The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

UNPACKING BLOCKCHAIN ADOPTION INTENTION AMONG SMEs UNDER INSTITUTIONAL VOIDS: AN EXTENDED DOI-TOE FRAMEWORK WITH ORDERED PROBIT EVIDENCE FROM MOROCCO

AIT HBIBI AMINA[1] & MAKHROUT SAMIR[2]

[1]Professor of Economics, Faculty of Legal, Economic and Social Sciences Marrakech, Cadi Ayyad University Marrakech, Morocco. Email: a.aithbibi@uca.ac.ma
[2]PhD in Economics, Faculty of Legal, Economic and Social Sciences Marrakech, Cadi Ayyad University Marrakech, Morocco. Email: makhrout.samir@gmail.com

Abstract

Despite the transformative potential of blockchain for SMEs, empirical adoption remains limited in emerging-market economies, where institutional uncertainty may constrain the translation of perceived innovation attributes into adoption decisions. This study examines the technological, organizational, and environmental determinants of blockchain adoption intention among Moroccan SMEs and investigates whether institutional conditions shape the effectiveness of classical innovation-diffusion mechanisms. Drawing on Diffusion of Innovations (DOI) theory and complemented by the Technology-Organization-Environment (TOE) framework, we surveyed 306 SMEs across Morocco's 12 regions. Using multi-item measures and a maximum-likelihood Ordered Probit model with marginal effects, the study finds that perceived complexity, cost, and risk significantly reduce adoption intention, whereas compatibility, trialability, financial slack, and regulatory trust increase it. In contrast, observability is not significantly associated with adoption intention. An exploratory interaction analysis, however, indicates that the relationship between observability and adoption becomes positive when regulatory trust is high. These findings suggest that the effects of DOI attributes may be institutionally contingent rather than universal: visibility of successful innovation does not necessarily translate into adoption when firms lack confidence in the institutional environment surrounding the technology. The study therefore extends blockchain adoption research by positioning institutional conditions as a potential boundary condition of DOI mechanisms and provides policy implications for strengthening regulatory trust, experimentation opportunities, and SME digital capabilities in Morocco.

Keywords: Blockchain, Smes, Diffusion of Innovations, TOE, Ordered Probit, Institutional Voids, Morocco, Technology Adoption, Morocco Digital 2030.

JEL Codes: O33, O55, L26, M15

1. INTRODUCTION

Digital transformation is increasingly recognized as a vital driver of competitiveness and organizational resilience. Among the emerging technologies of the Industry 4.0 era, blockchain -originally conceptualized as a distributed, transparent, and immutable ledger functioning without central intermediation (Nakamoto, 2008)- has evolved from its initial cryptocurrency applications toward smart contracts and enterprise-level operational workflows (Swan, 2015). For Small and Medium Enterprises (SMEs), which account for over 90% of formal enterprises and 72% of employment in Morocco, blockchain technology carries significant potential for improving transaction efficiency, transparency, traceability, and coordination across business

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

networks. From a Transaction Cost Theory perspective, blockchain-based smart contracts may reduce contractual uncertainty, information asymmetry, and coordination frictions, while the Resource-Based View emphasizes the role of organizational resources and capabilities in enabling firms to capture value from blockchain-enabled processes. These perspectives therefore suggest that the potential benefits of blockchain do not automatically translate into adoption: firms must both perceive sufficient economic value and possess the organizational and institutional conditions required to implement the technology effectively. Despite these potential benefits, actual blockchain adoption among SMEs remains limited, particularly in emerging-market environments where technological, organizational, and institutional constraints may interact.

A systematic review of the recent literature reveals that only 23% of SME blockchain studies focus on adoption intention, with over 70% concentrated in Asia and merely 4% in Africa, none of which examine the Maghreb region. Morocco provides a theoretically informative emerging-market setting for examining this issue. The country is pursuing its ambitious "Morocco Digital 2030" strategy to position itself as a regional digital hub, with institutions such as the Digital Development Agency (ADD) and Maroc PME supporting SME digitalization. However, existing support mechanisms focus primarily on physical equipment rather than intangible technological experimentation. Concurrently, the domestic legal framework remains in transition: monetary authorities have maintained a cautious stance toward digital assets (Bank Al-Maghrib, 2023). This regulatory ambiguity, combined with a structural scarcity of internal IT capabilities -where only 23% of Moroccan SMEs maintain dedicated IT departments (ANRT, 2023)- and severe capital constraints, where 68% of SMEs cite access to finance as a major obstacle (HCP, 2022), suggests that adoption frameworks derived from advanced economies cannot be directly transposed to the Moroccan context. More broadly, Morocco's position in international business-regulation assessments reflects both progress and persistent structural gaps in the institutional environment surrounding enterprise activity and financial innovation (World Bank, 2020).

Beyond this geographical gap, a more fundamental theoretical issue remains unresolved. DOI research generally assumes that perceived innovation attributes such as compatibility, observability, and trialability influence adoption by reducing uncertainty, facilitating learning, and making the consequences of innovation more visible to potential adopters. Yet these mechanisms may not operate uniformly across institutional environments. In emerging economies, firms may observe successful applications of an innovation without being willing to adopt it when regulatory uncertainty, limited institutional support, or weak confidence in formal rules increase the perceived consequences and risks of adoption. Thus, the relevant question is not only whether DOI attributes influence adoption, but also whether the institutional environment enables firms to translate these perceptions into adoption intentions. This issue is particularly relevant for blockchain because its adoption involves not only technological and organizational considerations but also questions of regulatory legitimacy, transaction security, data governance, and institutional trust.

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

In light of this dual observation -the significant potential of blockchain alongside the limited understanding of how innovation-diffusion mechanisms operate under institutional uncertainty in North Africa- our central research problem asks: What are the key technological, organizational, and environmental determinants of blockchain adoption intention among Moroccan SMEs, and under what institutional conditions do the classical mechanisms of technological diffusion operate effectively?

To address this question, this study draws primarily on Rogers' Diffusion of Innovations (DOI) theory and complements it with the Technology-Organization-Environment (TOE) framework. DOI provides the core theoretical lens for examining how SMEs evaluate blockchain's perceived characteristics, including complexity, compatibility, observability, cost, risk, and trialability, whereas TOE captures organizational readiness and environmental conditions that may facilitate or constrain adoption. We further argue that these conditions are particularly important in emerging-market environments, where institutional uncertainty may prevent perceived innovation attributes from translating automatically into adoption intentions. Accordingly, financial slack and regulatory trust are incorporated as contextual variables that capture important organizational and environmental conditions surrounding blockchain adoption. Rather than assuming that DOI mechanisms operate uniformly across contexts, this study examines whether institutional conditions may constitute an important boundary condition for the effectiveness of these mechanisms.

This study builds upon and substantially extends earlier exploratory work by Makhrout et al. (2024), which provided initial ordered probit evidence on blockchain adoption intention among Moroccan SMEs using a basic DOI framework. The present research advances that foundation by moving beyond a predominantly attribute-based explanation of adoption and by examining the organizational and environmental conditions under which innovation perceptions may translate into adoption intention. In particular, the study investigates whether the absence of a significant direct relationship between observability and adoption can be interpreted in light of the institutional conditions surrounding blockchain adoption. This allows the analysis to move beyond the question of whether SMEs can observe the benefits of an innovation toward the more fundamental question of whether they have sufficient confidence in the institutional environment to act upon what they observe.

This study makes three contributions to the literature. First, theoretically, it extends DOI research by highlighting the potential institutional contingency of innovation-diffusion mechanisms. While observability is traditionally expected to facilitate adoption by providing visible evidence of an innovation's use and benefits, the findings suggest that visibility alone may not necessarily translate into adoption intention when firms operate under institutional uncertainty. The exploratory interaction between observability and regulatory trust provides preliminary evidence that the effectiveness of a DOI attribute may depend on the institutional conditions surrounding the innovation. Second, the study complements DOI with the TOE framework by showing that adoption depends not only on how SMEs perceive an innovation but also on whether they possess the organizational resources and environmental confidence required to act on those perceptions. This positioning clarifies the respective roles of DOI and

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

TOE rather than treating their integration as an end in itself. Third, empirically and practically, the study provides evidence from a refined sample of 306 Moroccan SMEs across all 12 regions and translates the findings into policy implications aligned with the Morocco Digital 2030 strategy, particularly regarding experimentation opportunities, financial support, digital capabilities, and regulatory confidence.

