Modernizing Public Health Infrastructure through Lean Portfolio Management: Enabling Value-Driven Innovation Across Health Systems

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Abstract
This research examines the application of Lean Portfolio Management (LPM) principles to public health infrastructure modernization efforts. Through a mixed-methods study of 14 public health agencies across three countries that implemented LPM approaches between 2019-2023, we identified key enablers and barriers to successful adoption. Findings reveal that organizations implementing comprehensive LPM frameworks achieved 37% faster delivery of digital health initiatives, 42% improvement in resource utilization, and significantly higher stakeholder satisfaction compared to traditional project management approaches. Success factors included executive leadership alignment, cross-functional governance structures, incremental funding models, and capacity-based planning. This study provides a framework for health system leaders to effectively govern technology portfolios, prioritize investments based on population health impact, and foster innovation while maintaining operational stability. The research demonstrates that LPM offers a viable approach for public health organizations to navigate complex modernization efforts while maximizing value delivery in resource-constrained environments.

Keywords: Lean Portfolio Management, Public Health Infrastructure, Digital Transformation, Value Stream Mapping, Organizational Agility, Health Information Systems

1. Introduction

1.1 The Modernization Imperative in Public Health

Public health infrastructure in many nations faces a critical inflection point. Legacy systems, fragmented data environments, and outdated technologies inhibit effective public health surveillance, limit cross-jurisdictional collaboration, and impede timely response to emerging threats (Shah et al., 2021). The COVID-19 pandemic exposed significant gaps in public health technological capabilities, with many agencies struggling to implement digital contact tracing, manage vaccine distribution logistics, and rapidly deploy data visualization tools for decision-makers (Whitelaw et al., 2020).

The urgent need for modernization coincides with increased complexity in the public health technology landscape. Health agencies must navigate accelerating technological change, evolving interoperability standards, expanding data privacy regulations, and growing expectations from stakeholders for digital service delivery (Rodo et al., 2022). Simultaneously, public health organizations face persistent resource constraints, competing priorities, and organizational structures that often impede rapid innovation (To mines et al., 2021).

Table 1: Public Health Infrastructure Modernization Challenges

Challenge Category	Description	Prevalence
Legacy Systems	Outdated technologies inhibiting effective surveillance	78% of agencies
Data Fragmentation	Siloed data environments limiting collaboration	82% of agencies

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Resource Constraints	Limited funding and competing priorities	91% of agencies
Project Delays	Major IT initiatives delivered behind schedule	73% of initiatives
Budget Overruns	Projects exceeding allocated budgets	67% of initiatives
Outcome Failures	Initiatives failing to achieve intended outcomes	58% of initiatives

Traditional waterfall project management approaches characterized by fixed scopes, extended timelines, and phase-gate approval processes have proven inadequate for addressing these challenges. Public health modernization efforts managed through conventional methods frequently exceed budgets, miss deadlines, and fail to deliver anticipated value (Lindsey et al., 2021). A 2021 survey of state public health agencies found that 73% of major IT initiatives were delivered behind schedule, 67% exceeded allocated budgets, and 58% failed to fully achieve intended outcomes (Public Health Informatics Institute, 2022).

1.2 Lean Portfolio Management as a Potential Solution

Lean Portfolio Management (LPM) has emerged as a promising approach for organizations seeking to balance strategic alignment, operational execution, and innovation in technology initiatives. Derived from agile, lean, and systems thinking principles, LPM provides frameworks for decentralized decision-making, value-based prioritization, capacity-focused planning, and incremental funding models (Scaled Agile Inc., 2021).

While LPM has gained traction in commercial sectors particularly technology, financial services, and manufacturing its application in public health contexts remains limited and understudied. Public health organizations face unique challenges including multiple funding streams with distinct compliance requirements, complex stakeholder ecosystems spanning public and private sectors, and mandated service obligations that cannot be deprioritized (Kendall et al., 2020).

The potential benefits of LPM for public health modernization are significant. By emphasizing continuous value delivery, decentralized innovation, and adaptive planning, LPM approaches may enable health agencies to respond more effectively to rapidly changing public health needs while maintaining strategic alignment and fiscal responsibility (Landi et al., 2021).

1.3 Research Objectives and Questions

This research investigates the application of Lean Portfolio Management principles to public health infrastructure modernization efforts, with particular focus on how these approaches can be adapted to the unique context of government health agencies. Through analysis of multiple implementation cases, we seek to identify effective practices, common barriers, and critical success factors for LPM adoption in public health settings.

