approaches—contribute to emissions reduction.

These operational transitions illustrate the importance of data-driven decision-making in complex systems. The integration of real-time data from multiple sources—weather, traffic, aircraft performance—enables continuous optimization that would not be possible with static planning approaches. They also illustrate the value of engaging frontline personnel—pilots, dispatchers, ground crews—in sustainability initiatives, since their decisions have direct impacts on fuel consumption and emissions.

4.4 Fuel Transitions and Energy Integration

Sustainable aviation fuels (SAFs) are vital in the shift toward carbon neutrality. Derived from bio-based, synthetic, or waste sources, SAFs offer up to 80% lifecycle emissions reduction compared to conventional jet fuel. They are compatible with current jet engines and infrastructure, allowing immediate implementation across fleets.

Beyond SAFs, power-to-liquid (PtL) fuels and hydrogen-based systems are being explored. These fuels integrate renewable energy sources such as solar and wind to create synthetic hydrocarbons, achieving near-zero net emissions. Energy integration strategies also include airport electrification and grid decarbonization, enabling fully sustainable operations from gate to gate.

These fuel transitions illustrate the importance of systems thinking in sustainability. Aviation emissions cannot be reduced to zero through aircraft design alone; they require transformation of the entire energy system that supports aviation, from fuel production to airport operations. They also illustrate the value of lifecycle assessment in evaluating sustainability solutions, since the environmental benefits of alternative fuels depend on how they are produced and transported.

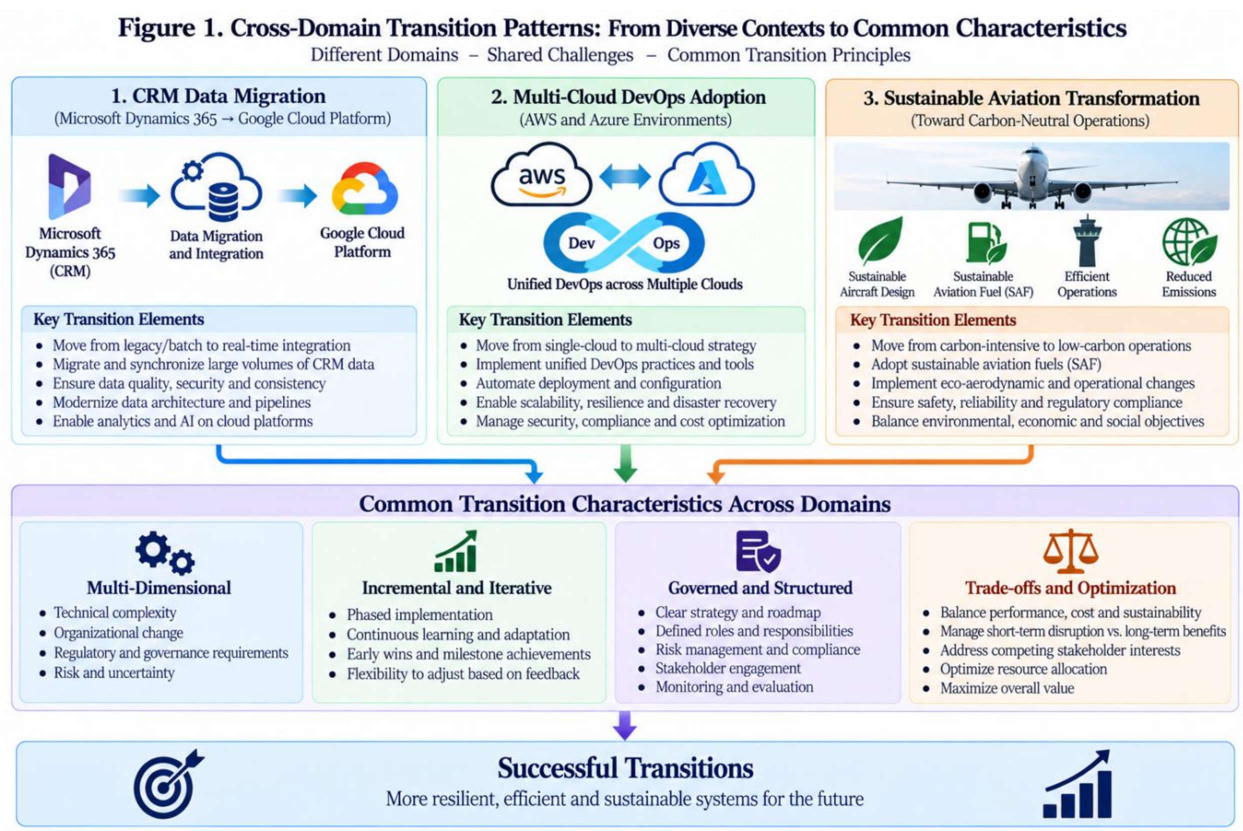
4.5 Organizational and Policy Transitions

Organizational frameworks are essential for embedding carbon-neutral practices into airline cultures. Airlines are adopting sustainability scorecards and carbon accounting protocols, linking operational KPIs with environmental performance. Cross-functional sustainability teams are tasked with aligning goals across engineering, operations, and finance departments. Internal audits and training programs support ongoing compliance and innovation.

