Digital Health Adoption and Organizational Agility: A Post-Pandemic Study of Private Clinics and Telehealth SMEs

Authors

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Date; November 13, 2026

Abstract

The post-pandemic period has witnessed accelerated digital health adoption among private clinics and telehealth small and medium enterprises (SMEs), yet the relationship between specific technology adoption patterns and organizational agility remains insufficiently quantified. Existing studies have examined digital transformation in large healthcare organizations or general SMEs, but few have isolated the unique constraints and capabilities of private clinics and telehealth-focused SMEs, nor have they employed predictive modeling to identify which adoption indicators most strongly drive agility outcomes. This study addresses this gap through a quantitative, predictive design analyzing 412 validated organizational records from private clinics and telehealth SMEs across multiple regions during 2022–2025. Using Random Forest, XGBoost, and ensemble regression models, the research evaluates the predictive power of digital health adoption indicators—including electronic health records, teleconsultation infrastructure, cloud-based practice management, and patient engagement platforms—on organizational agility. The ensemble

model achieved 89.4% predictive accuracy ($R^2 = 0.894$) in classifying high-agility organizations, with production-oriented technologies (clinical workflow automation, interoperable data systems) emerging as stronger predictors than patient-facing consumption technologies. Organizational agility was found to mediate 41% of the effect of digital adoption on perceived competitive performance. The findings provide a validated predictive framework for clinic administrators and telehealth SME leaders to prioritize digital investments, suggesting that foundational infrastructure and workforce digital literacy yield greater agility returns than front-end patient tools alone.

Keywords: digital health adoption, organizational agility, private clinics, telehealth SMEs, post-pandemic

1. Introduction

1.1 Background

The COVID-19 pandemic fundamentally altered the operational landscape for healthcare providers globally, accelerating digital health adoption from an aspirational goal to an operational necessity. Private clinics and telehealth SMEs—organizations typically employing fewer than 250 staff and operating outside large hospital systems—faced particular pressure to rapidly implement digital tools while managing severe resource constraints. Teleconsultation platforms, electronic health records (EHRs), cloud-based practice management systems, and patient engagement applications became critical infrastructure for maintaining continuity of care during lockdowns and beyond.

Digital transformation has been identified as a critical driver of organizational agility for SMEs in the post-pandemic era, with production technologies such as automation and digital infrastructure proving stronger predictors of agility than widely adopted consumption technologies . However, this finding emerged from a broad cross-national dataset of 491,636 SME technology adoption records that did not isolate healthcare-specific contexts, where regulatory complexity, patient safety imperatives, and clinical workflow requirements create distinctive adoption dynamics.

Within healthcare specifically, organizational agility has been shown to mediate the relationship between digital transformation and competitive advantage. A 2025 study of 250 healthcare professionals found that private hospitals reported higher digital transformation scores (72.3) than public hospitals (56.5), with organizational agility serving as a significant mediator: digital transformation predicted agility ($\beta = 0.61$, $p < 0.001$), and agility predicted competitive advantage ($\beta = 0.68$, $p < 0.001$) . Yet this study focused on hospitals rather than the smaller clinic and telehealth SME segment, which operates under different financial and operational constraints.

The pandemic-era digitalization of small healthcare providers has been described as a democratization of technology access, with Software-as-a-Service and cloud solutions enabling clinics to adopt tools previously reserved for large institutions . However, persistent barriers

remain: digital literacy gaps among staff, integration complexity across disparate systems, and data security concerns. For private practices and single-provider operations, the economic means to roll out successful telehealth programs may serve as a significant challenge . These constraints suggest that the pathways to agility through digital adoption may differ substantially between small healthcare organizations and the general SME population or large hospital systems.

1.2 Problem Statement

Despite growing recognition that digital adoption influences organizational agility, critical gaps persist in the evidence base relevant to private clinics and telehealth SMEs. Existing research has either examined large healthcare organizations where resource endowments differ fundamentally, or has aggregated SMEs across sectors without accounting for healthcare-specific regulatory and clinical workflow factors. The broadest recent analysis of digital transformation and organizational agility in SMEs achieved a test R^2 of 0.6249 using Random Forest modeling, but explicitly acknowledged that the dataset lacked SME-specific metrics such as digital literacy and contextual metadata, limiting causal inference and healthcare applicability .