The remainder of this paper is structured as follows. Section 2 reviews the literature on blockchain adoption, innovation diffusion, and the organizational and environmental conditions surrounding technological adoption, and develops six research hypotheses alongside the TOE-related variables. Section 3 details the empirical methodology, including the sampling strategy, scale operationalization, and econometric specification. Section 4 presents the descriptive statistics, measurement model validation, and Ordered Probit estimations. Section 5 discusses the findings through the lens of DOI, TOE, and institutional contingency, and develops the theoretical, managerial, and policy implications. Finally, Section 6 concludes by outlining the study's limitations and directions for future research.

2. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Blockchain Adoption among SMEs in Emerging-Market Contexts

Blockchain adoption among SMEs should be understood as a multidimensional decision shaped by technological perceptions as well as organizational and environmental conditions. Unlike large corporations, SMEs generally operate with more limited financial resources, fewer specialized technological capabilities, and greater sensitivity to uncertainty surrounding new technologies. These constraints may become particularly consequential for blockchain because adoption can require investment in digital infrastructure, employee training, system integration, and organizational adaptation. At the same time, the potential benefits of blockchain -including enhanced transparency, traceability, transaction efficiency, and reduced information asymmetries- may create incentives for adoption when firms perceive that these benefits outweigh the associated costs and risks (Iansiti &Lakhani, 2017; Wong et al., 2020; Clohessy &Acton, 2019).

From a Transaction Cost Theory perspective, blockchain-based smart contracts and shared ledgers may reduce information asymmetries, verification costs, uncertainty, and coordination frictions by improving transparency and traceability (Williamson, 1985). This is consistent with the broader digital economics literature, which shows that platform-based and intermediation-reducing business models can lower transaction and coordination costs across economic exchanges (Brousseau &Pénard, 2007). These potential benefits may be particularly relevant for SMEs, which often face greater resource constraints and weaker bargaining positions than large firms. From a Resource-Based View perspective, however, the ability to capture these benefits depends on the organizational resources and capabilities available to the firm (Barney, 1991). Blockchain adoption may therefore generate value only when firms possess sufficient financial, managerial, and technological capabilities to integrate the technology into their existing activities. These perspectives suggest that the potential benefits of blockchain do not automatically translate into adoption: firms must both perceive sufficient

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

economic value and possess the organizational conditions required to implement the technology.

The emerging-market context adds an additional layer of complexity. In environments where regulatory frameworks are evolving and institutional support for emerging technologies remains uncertain, firms may face difficulties in assessing the legitimacy, security, and long-term viability of blockchain applications. Institutional uncertainty can affect not only the perceived risks associated with blockchain but also the extent to which firms can translate positive perceptions of the technology into adoption intentions. The institutional environment may therefore shape the credibility of information available to potential adopters and influence their willingness to commit resources to an emerging technology (Khanna &Palepu, 2010; Kshetri, 2017).

Previous research on blockchain adoption has predominantly examined technological characteristics such as relative advantage, compatibility, complexity, observability, and trialability, while a growing body of research has incorporated organizational and environmental factors. For example, Clohessy and Acton (2019) examined blockchain adoption from an innovation-theory perspective and identified organizational and technological determinants of adoption, while Wong et al. (2020) demonstrated the importance of innovation characteristics in the context of Malaysian SMEs. Kamble et al. (2019) similarly showed that DOI-related characteristics help explain blockchain adoption in supply-chain settings. However, evidence regarding the effects of individual DOI attributes, particularly observability, remains mixed across contexts (Clohessy &Acton, 2019; Wong et al., 2020). More recently, Bhat et al. (2026) confirm, within a TOE framework, that technological, organizational, and environmental drivers jointly shape both blockchain adoption and firm-level performance outcomes among SMEs, reinforcing the relevance of a multidimensional approach to the phenomenon.

This study addresses this issue by using Diffusion of Innovations (DOI) as its core theoretical lens and complementing it with selected organizational and environmental conditions from the Technology-Organization-Environment (TOE) framework**.** The objective is not simply to combine two theories, but to distinguish between how SMEs perceive blockchain as an innovation and the organizational and institutional conditions that may enable them to act upon these perceptions.

2.2 Diffusion of Innovations as the Core Theoretical Lens

Rogers' (1962, 2003) Diffusion of Innovations (DOI) theory provides the principal theoretical foundation for explaining why organizations differ in their willingness to adopt new technologies. DOI proposes that the perceived characteristics of an innovation influence the rate and likelihood of adoption. Five attributes are central to the framework: relative advantage, compatibility, complexity, trialability, and observability (Rogers, 2003).

The DOI framework is particularly relevant to organizational technology adoption because potential adopters do not evaluate an innovation solely according to its technical characteristics. Rather, they assess whether it offers meaningful advantages, whether it fits existing practices,

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

whether it is difficult to understand or implement, whether it can be tested before full adoption, and whether its consequences can be observed. These perceptions influence uncertainty and the expected consequences of adoption (Rogers, 2003).

Moore and Benbasat (1991) subsequently operationalized several innovation characteristics through the Perceived Characteristics of Innovating (PCI) instrument, which has been widely used in information-systems research. Their work provides an important empirical foundation for measuring constructs such as compatibility, complexity, observability, and trialability in organizational technology-adoption studies.

DOI is particularly appropriate for blockchain adoption because blockchain represents a relatively complex and unfamiliar technology for many SMEs. Its distributed architecture, cryptographic mechanisms, smart contracts, and implications for data governance may make it difficult for firms to assess its practical value and implementation requirements. At the same time, visible evidence of successful applications, opportunities to experiment with the technology, and compatibility with existing organizational processes may reduce uncertainty and increase adoption intention (Clohessy &Acton, 2019; Wong et al., 2020).

Empirical evidence, however, indicates that DOI attributes may not operate identically across institutional and technological contexts. Clohessy and Acton (2019), for example, found significant effects for complexity, compatibility, and relative advantage but a non-significant effect for observability. Wong et al. (2020) similarly reported heterogeneous effects across innovation attributes in Malaysian SMEs. Kamble et al. (2019) also demonstrated the relevance of DOI characteristics to blockchain adoption but highlighted the importance of contextual conditions. These mixed findings suggest that DOI mechanisms may be context-sensitive rather than universally uniform**.**

Nevertheless, DOI alone does not explicitly specify how organizational resources or environmental conditions influence firms' ability to translate perceptions of an innovation into adoption decisions. This limitation provides a rationale for complementing DOI with the TOE framework.

Accordingly, this study treats DOI as the core theoretical lens, while TOE provides a complementary contextual perspective on organizational and environmental conditions. This distinction is important because the contribution of the study does not lie merely in combining DOI and TOE, but in examining whether the conditions surrounding the firm influence the extent to which DOI mechanisms translate into adoption intention.

2.3 DOI Attributes and Blockchain Adoption

2.3.1 Perceived Complexity

Complexity refers to the degree to which an innovation is perceived as relatively difficult to understand and use (Rogers, 1962, 2003). Within DOI, complexity is generally expected to have a negative effect on adoption because technologies that are perceived as difficult increase uncertainty and the cognitive and organizational effort required for implementation.

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

For SMEs, this mechanism may be particularly important in the case of blockchain. The technology involves distributed architectures, cryptographic mechanisms, consensus processes, smart contracts, and new approaches to data management. SMEs with limited technological expertise may therefore perceive blockchain as difficult to understand and integrate into existing business processes. The absence of specialized IT capabilities may further increase perceived implementation difficulties (Clohessy & Acton, 2019; Wong et al., 2020).

This relationship can also be understood through the concept of absorptive capacity**,** which refers to a firm's ability to recognize, assimilate, and exploit external knowledge (Cohen & Levinthal, 1990). SMEs with limited technological knowledge may have greater difficulty evaluating and applying blockchain-related knowledge. As a result, the perceived complexity of blockchain may become an especially important barrier to adoption.

