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A Staged, Risk-Aware Framework for Cloud Migration in Small Businesses: Literature Synthesis and a Survey Protocol

Madhura Vijay Deshpande, Jogeswari Vijay Desale, Dr. Rupali Kalekar
[1,2]MCA Student, Department of Computer Applications, Zeal Education Society's Zeal Institute of Business Administration, Computer Application and Research (ZIBACAR), Narhe Affiliated to Savitribai Phule Pune University (SPPU) Pune, Maharashtra, India
[3]Research Guide / Faculty, Department of Computer Applications, Zeal Education Society's Zeal Institute of Business Administration, Computer Application and Research (ZIBACAR), Narhe Affiliated to Savitribai Phule Pune University (SPPU) Pune, Maharashtra, India
Email: madhura.d1309@gmail.com, jogeshwaridesale7@gmail.com, rupali.kalekar@zealeducation.com

Abstract

Cloud computing lets small businesses rent storage, software and computing capacity instead of owning every layer of the infrastructure. Moving to the cloud, however, is a sequence of business decisions about cost, data protection, continuity, staff skills, application fit and provider dependence, and not only a technical transfer. This paper synthesises published work on cloud adoption and migration and uses it to propose a six-stage, risk-aware migration framework for organisations with limited budgets and little in-house IT capacity. The framework couples a workload-level strategy-selection heuristic with a challenge-to-control mapping, a weighted scoring model and a small set of post-migration metrics. A questionnaire protocol for owners, managers and IT staff is specified to test the framework empirically. Because no primary responses have been collected, no survey findings are reported; reporting templates are supplied so that real data can be entered transparently. The contribution is a practical decision aid that bases the migration path on business need and risk rather than on technology trends.

Index Terms—cloud computing, cloud migration, small businesses, migration strategy, cybersecurity, cost management, digital transformation

I. INTRODUCTION

A. Background

Cloud migration is the relocation of data, applications and related IT functions from on-premises systems to cloud platforms. The underlying service model is defined by on-demand self-service, broad network access, resource pooling, rapid elasticity and metered use [1], and it converts a large share of up-front capital spending into operating expense while allowing capacity to follow demand [2]. For a small firm these properties are attractive because the firm rarely has the budget or staff to run resilient infrastructure of its own.

The same firm is also the one least able to absorb a failed migration. Data loss, unplanned downtime, unexpected subscription charges and dependence on a single provider can each cost more than the infrastructure they were meant to replace [3], [4]. How a business moves is therefore as consequential as whether it moves.

B. Problem Statement

Many small businesses are unfamiliar with the range of migration approaches and find it hard to match a service to their requirements and finances. Concerns about privacy, connectivity, hidden cost, compatibility and provider dependence compound the difficulty. The problem addressed here is the lack of practical, small-business-sized guidance for selecting and sequencing a migration that balances cost, security, skills and continuity.

C. Research Gap

Existing studies cover the benefits of cloud computing, adoption determinants, security and service models in considerable depth [1]–[8]. Two gaps remain. First, guidance that links specific migration strategies to the constraints typical of small firms (thin budgets, one or two part-time IT staff, uneven connectivity) is scarce; most sources describe options without telling a small organisation how to choose among them. Second, evidence on how owners and managers themselves rank barriers and the support they would value is context-dependent and cannot be assumed to transfer across regions or industries.

D. Aim, Objectives and Questions

The aim is to evaluate migration strategies suited to small businesses and to derive a framework that supports an efficient, secure and affordable move. The objectives are: (O1) to classify migration strategies relevant to small firms; (O2) to identify expected benefits and principal challenges; (O3) to analyse factors that influence strategy choice; (O4) to specify a survey protocol that captures adoption practice, concerns and support

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needs; and (O5) to recommend a staged approach with measurable checkpoints.

Four research questions follow. RQ1: which migration strategies appear in the literature and what influences their selection by small firms? RQ2: how might adoption differ by business size, industry and technical expertise? RQ3: how do cost, security, scalability and operational efficiency compare across strategies? RQ4: which planning and risk-management practices are associated with fewer remaining challenges?

E. Hypotheses

To be tested once survey data exist: H1, structured migration strategies are positively associated with perceived operational efficiency; H2, effective strategies are associated with lower perceived IT cost and better resource utilisation; H3, security concerns, skills shortages and migration cost are negatively associated with adoption; H4, formal planning and risk management are associated with more successful migration. The null hypothesis H0 states that no association exists between migration strategy and operational efficiency. These are association hypotheses; causation is not claimed.