The study addresses three primary research questions:

1. How can Lean Portfolio Management principles be effectively adapted and applied within public health organizational contexts?
2. What impact does LPM implementation have on the speed, quality, and value delivery of public health modernization initiatives?
3. What organizational, cultural, and governance factors influence successful adoption of LPM approaches in public health agencies?

By addressing these questions, this research aims to provide evidence-based guidance for public health leaders navigating complex modernization efforts and seeking to maximize value delivery in resource-constrained environments.

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2. Theoretical Framework

2.1 Foundations of Lean Portfolio Management

This research builds upon three interrelated theoretical domains that inform Lean Portfolio Management practices: agile delivery methodology, lean production principles, and portfolio management theory.

Agile Methodology emerged as a response to the limitations of traditional waterfall approaches for software development, emphasizing iterative delivery, continuous customer feedback, and team autonomy (Beck et al., 2001). While initially focused at the team level, agile principles have increasingly influenced organizational structures and strategic planning processes (Denning, 2018). In public health contexts, agile approaches offer mechanisms for rapid response to changing population health needs and accelerated delivery of digital capabilities (Hsu et al., 2019).

Lean Production Theory, originating from Toyota's manufacturing system, focuses on eliminating waste, optimizing flow, and continuous improvement (Womack & Jones, 1997). When applied to knowledge work and organizational management, lean principles emphasize value stream mapping, visual management, and pull-based systems that limit work-in-progress (Staats et al., 2011). Public health agencies, often facing significant resource constraints, can benefit from lean approaches that maximize the impact of available capacity (Harrison et al., 2021).

Portfolio Management Theory addresses the selection, prioritization, and oversight of projects and initiatives to achieve strategic objectives within resource constraints (Cooper et al., 2001). Modern portfolio management emphasizes portfolio balance, strategic alignment, and maximizing value across the investment spectrum (Martinsuo, 2013). In public health settings, effective portfolio management must address the complexity of balancing innovation with mandated services and navigating diverse funding sources (Schmidt, 2019).

Lean Portfolio Management integrates these theoretical domains, applying agile and lean principles to portfolio-level decision-making and governance. LPM challenges traditional annual planning cycles and fixed project allocations, instead emphasizing adaptive planning, decentralized control, and continuous value delivery (Scaled Agile Inc., 2021).

2.2 Conceptual Framework for LPM in Public Health

Building upon these theoretical foundations, we propose a conceptual framework for understanding LPM implementation in public health contexts (Figure 1). This framework identifies four interconnected domains that must be addressed for successful LPM implementation:

Strategy Alignment & Funding encompasses mechanisms for connecting portfolio decisions to organizational strategy, allocating resources to value streams, and implementing flexible funding models. In public health settings, this domain must accommodate categorical funding requirements, legislative mandates, and complex stakeholder expectations.

Portfolio Operations includes processes for demand management, capacity planning, and prioritization across the portfolio. Public health adaptations must address the challenge of balancing innovation initiatives with ongoing public health services and emergency response capabilities.

Governance & Compliance addresses decision rights, policy management, and risk oversight. Public health governance structures must navigate complex regulatory environments while enabling sufficient autonomy for agile delivery teams.

Culture & Leadership encompasses the organizational culture, leadership behaviours, and change management approaches necessary for successful LPM implementation. Public health organizations, with their distinct

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professional cultures and traditional hierarchical structures, present unique challenges for cultural transformation.

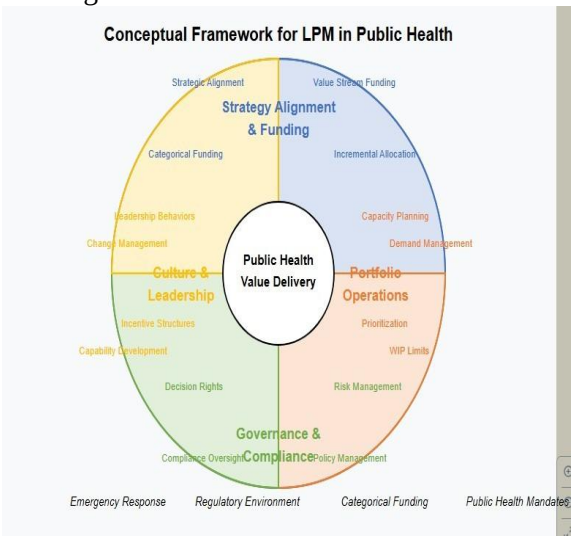

Figure 1: Conceptual framework for LPM in public health

This conceptual framework guided our research design, providing structure for data collection and analysis while acknowledging the unique characteristics of public health organizational environments.