Empirical evidence supports this expectation. Clohessy and Acton (2019) and Wong et al. (2020) reported negative relationships between perceived complexity and blockchain adoption. Kamble et al. (2019) similarly identified technological characteristics as important determinants of blockchain adoption in supply-chain contexts.

Therefore:

H1: Perceived complexity negatively influences blockchain adoption intention among Moroccan SMEs

2.3.2 Perceived Compatibility

Compatibility refers to the extent to which an innovation is perceived as consistent with existing values, previous experiences, organizational practices, technological infrastructure, and business needs (Rogers, 2003).

Compatibility is particularly relevant to blockchain adoption because SMEs are unlikely to adopt a technology solely because it is innovative. They must also perceive that it can be incorporated into existing operational processes and technological systems. When blockchain applications are compatible with existing business practices, adoption may require less organizational adaptation and generate lower implementation uncertainty.

In contrast, when SMEs perceive a substantial gap between blockchain and their existing systems, routines, or capabilities, the organizational disruption and adjustment costs associated with adoption may discourage implementation. Compatibility may therefore reduce the perceived distance between an existing organizational configuration and a new technological solution.

Empirical research generally supports this argument. Clohessy and Acton (2019) found a positive relationship between compatibility and blockchain adoption, while Wong et al. (2020) identified compatibility as an important determinant among Malaysian SMEs. Kamble et al. (2019) likewise showed that compatibility contributes to blockchain adoption in supply-chain environments.

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

From a DOI perspective, higher compatibility should consequently increase the perceived feasibility of blockchain and encourage adoption intention.

H2: Perceived compatibility positively influences blockchain adoption intention among Moroccan SMEs

2.3.3 Perceived Observability

Observability refers to the extent to which the results and consequences of an innovation are visible to potential adopters (Rogers, 2003). In the context of blockchain, observability may arise from visible evidence of successful applications, demonstrations of efficiency improvements, traceability benefits, or examples of other firms using blockchain successfully.

According to DOI, observing successful adoption can reduce uncertainty by providing potential adopters with information about the practical consequences of an innovation. SMEs may therefore become more willing to adopt blockchain when they can observe concrete examples of its benefits and implementation.

However, empirical evidence regarding observability in blockchain adoption is mixed. Clohessy and Acton (2019) found no significant effect of observability, while Kamble et al. (2019) reported a positive relationship. Wong et al. (2020) also found relatively weak evidence for this attribute. Such differences suggest that the informational value of observability may depend on the context in which firms evaluate visible evidence of innovation adoption.

The institutional environment may be particularly relevant in this regard. Observing other firms using blockchain provides information about the technology's potential benefits, but it does not necessarily resolve uncertainty regarding regulatory legitimacy, legal protection, transaction security, or the long-term viability of adoption. In institutionally uncertain environments, SMEs may therefore observe successful applications without considering them sufficiently reliable or transferable to their own circumstances.

Thus, observability may not automatically generate adoption intention when institutional confidence is limited. The present study nevertheless retains the conventional DOI prediction as a direct hypothesis and subsequently examines the potential role of regulatory trust through an exploratory interaction analysis.

H3: Perceived observability positively influences blockchain adoption intention among Moroccan SMEs

2.3.4 Perceived Cost

Perceived cost refers to the extent to which firms anticipate financial burdens associated with implementing and maintaining an innovation. Although cost is not one of Rogers' (2003) five original DOI attributes**,** it has increasingly been incorporated into technology-adoption research because the financial implications of implementation can substantially affect firms' willingness to adopt emerging technologies (Wong et al., 2020).

Accordingly, perceived cost is treated in this study as an extension of the DOI-based adoption model rather than as an operationalization of relative advantage**.** This distinction is theoretically

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

important because relative advantage refers to the perceived superiority of an innovation over an existing alternative, whereas perceived cost captures the financial burden associated with adoption.

Blockchain adoption may involve expenditures related to infrastructure, software integration, employee training, cybersecurity, external technical expertise, and system maintenance (Wong et al., 2020). For SMEs operating under financial constraints, these costs may represent a significant barrier to adoption.

The relevance of financial constraints can also be interpreted through the organizational slack perspective. Bourgeois (1981) argues that organizational slack provides firms with resources that can be allocated to discretionary activities, including innovation. Firms with limited slack may therefore be more sensitive to the costs and risks associated with emerging technologies.

Empirical evidence indicates that perceived cost can inhibit blockchain adoption, particularly among SMEs (Wong et al., 2020; Alazab et al., 2021). The perception that blockchain requires substantial initial and continuing expenditure may therefore reduce the expected net benefits of adoption and discourage firms from committing resources to the technology.

H4: Perceived cost negatively influences blockchain adoption intention among Moroccan SMEs

2.3.5 Perceived Risk

Perceived risk refers to the uncertainty and potential negative consequences that firms associate with adopting an emerging technology. In blockchain adoption, perceived risk may include concerns regarding technological failures, cybersecurity, data protection, operational disruption, financial losses, and regulatory uncertainty (Clohessy & Acton, 2019; Kshetri, 2017). These concerns are particularly important for SMEs because they often possess fewer resources to absorb unexpected implementation failures than larger organizations. The adoption of a technology whose legal and regulatory status remains uncertain may further increase perceived risk.

Blockchain-specific research confirms the importance of risk in technology adoption. Clohessy & Acton (2019) identified perceived risk as an important barrier to blockchain adoption, while Kshetri (2017) highlighted the cybersecurity and privacy implications associated with blockchain technologies. Wong et al. (2020) likewise incorporated risk into their analysis of blockchain adoption among SMEs. Regulatory uncertainty is particularly relevant because perceived technological risk may be amplified when firms lack confidence in the institutional framework governing blockchain-related activities. Thus, perceived risk represents not only a technological concern but also an important channel through which institutional uncertainty may enter the adoption decision.

When SMEs perceive blockchain as risky, the expected costs and uncertainty associated with adoption may outweigh the perceived benefits.

H5: Perceived risk negatively influences blockchain adoption intention among Moroccan SMEs

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

2.3.6 Trialability

Trialability refers to the extent to which an innovation can be experimented with on a limited basis before full-scale adoption (Rogers, 2003). Trialability can reduce uncertainty by allowing firms to evaluate an innovation through direct experience without immediately committing substantial financial or organizational resources.

This attribute is particularly relevant for SMEs because experimentation can reduce uncertainty without requiring an immediate full-scale commitment of resources. In the case of blockchain, SMEs may benefit from pilot projects, limited applications, demonstration environments, or controlled experiments that allow them to evaluate the technology's usefulness and compatibility before committing to broader implementation.

The learning mechanism underlying trialability is consistent with DOI's emphasis on uncertainty reduction through direct experience (Rogers, 2003). Empirical evidence from blockchain adoption also provides support for a positive role of trialability (Clohessy & Acton, 2019; Wong et al., 2020).

By providing opportunities for learning and reducing the perceived consequences of failure, trialability should increase firms' confidence in their ability to adopt blockchain.

H6: Perceived Trialability Positively Influences Blockchain Adoption Intention among Moroccan Smes

2.4 Organizational and Environmental Conditions: A TOE Perspective

While DOI provides the core explanation of how SMEs perceive the characteristics of blockchain, it does not fully capture the organizational resources and environmental conditions that may determine whether these perceptions can be translated into adoption. The Technology-Organization-Environment (TOE) framework developed by Tornatzky and Fleischer (1990) provides a complementary perspective by arguing that technological adoption is shaped by technological characteristics, organizational conditions, and the external environment.

The TOE framework has been widely applied to organizational technology-adoption research, including cloud computing and other digital technologies (Oliveira et al., 2014). It is particularly useful in the present context because it allows the analysis to incorporate conditions that are external to the perceived characteristics of blockchain itself.