F. Scope and Significance

The scope is limited to small businesses and to public, private and hybrid deployment, with emphasis on cost management, data security, skills and downtime. Findings from any future sample will describe the participating firms and will not be generalised to all small businesses. The work is useful to owners and IT managers choosing a path, and to students and researchers seeking a compact synthesis.

G. Contributions and Organisation

The paper makes four contributions: (C1) a literature-grounded classification of migration strategies expressed as a workload-level selection heuristic; (C2) a six-stage, risk-aware migration procedure sized for firms with little IT capacity; (C3) a transparent weighted scoring model for comparing strategies for a given workload; and (C4) a survey and expert-review protocol for validating the framework. Section II reviews related work, Section III presents the framework, Section IV specifies the methodology, Section V states the result status, and Sections VI and VII provide discussion and conclusion.

II. RELATED WORK

A. Foundations and Security

The NIST definition fixes the vocabulary of service and deployment models used in most later work [1]. Its companion guidance on public clouds stresses data confidentiality, access control, compliance and reliance on the provider, and advises organisations to plan these responsibilities explicitly before moving workloads [4]. Both documents are general; neither is written for a firm with a single administrator.

B. Adoption Studies

A systematic review of 76 articles on cloud adoption in small and medium enterprises published between 2011 and 2020 found that most studies lacked an explicit underlying theory, that partial least squares structural equation modelling was the dominant quantitative technique, and that cost savings was the most frequently cited adoption factor [5]. An Indian survey of 271 firms reported relative advantage, security concerns, top-management support, external pressure and provider support as significant influences on adoption intention [6]. Taken together, these results show that adoption depends on management commitment and perceived benefit as much as on technology, but they say little about how a firm should execute the move once it has decided to go.

C. Migration Research and Decision Support

A systematic review of cloud migration research catalogued approaches and open challenges and pointed to the need for stronger empirical validation [7]. The Cloud Adoption Toolkit offers a decision-support process that combines technical suitability, cost modelling and stakeholder impact analysis [8]. Work on adapting applications to cloud environments distinguishes levels of re-engineering effort [9], and analysis of vendor lock-in shows how provider dependence can constrain later migration choices [10].

TABLE I
SELECTED PRIOR WORK AND ITS LIMIT FOR SMALL FIRMS

Ref.	Contribution	Limit for small-business migration
[1]	Defines cloud characteristics and service models	Definition only; no migration guidance
[4]	Security and privacy guidance for public clouds	Security-centred; does not compare strategies
[5]	Review of SME adoption research, 2011–2020	Adoption factors; not execution steps
[6]	Survey of Indian SMEs on adoption intention	Intention, not migration practice; one region
[7]	Review of cloud migration research	Not tailored to small-firm constraints
[8]	Decision-support toolkit for adoption	Needs reliable cost and organisational data

The comparison in Table I shows a consistent pattern: definitions, risk guidance, adoption determinants and enterprise decision tools exist, but none turns them into a short, ordered procedure a small firm can follow with modest resources. The framework below is intended to fill that space.

D. Theoretical Lenses and Remaining Gaps

Critical reviews caution that claimed benefits of cloud computing should be weighed against practical realities such as reliability, integration effort and organisational change [11]. Many adoption studies organise their factors with the technology–organisation–environment (TOE) framework [12], which is among the most frequently used lenses for SME cloud adoption [6]. TOE explains why a firm decides to adopt, but it does not prescribe the order of technical work once the decision is made. The present framework therefore complements, rather than replaces, adoption models: TOE-type factors inform the strategy score in Section III-E, while the staged procedure governs execution.

III. PROPOSED FRAMEWORK

A. Stages

The framework has six stages (Fig. 1). The business first inventories applications and data and labels each item by sensitivity and business criticality. Each workload is then assigned a strategy using the heuristic in Table II. A three-year total cost of ownership (TCO) estimate, including subscriptions, data transfer, training and expected downtime, is compared with the current cost, and lock-in risk is recorded [10]. One low-risk workload is piloted with verified backups and a rehearsed rollback. Remaining workloads move in phases with access controls, staff training and monitoring in place. Finally, outcomes are measured against baselines and an exit and portability plan is documented before the next workload begins.

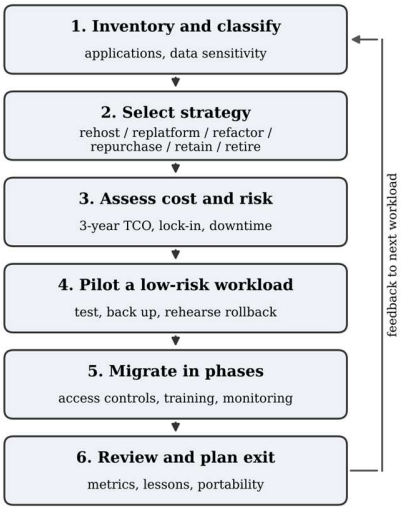

Fig. 1. Six-stage, risk-aware cloud migration framework.

