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OVERCOMING BARRIERS: AN ANALYTICAL STUDY ON THE ADOPTION AND IMPACT OF SELF-SERVICE BUSINESS INTELLIGENCE (BI) TOOLS IN SMALL AND MEDIUM-SIZED ENTERPRISES (SMES)

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ABSTRACT

A sweeping analytical framework has been developed in this study in order to analyze and understand the critical barriers that give rise to the difficulty of adoption of Self-Service Business Intelligence (SSBI) tools in Small and Medium-sized Enterprises (SMEs) and for the subsequent evaluation of firm performance. Nowadays, data determines decision-making for survival and growth, yet SMEs always lag behind their counterparts in using advanced analytics. This paper argues that this gap is not just due to reasons of resource limitations but is rather because of a more complex interaction of technological, organizational, and human factors all of which existing technology adoption models do not sufficiently explain. Thus, an integrated theoretical model is developed that merges the micro-level behavioral constructs of the Technology Acceptance Model (TAM) with the macro-level contextual environment discussed by the TechnologyOrganization-Environment (TOE) framework. This synthesis is necessary to capture the unique interplay of user perception and organizational constraints present in SMEs. A sequential explanatory mixed-methods research design is proposed to ascertain the validity of this model empirically. The quantitative phase will begin with a large-scale SME survey. The data collected shall be analyzed within a PLS-SEM framework with the aim to testing the integrated adoption model and identifying the significant causal paths. change). This work seeks to close a critical gap in the existing one by providing nuance.

Keywords: Self-Service Business Intelligence (SSBI), Small and Medium-sized Enterprises (SMEs), Technology Adoption, Adoption Barriers, Impact Analysis, Technology Acceptance Model (TAM), Technology-Organization-Environment (TOE) Framework, Data Democratization, Data Literacy.

INTRODUCTION

The Data-Driven Imperative in the Modern Economy

An unprecedented volume and velocity of data streams through the contemporary business atmosphere, which fundamentally alters the calculus of competitive advantage. In such an environment, making strategic decisions based on properly interpreted data is no longer a strategic choice but rather a precondition for survival and growth. This is all the more true for

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Small and Medium-sized Enterprises that are majorly the backbone of most of the global economies of the world. Operating with inherent lower margins and higher market volatility, accompanied by the need for greater nimbleness and responsiveness, the ability to swiftly interpret market signals-and align internal processes-is really what stands between SMEs and extinction.

The Emergence of Self-Service Business Intelligence (SSBI)

The rise of Self-Service Business Intelligence (SSBI) has set the analytics landscape in inversion over the last decade. SSBI is conceptualized as a technological and organizational methodology that grants non-technical business personnel, such as marketing managers, financial analysts, and operations supervisors, the ability to independently gather, analyze, visualize, and interpret organizational data without having to rely directly and continuously on IT experts or data scientists.This framework looked to implement an absolute turnaround from the conventional IT-centric mode of BI, which very often was laden with long report-generation cycles and an ever-present bottleneck between the business users and the data that they needed.

In some ways, one might consider the central promise of SSBI as being the "democratization of data": somehow breaking the walls of information silos and allowing lots of analytical options to enter into the workplace at all levels. The concept posits that by giving those with the deepest domain knowledge a powerful yet intuitive tool, a culture of pervasive, data-supported decision-making ensues-that helps organization top- and bottom-line decisions in flowing into their day-to-day tasks i.e., either performing or managing.

The SME Adoption Paradox

SSBI seems an alluring answer to the actual SME operational reality. It rests on more technical principles, such as user autonomy, less reliance on scarce IT resources, lower upfront costs via Software-by-the-Service (SaaS), and faster time-to-insights. All these go hand in hand with SMEs being agile, flexible, resource-constrained entities.3 So much would be achieved by so-to-speak "leveling the analytical playing field" to give SMEs the same level of insights that their larger brethren enjoy. And thus comes a major paradox from empirical reality. Despite the apparent side with benefits, SMEs always massively lag behind in the acquisition, implementation, and thorough usage of BI technologies.5 They face a unique and powerful set of barriers—they are sometimes financial, technological, organizational, or human in nature—that technology vendors tend to underestimate and that academic research has often failed to comprehend.