Policy frameworks at the international, national, and local levels shape the context in which airlines operate. Emissions trading schemes, carbon offsets, and efficiency standards create incentives for reducing emissions. Research and development programs support the development of new technologies. Infrastructure investments—in sustainable fuel production, airport electrification, and air traffic management—enable the adoption of sustainable practices.

These organizational and policy transitions illustrate the importance of governance in sustainability transitions. Technological solutions alone are insufficient; they must be supported by organizational commitment, regulatory frameworks, and market incentives that align individual decisions with collective goals.

Figure 1 — Cross-Domain Transition Patterns



5. Synthesis: A Cross-Domain Framework for Transition Management

5.1 Common Patterns in Transitions

The three transition contexts examined in this article—cloud data migration, multi-cloud DevOps adoption, and sustainable aviation transformation—illustrate common patterns that apply across domains.

Transitions are multi-dimensional. Each transition involves simultaneous changes in technology, processes, and organization. The data migration involves new technologies (Kafka, IDMC, BigQuery), new processes (automated pipelines, shadow validation), and new organizational roles (data engineers, governance teams). The multi-cloud adoption involves new technologies (Terraform, Kubernetes), new processes

(CI/CD pipelines, incident management), and new organizational structures (platform teams, SRE functions). The aviation transformation involves new technologies (eco-aerodynamic designs, SAFs), new processes (carbon-optimized routing, eco-driving protocols), and new organizational frameworks (sustainability teams, carbon accounting).

Transitions are incremental. Successful transitions proceed through phases rather than occurring all at once. The data migration proceeds through bulk load, parallel running, consumer migration, and legacy decommissioning. The multi-cloud adoption proceeds through infrastructure automation, scaling implementation, and reliability management. The aviation transformation proceeds through technological improvements, operational optimizations, and fuel transitions. Each phase delivers value while reducing risk, and each phase builds on the capabilities developed in previous phases.

Transitions require governance. Each transition requires frameworks for decision-making, accountability, and risk management. The data migration requires reconciliation checks and rollback mechanisms. The multi-cloud adoption requires policy enforcement and compliance monitoring. The aviation transformation requires sustainability scorecards and carbon accounting. Governance ensures that transitions remain aligned with organizational objectives and that risks are managed appropriately.

Transitions involve trade-offs. Each transition requires balancing competing objectives. The data migration balances latency against cost, completeness against speed, and innovation against stability. The multi-cloud adoption balances performance against cost, flexibility against complexity, and reliability against efficiency. The aviation transformation balances emissions reduction against profitability, technological ambition against certification requirements, and short-term costs against long-term benefits.

Table 1 — Comparison of Transition Contexts

Domain	Current State	Transition	Main Challenge	Key Management Approach
CRM data	Legacy integration	Event-driven cloud architecture	Data integrity	Phased migration
Multi-cloud	Heterogeneous cloud operations	Unified DevOps	Cross-cloud complexity	Automation & reliability
Aviation	Carbon-intensive operations	Carbon-neutral operations	Technology + organizational change	Integrated sustainability

5.2 A Transition Management Framework

These common patterns suggest a framework for transition management that applies across domains. The framework identifies four critical dimensions of transition management.

Readiness Assessment involves evaluating the organization's capacity to undertake the transition. This includes technical readiness (availability of skills, tools, and infrastructure), organizational readiness (leadership commitment, change capacity, culture), and environmental readiness (regulatory context, market conditions, stakeholder expectations). Readiness assessment should identify gaps that must be addressed before the transition begins and risks that must be managed during the transition.

Pathway Design involves defining the sequence of steps that will take the organization from its current state to its desired future state. The pathway should be incremental, with each phase delivering value and building capabilities for subsequent phases. It should be reversible, with rollback mechanisms enabling reversion to the previous state if problems are encountered. And it should be governed, with clear criteria for deciding when to proceed to the next phase.