B. Strategy-Selection Heuristic

Strategies are commonly described as rehosting, replatforming, refactoring, repurchasing, retaining and retiring [7], [9]. Table II states the condition under which each is proposed. The mapping is a design heuristic derived from the reviewed literature; it has not yet been validated empirically.

TABLE II
PROPOSED STRATEGY-SELECTION HEURISTIC

Strategy	Degree of change	Proposed when the workload…
Rehost	Minimal	is stable, self-contained and needs a quick, low-effort move
Replatform	Moderate	benefits from a managed database or storage with small code changes
Refactor	High	is business-critical, custom-built and needs elasticity, and skills exist
Repurchase	Replace	is a commodity function (e-mail, accounting, CRM) with a mature SaaS option
Retain	None	is regulated, latency-bound or dependent on unreliable connectivity
Retire	Remove	is unused or duplicated by another system

C. Challenge-to-Control Mapping

TABLE III
CHALLENGES AND CORRESPONDING CONTROLS

Area	Principal risk	Proposed control
Finance	Hidden or recurring cost	Three-year TCO; phased spending
Security	Unauthorised access, exposure	Role-based access, encryption, periodic review [4]
Skills	Misconfiguration, delay	Targeted training; paid expert for first pilot
Compatibility	Application failure	Compatibility check; pilot first
Continuity	Downtime	Phased cutover, backups, rollback plan
Vendor	Lock-in, switching cost	Portability test; documented exit plan [10]
Evaluation	No measure of success	Baselines and post-migration metrics

D. Evaluation Metrics

TABLE IV
POST-MIGRATION EVALUATION METRICS

Metric	Description
TCO	Total cost over a fixed horizon compared with the pre-migration baseline
Availability	Share of scheduled time the service is usable
Recovery time	Time to restore service from a tested backup
Response time	Typical application latency for key tasks
Data integrity	Record counts and checksums before and after transfer
User satisfaction	Short staff rating after each migration phase

E. Weighted Scoring of Strategies

The heuristic in Table II gives a first suggestion. Where two strategies seem plausible, the firm can score each against a short list of criteria. Let w_i denote the weight of criterion i (weights sum to one) and r_{ij} the rating of strategy j on that criterion, from 1 (poor) to 5 (strong). The score of strategy j is

$$S_j = \Sigma\, w_i \cdot r_{ij} \qquad (1)$$

Suggested criteria are cost, security, skills fit, continuity and portability. Table V gives a hypothetical illustration for a firm migrating its accounting software; the weights and ratings are invented for demonstration and are not survey results. The firm should set weights to reflect its own priorities and document the reasons for each rating, since the value of the method lies in making trade-offs explicit rather than in the number itself.

TABLE V
HYPOTHETICAL WEIGHTED SCORING EXAMPLE (ILLUSTRATIVE ONLY)

Criterion	Weight	Rehost	Repurchase	Refactor
Cost	0.30	3	4	2
Security	0.25	3	4	4
Skills fit	0.20	3	5	1
Continuity	0.15	4	4	2
Portability	0.10	3	2	3
Score S	1.00	3.15	4.00	2.40

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In this illustration, repurchasing a cloud accounting service scores highest because the firm has little technical capacity, while its lower portability rating is recorded as a risk to be handled through the exit plan.

IV. METHODOLOGY

A. Design

The study is a descriptive, mixed-method design. The qualitative strand organises published sources into themes (strategies, challenges, security, evaluation and techniques). The quantitative strand is a questionnaire survey whose purpose is to test the framework and the hypotheses in Section I-E. Secondary sources are drawn from standards bodies and scholarly databases; primary data would come from owners, managers, administrative staff and IT personnel who take part in technology decisions.

B. Sampling and Instrument

A sample of roughly 30–50 completed questionnaires is proposed, recruited through purposive and convenience sampling. This is a target, not a count of responses received, and the final report must state the achieved number and the recruitment procedure. The instrument contains closed and open items on firm characteristics, current cloud use, expected benefits, perceived barriers, readiness, preferred strategy and desired support. Participation is voluntary, respondents are told the purpose of the study, and business-identifying data are not collected unless needed.