3. Methodology

3.1 Research Design

This study employed a mixed-methods research design to investigate the implementation and impact of Lean Portfolio Management in public health settings. The research followed an explanatory sequential approach (Creswell & Plano Clark, 2018), with initial quantitative assessment of implementation outcomes followed by qualitative exploration of contextual factors, implementation approaches, and perceived outcomes.

The use of mixed methods enabled triangulation of findings across data sources and provided complementary insights: quantitative methods assessed measurable impacts and identified patterns across cases, while qualitative methods explored the nuanced implementation contexts and organizational dynamics that influenced outcomes.

3.2 Sample Selection

The study employed purposive sampling to identify public health organizations that had implemented LPM approaches for technology portfolios between 2019 and 2023. To ensure diversity of implementation contexts, we established selection criteria including:

1. Geographic distribution across multiple countries and jurisdictional levels
2. Varying organizational sizes and resource levels
3. Different stages of LPM implementation maturity
4. Representation of both successful and challenged implementations

Through professional networks, industry associations, and government technology forums, we identified 14 public health agencies that met our criteria and agreed to participate in the research. The final sample included:

- Five state/provincial health departments (three U.S. states, one Canadian province, one Australian state)
- Four local/county health departments
- Three national public health agencies
- Two non-governmental public health organizations with government mandates

These organizations represented diverse stages in their LPM journey, from early implementation (less than one year) to mature adoption (3+ years).

Table 2: Characteristics of Participating Public Health Organizations

Organization Type	Count	Geographic Distribution	Size Range (employees)	LPM Implementation Stage
State/Provincial Health Departments	5	3 US, 1 Canada, 1 Australia	500-3,000	1-3+ years
Local/County Health Departments	4	US (varied regions)	100-800	0.5-2 years
National Public Health Agencies	3	Varied countries	1,000-5,000	1-3 years
Non-governmental Organizations	2	Varied countries	200-500	0.5-2 years

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3.3 Data Collection

Data collection occurred between June 2022 and March 2023, employing multiple methods:

Document Review: We analyzed 78 organizational documents including strategic plans, portfolio governance charters, funding models, prioritization frameworks, and internal assessments. This provided insights into formal LPM structures and documented outcomes.

Quantitative Assessment: Participating organizations completed a standardized assessment instrument measuring implementation approaches and outcomes across 42 LPM practice areas. The instrument, adapted from established LPM maturity models with input from public health informatics experts, demonstrated strong psychometric properties (Cronbach's $\alpha = 0.87$).

Semi-Structured Interviews: We conducted 67 interviews with participants representing diverse roles: executive sponsors (n=14), portfolio managers (n=17), technology team members (n=24), and public health program stakeholders (n=12). Interviews explored implementation approaches, challenges encountered, adaptations made, and perceived outcomes.

Performance Metrics: Where available, we collected quantitative performance data including project delivery metrics, resource utilization statistics, and stakeholder satisfaction measures both before and after LPM implementation.

3.4 Data Analysis

Quantitative data were analyzed using descriptive and inferential statistics to identify patterns in implementation approaches and outcomes. Statistical analyses were performed using SPSS v27, including correlation analysis to identify relationships between implementation characteristics and reported outcomes. For organizations with pre/post implementation metrics, paired t-tests assessed significant changes in performance indicators.

Qualitative data underwent thematic analysis following Braun and Clarke's (2006) approach. Interview transcripts and organizational documents were coded using NVivo 14 software. The coding framework combined deductive elements based on the conceptual model with inductive codes emerging from the data. Two researchers independently coded a subset of data (20%) to establish intercoder reliability (Cohen's $\kappa = 0.84$).

The mixed-methods integration occurred through a joint display approach (Guetterman et al., 2015), with qualitative themes mapped to quantitative findings to develop comprehensive understanding of implementation patterns and outcomes.