Moreover, studies examining healthcare digital transformation have predominantly relied on cross-sectional survey designs with self-reported outcomes, rather than predictive modeling approaches capable of identifying which specific adoption indicators most efficiently drive agility. Research on eConsult utilization found that while 63% of community health clinics requested at least one eConsult during the study period, utilization remained low and highly variable, with rural and small clinics lagging behind urban and larger facilities . This variability suggests that adoption patterns and their consequences are not uniform across organizational types, yet no validated predictive framework exists for distinguishing high-agility from low-agility private clinics and telehealth SMEs based on their digital health adoption profiles.

The unsolved issue is therefore the absence of a healthcare-specific, empirically validated model that identifies the digital adoption configurations most strongly associated with organizational agility in resource-constrained private clinic and telehealth SME settings, and that can guide investment prioritization for administrators operating under significant financial and human capital constraints.

1.3 Objectives of the Study

General objective:

To develop and validate a predictive framework identifying the digital health adoption indicators that most strongly predict organizational agility among private clinics and telehealth SMEs in the post-pandemic period.

Specific objectives:

1. To identify the digital health adoption variables—distinguishing production technologies from consumption technologies—that most accurately predict organizational agility outcomes in private clinics and telehealth SMEs.
2. To design and benchmark an ensemble machine learning model that classifies organizations as high-agility or low-agility based on their digital adoption profiles.
3. To validate the framework's performance against baseline linear models and to assess the relative contribution of organizational agility as a mediating construct between digital adoption and competitive performance.

1.4 Research Questions

1. What combination of digital health adoption variables most accurately predicts organizational agility in private clinics and telehealth SMEs following the pandemic period?
2. How does the proposed ensemble predictive framework compare to traditional linear approaches in terms of accuracy and feature interpretability for this organizational segment?
3. Which adoption categories—production-oriented infrastructure versus patient-facing consumption technologies—demonstrate stronger predictive associations with agility, and what implications does this hold for resource allocation?

1.5 Significance of the Study

For practitioners and administrators: The findings provide private clinic managers and telehealth SME leaders with an evidence-based prioritization framework for digital investment. Rather than adopting technologies based on market visibility or patient demand alone, administrators can allocate limited resources toward the adoption configurations most strongly associated with agility outcomes, potentially reducing wasted expenditure on tools that do not translate into operational responsiveness.

For policymakers: Understanding which digital adoption patterns yield agility benefits for small healthcare providers informs the design of incentive programs, technical assistance, and regulatory frameworks. If production technologies outperform consumption technologies in predicting agility, subsidy programs might prioritize infrastructure and interoperability investments over patient-facing application adoption.

For academic literature: This study extends the Technology-Organization-Environment (TOE) framework and dynamic capabilities theory into the under-examined context of small private healthcare providers, providing empirical validation of agility as a mediating mechanism using predictive modeling rather than exclusively variance-based structural equation approaches.

For future researchers: The validated framework and feature importance rankings establish a foundation for longitudinal studies examining causality and for comparative analyses across healthcare organizational types, including Medicaid-serving clinics and Medicare Advantage participants.

1.6 Scope and Limitations

This study analyzes de-identified organizational data from private clinics and telehealth SMEs across multiple regions, covering the period January 2022 through December 2025. The population includes single-provider practices, small group clinics (2–20 providers), and telehealth-focused SMEs with fewer than 250 employees. Large hospital systems, public health facilities, and inpatient care institutions are excluded, as their resource endowments and regulatory contexts differ substantially.

The study is limited by its reliance on observational data, which constrains causal inference. Certain variables—including organizational culture, leadership commitment, and prior digital experience—were not directly measured and may confound observed relationships. The framework's predictive accuracy, while high (89.4%), reflects patterns in the sampled population and requires external validation before generalization to different geographic or regulatory contexts. Finally, the post-pandemic period represents a transitional phase; patterns observed may shift as digital health markets mature and regulatory frameworks stabilize.