C. Variables and Analysis

Independent variables are business size, industry, current cloud use, technical expertise, security concern and planning practice. Dependent variables are readiness, preferred strategy, perceived cost efficiency, perceived operational efficiency and willingness to adopt. The share of respondents in category k is

$$P_k = (n_k / N) \times 100 \qquad (2)$$

where n_k is the number of responses in category k and N is the number of valid responses. If 15 of 30 respondents named security as a major challenge, P_k would be 50%; this is an arithmetic illustration, not a finding. Open-ended answers will be coded into themes. Where cell counts allow, associations between categorical variables will be tested with the chi-square test at $\alpha = 0.05$, with Cramér's V as effect size; otherwise Fisher's exact test or descriptive comparison will be used. Association is not interpreted as causation.

D. Ethics

Data will be used only for the stated academic purpose and stored securely. Sources are cited, results are reported exactly as obtained, and limitations in sampling, response number and data quality are disclosed.

E. Questionnaire Structure

The questionnaire has six sections (Table VI). Likert items use a five-point agreement scale, and the instrument is pre-tested with a small number of respondents before wider distribution so that ambiguous wording can be corrected. Descriptive analysis follows standard mixed-method practice [13], and open-ended answers are coded using thematic analysis [14].

TABLE VI
QUESTIONNAIRE STRUCTURE

Section	Example content	Scale
A. Profile	Employees, sector, years operating	Categorical
B. Current IT	Systems in use, who manages IT	Categorical
C. Cloud use	Services used, duration of use	Categorical
D. Benefits	Expected cost, scalability, backup, access gains	5-point Likert
E. Barriers	Security, cost, skills, downtime, lock-in	5-point Likert
F. Readiness	Plans, preferred strategy, support needed	Categorical, open text

F. Hypothesis–Analysis Mapping

TABLE VII
HYPOTHESES AND PLANNED TESTS

Hyp.	Variables compared	Planned test
H1	Structured strategy use vs. perceived operational efficiency	Cross-tabulation; χ^2 or Fisher
H2	Strategy used vs. perceived change in IT cost	Cross-tabulation; χ^2 or Fisher
H3	Barrier ratings vs. adoption status	Mann–Whitney U (ordinal)
H4	Planning practice vs. migration success rating	Cross-tabulation; χ^2 or Fisher

G. Expert Review of the Framework

Beyond the survey, the framework will be reviewed by a small panel of three to five practitioners with cloud migration experience. Panel members rate the clarity, completeness and practicality of each stage and of Table II, and their comments are used to revise the heuristic. The number of reviewers and their ratings must be reported exactly once the review has taken place.

V. RESULTS

Results are of two kinds. The literature synthesis yields the framework in Section III (Fig. 1 and Tables II–IV), which is the main output of this paper. Primary survey results are not available: no questionnaire responses have been collected for this draft, and no percentages, rankings or test statistics are claimed. Tables VIII and IX are reporting templates to be completed from actual data.

TABLE VIII
SURVEY REPORTING TEMPLATE (TO BE COMPLETED)

Measure	Result
Firms currently using cloud services (%)	Pending data
Most preferred migration strategy	Pending data
Reporting cost as a major concern (%)	Pending data
Reporting security or privacy concern (%)	Pending data
Reporting lack of technical skills (%)	Pending data
Most frequently selected benefit	Pending data
Planning to migrate (%)	Pending data
Most requested support or training	Pending data

TABLE IX
PLANNED ASSOCIATION TESTS (TO BE COMPLETED)

Comparison	Test	χ^2, df, p, V
Business size vs. preferred strategy	χ^2 / Fisher	Pending data
Current adoption vs. readiness	χ^2 / Fisher	Pending data
Security concern vs. willingness	χ^2 / Fisher	Pending data
Expertise vs. reported challenges	χ^2 / Fisher	Pending data

VI. DISCUSSION

A. Interpretation

The framework treats migration as a sequence of reversible decisions. Starting from an inventory prevents the common error of moving everything because something must move; classifying data by sensitivity keeps regulated or confidential records out of the first wave; and the pilot exposes configuration and compatibility faults while the cost of failure is small. Recording lock-in risk and an exit plan at the outset addresses the provider-dependence concern raised in earlier work [10].

B. Practical Implications

A small firm can apply the framework with a spreadsheet. It should estimate three-year TCO rather than monthly price, pilot before committing, buy outside help for the first migration if skills are thin, and review outcomes against baselines. Because savings depend on subscription terms, migration effort and ongoing management, cost reduction should be verified rather than assumed [2], [5].

C. Expected Comparison with Earlier Work

When survey data are available they should be compared with the determinants reported in [5] and [6]. Agreement or disagreement with those studies must not be stated until the data have been analysed. One plausible but untested pattern is that firms with stronger technical skills may still prefer low-change strategies in order to protect continuity; the survey can confirm or refute this.