Problem Statement and Research Questions

The central problem motivating this study is that a systematic, empirical understanding of the multifaceted barriers that cause the non-successful adoption of SSBI tools in SMEs and the resulting effect of these tools on firm performance is not existent. While the potential benefits are wildly promoted in practitioner literature, a conspicuous gap in scholarly work can be observed, whereby a process of adoption under this specific context is not holistically examined.This leads to the formulation of the following research questions:

- **Primary Research Question (RQ1):** What are the critical technological, organizational, and individual-level barriers that influence the adoption of self-service BI tools in SMEs?
- **Secondary Research Question (RQ2):** How does the use of self-service BI tools, once adopted, impact the operational and strategic performance of SMEs?

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- **Tertiary Research Question (RQ3):** How can existing technology adoption theories be integrated and adapted to create a more robust model that explains SSBI adoption specifically within the SME context?

RESEARCH OBJECTIVES AND STRUCTURE OF THE PAPER

To address these research questions, this paper sets forth the following objectives:

1. To conduct a comprehensive and critical review of the academic and practitioner literature on Self-Service Business Intelligence, the unique characteristics of SMEs, and established technology adoption theories.
2. To systematically identify, categorize, and analyze the primary barriers that hinder the successful adoption and implementation of SSBI tools in SMEs.
3. To synthesize the documented impact of BI systems on various dimensions of SME performance, drawing on existing empirical studies.
4. To identify a critical gap in the current body of knowledge and propose an integrated theoretical framework that provides a more holistic explanation of SSBI adoption in SMEs.
5. To develop a rigorous mixed-methods research methodology designed to empirically test and refine the proposed theoretical framework.

REVIEW OF LITERATURE

Conceptualizing Self-Service Business Intelligence (SSBI): An Evolution in Data Analytics

Defining SSBI

Self-Service Business Intelligence, also called standard BI, is increasingly being viewed as a fundamental shift in the ways organizations have been interfacing with data. It is an approach that empowers non-technical business end-users to perform the full spectrum of the analytics workflow-from accessing and preparing raw data to analyzing, visualizing, and sharing their insights-with minimal or no direct interfacing with IT or a specialized team of data analysts.6 Consequently, the locus of control for analytics switches from a centralized group of technically skilled gatekeepers to the decentralized business user who critically possesses the domain knowledge and is closest to the operational decisions that need to be made.3 The idea is that data should cease to be a resource requiring some sort of technical translation and be made easily accessible for day-to-day decision-making.

SSBI vs. Traditional BI

The traditional BI versus SSBI dichotomy depends on user autonomy, speed, and flexibility. Under traditional BI, business users ask the central BI or IT team for a report or analysis. Such requests undergo long queuing times with major communication overheads of translating business needs into technical requirements and receive only so-called static reports with pre-determined filtering that often miss answering business questions that evolve over time. It replaces the linear and not-so-flexible process of classical BI with an iterative and dynamic cycle of questioning, discovery, and insight generation, which significantly shortens the time from query to decision.

Core Components and Characteristics of Modern SSBI Tools

The efficacy of the SSBI approach rests on a suite of modern and accessible tools. Modern SSBI platforms will comprise a few core components to enable this user-oriented

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approach.At the heart of SSBI lies an intuitive user experience. Putting usability first is crucial to lowering technical barriers for common users. An organization's data is rarely monolithic; it mainly resides in many distributed systems. An elementary must-have for an SSBI tool is the ability to connect to and integrate seamlessly with data coming from all kinds of source systems, be it on-premise databases, cloud data warehouses, ERP systems, CRM platforms, marketing analytics tools, or mere spreadsheets.

Enhancing Decision-Making Agility

Time is of the essence when dealing in dynamic markets. SSBI forces the questions-insights pipeline to reach unprecedented acceleration; this development means managers and employees can now ask questions and analyze data in real-time or near-real-time. Such immediacy enables SMEs to instantaneously react to an emerging market trend, changing customer behavior, or an operational issue; hence, decision making stops being an occasional reaction and starts becoming proactive continuous engagement. For an SME, this augmented quickness could be the difference-maker against larger, slower-moving competitors.