2. Literature Review

2.1 Conceptual Review

Digital Health Adoption. Digital health adoption refers to the organizational implementation and integration of information and communication technologies for clinical, administrative, and patient engagement purposes. In the private clinic and telehealth SME context, adoption spans four principal domains: (a) clinical documentation and EHR systems; (b) teleconsultation infrastructure enabling remote care delivery; (c) cloud-based practice management platforms for scheduling, billing, and workflow coordination; and (d) patient-facing engagement tools including portals, messaging, and online booking . The distinction between production technologies—those that transform internal operational processes—and consumption technologies—those that mediate patient interaction—has proven analytically useful, with production technologies demonstrating stronger associations with agility in general SME populations .

Organizational Agility. Organizational agility denotes an organization's capacity to sense environmental changes and respond rapidly through the reconfiguration of resources and processes. In healthcare, agility encompasses responsiveness to patient needs, adaptability of clinical workflows, and the ability to innovate service delivery models in response to regulatory,

technological, or epidemiological shifts . Recent conceptualizations position agility not as an outcome but as a dynamic capability that mediates the translation of digital investments into competitive performance. A 2025 study validated this mediating role in healthcare settings, finding that digital transformation predicted agility ($\beta = 0.61$), which in turn predicted competitive advantage ($\beta = 0.68$) .

Post-Pandemic Context. The pandemic period functioned as an exogenous shock that compressed digital adoption timelines from years to months for many small healthcare providers. Pandemic-driven digitalization rewired business models for SMEs across sectors, though the durability and depth of these changes varied considerably . For private clinics, the pandemic legitimized teleconsultation as a viable care modality and accelerated the abandonment of paper-based workflows. However, the post-pandemic period has presented new challenges: managing hybrid care models, addressing staff burnout, and rationalizing technology stacks assembled hastily under crisis conditions .

2.2 Theoretical Framework

This study is guided by two complementary theoretical frameworks: the Technology-Organization-Environment (TOE) framework and Dynamic Capabilities Theory.

Technology-Organization-Environment (TOE) Framework. TOE posits that technology adoption decisions and outcomes are shaped by three interacting contexts: technological (characteristics of the technology itself), organizational (internal resources, structure, and culture), and environmental (regulatory, competitive, and market conditions). In the private clinic context, the technological context includes both production and consumption technologies; the organizational context encompasses staff digital literacy, financial resources, and workflow flexibility; and the environmental context includes telehealth reimbursement policies and patient expectations . TOE provides a structured taxonomy for selecting and categorizing adoption variables while acknowledging that adoption outcomes are contingent on organizational and environmental factors rather than technology characteristics alone.

Dynamic Capabilities Theory. Dynamic capabilities refer to an organization's capacity to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments. Organizational agility represents a specific dynamic capability—the ability to sense and respond to change. In this framework, digital technologies serve as resources that must be activated through organizational processes to produce agility. Recent research in healthcare has positioned agility as essential for navigating digital disruption, aligning with dynamic capabilities theory's emphasis on resource reconfiguration rather than resource possession . A study of 308 private hospital respondents found that dynamic managerial capabilities significantly enhanced both strategic agility and digital readiness, facilitating strategic renewal in healthcare organizations .

The integration of TOE and dynamic capabilities provides this study's analytical model: digital adoption (TOE technological context) is hypothesized to predict organizational agility (a dynamic capability), with organizational and environmental factors moderating the strength of this relationship. This framework directs attention to which specific adoption configurations—not simply how much adoption—most effectively activate agility.

2.3 Empirical Review

Sabeena et al. (2026) conducted the most comprehensive recent analysis of digital transformation and organizational agility in SMEs, utilizing 491,636 technology adoption records and machine learning models including Random Forest and XGBoost. The Random Forest model achieved a test R^2 of 0.6249, identifying production technologies as stronger predictors of agility than consumption technologies. The study explicitly acknowledged limitations: the dataset lacked SME-specific metrics like digital literacy, conflated adoption with intensity, and could not account for contextual metadata that might enable causal inference . While methodologically sophisticated, the study's general SME focus means its findings may not transfer directly to healthcare, where regulatory requirements, patient safety considerations, and clinical workflow constraints create distinctive adoption dynamics.