In this study, TOE is not treated as a competing theory to DOI**.** Rather, it provides a contextual lens for examining whether SMEs possess the resources and institutional confidence required to act upon their perceptions of blockchain. Two conditions are particularly relevant**:** financial slack**,** representing organizational capacity to allocate resources to innovation, and regulatory trust**,** representing confidence in the institutional and legal environment surrounding blockchain-related activities. Firm size and industry sector are included as additional control variables.

This positioning is consistent with previous blockchain research combining innovation characteristics with organizational and environmental factors (Clohessy & Acton, 2019; Wong

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

et al., 2020), while allowing the present study to place greater emphasis on the contextual conditions surrounding DOI mechanisms.

2.4.1 Financial Slack

Financial slack represents the extent to which a firm possesses financial resources that can be allocated to innovation without threatening its ongoing operations. Bourgeois (1981) conceptualizes organizational slack as resources that provide firms with flexibility in responding to uncertainty and pursuing discretionary activities.

For SMEs, financial slack is particularly relevant because blockchain adoption may involve expenditure on digital infrastructure, software integration, employee training, external expertise, and experimentation. Firms with greater financial capacity are better positioned to absorb the uncertainty and initial costs associated with emerging technologies.

Previous blockchain research has emphasized the importance of organizational resources and financial capacity in facilitating adoption (Clohessy & Acton, 2019). Financial resources can also provide SMEs with greater flexibility to experiment with new technologies and overcome temporary implementation difficulties.

From a TOE perspective, financial slack therefore represents an organizational readiness condition that can enable SMEs to act upon favorable perceptions of blockchain.

2.4.2 Regulatory Trust and Institutional Conditions

Regulatory trust captures the extent to which SMEs believe that the institutional and legal environment provides sufficient protection and predictability for blockchain-related activities. This dimension is particularly relevant in emerging-market environments where regulatory frameworks for new digital technologies may remain evolving or ambiguous.

The environmental dimension of TOE emphasizes the role of external institutional and regulatory conditions in shaping technology adoption (Tornatzky & Fleischer, 1990; Oliveira et al., 2014). For blockchain, regulatory conditions may be particularly important because adoption can involve questions concerning legal recognition, data governance, transaction security, and institutional responsibility.

Regulatory trust can reduce uncertainty by providing firms with greater confidence that blockchain-related transactions will be recognized, protected, and governed through predictable institutional arrangements. When firms perceive the regulatory environment as credible and supportive, they may be more willing to allocate resources to emerging technologies whose long-term viability depends partly on institutional recognition.

The relevance of institutional conditions is also consistent with the institutional-voids perspective developed by Khanna and Palepu (2010), which emphasizes that weaknesses or gaps in formal institutions can increase uncertainty and transaction difficulties in emerging markets. In such contexts, firms may rely more heavily on institutional signals when evaluating unfamiliar technologies.

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

From a TOE perspective, regulatory trust therefore represents an **environmental condition** that may directly influence adoption intention. More importantly, it may also determine whether information generated through observability becomes sufficiently credible to influence adoption decisions. SMEs may observe successful blockchain applications elsewhere but remain reluctant to imitate them if they doubt the regulatory legitimacy or long-term institutional support surrounding the technology. Conversely, when regulatory trust is higher, observed evidence of successful adoption may become more credible and actionable.

This reasoning provides the theoretical basis for examining the potential institutional contingency of DOI mechanisms. Because the interaction between observability and regulatory trust is examined exploratorily rather than specified as a confirmatory hypothesis**,** the moderation analysis is presented subsequently as an extension of the main DOI-TOE model.

2.4.3 Firm Size

Firm size is included as an organizational control because larger SMEs may possess greater financial, managerial, and technological resources than smaller firms. Larger organizations may also have greater capacity to absorb the costs and risks associated with experimenting with emerging technologies.

The relationship between organizational size and technology adoption has been examined extensively in information-systems research, including blockchain adoption (Wong et al., 2020). Larger firms may benefit from economies of scale and greater access to specialized capabilities, although these advantages may be reduced when financial resources and institutional confidence are explicitly considered. Controlling for firm size therefore allows the analysis to distinguish the effects of the theoretically central DOI and TOE variables from systematic differences associated with organizational scale.

2.4.4 Industry Sector

Industry sector is included as an additional control because the potential relevance and feasibility of blockchain may vary across economic activities. Sectors characterized by complex supply chains, significant information-sharing requirements, and traceability needs, or multiple interorganizational transactions may have stronger incentives to consider blockchain applications (Kamble et al., 2019; Wong et al., 2020).

Controlling for industry sector helps account for these structural differences in the business environment and ensures that the estimated relationships between DOI attributes, TOE conditions, and adoption intention are not driven solely by sectoral composition.

2.5 Institutional Contingency of DOI Mechanisms

The preceding discussion suggests that DOI attributes should not necessarily be interpreted as context-independent determinants of technology adoption. In particular, observability is expected to reduce uncertainty by providing firms with visible evidence of an innovation's usefulness and feasibility (Rogers, 2003). However, the informational value of observed adoption may depend on the institutional environment in which firms evaluate that evidence.

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

The mixed empirical evidence regarding observability in blockchain adoption provides a useful starting point for this argument. While some studies identify a positive effect, others report weak or non-significant relationships (Clohessy & Acton, 2019; Wong et al., 2020; Kamble et al., 2019). These inconsistencies may indicate that the effect of observability depends not only on whether successful applications are visible, but also on whether firms perceive the institutional environment surrounding those applications as sufficiently credible.

When regulatory arrangements are perceived as uncertain, observing other firms adopting blockchain may provide insufficient reassurance regarding legal protection, transaction security, regulatory recognition, or the sustainability of the technology. In such circumstances, visibility may generate awareness without necessarily generating adoption intention. SMEs may recognize that blockchain is being successfully implemented elsewhere while remaining uncertain about whether similar outcomes can be achieved within their own regulatory and organizational environment.

Regulatory trust may therefore represent an important contextual condition surrounding the diffusion process. When SMEs have greater confidence in the regulatory environment, observed examples of blockchain adoption may become more credible, transferable, and actionable. Conversely, low regulatory trust may weaken the extent to which observable evidence reduces uncertainty. This argument does not imply that regulatory trust replaces the DOI mechanism; rather, it suggests that the effectiveness of an innovation attribute may depend partly on the institutional conditions under which that attribute is perceived**.**

This perspective is consistent with the broader institutional-voids literature, which emphasizes that institutional weaknesses can alter how firms coordinate, assess uncertainty, and make strategic decisions in emerging markets (Khanna & Palepu, 2010). In the context of blockchain, institutional uncertainty may therefore represent a boundary condition affecting the informational value of visible innovation outcomes rather than merely an additional determinant of adoption.

Accordingly, the present study estimates the conventional DOI relationships first and subsequently conducts an exploratory interaction analysis between observability and regulatory trust**.** The purpose of this additional analysis is not to establish a new confirmatory hypothesis, but to assess whether the direct effect of observability may conceal an institutionally contingent relationship. This approach is consistent with the exploratory nature of the interaction identified in the empirical analysis and avoids overstating the evidence as a pre-specified causal moderation effect.

2.6 Conceptual Framework and Hypotheses Summary

Based on the preceding theoretical discussion, the proposed framework positions DOI as the primary theoretical explanation of blockchain adoption intention**,** with complexity, compatibility, observability, perceived cost, perceived risk, and trialability representing the principal innovation-related determinants. The TOE framework complements DOI by incorporating financial slack as an organizational condition and regulatory trust as an environmental condition. Firm size and industry sector are included as control variables.

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

The framework therefore distinguishes between two analytically different questions. First, do SMEs' perceptions of blockchain's characteristics influence their adoption intention? Second, do organizational and institutional conditions facilitate or constrain firms' ability to translate those perceptions into adoption decisions?

The Six Hypotheses Are Summarized As Follows:

H1: Perceived complexity negatively influences blockchain adoption intention among Moroccan SMEs.

H2: Perceived compatibility positively influences blockchain adoption intention among Moroccan SMEs.

H3: Perceived observability positively influences blockchain adoption intention among Moroccan SMEs.

H4: Perceived cost negatively influences blockchain adoption intention among Moroccan SMEs.