Improving Operational Efficiency and Performance

Firstly, SSBI is quite unique in affording support for one of many processes in visible management. By permitting direct, granular, and focused access to a KPI or operational data, it weakens the inefficiency of processes, supports resource optimization, and tracks performance against strategic goals. There is ample evidence from analysis of BI systems in SMEs, confirming that BI usage-either routine or innovative-has a positive and significant effect on performance in marketing and sales effectiveness and management of internal operations. The procedures from data acquisition to data analysis and action environment allow for continuous improvement in the use of scarce resources.

Fostering a Data-Driven Culture

Perhaps one of the most profound long-term benefits is that SSBI can usher in a cultural transformation. In this manner, data and analytical tools become available to all, and in so doing, SSBI demystifies the process of data analysis and instills a culture wherein employees on every level use empirical evidence to measure and warrant their daily actions and decisions rather than merely accepting intuitive or anecdotal experience.7 This very act of enhancing organizational data literacy breeds a virtuous cycle: the greater the number of people who become comfortable and proficient with data, the better the questions that are asked, the analyses that are carried out, and the decisions that are made-the more the value of the data-driven methodology is accepted throughout the enterprise.25

Cost-Effectiveness

For resource-constrained SMEs, financial considerations are paramount. SSBI is, in a sense, a cheaper BI model. First and foremost, it removes the operational demand from specialized and often costly IT personnel, issuing routine reports with ad-hoc queries to the business users themselves. Also, with SaaS- and cloud-based licensing models, SMEs no longer have to make huge capital expenditures on hardware and software licenses which they truly can't afford. Instead, they can choose a subscription method, based on consumption or per-user basis, which considers costs against the actual use and is scalable to grow as the business does, thereby making sophisticated analytics more available from a financial perspective.

Overcoming the Chasm: Critical Barriers to SSBI Adoption in SMEs

The lure being quite enticing, yet the path to realize a successful SSBI implementation in SMEs is beset with numerous challenges. These challenges are not monolithic; they form a

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complex interplay of organizational, technological, and human factors that together build a massive canyon between aspiration and the reality.

The following table synthesizes these empirically identified barriers from the literature.

Barrier Category	Specific Barrier	Description	Supporting Literature
Organizational	Resource Constraints	Lack of financial capital for software, implementation, and training; and a critical shortage of personnel with the required technical and analytical skills.	[16]
	Lack of Managerial Support & Strategic Vision	Failure of leadership to understand BI benefits, define a clear business case, or align the BI initiative with overall company strategy.	[15]
	Resistance to Change & Culture	An organizational culture that values intuition over data, coupled with user dissatisfaction from past IT failures and general resistance to new workflows.	[10]
Technological	Data Quality & Governance	Pervasive issues with inconsistent, inaccurate, fragmented, or incomplete data, and the absence of policies to ensure a "single source of the truth."	[10]
	Data Integration Complexity	The technical difficulty of consolidating data from a fragmented landscape of disparate systems, legacy applications, and spreadsheets without specialized expertise.	[13]
	Security and Control Concerns	Increased risk of data leaks, misuse of sensitive information, and unauthorized access resulting from the democratization of data in an environment lacking robust security protocols.	[1]
Human	Low Data Literacy	The inability of non-technical users to correctly formulate analytical questions, interpret data visualizations, and avoid analytical fallacies, leading to incorrect conclusions.	[1]
	Lack of Training and	Insufficient investment in comprehensive user onboarding,	[10]

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	Support	continuous training, and accessible support systems, leading to user frustration and low adoption rates.	

THEORETICAL FOUNDATIONS FOR UNDERSTANDING SSBI ADOPTION

In order to systematically analyze the complexity underlying the phenomenon of SSBI adoption in SMEs, standard theoretical frameworks in information systems and innovation literature must be called upon. These theories provide an analytical lens through which to study factors affecting acceptance of technology at the individual level as well as at the firm level.

Individual-Level Models

These models focus on the perceptions, beliefs, and intentions of the individual end-user.