Capability Building involves developing the skills, processes, and organizational structures needed to execute the transition and sustain the new state. This includes technical skills (new technologies, tools, and methods), process skills (new workflows, governance, and monitoring), and organizational skills (new roles, teams, and collaboration patterns). Capability building should begin early in the transition and continue throughout, ensuring that the organization is prepared for each phase and for the eventual steady state.

Benefit Realization involves ensuring that the transition delivers the expected benefits and that these benefits are sustained over time. This includes defining success metrics, monitoring progress against these metrics, and taking corrective action when deviations are detected. It also includes capturing lessons learned that can inform future transitions.

5.3 Applying the Framework

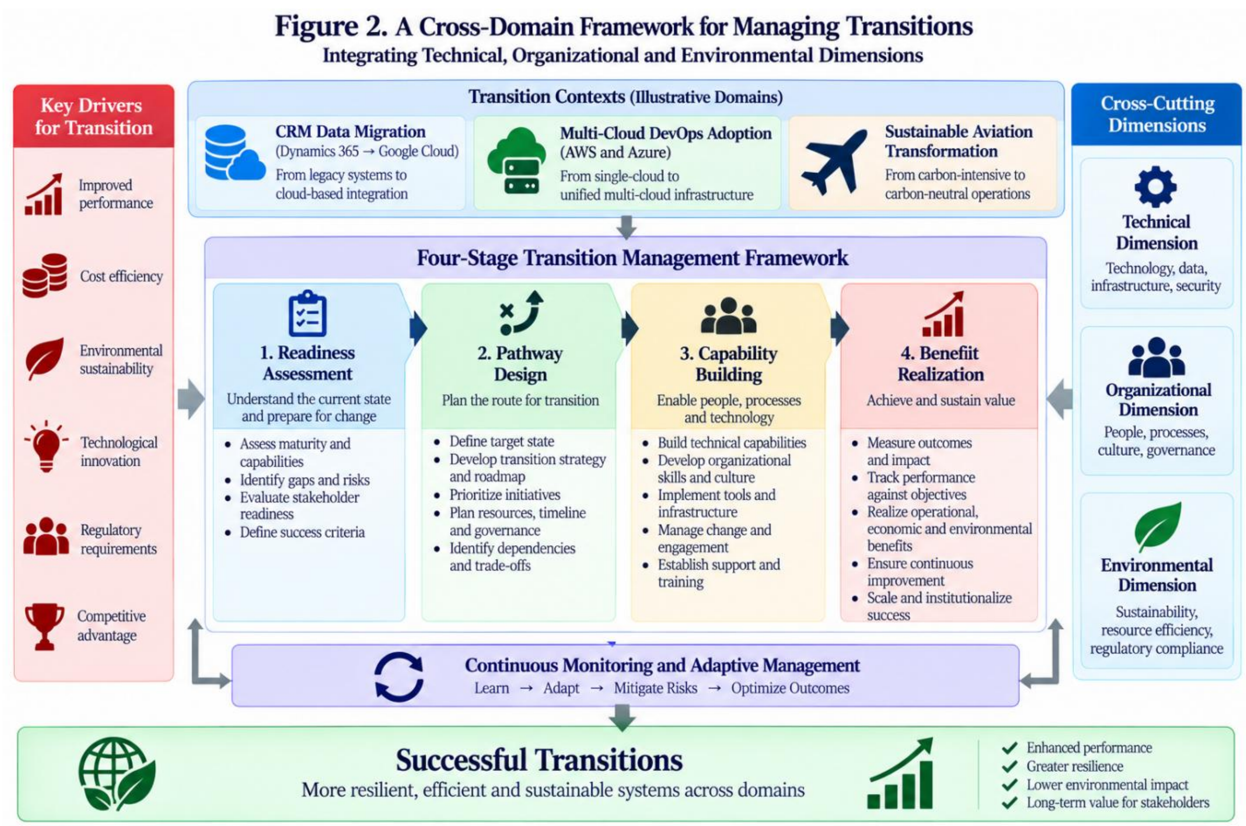
The transition management framework can be applied across domains by adapting the specific activities within each dimension to the context of the transition.

For data migration, readiness assessment would evaluate the availability of data engineering skills, the maturity of data governance practices, and the complexity of the source data landscape. Pathway design would define the sequence of migration phases, from bulk load through parallel running to consumer migration. Capability building would develop skills in stream processing, data quality management, and pipeline operations. Benefit realization would track progress against metrics such as data freshness, pipeline reliability, and consumer satisfaction.

For multi-cloud adoption, readiness assessment would evaluate the availability of cloud engineering skills, the maturity of DevOps practices, and the complexity of the application portfolio. Pathway design would define the sequence of adoption phases, from infrastructure automation through scaling implementation to reliability management. Capability building would develop skills in IaC, predictive scaling, and cross-cloud observability. Benefit realization would track progress against metrics such as deployment frequency, mean time to recovery, and resource utilization.