H5: Perceived risk negatively influences blockchain adoption intention among Moroccan SMEs.

H6: Perceived trialability positively influences blockchain adoption intention among Moroccan SMEs.

The potential interaction between observability and regulatory trust is examined subsequently as an exploratory extension of the main model rather than as a pre-specified confirmatory hypothesis.

3. METHODOLOGY

This section presents the empirical strategy used to examine the determinants of blockchain adoption intention among Moroccan SMEs. The study adopts a positivist research paradigm and a quantitative cross-sectional design. Consistent with the theoretical framework, the empirical strategy distinguishes between innovation-related perceptions derived from Rogers' (2003) Diffusion of Innovations (DOI) theory and organizational and environmental conditions informed by the Technology-Organization-Environment (TOE) framework (Tornatzky & Fleischer, 1990). DOI constitutes the core theoretical framework, whereas TOE provides a complementary contextual perspective.

The empirical strategy proceeds in four stages. First, the study develops and operationalizes the constructs using multi-item measures adapted from established scales. Second, the reliability and validity of the measurement instruments are assessed using complementary psychometric criteria. Third, because the dependent variable -blockchain adoption intention- is measured on an ordered five-point scale, an Ordered Probit model is estimated using maximum likelihood. Finally, marginal effects and alternative specifications are used to assess the robustness and substantive interpretation of the findings.

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

3.1 Theoretical Framework and Research Model

This study is anchored primarily in Rogers' (2003) Diffusion of Innovations theory. DOI explains adoption intention through the perceived characteristics of an innovation, particularly complexity, compatibility, observability, relative advantage, and trialability. In the present study, complexity, compatibility, observability, and trialability are operationalized as core DOI-related constructs.

Perceived cost and perceived risk are incorporated as extensions of the DOI-based adoption framework rather than as original DOI attributes. Perceived cost captures the financial burden associated with blockchain implementation, whereas perceived risk captures uncertainty regarding technological, security, and regulatory consequences. This extension is consistent with previous research on blockchain adoption, which has shown that the financial and institutional risks associated with emerging technologies can be particularly important for SMEs (Clohessy & Acton, 2019; Wong et al., 2020).

The study further incorporates two contextual conditions derived from the TOE framework (Tornatzky & Fleischer, 1990**):** financial slack (FUND) as an organizational condition and regulatory trust (REGU) as an environmental and institutional condition. These variables do not replace the DOI mechanisms; rather, they capture conditions that may influence SMEs' capacity and confidence to translate favorable perceptions of blockchain into adoption intentions.

Firm size (SIZE) and industry sector (SECT) are included as control variables.

The empirical model is therefore specified as follows:

$$BLOCKi* = \alpha + \beta1COMPi + \beta2COMPATi + \beta3OBSVi + \beta4COSTi + \beta5RISKi + \beta6 TRIAi + \beta7REGUi + \beta8FUNDi + \beta9SIZEi + \beta10SECTi + \varepsilon i$$

where $BLOCKi*$ represents the unobserved latent propensity of SME i to adopt blockchain.

The observed adoption-intention variable BLOCKi is ordinal and takes five categories:

1 = very low intention

2 = low intention

3 = moderate intention

4 = high intention

5 = very high intention.

The observed outcome is related to the latent propensity through four unknown threshold parameters:

$$BLOCKi = j \text{ if } \mu j-1 < BLOCKi* \leq \mu j$$

where:

$\mu0=-\infty, \mu5=+\infty$

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

and:

$\mu 1 < \mu 2 < \mu 3 < \mu 4$.

The coefficients and threshold parameters are estimated jointly using maximum likelihood.

The primary hypotheses correspond to the six DOI-based relationships developed in Section 2:

- H1: Perceived complexity negatively influences blockchain adoption intention.
- H2: Perceived compatibility positively influences blockchain adoption intention.
- H3: Perceived observability positively influences blockchain adoption intention.
- H4: Perceived cost negatively influences blockchain adoption intention.
- H5: Perceived risk negatively influences blockchain adoption intention.
- H6: Perceived trialability positively influences blockchain adoption intention.

The interaction between observability and regulatory trust is not included in the confirmatory model specification above**.** It is examined subsequently as an exploratory extension to assess whether the effect of observability varies according to the level of regulatory trust.

3.2 Measurement Development

All latent constructs were measured using multi-item scales adapted from previously validated instruments. A five-point Likert scale ranging from 1 = "Strongly disagree" to 5 = "Strongly agree" was employed.

The dependent variable, Blockchain Adoption Intention (BLOCK)**,** was measured using five items adapted from Venkatesh et al. (2003), capturing respondents' intention, willingness, and plans to adopt or invest in blockchain-related solutions within the following 24 months.

The six innovation-related constructs were operationalized as follows.

Perceived Complexity (COMP) was measured using five items adapted from Moore and Benbasat (1991), capturing the perceived difficulty of learning, understanding, and using blockchain. Items were worded to reflect the difficulty associated with blockchain implementation. Higher values therefore indicate higher perceived complexity.

Perceived Compatibility (COMPAT) was measured using five items adapted from Moore and Benbasat (1991), focusing on the extent to which blockchain is perceived as compatible with the firm's existing technological infrastructure, organizational processes, and business practices.

Perceived Observability (OBSV) was measured using five items adapted from Moore and Benbasat (1991), capturing the extent to which SMEs can observe successful blockchain applications and their benefits among other firms.

Perceived Cost (COST) was measured using five items adapted from Wong et al. (2020), covering perceived investment, training, integration, and maintenance costs associated with blockchain adoption.

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

Perceived Risk (RISK) was measured using five items adapted from Clohessy and Acton (2019), covering perceived technological, security, performance, and regulatory risks associated with blockchain.

Trialability (TRIA) was measured using five items adapted from Moore and Benbasat (1991), capturing the extent to which SMEs have opportunities to experiment with blockchain on a limited basis before committing to full implementation.

The two contextual TOE variables were operationalized as follows.

Regulatory Trust (REGU) was measured using three items capturing SMEs' confidence that the Moroccan legal and regulatory environment provides sufficient protection and predictability for blockchain-related transactions. The scale was informed by previous technology-adoption research, including Oliveira et al. (2014) and Wong et al. (2020).

Financial Slack (FUND) was measured using three items capturing the availability of financial resources that SMEs can allocate to digital innovation. The scale was informed by the organizational-adoption literature and previous blockchain research (Clohessy & Acton, 2019).

Two additional control variables were included. Firm size (SIZE) was measured as the natural logarithm of the number of full-time employees. Industry sector (SECT) was coded as a binary variable distinguishing high-technology sectors from conventional sectors.

The questionnaire was originally developed in French and subsequently translated into Arabic using a back-translation procedure following Brislin (1970). A pilot test involving SME managers and academics was conducted to assess the clarity, relevance, and comprehensibility of the items before the main survey.

Table 1: Construct Operationalization and Scale Reliability

Variable	Code	Type	Scale Source	Nb items	Cronbach's Alpha (α)
Blockchain Adoption Intention	BLOCK	Dependent (Ordinal 1-5)	Venkatesh et al. (2003) - UTAUT	5	0.89
Perceived Complexity	COMP	Independent (DOI)	Moore & Benbasat (1991)	5	0.87
Perceived Compatibility	COMPAT	Independent (DOI)	Moore & Benbasat (1991)	5	0.85
Observability	OBSV	Independent (DOI)	Moore & Benbasat (1991)	5	0.88
Perceived Cost	COST	Independent (DOI)	Wong et al. (2020)	5	0.86
Perceived Risk	RISK	Extended DOI	Clohessy & Acton (2019)	5	0.84
Trialability	TRIA	Independent (DOI)	Moore & Benbasat (1991)	5	0.86
High-Tech Sector	SECT	Control (Binary 0/1)	Wong et al. (2020)	1	-
Firm Size (ln employees)	SIZE	Control (Continuous)	Hair et al. (2019)	1	-
Regulatory Trust	REGU	Control (TOE)	Wong et al. (2020); Oliveira	3	0.86

ISSN 1533-9211

DOI: 10.5281/zenodo.22226058

			et al. (2014)		
Financial Resources	FUND	Control (TOE)	Clohessy et al. (2019)	3	0.88

Notes: All latent constructs were measured using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). DOI = Diffusion of Innovations; TOE = Technology-Organization-Environment. Reliability threshold: α> 0.70 acceptable, > 0.80 good (Nunnally et Bernstein, 1994). All constructs exceed the recommended cut-off. Instrument translation followed Brislin's (1970) back-translation procedure (French - Arabic)

Source: Authors

3.3 Sampling and Data Collection

The target population consisted of Moroccan SMEs defined according to the criteria adopted by the Moroccan SME institutional framework. The study excluded auto-entrepreneurs in order to maintain a relatively homogeneous organizational population.