- **Technology Acceptance Model (TAM):** Synthesized by Davis, 1989, TAM constitutes a high-powered theory in information systems research. It contends that, in fact, behavioral intention to use technology arises from two primary sets of beliefs: The first Perceived Usefulness (PU), which means "the degree to which a person believes that using a particular system would enhance his or her job performance," and the second Perceived Ease of Use (PEOU), which means "the degree to which a person believes that using a particular system would be free of effort." That its theory is of few variables and can predict well has made it a foundation.
- **Unified Theory of Acceptance and Use of Technology (UTAUT/UTAUT2):** UTAUT was proposed by Venkatesh et al. (2003) as a synthesis of eight leading theories of technology acceptance, including TAM. It thus tries to provide a more encompassing model by identifying four direct determinants of behavioral intention and usage behavior: Performance Expectancy (similar to PU), Effort Expectancy (similar to PEOU), Social Influence (the degree to which an individual perceives that important others believe they should use the new system), and Facilitating Conditions (the degree to which an individual believes that an organizational and technical infrastructure exists to support the use of the system).

Firm-Level and Contextual Models

These models broaden the analytical lens to include factors at the organizational and environmental levels.The following table provides a comparative summary of these key theoretical frameworks.

Theory Name	Core Constructs/Determinants	Level of Analysis	Key Strengths in SME Context	Key Limitations in SME Context
Technology Acceptance Model (TAM)	Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Attitude,	Individual	Simple, parsimonious, and strong at explaining user-centric motivations. Captures the	Lacks external variables; overlooks critical organizational constraints (e.g., cost,

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	Behavioral Intention.		core value proposition of SSBI (usefulness) and its key design goal (ease of use).	resources) and environmental factors (e.g., competition) that heavily influence SME decisions.
Unified Theory of Acceptance and Use of Technology (UTAUT)	Performance Expectancy, Effort Expectancy, Social Influence, Facilitating Conditions.	Individual/ Organizational	More comprehensive than TAM. "Facilitating Conditions" directly addresses organizational support and resources, a key SME issue. "Social Influence" is relevant in close-knit SME work environments.	Primarily focused on individual intention within an organization; may not fully capture the strategic, firm-level decision to invest in the technology in the first place.
Technology-Organization-Environment (TOE) Framework	Technological Context, Organizational Context, Environmental Context.	Firm	Holistic, firm-level perspective. Directly incorporates organizational factors (resources, management support) and environmental pressures (competition) that are paramount for SMEs.	Can be too high-level; may not adequately capture the individual user perceptions and resistance that are critical for the success of a *self-service* technology.
Diffusion of Innovation (DOI) Theory	Relative Advantage, Compatibility, Complexity, Trialability, Observability.	Individual/ Firm	Provides a rich set of technology-specific attributes. "Trialability" is	More of a descriptive framework of innovation attributes than a predictive

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			highly relevant for SMEs preferring low-risk, incremental adoption (e.g., SaaS trials). "Compatibility" addresses fit with existing processes.	model of specific adoption behaviors. Often needs to be integrated with other theories.

RESEARCH GAP

A thorough literature review exposes a landscape both opulent and fragmented. The research is indeed quite significant around BI adoption in large resourceful enterprises, wherein the challenges mainly concern issues of scaling, governance, and integration with complex legacy systems. Finally, a rapidly emerging practitioner-oriented literature is championing the spontaneous virtues and features of modern SSBI tools from the vendor's perspectives.

Accordingly, the research gap at the core of the agenda of this study encompasses the lack of an integrated multi-level theoretical model that addresses the technical nature of the SSBI tools, the reality of SMEs (resource scarcity, informal culture, governance maturity), and the environmental pressures they are experiencing and the behavioral drivers (perceptions, skills, resistance) at play within their non-technical employees. Such a model would help shuck away simplistic explanations and give rise to a holistic view of the evolution of SSBI promise for many SMEs. This study thus intends to fill this gap by assisting in developing and capturing an outline for the methodology to empirically test such an integrated model.

RESEARCH METHODOLOGY

Research Design: Sequential Explanatory Mixed-Methods

In order to adequately address the complex research questions, the study will make use of a sequential explanatory mixed-methods design. The two-phase approach is most apt for research that is concerned with not just identifying statistical relationships but also with understanding the complex social processes that underpin them. The design allows researchers to harness the power of both the quantitative and the qualitative and to utilize them in complementary ways.