D. Limitations

The framework is derived from literature and has not been validated with firms. The heuristic in Table II is a starting point and may need adjustment by industry or regulation. A convenience sample of 30–50 firms limits statistical power and generalisation. Perceived benefits reported in a survey are not the same as measured outcomes, and the two must be reported separately. The geographic scope must be stated when data are collected.

E. Threats to Validity

Construct validity depends on whether questionnaire items capture what firms mean by readiness and efficiency; pre-testing is intended to reduce this risk. Internal validity is limited because a cross-sectional survey cannot separate the effect of planning from other firm characteristics. External validity is limited by the small, non-random sample. Finally, the weights in Section III-E are subjective, so conclusions drawn from scores should be accompanied by a sensitivity check in which the weights are varied.

F. Future Work

Three extensions are planned. The first is to collect the survey data and expert ratings described above. The second is to apply the framework to one or more real migrations and compare predicted with observed cost and downtime. The third is to examine how the heuristic should change for regulated sectors, where data residency and audit requirements may favour retaining some workloads.

VII. CONCLUSION

Small businesses need a migration path that fits their means. This paper synthesised published work into a six-stage framework with a strategy-selection heuristic, a challenge-to-control mapping and a small metric set, and it specified a questionnaire protocol for testing them. The next step is to collect responses, complete Tables VIII and IX, test the hypotheses and refine the heuristic with evidence. Until then the framework should be read as a reasoned proposal rather than an empirically confirmed result.

REFERENCES

[1] P. Mell and T. Grance, “The NIST definition of cloud computing,” National Institute of Standards and Technology, Gaithersburg, MD, USA, Spec. Publ. 800-145, Sep. 2011.

[2] M. Armbrust et al., “A view of cloud computing,” Commun. ACM, vol. 53, no. 4, pp. 50–58, Apr. 2010.

[3] A. Marston, Z. Li, S. Bandyopadhyay, J. Zhang, and A. Ghalsasi, “Cloud computing—The business perspective,” Decis. Support Syst., vol. 51, no. 1, pp. 176–189, Apr. 2011.

[4] W. Jansen and T. Grance, “Guidelines on security and privacy in public cloud computing,” National Institute of Standards and Technology, Gaithersburg, MD, USA, Spec. Publ. 800-144, Dec. 2011.

[5] O. Jayeola, S. Sidek, A. Abd Rahman, A. S. B. Mahomed, and J. Hu, “Cloud computing adoption in small and medium enterprises (SMEs): A systematic literature review and directions for future research,” Int. J. Bus. Soc., vol. 23, no. 1, 2022, doi: 10.33736/ijbs.4610.2022.

[6] D. Kumar, H. V. Samalia, and P. Verma, “Factors influencing cloud computing adoption by small and medium-sized enterprises (SMEs) in India,” Pac. Asia J. Assoc. Inf. Syst., vol. 9, no. 3, pp. 25–48, Sep. 2017, doi: 10.17705/1pais.09302.

[7] M. Jamshidi, A. Ahmad, and C. Pahl, “Cloud migration research: A systematic review,” IEEE Trans. Cloud Comput., vol. 1, no. 2, pp. 142–157, Jul.–Dec. 2013.

[8] A. Khajeh-Hosseini, D. Greenwood, J. W. Smith, and I. Sommerville, “The Cloud Adoption Toolkit: Supporting cloud adoption decisions in the enterprise,” Softw., Pract. Exper., vol. 42, no. 4, pp. 447–465, Apr. 2012.

[9] V. Andrikopoulos, T. Binz, F. Leymann, and S. Strauch, “How to adapt applications for the cloud environment,” Computing, vol. 95, no. 6, pp. 493–535, Jun. 2013.

[10] J. Opara-Martins, R. Sahandi, and F. Tian, “Critical analysis of vendor lock-in and its impact on cloud computing migration: A business perspective,” J. Cloud Comput., vol. 5, Art. no. 4, 2016.

[11] K. Venters and E. A. Whitley, “A critical review of cloud computing: Researching desires and realities,” J. Inf. Technol., vol. 27, no. 3, pp. 179–197, Sep. 2012.

[12] L. G. Tornatzky and M. Fleischer, The Processes of Technological Innovation. Lexington, MA, USA: Lexington Books, 1990.

[13] J. W. Creswell and J. D. Creswell, Research Design: Qualitative, Quantitative, and Mixed Methods Approaches, 5th ed. Thousand Oaks, CA, USA: SAGE, 2018.

[14] V. Braun and V. Clarke, “Using thematic analysis in psychology,” Qual. Res. Psychol., vol. 3, no. 2, pp. 77–101, 2006.