Morocco represents a relevant empirical context for examining blockchain adoption because SMEs operate in an environment characterized by increasing digitalization alongside financial, technological, and institutional constraints. The study therefore seeks to examine whether the determinants identified by DOI remain relevant when firms operate under these contextual conditions. A stratified sampling strategy was employed to ensure variation across Morocco's regions and economic sectors. The sampling frame was constructed using available institutional sources, including Regional Investment Centers (CRI), Chambers of Commerce, Industry and Services (CCIS), and Maroc PME.

Data were collected between January and April 2024. Questionnaires were administered through both face-to-face and online channels. The target respondents were owner-managers, CEOs, and CTOs because these individuals were considered sufficiently informed about their firms' technological decisions and adoption intentions. A total of 450 questionnaires were distributed. Of these, 328 were returned, and 306 usable observations remained after excluding incomplete questionnaires and responses exhibiting straight-lining patterns. The final analytical sample therefore consisted of 306 SMEs**.**

The sample included firms from services, industry, commerce, and high-technology activities and covered all twelve Moroccan regions. The average firm age was 11.4 years and average employment was 47 employees. To assess potential non-response bias, early and late respondents were compared following Armstrong and Overton (1977). No statistically significant differences were identified for the principal firm characteristics and adoption-intention measure, suggesting that systematic non-response bias was unlikely to materially affect the results.

3.4 Common Method Bias

Because the study relies on self-reported questionnaire data collected from a key informant within each firm, potential common method variance was considered (Podsakoff et al., 2003).

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

Several procedural remedies were implemented during questionnaire design and administration. Respondents were assured that their responses would remain anonymous and confidential, thereby reducing potential evaluation apprehension and social-desirability concerns. Items were presented in a manner designed to reduce respondents' ability to infer the expected relationships among constructs. Ambiguous, double-barreled, and overly technical wording was removed or revised during the pilot-testing stage.

Two statistical diagnostics were additionally employed. First, Harman's single-factor test was used as a preliminary diagnostic. The first factor accounted for 28.4% of the total variance, which does not suggest that a single factor dominates the covariance structure. Second, the marker-variable approach proposed by Lindell and Whitney (2001) was used as an additional diagnostic. The marker variable exhibited only a weak correlation with the substantive constructs (r=0.08), providing further evidence that common method variance was unlikely to drive the main findings.

These procedures should nevertheless be interpreted as diagnostic rather than definitive tests of common method bias.

3.5 Measurement Model Assessment

Before estimating the structural model, the psychometric properties of the multi-item constructs were evaluated.

Internal consistency reliability was assessed using Cronbach's alpha (α) **and** Composite Reliability (CR)**.** Values above 0.70 were considered acceptable, following Nunnally and Bernstein (1994) and Hair et al. (2019).

Convergent validity was assessed using the Average Variance Extracted (AVE)**.** Values above 0.50 indicate that a construct explains more than half of the variance of its indicators (Fornell & Larcker, 1981; Hair et al., 2019).

Discriminant validity was assessed primarily using the Heterotrait-Monotrait ratio (HTMT) proposed by Henseler et al. (2015). A conservative threshold of 0.85 was used to assess whether constructs were empirically distinguishable.

The measurement model was evaluated independently from the structural Ordered Probit estimation. Specifically, the measurement assessment was intended to establish that the multi-item scales provide sufficiently reliable and distinct measures of the theoretical constructs before composite scores were used in the econometric analysis.

The results reported in Section 4 indicate satisfactory internal consistency and convergent and discriminant validity across the constructs.

3.6 Econometric Strategy: Ordered Probit Model

The dependent variable, blockchain adoption intention, is measured on an ordered five-point scale. Treating this outcome as a continuous variable in an ordinary least squares regression would impose an equal-distance assumption between response categories that is not required by the measurement scale (Wooldridge, 2010).

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

The study therefore employs a Maximum Likelihood Ordered Probit model, which assumes an underlying continuous latent adoption propensity and maps this latent variable into the five observed ordered categories through estimated threshold parameters (Greene, 2012)

The Ordered Probit specification is appropriate because it preserves the ordinal ranking of the dependent variable without requiring the assumption that the distance between adjacent categories is identical.

The model was estimated using Stata 18.0**,** with additional estimation in R used as a computational robustness check.

In an Ordered Probit model, the estimated coefficients indicate the direction of the association between an explanatory variable and the underlying latent adoption propensity but cannot be interpreted directly as changes in the probability of belonging to a particular response category. Accordingly, marginal effects were calculated to facilitate substantive interpretation.

Particular attention was given to the probability of reporting the highest adoption-intention category (BLOCK=5). The marginal effect represents the change in the predicted probability of belonging to this category associated with a one-unit change in the explanatory variable, holding the other covariates constant.

3.7 Model Diagnostics and Robustness Checks

Several diagnostic procedures were conducted to assess the adequacy of the econometric specification.

First, multicollinearity was assessed using pairwise correlations and Variance Inflation Factors (VIFs). The estimated VIF values were below 2.5, indicating that severe multicollinearity was unlikely to affect coefficient estimates.

Second, overall model significance was assessed using the likelihood-ratio chi-square statistic. McFadden's pseudo-R^2 and log-likelihood were also reported as complementary indicators of model fit.

Third, the estimated threshold parameters were examined to ensure that they were properly ordered, as required by the Ordered Probit model.

Fourth, marginal effects were calculated for the probability of the highest adoption-intention category to facilitate substantive interpretation.

Finally, robustness was examined through alternative model specifications, including an Ordered Logit model**,** the measurement-model validation described above, and a sub-sample analysis excluding firms with fewer than ten employees. These checks assess whether the principal conclusions remain stable under alternative estimation assumptions and sample definitions.

3.8 Exploratory Institutional-Contingency Analysis

The direct effect of perceived observability was first estimated within the baseline Ordered Probit specification. Because the estimated coefficient was statistically non-significant, an

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

exploratory post-hoc analysis was subsequently conducted to examine whether the effect of observability depends on SMEs' confidence in the regulatory environment.

Drawing on institutional voids theory (Khanna & Palepu, 2010), we argue that observable evidence of successful blockchain applications may not be sufficient to reduce adoption uncertainty when firms lack confidence in the institutional and legal environment. Conversely, when regulatory trust is high, observed success stories may provide more credible and actionable information to potential adopters.

To examine this possibility, an extended Ordered Probit specification was estimated including an interaction between centered perceived observability and centered regulatory trust:

$$BLOCKi* = \alpha + \beta1OBSVi + \beta2REGUi + \beta3(OBSVi \times REGUi) + Xi'\gamma + \varepsilon i$$

where OBSVi and REGUi denote mean-centered measures of perceived observability and regulatory trust, respectively, and Xi represents the remaining DOI variables, financial slack, firm size, and industry sector.

The interaction coefficient was interpreted as evidence of whether the relationship between observability and adoption intention varies with regulatory trust. Because this interaction was not specified as an a priori hypothesis and was motivated by the pattern observed in the baseline estimation, it is interpreted as exploratory and hypothesis-generating rather than confirmatory**.**

To facilitate interpretation of the interaction in the nonlinear Ordered Probit framework, conditional average marginal effects of observability on the probability of belonging to the highest adoption-intention category (ADOPT=5) were calculated at low (-1SD) and high (+1SD) levels of regulatory trust.