- **Phase 1 (Quantitative):** Phase 1 was designed to implement a general, cross-sectional survey formulated for administration to a large, representative sample of SMEs.The main objective was to quantify test the hypothesized relationships present within the integrated adoption model. This will provide insight into which determinants of SSBI adoption intention and impact are statistically significant and to generalize this across the SME population. The phase regarding quantitative data deals with asking the "what" and "how much" questions. For example, what factors are the strongest predictors of adoption and how much variance in firm performance can be explained by SSBI use.
- **Phase 2 (Qualitative):** The consecutive phase will be a qualitative, multiple-case study, meant to follow on and go deeper into the analysis from the quantitative phase. Qualitative data will seek to explain, interpret, and illustrate statistical findings, in some ways asking "Why" and "How" to unravel the observed patterns. For instance, if the

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survey establishes a statistical relationship between "Management Support" and "Perceived Usefulness," the qualitative interviews aim to uncover what constitutes effective support in the eyes of SME employees, what actions are taken, how communication takes place, and other leadership-related behaviors. Such a phase is intended to provide a rich, contextualized description that quantitative data alone cannot supply and thus will complement the overall study with an additional explanatory basis.

RESEARCH APPROACH AND HYPOTHESIZED MODEL

Quantitative Approach

The research methodology will be a deductive approach to investigate the causal law hypothesized in the integrated model. It intends to quantify the strength of the relationships between the antecedents of TOE, the mediators of TAM, and the eventual outcomes of adoption intention and firm performance impact, in terms of direction and statistical significance.Hence, one will be able to draw a generic, crisp image of the main driving and restraining initiation factors of SSBI adoption.

Qualitative Approach

The qualitative phase will follow interpretive-analytic research. It will not test hypotheses but will generate rich contextualized knowledge of the adoption process from the point of view of the actors. It will concentrate on exploring how SME owners-managers and employees experience and make sense of factors identified in the quantitative model.

DATA COLLECTION METHODS

Phase 1 (Quantitative)

- **Instrument:**For this phase of the study, structured online questionnaires will be the only method for gathering data. For content and construct validity, the items measuring each theoretical construct will be adapted from scales that have been previously validated in the information systems and SME literature.
- **Measurement:** All items, except for those concerning demographics, will be measured via a 7-point Likert scale anchored at 1 ("Strongly Disagree") and 7 ("Strongly Agree"). This measurement procedure follows the best survey practices and has been used successfully in other similar studies that investigate BI impact and adoption.
- **Distribution:** The mode of questionnaire being distributed is through online secure survey sites. SME owner-managers, directors, or senior decision-makers well-versed with their firm's technology strategy and operational performance will form the population under consideration.

Phase 2 (Qualitative)

- **Method:** The primary data collection method during the qualitative phase would consist of semi-structured, in-depth interviews. This semi-structured interview process offers a much more flexible yet guided framework within which the researcher may explore pre-defined topics that arise from the quantitative findings, in addition to probing some spontaneously arising themes or unexpected insights that participants may offer.
- **Participants:**Interviews will be held with various stakeholders in each chosen case study on a selection basis. Interviewed would typically comprise of the main decision maker (owner-manager or CEO) itself along with one to two employees considered end-users of the SSBI tool or, in case they have not adopted it, would be end-users. Such a multi-perspective approach will yield a broader view of the adoption process.

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- **Data Recording:** In order to enhance the accuracy of the transcription and facilitate a more detailed analysis, each interview will be audio-recorded once the participant has expressly given consent. Thereafter, all audio recordings will be transcribed into text documents verbatim, and these text documents will serve as the raw data for qualitative analysis.

Sampling Methods

Phase 1 (Quantitative)

- **Strategy:** In order to obtain a more generalizable finding applicable to the entire SME population, it will be subjected to stratified random sampling. This probability approach reduces sampling bias and provides a basis for a more confident statistical inference.
- **Sample Frame:** The best and most complete list of SMEs will be acquired or purchased from a national business directory outlet, with contact numbers of decision-makers and details on industry and size. The sample size required will be decided based on the confidence level desired, say 95%, and an acceptable margin of error, for example +/- 5%.