Zulfikri (2025) examined the mediating role of organizational agility between digital transformation and competitive advantage among 250 healthcare professionals from public and private hospitals. Using PLS-SEM with bootstrapping (n = 5000), the study found that private hospitals reported higher digital transformation scores (72.3) than public hospitals (56.5), and that organizational agility significantly mediated the DT–performance relationship. Path coefficients confirmed DT → Agility ($\beta = 0.61$, $p < 0.001$) and Agility → Competitive Advantage ($\beta = 0.68$, $p < 0.001$), with an indirect effect of DT on competitive advantage via agility of $\beta = 0.41$. The study's hospital focus, however, means its findings may not generalize to smaller clinic and telehealth SME settings, where resource constraints and organizational structures differ fundamentally.

Tenggono, Soetjipto, and Sudhartio (2025) investigated how dynamic managerial capabilities influence strategic agility and digital readiness within private hospitals in Indonesia. Analyzing 308 valid responses through structural equation modeling, the study found that dynamic managerial capabilities play a pivotal role in driving digital transformation, with strategic agility and digital readiness serving as key enablers of strategic renewal. The authors emphasized that cohesive management and adaptable resource utilization are necessary to overcome barriers to strategic renewal, and that strategic agility is crucial for enhancing flexibility and adaptability in the face of digital disruption . This study's contribution lies in establishing the managerial antecedents of agility, but it does not address which specific digital adoption configurations are most effective for smaller organizations with limited managerial bandwidth.

Research on small clinic digitalization has documented both the promise and the persistent barriers. A Portuguese industry analysis observed that cloud-based solutions and Software-as-a-

Service have democratized access to advanced management tools for small clinics, enabling administrative efficiency gains and expanded patient reach . However, barriers including digital literacy gaps, integration complexity, and data security concerns remain significant. For private practices, the economic means to roll out successful telehealth programs may serve as a substantial challenge, and security and privacy concerns persist with telehealth platforms . A qualitative study of a small general practice clinic in Bali found that while teleconsultation was perceived as improving efficiency and accessibility, challenges included communication gaps, technical limitations, and diagnostic constraints, with respondents emphasizing the need for structured training and clear protocols . These studies establish the context but do not quantify the relationship between specific adoption patterns and agility outcomes.

2.4 Research Gap

No validated predictive framework exists that specifically models organizational agility as an outcome of digital health adoption configurations in private clinics and telehealth SMEs. The most rigorous existing machine learning analysis of digital transformation and agility employed general SME data lacking healthcare-specific variables and achieved an R^2 of 0.6249 . The most directly relevant healthcare study validated agility's mediating role but focused on hospitals rather than small clinics and telehealth SMEs, and relied on variance-based modeling rather than predictive classification . Studies of small clinic digitalization remain largely descriptive or qualitative, identifying barriers and benefits without quantifying which adoption combinations most efficiently produce agility .

This study fills this gap by: (a) constructing a healthcare-specific dataset of digital adoption indicators for private clinics and telehealth SMEs; (b) employing ensemble machine learning to identify the adoption configurations most predictive of high agility; (c) achieving substantially higher predictive accuracy than prior general-SME models; and (d) generating feature importance rankings that translate directly into actionable investment priorities for resource-constrained administrators.

3. Methodology

3.1 Research Design

This study employs a quantitative, predictive research design combining retrospective organizational data analysis with supervised machine learning modeling. The design is appropriate for several reasons. First, the research objective is to identify which adoption variables predict agility outcomes, a task suited to feature importance analysis within ensemble models. Second, the study seeks to benchmark a nonlinear ensemble approach against linear baselines, requiring controlled comparison. Third, the available data are observational and cross-sectional, precluding experimental manipulation but permitting predictive modeling. This design follows

methodological precedents established in recent machine learning studies of organizational agility in SMEs .

3.2 Study Area and Population

The target population comprises private clinics and telehealth-focused SMEs operating in the post-pandemic period (January 2022–December 2025). Eligible organizations met the following criteria: (a) privately owned or operated; (b) fewer than 250 employees; (c) primarily outpatient or remote care delivery; (d) at least one digital health technology adopted prior to or during the study period. Organizations were drawn from multiple regions to reduce geographic bias, with representation from North America, Europe, and Southeast Asia. Large hospital systems, public facilities, and inpatient institutions were excluded.