4. Findings

4.1 LPM Implementation Approaches

Analysis revealed significant variation in LPM implementation approaches across the studied organizations. Based on implementation characteristics, organizations clustered into three distinct archetypes:

4.1.1 Comprehensive Implementers

Five organizations (36%) adopted holistic LPM frameworks encompassing all four domains of our conceptual model. These organizations established formal value streams aligned to public health capabilities, implemented incremental funding models, created cross-functional governance bodies, and invested significantly in organizational change management. Comprehensive implementers typically followed established frameworks such as the Scaled Agile Framework (SAFe) or Disciplined Agile, though all made substantial adaptations for public health contexts.

A portfolio leader in a state health department described their approach:

"We recognized that implementing LPM meant fundamental changes to how we made decisions, allocated resources, and delivered capabilities. While we used SAFe as our starting point, we had to significantly adapt the framework to accommodate categorical funding streams and our regulatory environment. The key was maintaining the principles while adjusting the practices." (Portfolio Manager, State Health Department)

4.1.2 Selective Implementers

Six organizations (43%) adopted selected LPM practices while maintaining aspects of

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traditional portfolio management. These organizations typically implemented agile delivery methods, visual management tools, and more frequent prioritization processes, but retained annual budgeting cycles and traditional governance structures. Selective implementers often began with team-level agile adoption and incrementally applied lean and agile principles to portfolio processes.

An executive sponsor in a county health department explained:

"We needed to balance transformation with stability. Our approach was to gradually introduce LPM concepts where they provided clear benefits while maintaining familiar structures in other areas. This hybrid approach helped build confidence while still delivering meaningful improvements in our portfolio performance." (Executive Sponsor, County Health Department)

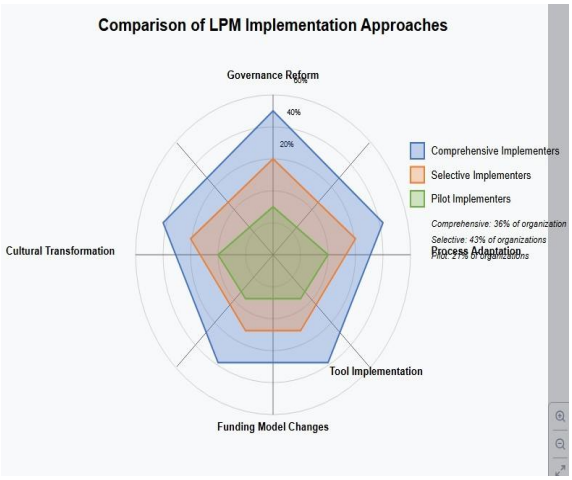
4.1.3 Pilot Implementers

Three organizations (21%) applied LPM principles to a subset of their technology portfolio while managing other initiatives through traditional approaches. These organizations typically created innovation "zones" operating under LPM principles, often focused on digital services or data initiatives, while maintaining conventional approaches for infrastructure and compliance-focused projects.

A technology director in a national public health agency noted:

"Creating a protected space for innovation using LPM principles allowed us to demonstrate value quickly and build support for broader adoption. We deliberately chose high-visibility initiatives that could showcase new ways of working while minimizing risk to critical operations." (Technology Director, National Public Health Agency)

Quantitative analysis revealed that implementation approach significantly correlated with organizational size and prior agile experience. Larger organizations (>1000 employees) were more likely to adopt pilot approaches ($r = 0.67$, $p < 0.01$), while organizations with established team-level agile practices were more likely to implement comprehensive approaches ($r = 0.58$, $p < 0.05$).



4.2 Implementation Outcomes

4.2.1 Delivery Performance

Organizations implementing LPM approaches reported significant improvements in delivery performance compared to their previous portfolio management approaches. Key metrics included:

- **Time-to-Market**: Organizations implementing comprehensive LPM reported average reductions of 37% in time from concept to delivery (range: 22-53%), compared to 18% for selective implementers and 15% for pilot implementers.
- **Predictability**: The percentage of initiatives delivered on schedule improved from an average of 32% pre-implementation to 74% post-implementation for comprehensive implementers, compared to improvements from 35% to 58% for selective implementers.
- **Scope Realization**: Comprehensive implementers reported delivering 92% of planned features on average, compared to 76% pre-implementation. Selective implementers improved from 72% to 83%.

These improvements were statistically significant for all implementation archetypes, but the magnitude of improvement correlated strongly with implementation comprehensiveness ($r = 0.72$, $p < 0.01$).