3.9 Ethical and Data-Quality Considerations

Participation in the survey was voluntary. Respondents were informed about the academic purpose of the study and assured that individual responses would remain confidential and would be analyzed only in aggregate form. Data screening procedures were conducted before estimation to identify incomplete responses, inconsistent patterns, and straight-lining behavior.

4. RESULTS

4.1 Descriptive Statistics and Measurement Model Assessment

The final sample comprises 306 Moroccan SMEs. The descriptive statistics indicate a moderate overall propensity toward blockchain adoption, with a mean adoption-intention score of 2.89 on a five-point scale (SD = 1.12). Perceived complexity records the highest mean among the DOI-related constructs...

The reliability and validity assessment indicates satisfactory psychometric properties for all multi-item constructs. Cronbach's alpha values range from 0.84 to 0.89, while composite reliability values range from 0.87 to 0.91. AVE values range from 0.58 to 0.72, exceeding the recommended threshold of 0.50.

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

Table 2: Reliability, Convergent Validity and Descriptive Statistics (N=306)

Construct	Mean	SD	Cronbach α	CR	AVE	VIF
BLOCK	2.89	1.12	0.89	0.91	0.72	-
COMP	3.75	0.94	0.87	0.89	0.62	1.84
COMPAT	3.12	1.05	0.85	0.88	0.60	1.52
OBSV	2.65	1.08	0.88	0.90	0.64	1.31
COST	3.68	0.98	0.86	0.89	0.61	1.93
RISK	3.54	0.91	0.84	0.87	0.58	1.76
TRIA	2.81	1.12	0.86	0.89	0.62	1.45
REGU	2.94	1.03	0.86	0.90	0.69	1.62
FUND	2.71	1.15	0.88	0.91	0.71	1.71

Note: CR=Composite Reliability; AVE=Average Variance Extracted; VIF=Variance Inflation Factor on linear counterpart. Thresholds: $\alpha>0.70$, CR>0.70, AVE>0.50, VIF<5 (Hair et al., 2019).

Source: Authors

The correlation matrix provides preliminary evidence consistent with the theoretical model. The strongest correlation is observed between perceived complexity and perceived cost ($r=0.42, p<0.01$), while the correlations between the principal explanatory variables remain below 0.60. The correlation between adoption intention and perceived complexity is negative ($r=-0.45, p<0.01$), whereas compatibility ($r=0.38, p<0.01$) and trialability ($r=0.29, p<0.01$) are positively associated with adoption intention. Regulatory trust is also positively correlated with adoption intention ($r=0.32, p<0.01$). These associations provide preliminary support for the hypothesized relationships but do not substitute for the multivariate analysis reported below.

Table 3 reports the Pearson correlation matrix among the principal constructs included in the empirical model. The correlations are generally moderate, with no coefficient exceeding a level that would raise concerns about severe multicollinearity.

Table 3: Correlation Matrix

	BLOCK	COMP	COMPAT	COST	RISK	TRIA	REGU
BLOCK	1						
COMP	-0.45**	1					
COMPAT	0.38**	-0.31**	1				
COST	-0.39**	0.42**	-0.28**	1			
RISK	-0.41**	0.35**	-0.24**	0.33**	1		
TRIA	0.29**	-0.22**	0.31**	-0.19*	-0.15*	1	
REGU	0.32**	-0.18*	0.27**	-0.21**	-0.38**	0.24**	1

**p<0.01, *p<0.05.

Source: Authors

The strongest correlation is observed between perceived complexity and perceived cost ($r=0.42, p<0.01$), whereas the correlations between the principal explanatory variables remain moderate.

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

4.2 Baseline Ordered Probit Results

Following validation of the measurement instruments, the six DOI-related hypotheses and the contextual organizational and environmental conditions were examined using a Maximum Likelihood Ordered Probit model. The dependent variable is the five-category measure of blockchain adoption intention. The baseline model is statistically significant overall (LR $\chi2(10)=89.12$, $p<0.001$), with a log-likelihood of -385.42 and a McFadden pseudo-R^2 of 0.18. The model correctly classifies 62.3% of observations according to the reported count-R2 measure. The estimated threshold parameters are strictly increasing, consistent with the ordinal structure of the dependent variable. Because Ordered Probit coefficients indicate the direction of the relationship with the underlying latent adoption propensity rather than changes in probabilities, the substantive interpretation below focuses on the marginal effects for the highest adoption-intention category (BLOCK=5).

Table 4: Ordered Probit Results - Determinants of Blockchain Adoption Intention

Variable	Coef. (β)	Std. Err.	z-stat	P>|z|	Marg. Eff. P(Y=5)
COMP (H1-)	-0.654	0.218	-3.00	0.003***	-0.121***
COMPAT (H2+)	0.568	0.220	2.58	0.010**	+0.105**
OBSV (H3+)	-0.180	0.210	-0.86	0.392	-0.033 ns
COST (H4-)	-0.515	0.214	-2.41	0.016**	-0.095**
RISK (H5-)	-0.616	0.224	-2.75	0.006***	-0.114***
TRIA (H6+)	0.399	0.219	1.82	0.069*	+0.074*
SECT	0.449	0.224	2.00	0.046**	+0.083**
SIZE (ln)	0.089	0.103	0.86	0.387	+0.016 ns
REGU	0.470	0.214	2.19	0.029**	+0.087**
FUND	0.698	0.231	3.02	0.003***	+0.129***

Model: LR chi2(10)=89.12, Prob>chi2=0.0000; Pseudo R^2=0.18; Log Likelihood=-385.42; /cut1=-2.14***, /cut2=-0.89**, /cut3=0.12**, /cut4=1.34***; Brant test $\chi2=12.34$, $p=0.42$ (parallel assumption holds); Count R2=62.3%. ***p<0.01, **p<0.05, *p<0.10. Marginal effects at means.

Source: Authors

The results reported in Table 4 provide evidence supporting several of the DOI-based hypotheses.

4.2.1 DOI-Related Determinants

The results provide strong support for several of the core DOI mechanisms.

Perceived complexity (H1) has a negative and statistically significant effect on blockchain adoption intention ($\beta=-0.654$, $p=0.003$). Its marginal effect indicates that a one-unit increase in perceived complexity is associated with **a** 12.1 percentage-point reduction in the probability of reporting the highest adoption-intention category. H1 is therefore supported.

Perceived compatibility (H2) has a positive and statistically significant coefficient ($\beta=0.568$, $p=0.010$). The corresponding marginal effect is +10.5 percentage points, indicating that SMEs perceiving blockchain as more compatible with their existing organizational and technological

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

environment are substantially more likely to report very high adoption intention. H2 is supported.

In contrast, **perceived observability (H3)** does not have a statistically significant direct effect (β=−0.180, p=0.392). The estimated marginal effect is -3.3 percentage points and is statistically insignificant. Thus, H3 is not supported. Importantly, this non-significant result does not imply that observability is irrelevant to adoption; rather, it motivates a closer examination of its potential institutional contingency, which is explored in the following section.

Perceived cost (H4) is negatively associated with adoption intention (β=−0.515, p=0.016). A one-unit increase in perceived cost reduces the probability of belonging to the highest adoption category by approximately **9.5 percentage points**. H4 is therefore supported.

Perceived risk (H5) exhibits a negative and statistically significant relationship with adoption intention (β= -0.616, p=0.006). The associated marginal effect is **-11.4 percentage points,** making perceived risk one of the strongest negative DOI-related determinants in the baseline specification. H5 is supported.

Finally, **trialability (H6)** has a positive coefficient (β=0.399, p=0.069). Its marginal effect is **+7.4 percentage points**. The result is statistically significant at the 10% level and therefore provides marginal support for H6.

Overall, the baseline estimation supports four of the six DOI hypotheses at conventional significance levels, provides marginal support for H6, and does not support H3. The results therefore suggest that DOI mechanisms are relevant to blockchain adoption among Moroccan SMEs, but that the classical positive prediction concerning observability does not hold as a direct effect in this setting.