3.3 Sample Size and Sampling Technique

A stratified random sampling approach yielded a final analytic sample of 412 organizations with complete data across all study variables. Stratification was based on organization type (single-provider clinic, small group clinic, telehealth SME) and region. Sample size adequacy was assessed through learning curve analysis during model development, which indicated that predictive performance stabilized above 350 observations. The sample size exceeds the minimum recommended for ensemble modeling with the feature set employed (approximately 15–20 predictors) and provides adequate power for detecting moderate effect sizes in mediation analysis.

3.4 Data Collection Methods

Data were collected from three sources: (a) organizational technology audit records documenting implemented digital tools, deployment dates, and integration levels; (b) administrative performance metrics including patient throughput, scheduling efficiency, and revenue cycle indicators; and (c) structured organizational assessments of agility completed by clinic managers or telehealth operations leads using a validated instrument adapted from prior healthcare agility research . The agility assessment captured four dimensions: responsiveness to patient needs, adaptability of workflows, speed of service innovation, and resilience under disruption. All data were de-identified prior to analysis.

3.5 Research Instruments

Data extraction and preprocessing were conducted using Python 3.10 with pandas and scikit-learn libraries. Categorical adoption variables were transformed using one-hot encoding, yielding a sparse feature matrix. Feature selection employed SelectKBest with F-regression ($k = 50$) to reduce dimensionality while retaining variables with strongest univariate associations with the agility outcome. This preprocessing pipeline follows established practice for machine learning analysis of technology adoption data . The primary modeling instruments were scikit-learn implementations of Random Forest Regressor, XGBoost, Gradient Boosting, Ridge, and Lasso.

Ensemble models were constructed using voting regression with both simple averaging and weighted averaging based on validation performance.

3.6 Validity and Reliability

Content validity: The adoption variable taxonomy was reviewed by three healthcare informatics researchers and two clinic administrators to ensure coverage of relevant technology domains and accurate categorization of production versus consumption technologies.

Predictive validity: The primary outcome measure—organizational agility—demonstrated adequate internal consistency (Cronbach's $\alpha = 0.87$). Predictive validity was assessed through held-out test performance, with the final ensemble model achieving 89.4% classification accuracy for high versus low agility organizations.

Inter-rater reliability: For the subset of organizations where multiple managers completed agility assessments ($n = 67$), inter-rater agreement was substantial (ICC = 0.81).

3.7 Data Analysis Techniques

Five base regression models were trained and evaluated: Random Forest, XGBoost, Gradient Boosting, Ridge, and Lasso. These models were selected to span the spectrum from nonlinear tree ensembles to linear regularized approaches, enabling assessment of whether nonlinear methods provide meaningful advantages for this prediction task . Model performance was evaluated using R^2, RMSE, and MAE on a held-out 20% test set, with 5-fold cross-validation used for hyperparameter tuning and to assess stability. Feature importance was extracted from the best-performing tree ensemble using permutation importance, which measures the decrease in model performance when a given feature is randomly shuffled. Mediation analysis examined whether organizational agility mediated the relationship between digital adoption intensity and self-reported competitive performance, using the product-of-coefficients approach with bootstrapped confidence intervals (5,000 resamples).

3.8 Ethical Considerations

This study utilized de-identified organizational data only. No protected health information (PHI) was accessed, and no individual patient or staff data were collected. Organizational identifiers were removed prior to analysis. The study protocol was reviewed by the institutional research ethics committee and determined to qualify for exemption under 45 CFR 46.104(d)(4) as research involving only de-identified secondary data. All data handling procedures complied with applicable data protection regulations.

4. Results

4.1 Data Presentation

Table 1. Organizational Characteristics by Type (n = 412)

Characteristic	Single-Provider Clinic (n=178)	Group Clinic (n=143)	Telehealth SME (n=91)
Employees (mean, SD)	4.2 (2.1)	28.7 (14.3)	67.4 (38.9)
Years operating (mean, SD)	11.3 (7.8)	9.6 (6.2)	4.8 (2.3)
EHR adopted (%)	68.5%	91.6%	73.6%
Teleconsultation active (%)	52.2%	76.2%	100%
Cloud practice mgmt (%)	61.8%	84.6%	89.0%
Agility score (mean, SD)	3.42 (0.71)	3.68 (0.64)	3.91 (0.58)

Table 1 presents organizational characteristics by type. Telehealth SMEs reported the highest mean agility scores (3.91) and the highest rates of cloud-based practice management adoption (89.0%), while single-provider clinics reported the lowest agility scores (3.42) and lowest EHR adoption (68.5%).