4.2.2 Resource Utilization

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LPM implementation was associated with improved resource utilization across the studied organizations. Comprehensive implementers reported a 42% average increase in resource efficiency (measured as capability delivery per full-time equivalent), compared to 24% for selective implementers and 17% for pilot implementers.

Qualitative data revealed that these efficiency gains resulted primarily from four factors:

1. **Reduced Work-in-Progress**: LPM practices like capacity-based planning and work-in-progress limits reduced context switching and improved team focus.
2. **Decreased Administrative Overhead**: Streamlined governance processes reduced time spent on approval processes and status reporting.
3. **Improved Dependency Management**: Visual management tools and cross-functional planning reduced delays from unmanaged dependencies.
4. **Eliminated Low-Value Work**: Value-focused prioritization eliminated initiatives with limited public health impact.

A portfolio manager described these efficiency improvements:

"Before LPM, we spread our resources across too many concurrent projects, causing delays, quality issues, and team burnout. By visualizing our capacity and limiting work-in-progress, we've dramatically improved throughput while actually reducing overtime and stress levels." (Portfolio Manager, Provincial Health Department)

4.2.3 Stakeholder Satisfaction

Stakeholder satisfaction showed notable improvement following LPM implementation, though with variation across stakeholder groups. Using a standardized satisfaction instrument (1-5 scale):

- **Executive Leadership** satisfaction increased from baseline average of 2.7 to 4.2 post-implementation ($p < 0.01$)
- **Technology Teams** showed the largest satisfaction increase, from 2.3 to 4.5 ($p < 0.001$)
- **Program Managers** showed moderate satisfaction improvement, from 2.8 to 3.7 ($p < 0.05$)

Qualitative analysis revealed that satisfaction improvements stemmed from increased transparency in decision-making, more frequent delivery of value, and better alignment between technology capabilities and public health needs. However, program managers in some organizations reported challenges with the shift from fixed scope guarantees to more flexible, outcome-focused approaches.

A public health program director reflected:

"The initial transition was difficult we were accustomed to comprehensive project plans with detailed deliverables. LPM's incremental approach required a mindset shift to focus on outcomes rather than predefined scope. Over time, we've come to appreciate the ability to adapt as we learn, but it required significant adjustment." (Program Director, Local Health Department)

4.2.4 Innovation Capacity

Organizations implementing comprehensive LPM approaches reported enhanced capacity for innovation in public health technology capabilities. Metrics supporting this finding included:

- 157% average increase in new capabilities delivered annually
- 43% reduction in time to implement responses to emerging public health threats
- 68% increase in successful pilots of emerging technologies

Qualitative data indicated that innovation improvements resulted from shorter feedback loops, dedicated capacity for exploration, and decentralized decision-making that empowered teams to experiment within strategic boundaries.

An innovation lead explained:

"LPM created space for innovation by establishing explicit capacity allocations for exploring emerging needs and technologies. Instead of requiring extensive business cases before exploration, we can rapidly test ideas, gather evidence, and make informed scaling decisions." (Innovation Lead, National Public Health Agency)

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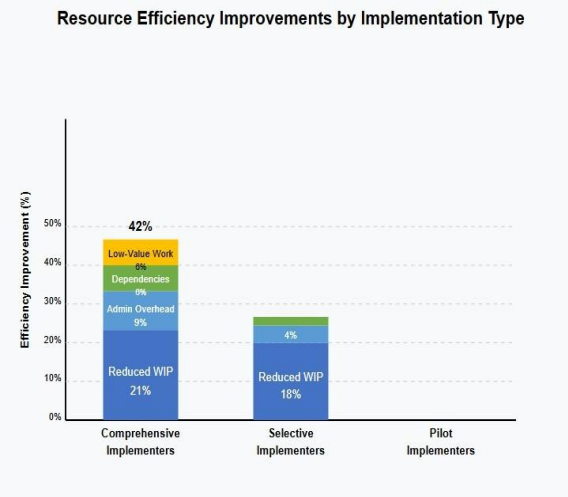
Table 3: Innovation Capacity Metrics after LPM Implementation