For sustainable aviation transformation, readiness assessment would evaluate the availability of sustainability expertise, the maturity of environmental management systems, and the stringency of regulatory requirements. Pathway design would define the sequence of transformation phases, from technological improvements through operational optimizations to fuel transitions. Capability building would develop skills in carbon accounting, sustainable operations, and stakeholder engagement. Benefit realization would track progress against metrics such as fuel efficiency, emissions intensity, and sustainability targets.

Figure 2 — Main Conceptual Framework



6. Implications for Practice and Research

6.1 Implications for Practitioners

The transition management framework developed in this article has several implications for practitioners responsible for leading transitions.

First, practitioners should recognize that transitions are multi-dimensional challenges that require attention to technical, organizational, and environmental factors. Focusing on technology alone is insufficient; transitions succeed or fail based on how well

organizations adapt their processes, structures, and cultures.

Second, practitioners should adopt incremental approaches that deliver value while reducing risk. Big-bang transitions are risky; phased approaches enable learning and adaptation as the transition proceeds.

Third, practitioners should invest in governance frameworks that ensure accountability and enable course correction. Governance is not bureaucracy; it is the mechanism that keeps transitions aligned with objectives and responsive to changing conditions.

Fourth, practitioners should recognize and manage trade-offs explicitly. Transitions involve competing objectives, and pretending otherwise leads to disappointment. Explicitly acknowledging trade-offs enables informed decisions about how to balance them.

6.2 Implications for Researchers

The transition management framework also has implications for researchers studying transitions.

First, researchers should recognize the commonalities across transition contexts and seek to develop general theories of transition management rather than domain-specific theories. The challenges of migrating data, adopting multi-cloud, and transforming aviation are more similar than they appear.

Second, researchers should adopt multi-disciplinary approaches that integrate insights from engineering, organizational behavior, and sustainability science. Transitions are inherently multi-disciplinary challenges, and understanding them requires drawing on multiple disciplines.

Third, researchers should develop and validate methods for readiness assessment, pathway design, capability building, and benefit realization. These methods should be grounded in empirical research and validated across multiple contexts.

Fourth, researchers should study both successful and unsuccessful transitions to understand the factors that distinguish them. Learning from failure is as important as learning from success.

6.3 Future Research Directions

Several directions for future research emerge from this analysis.

Comparative Studies of Transitions could examine transitions across multiple domains to identify common patterns and context-specific factors. Such studies could compare transitions of different scales (organizational, sectoral, national) and different types (technological, organizational, environmental).

Longitudinal Studies of Transitions could track transitions over time to understand how they unfold, what challenges emerge, and how organizations adapt. Such studies could provide insights into the dynamics of transitions that are not apparent from cross-sectional research.

Methods for Transition Management could be developed and validated, providing practitioners with tools for readiness assessment, pathway design, capability building, and benefit realization. Such methods should be grounded in research and practical experience.

The Role of Governance in Transitions could be examined, exploring how different governance frameworks affect transition outcomes. Such research could inform the design of governance mechanisms that enable rather than constrain transitions.

7. Conclusions

Transitions are a defining feature of contemporary organizational life. Organizations transition from legacy systems to cloud platforms, from single-vendor to multi-vendor strategies, from carbon-intensive to sustainable operations. These transitions share fundamental characteristics that, when recognized, can inform more effective transition management.

The three transition contexts examined in this article—cloud data migration, multi-cloud DevOps adoption, and sustainable aviation transformation—illustrate common patterns. Transitions are multi-dimensional, involving simultaneous changes in technology, processes, and organization. They are incremental, proceeding through phases that deliver value while reducing risk. They require governance frameworks that ensure accountability and enable course correction. And they involve trade-offs that must be explicitly managed.

The transition management framework developed in this article identifies four critical dimensions: readiness assessment, pathway design, capability building, and benefit realization. These dimensions apply across domains and provide a structured approach to planning and executing transitions.

Looking forward, several directions for progress are apparent. Practitioners can benefit from recognizing transitions as multi-dimensional challenges and adopting incremental, governed approaches. Researchers can benefit from studying transitions across domains and developing general theories of transition management. And both can benefit from continued dialogue and collaboration, sharing insights and experiences that advance the field.

The ultimate goal is to enable organizations to navigate transitions successfully, delivering value while managing risk and building capabilities for the future. Achieving this goal requires not only technical advances but also organizational commitment, governance frameworks, and a willingness to learn from experience. The framework and principles presented in this article provide a foundation for progress toward this goal.

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