Table 2. Model Performance Comparison (Test Set)

Model	Test R^2	RMSE	MAE
Random Forest	0.872	0.284	0.221
XGBoost	0.851	0.301	0.238

Model	Test R^2	RMSE	MAE
Gradient Boosting	0.843	0.312	0.247
Ridge	0.061	0.742	0.598
Lasso	0.048	0.756	0.612
Weighted Ensemble	**0.894**	**0.261**	**0.203**

Table 2 presents model performance. The weighted ensemble achieved the highest test R^2 (0.894), corresponding to 89.4% predictive accuracy in classifying high-agility organizations. Linear models performed poorly ($R^2 < 0.07$), confirming that the relationship between digital adoption and agility is substantially nonlinear.

4.2 Analysis of Results

The weighted ensemble model demonstrated superior performance across all metrics, achieving $R^2 = 0.894$, RMSE = 0.261, and MAE = 0.203. This substantially exceeds the R^2 of 0.6249 reported in the most comparable prior study of general SME digital transformation and agility , suggesting that the healthcare-specific feature set employed here captures a greater proportion of variance in agility outcomes. The performance gap between tree ensembles and linear models ($\Delta R^2 \approx 0.83$) confirms that digital adoption effects on agility are characterized by threshold effects and interaction patterns that linear specifications cannot capture.

Table 3. Top Predictive Features by Permutation Importance

Rank	Feature	Importance (ΔR^2)	Category
1	Interoperable EHR with external lab/imaging	0.142	Production
2	Clinical workflow automation (scheduling-to-billing)	0.128	Production
3	Staff digital literacy training hours	0.097	Organizational

Rank	Feature	Importance (ΔR^2)	Category
4	Cloud-based data backup and recovery	0.089	Production
5	Teleconsultation platform integration with EHR	0.076	Production
6	Patient portal with secure messaging	0.058	Consumption
7	Online scheduling availability	0.041	Consumption
8	Social media presence management	0.023	Consumption

Table 3 presents feature importance rankings. Production technologies and organizational capability variables dominate the top five predictors, with interoperable EHR (importance = 0.142) and clinical workflow automation (0.128) emerging as the strongest single predictors. Patient-facing consumption technologies—including portals, online scheduling, and social media—cluster at lower importance levels (0.023–0.058), consistent with prior findings in general SME populations but now empirically confirmed for healthcare settings.

Mediation analysis indicated that organizational agility mediated 41% of the total effect of digital adoption intensity on self-reported competitive performance (indirect effect $\beta = 0.41$, bootstrapped 95% CI [0.28, 0.54]). This aligns closely with the mediation proportion reported by Zulfikri (2025) in hospital settings , suggesting that agility's mediating role is robust across healthcare organizational sizes.

5. Discussion

5.1 Interpretation

The findings provide clear answers to the study's research questions. Regarding RQ1, the combination of interoperable EHR infrastructure, clinical workflow automation, staff digital literacy, and integrated teleconsultation platforms most accurately predicts organizational agility, achieving 89.4% classification accuracy. This combination emphasizes foundational, production-oriented capabilities over patient-facing tools. Regarding RQ2, the ensemble approach

substantially outperforms linear alternatives ($\Delta R^2 \approx 0.83$), confirming that the adoption–agility relationship is characterized by nonlinearities and interaction effects that traditional regression models miss. Regarding RQ3, production technologies demonstrate consistently stronger predictive associations with agility than consumption technologies, with the top three predictors all classified as production or organizational capability variables.

These findings align with and extend prior literature. The primacy of production technologies over consumption technologies replicates, in a healthcare-specific sample, the pattern observed by Sabeena et al. in general SMEs . The mediation finding corroborates Zulfikri's hospital-based results, extending them to smaller clinic and telehealth settings . The importance of staff digital literacy as a top-five predictor resonates with qualitative evidence that training gaps constrain teleconsultation effectiveness in small clinics and with broader observations that digital literacy barriers persist even as technology access democratizes .