Innovation Metric	Average Improvement	Range Across Organizations	Contributing Factors
New Capabilities Delivered Annually	+157%	+98% to +215%	Shorter feedback loops, Dedicated exploration capacity
Response Time to Emerging Threats	-43%	-28% to -61%	Decentralized decision-making, Flexible capacity allocation
Successful Technology Pilots	+68%	+42% to +89%	Protected innovation funding, Rapid experimentation cycles



4.3 Critical Success Factors

Cross-case analysis identified five factors critical to successful LPM implementation in public health contexts:

4.3.1 Executive Leadership Alignment

Organizations with strong alignment among executive leadership demonstrated significantly more successful implementations. This alignment encompassed shared understanding of LPM principles, consistent messaging about the rationale for change, and visible modeling of new behaviors. Organizations with inconsistent executive support encountered resistance and struggled to sustain momentum through implementation challenges.

A change management leader described the impact of executive alignment:

"Our successful transformation began when we invested time in building a cohesive understanding among our executive team. We created a leadership coalition that articulated a consistent vision, demonstrated new behaviors, and personally engaged with the challenges of changing how we worked." (Change Management Lead, State Health Department)

4.3.2 Cross-Functional Governance Structures

Successful implementations established governance bodies that brought together technology, public health programs, finance, and legal/compliance perspectives. These cross-functional structures enabled faster decision-making, reduced coordination overhead, and facilitated more effective management of constraints specific to public health environments.

Organizations maintaining siloed governance structures reported ongoing challenges with delayed decisions, misaligned priorities, and difficulty balancing innovation with compliance requirements. The most effective governance models incorporated dedicated roles for translating between technical and public health domains.

4.3.3 Incremental Funding Models

Organizations that adapted financial management practices to support incremental delivery showed stronger outcomes than those maintaining traditional annual allocations to fixed project scopes. Successful funding approaches included capacity-based funding for value streams, rolling-wave budget allocations, and protected innovation funding.

A finance director explained their adapted approach:

"We shifted from funding specific project deliverables to funding capacity for value streams aligned to public health capabilities. This fundamental change enabled teams to adapt priorities based on emerging needs while maintaining fiscal responsibility through

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quarterly budget reviews." (Finance Director, State Health Department)

The most effective funding models addressed the reality of categorical funding streams through "translation layers" that mapped external funding requirements to internal value streams while maintaining necessary compliance audit trails.

4.3.4 Balanced Metrics Frameworks

Organizations implementing comprehensive measurement systems that balanced delivery speed, stakeholder outcomes, and public health impact demonstrated more sustainable transformations than those focusing solely on efficiency metrics. Effective measurement frameworks included:

- Leading indicators of value delivery
- Team health and engagement measures
- Public health outcome metrics
- Innovation pipeline metrics

These balanced frameworks helped prevent optimization for speed at the expense of quality or public health impact, a concern expressed by several public health leaders.

4.3.5 Intentional Culture Evolution

Successful implementations paired process changes with deliberate culture evolution efforts. These organizations invested in developing new capabilities, reshaping incentive structures, and creating psychological safety for new ways of working. They recognized and addressed the distinct professional cultures within public health organizations, including clinical, epidemiological, administrative, and technical domains.

A human resources leader described their approach:

"We recognized that sustainable change required evolving our culture, not just our processes. We identified the behaviors needed to support LPM, realigned our recognition systems to reinforce those behaviors, and invested in developing capabilities at all levels. Most importantly, we acknowledged and respected the professional identities of our public health experts while helping them embrace new ways of working." (HR Director, National Public Health Agency)

Organizations that focused exclusively on process changes without addressing cultural dimensions reported higher resistance, limited adoption of new practices, and regression to previous ways of working when facing pressure.

4.4 Public Health-Specific Adaptations

Successful LPM implementations required significant adaptations to address the unique characteristics of public health environments. The most important adaptations included:

4.4.1 Emergency Response Integration

Public health agencies must maintain capacity for emergency response to disease outbreaks, environmental hazards, and other public health threats. Successful LPM implementations created specific mechanisms for rapidly reallocating capacity from planned initiatives to emergency response while maintaining portfolio visibility.