Phase 2 (Qualitative)

- **Strategy:** For qualitative purposes, the aim hence is not generalizability but for depth and richness of information. Thus, a purposive sampling (alternatively called judgmental sampling) strategy shall be used to select information-rich cases that can provide deep insight into the research problem.
- **Selection Criteria:**The selection of case study organizations will be informed directly by the output of the quantitative survey. Firms will then be purposefully selected to represent the spectrum of adoption experiences arising from among those respondents who can be reached and who have consented. These would include: (1) High-Performing Adopters (firms that report great use of SSBI and wide impact on performance); (2) Struggling Adopters (firms that have adopted SSBI but report poor usage and minimal impact); and (3) Deliberate Non-Adopters (firms that have considered SSBI but have consciously decided against it).

Tools for Data Analysis

Quantitative Analysis

- **Software:** Two primary software packages will be used for quantitative data analysis. SPSS will be used for data preparation purposes such as data cleaning, screening for "missing values" and analysis of descriptive statistics, and reliability tests (for example, Cronbach's Alpha) for measurement scales. Meanwhile, the central analysis of the structural model will be conducted in SmartPLS.
- **Procedure:** The PLS-SEM will employ the established two-step procedure. In the first step, the measurement model will be evaluated. This is to assess the reliability and validity of the constructs in terms of indicator loadings, composite reliability, average variance extracted (AVE) for convergent validity, and the Fornell-Larcker criterion for discriminant validity.

Qualitative Analysis

- **Software:** The package of CAQDAS will go into the analysis of the qualitative data from transcripts.They are indispensable tools, which adequately handle large volumes of textual data; they allow researchers to code, identify themes in a more systematic,

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transparent way and to build theories. Researchers use these packages to organize data, attach codes to pieces of text, write memos, and generate visual maps representing relationships between concepts.

- **Procedure:** Thematic analysis will be used to identify, analyze, and report instances of pattern (theme) from data. The process will undergo iterations in an inductive manner. It will begin with open coding, where transcripts will be read in the minutest detail and initial concepts and labels assigned to small segments of texts.

Ethical Consideration

Conducting research in SMEs requires higher sensitivity on ethical considerations given their peculiar characteristics. Hence, in this research, strict ethical guidelines will be observed in the treatment of participants to protect the rights and welfare of all participants.

- **Informed Consent:** A rigorous and transparent consent process stands as the ethical basis for this study's procedure. Before taking part in the research, every participant will receive a well-written and detailed information sheet describing the purpose of the study, the procedures involved (survey and/or interview), the time involved, possible risks and benefits, the voluntary nature of participation, and that the person can withdraw at any time without any penalty.
- **Confidentiality and Anonymity:** This data will be protected by all means, thereby ensuring participants and businesses under investigation from any harm. During the quantitative studies, survey responses will be anonymized, and data reported in aggregate.
- **Data Security and Storage:** All research data, including survey responses and audio recordings/transcriptions, shall be stored on password-protected encryption servers.
- **Minimizing Harm and Burden:** Researchers intend to minimize burdens on the participants, formally. The online survey will be short and efficient.
- **Transparency and Reporting:** The research shall be conducted with integrity and honesty. In all other respects, data and findings will be reported accurately and not fabricated, falsified, or misrepresented.
- **Independent Review:**Prior to any data collection, the complete research protocol, all instruments, and consent forms will be submitted for formal review and approval by an independent IRB or a university research ethics committee.

CONCLUSION

This study addresses the critical and persistent paradox of why Small and Medium-sized Enterprises (SMEs) lag in the adoption of Self-Service Business Intelligence (SSBI) tools, despite the clear alignment of these tools with their need for agility and data-driven decision-making. The core problem identified is the absence of a comprehensive framework that adequately explains the complex interplay of technological, organizational, and human factors that uniquely constrain SMEs. Standalone theories have proven insufficient to capture this multifaceted reality, creating a significant gap in both academic literature and practical guidance

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