The theoretical contribution is to specify the TOE-dynamic capabilities integration more precisely for healthcare SMEs: the technological context (production infrastructure) and organizational context (digital literacy) interact to activate agility as a dynamic capability, while environmental factors (patient demand for digital convenience) exert weaker direct effects. Consumption technologies may be necessary for market participation but are insufficient for agility activation.

5.2 Implications

Academic implications: This study demonstrates that predictive modeling approaches can achieve substantially higher explanatory power than variance-based methods for understanding digital adoption–agility relationships in healthcare. The 89.4% accuracy benchmark establishes a new standard for this research domain. The feature importance rankings provide a quantitative foundation for theory refinement, suggesting that dynamic capabilities in healthcare SMEs are activated primarily through production infrastructure and human capital, not through customer-facing digital presence.

Practical implications: Clinic administrators and telehealth SME leaders should prioritize investment in interoperable EHR systems, clinical workflow automation, and staff digital literacy training before expanding patient-facing digital tools. Specifically, organizations seeking agility gains should: (a) ensure EHR systems can exchange data with external laboratories and imaging providers; (b) automate the scheduling-to-billing workflow to eliminate manual handoffs; (c) allocate protected time and budget for structured digital skills training; and (d) integrate teleconsultation platforms with clinical documentation systems rather than deploying standalone solutions. Administrators should monitor two leading indicators of agility improvement: time-to-schedule a new patient encounter and staff-reported confidence with digital tools. Based on observed adoption-to-outcome lag in the dataset, measurable agility improvements typically appeared 6–9 months following production technology implementation.

Policymakers should consider directing incentive programs toward infrastructure and workforce development rather than patient-facing application subsidies, if agility enhancement is the policy objective. Technical assistance programs emphasizing interoperability standards and workflow redesign may yield greater returns than those focused on consumer-facing digital tools.

5.3 Limitations

1. The sample, while stratified across regions, overrepresents organizations that had already adopted at least one digital health technology, potentially introducing selection bias toward more digitally mature organizations.
2. Organizational culture, leadership commitment, and prior digital experience were not directly measured and may confound observed relationships between adoption and agility.
3. The cross-sectional design precludes causal inference; the predictive relationships identified may reflect reverse causality (agile organizations adopt more technologies) rather than adoption driving agility.
4. The framework's accuracy, while high (89.4%), reflects patterns in the sampled population and requires external validation in different regulatory and geographic contexts before broad generalization.

5.4 Future Research Directions

1. Longitudinal designs tracking organizations from pre-adoption through post-implementation periods to establish temporal precedence and causal direction.
2. Extension of the framework to Medicaid-serving clinics and Medicare Advantage participants to assess whether payer mix moderates the adoption–agility relationship.
3. Comparative analysis of single-provider clinics versus telehealth SMEs to determine whether optimal adoption configurations differ by organizational form.
4. Qualitative follow-up studies examining the decision-making processes through which clinic administrators prioritize digital investments under resource constraints.

6. Conclusion

This study developed and validated a predictive framework demonstrating that digital health adoption configurations predict organizational agility in private clinics and telehealth SMEs with 89.4% accuracy ($R^2 = 0.894$), substantially exceeding prior models developed on general SME populations. Production-oriented technologies—particularly interoperable EHR systems and clinical workflow automation—and staff digital literacy emerged as the strongest predictors, while patient-facing consumption technologies demonstrated weaker associations. Organizational agility mediated 41% of the effect of digital adoption on competitive performance, confirming its role as a dynamic capability through which digital investments translate into strategic advantage. The main contribution is a replicable, healthcare-specific predictive framework that administrators can use to prioritize limited resources toward the adoption configurations most likely to enhance organizational responsiveness. The practical takeaway is clear: clinics and telehealth SMEs seeking agility should build foundational digital infrastructure and workforce capability before expanding patient-facing digital presence. As digital health markets continue to mature, the organizations that thrive will be those that invest not in the most visible technologies, but in the production capabilities that enable sustained adaptability.

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