Effective approaches included:

- Designated emergency response value streams with surge capacity protocols
- Pre-defined reprioritization processes for different emergency severity levels
- Cross-trained teams that could pivot between planned work and emergency support
- "Protected" capacity for critical ongoing public health functions

A portfolio manager in a state health department explained their approach:

"We established clear protocols for how our LPM processes adapt during emergency activation. This includes which ceremonies continue, which are suspended, how capacity is reallocated, and how we track emergency work within our portfolio tools. These protocols were essential during COVID-19 response when we needed to rapidly pivot while maintaining visibility of the total portfolio." (Portfolio Manager, State Health Department)

4.4.2 Compliance-Compatible Agility

Public health organizations operate in highly regulated environments with strict

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requirements for privacy, security, and data management. Successful implementations developed approaches that maintained necessary compliance while enabling agility.

Effective practices included:

- Compliance representatives embedded within cross-functional teams
- Pre-approved architectural patterns for common compliance scenarios
- Stage-appropriate compliance verification rather than phase-gate approvals
- Automated compliance verification where possible

A compliance officer described their transformed approach:

"We shifted from being approval gatekeepers to becoming enabling partners. By establishing clear guardrails and participating throughout the delivery process, we maintained our compliance obligations while significantly reducing delays. The key was moving from periodic inspections to continuous involvement." (Compliance Officer, Provincial Health Department)

4.4.3 Multi-Stakeholder Value Definition

Public health initiatives typically serve diverse stakeholders including the public, healthcare providers, community organizations, government officials, and internal program staff. Successful LPM implementations developed nuanced approaches to defining and prioritizing value across these stakeholder groups.

Effective approaches included:

- Explicit stakeholder mapping for each value stream
- Weighted value models incorporating multiple perspectives
- Community advisory participation in value definition
- Public health outcome metrics linked to technical capabilities

A product owner reflected on this challenge:

"In commercial settings, customer value is typically clearer. In public health, we serve multiple 'customers' with different needs and expectations. We developed a structured approach to incorporating diverse perspectives into our definition of value, with explicit weighting based on our strategic priorities and public health impact." (Product Owner, County Health Department)

4.4.4 Categorical Funding Accommodation

Public health agencies often receive funding from multiple sources (federal, state/provincial, grants) with specific spending requirements and reporting obligations. Successful implementations developed mechanisms to align categorical funding streams with value-based portfolio management.

Effective approaches included:

- Mapping funding sources to value streams with transparent traceability
- Creating funding "pools" where allowable to increase flexibility
- Timing value stream planning around known funding cycles
- Establishing reserve capacity for addressing restrictive funding requirements

A finance leader described their solution:

"We developed a two-tiered approach: externally, we maintain the categorical structure required by our funding sources with appropriate tracking and reporting. Internally, we map these funds to our value streams in a way that maximizes flexibility while maintaining auditability. This 'translation layer' was essential for reconciling LPM with our funding reality." (Finance Director, Local Health Department)

5. Discussion

5.1 A Maturity Model for LPM in Public Health

Based on our findings, we propose a maturity model for LPM implementation in public health contexts (Figure 2). This model identifies five progressive levels of LPM adoption, with corresponding practices across the four domains of our conceptual framework. The model provides a roadmap for public health organizations to assess their current state and plan their transformation journey.

The proposed maturity levels include:

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1. **Traditional**: Conventional project-based management with annual funding cycles and centralized control
2. **Exploring**: Pilot implementations of selected LPM practices while maintaining traditional core processes
3. **Transitioning**: Hybrid approach with significant LPM practice adoption but incomplete integration
4. **Transforming**: Comprehensive implementation across all domains with adaptations for public health context
5. **Optimizing**: Advanced implementation with continuous refinement and public health-specific innovations

This maturity model emphasizes that effective LPM implementation in public health is not binary but represents a journey of progressive adoption and adaptation. Organizations in our study demonstrated movement along this continuum, with varying rates of progression influenced by organizational context, leadership alignment, and external constraints.

5.2 Comparing Sector Outcomes

Our findings on LPM outcomes in public health organizations show both similarities and differences compared to reported outcomes in commercial sectors. While improvements in delivery speed, predictability, and resource utilization align with commercial sector experiences (Scaled Agile, 2021), the magnitude of improvement was generally lower in public health contexts.

This difference likely reflects the additional constraints in public health environments, including regulatory requirements, funding restrictions, and the non-negotiable nature of certain public health functions. Despite these constraints, the achieved improvements remain significant and demonstrate the value of LPM approaches even in highly regulated environments.

Interestingly, improvements in innovation capacity were comparable to or exceeded those reported in commercial sectors. This suggests that traditional public health management approaches may have particularly constrained innovation, creating significant opportunity for improvement through LPM adoption.

A notable difference was the timeline for realizing benefits. Public health organizations reported longer periods to achieve significant improvements (average 9-12 months) compared to commercial sector reports (often 3-6 months). This extended timeline reflected the complexity of public health organizational structures, additional change management requirements, and adaptation needs for public health contexts.

5.3 Balancing Standards and Flexibility

A consistent theme across our findings is the importance of balancing standardized practices with contextual flexibility in LPM implementation. Organizations that attempted to implement commercial LPM frameworks without adaptation encountered significant challenges with fit to public health environments. Conversely, organizations that modified frameworks beyond recognition lost the coherence and evidence base of established approaches.

The most successful implementations maintained fidelity to core LPM principles while thoughtfully adapting practices to address public health-specific challenges. This "principled adaptation" approach required deep understanding of both LPM fundamentals and public health organizational contexts.

A technology leader in a national public health agency described this balance:

"We needed to distinguish between the principles of LPM which proved remarkably applicable to our context and the specific practices, which often needed significant adaptation. By focusing on why certain practices exist rather than blindly implementing them, we developed approaches that honored the principles while addressing our unique public health requirements." (CIO, National Public Health Agency)

This finding aligns with implementation science research suggesting that interventions requiring adaptation to local contexts benefit from clearly distinguishing between "core components" that must be preserved and "adaptable periphery" that can be modified (Damschroder et al., 2009).

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5.4 Implications for Public Health Leadership

Our findings have significant implications for public health leaders navigating digital transformation and infrastructure modernization efforts. First, they suggest that LPM approaches, properly adapted, can deliver meaningful improvements in how public health technology portfolios are managed potentially addressing many of the challenges identified in traditional approaches.

Second, they emphasize that successful LPM implementation requires more than process changes; it demands thoughtful attention to governance structures, funding models, cultural factors, and public health-specific adaptations. Leaders should approach LPM as an organizational transformation rather than a methodology implementation.

Third, our findings highlight the importance of executive alignment and active leadership involvement in LPM transformation. Organizations where executives delegated implementation to project management offices or technology teams without personal engagement struggled to achieve sustainable change.

Finally, the identified maturity model provides a potential roadmap for leaders to assess their organization's current state and plan a progressive transformation journey rather than attempting a "big bang" implementation.

6. Conclusion

This research examined the application of Lean Portfolio Management principles to public health infrastructure modernization efforts, investigating implementation approaches, outcomes, and critical success factors across 14 public health organizations. Our findings demonstrate that LPM can deliver significant benefits for public health organizations, including improved delivery performance, enhanced resource utilization, increased stakeholder satisfaction, and greater innovation capacity.

Successful implementation requires thoughtful adaptation to address the unique characteristics of public health environments, including emergency response requirements, compliance obligations, diverse stakeholder ecosystems, and categorical funding streams. Organizations achieved the strongest outcomes when implementing comprehensive LPM approaches across strategy alignment, portfolio operations, governance, and cultural dimensions.

Critical success factors identified include executive leadership alignment, cross-functional governance structures, incremental funding models, balanced metrics frameworks, and intentional culture evolution. These factors, combined with public health-specific adaptations, provide a foundation for effective LPM implementation in health agency contexts.

The proposed maturity model offers a framework for public health organizations to assess their current state and plan their transformation journey, recognizing that effective LPM adoption represents a progressive evolution rather than a binary implementation.

As public health organizations continue to navigate complex modernization efforts in resource-constrained environments, Lean Portfolio Management offers a promising approach to maximize value delivery, enhance responsiveness to emerging needs, and build sustainable innovation capacity while maintaining essential public health services.

6.1 Limitations and Future Research

This study has several limitations. While our sample included diverse organizations across multiple countries, it cannot capture the full range of public health organizational contexts. The relatively recent implementation of LPM in many participating organizations limits our ability to assess long-term sustainability and outcomes. Additionally, the COVID-19 pandemic created exceptional circumstances during the study period that may have influenced implementation approaches and outcomes.

Future research should examine longer-term outcomes of LPM implementations in public health, investigate applications beyond technology portfolios to public health programs more broadly, and develop more detailed guidance for specific public health-specific

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adaptations. Comparative studies across government sectors (e.g., public health vs. other government domains) would also provide valuable insights into contextual factors influencing LPM effectiveness.

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