4.3 Organizational and Environmental Conditions

The inclusion of the contextual TOE variables provides additional insight into the conditions under which Moroccan SMEs evaluate blockchain adoption.

Regulatory trust (REGU) has a positive and statistically significant association with adoption intention (β=0.470, p=0.029). The corresponding marginal effect indicates an 8.7 percentage-point increase in the probability of reporting very high adoption intention. This result suggests that confidence in the regulatory environment constitutes an important environmental condition for blockchain adoption.

Financial slack (FUND) exhibits an even stronger positive association (β=0.698, p=0.003). The marginal effect is +12.9 percentage points, making financial slack the strongest positive predictor in the baseline specification. This finding indicates that the availability of financial resources may be more consequential for adoption than structural firm size itself.

By contrast, firm size (SIZE) is not statistically significant (β=0.089, p=0.387), with a marginal effect of only +1.6 percentage points. Thus, after accounting for innovation perceptions and contextual conditions, larger organizational size does not appear to provide an independent adoption advantage in the present sample.

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

Industry sector is statistically significant: firms classified in high-technology sectors display a positive coefficient (β=0.449, p=0.046) and an estimated marginal effect of +8.3 percentage points**.**

Taken together, these findings support the value of introducing organizational and environmental conditions alongside DOI attributes. In particular, financial slack and regulatory trust appear more substantively important than firm size in explaining adoption intention.

4.4 Institutional Contingency of Observability: Exploratory Analysis

The non-significant direct effect of observability raises an important question: does observability fail to influence adoption generally, or does its effect depend on the institutional conditions surrounding the firm?

To investigate this possibility, an exploratory post-hoc analysis was conducted using an extended Ordered Probit specification. The interaction between mean-centered observability (OBSVc) and mean-centered regulatory trust (REGUc) was introduced to test whether the effect of observability varies according to SMEs' confidence in the regulatory environment.

The analysis should be interpreted as exploratory and hypothesis-generating rather than confirmatory, because the interaction was not specified among the original a priori hypotheses and was motivated by the non-significant direct effect observed in the baseline model.

The results demonstrate that the interaction between observability and regulatory trust is positive and statistically significant (β=0.342, SE = 0.156, p<0.05). This finding indicates that the relationship between perceived observability and blockchain adoption intention varies according to SMEs' level of regulatory trust. The inclusion of the interaction term also improves the explanatory performance of the model, with the McFadden pseudo-R^2 increasing from 0.18 in the baseline specification to 0.231 in the extended specification. The likelihood-ratio test confirms that the extended model provides a statistically significant improvement over the baseline model ($\chi 2$=6.84, p=0.009). Importantly, the direct effect of observability remains statistically insignificant in the interaction model (β=-0.192, SE=0.205), whereas regulatory trust remains positive and statistically significant (β=0.465, SE = 0.197, p<0.05). These results suggest that regulatory trust does not simply exert an independent influence on adoption intention but may condition the extent to which observable evidence of successful blockchain applications translates into stronger adoption intentions. Because interaction coefficients in nonlinear models cannot be interpreted directly in terms of changes in predicted probabilities, conditional average marginal effects were subsequently estimated at low and high levels of regulatory trust.

4.4.1 Interaction EFFECT

The results show that the interaction between observability and regulatory trust is positive and statistically significant:

$$\beta OBSV \times REGU = 0.342,\ SE = 0.156,\ p<0.05.$$

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

Thus, the relationship between observability and adoption intention varies significantly with the level of regulatory trust.

The inclusion of the interaction also improves the explanatory performance of the model. The pseudo-R^2 increases from 0.18 in Model 1 to 0.231 in Model 2**,** corresponding to an increase of 0.051. The likelihood-ratio test confirms that the extended specification provides a statistically significant improvement over the baseline model ($\chi 2=6.84$, $p=0.009$).

The direct coefficient of observability remains statistically insignificant in the interaction model ($\beta=-0.192$, $SE=0.205$), whereas regulatory trust remains positive and significant ($\beta=0.465$, $p<0.05$). The interaction therefore cannot be interpreted as simply reflecting the independent effect of regulatory trust. Rather, it indicates that the effect of observability changes systematically as regulatory trust increases.

4.4.2 Conditional Marginal Effects

Because interaction coefficients in nonlinear probability models are not directly interpretable as changes in predicted probabilities, conditional average marginal effects were estimated for the highest adoption-intention category.

At a low level of regulatory trust (-1 SD)**,** the effect of observability is negative but statistically insignificant: AME = -1.8 pp, p = 0.61.

Thus, when SMEs have limited confidence in the regulatory environment, observing successful blockchain applications does not significantly increase their probability of reporting high adoption intention.

At **a** high level of regulatory trust (+1 SD)**,** the relationship changes substantially. The marginal effect of observability becomes positive and statistically significant: AME=+6.3 pp,p=0.03.

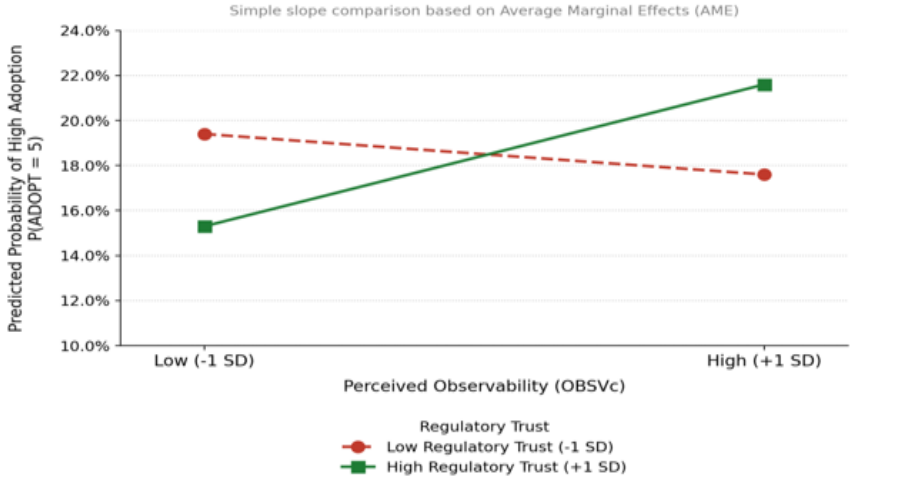
Hence, under relatively high regulatory trust, a one-unit increase in perceived observability is associated with a 6.3 percentage-point increase in the probability of reporting the highest adoption-intention category. Figure 1 provides a graphical representation of this conditional relationship. At low regulatory trust, the predicted probability of high adoption changes little as observability increases. At high regulatory trust, by contrast, the slope is positive and statistically significant.

These results provide exploratory evidence consistent with an institutional contingency of the observability mechanism**.** In other words, visibility of successful blockchain applications appears insufficient by itself to stimulate adoption intention. Its potential influence becomes more pronounced when SMEs operate under conditions of greater regulatory confidence. Because this interaction was identified post hoc and estimated using the same sample used for the baseline model, the result should not be interpreted as definitive causal evidence. Instead, it provides a theoretically relevant empirical pattern that warrants replication using an independent sample.

ISSN 1533-9211

DOI: 10.5281/zenodo.22226058

Figure 1: Predictive Probability P(ADOPT = 5) across REGU and OBSV Conditions



Note: *The solid line represents high regulatory trust (+1 SD) and the dashed line represents low regulatory trust (-1 SD).*

4.5 Robustness Checks

Three complementary robustness procedures were conducted to assess whether the main findings depend on the estimator, measurement approach, or sample composition.

4.5.1 Alternative Estimator: Ordered Logit

First, the baseline specification was re-estimated using an Ordered Logit model. The signs, relative magnitudes, and significance patterns of the principal determinants remain consistent with the Ordered Probit estimates. Perceived complexity and risk remain negative and highly significant, compatibility remains positive and significant, perceived cost remains negative and significant, while trialability remains positive at the 10% level and observability remains statistically insignificant. Financial slack remains strongly positive. These results indicate that the principal conclusions are not driven by the normality assumption underlying the Ordered Probit error distribution.

4.5.2 Measurement Robustness: PLS-SEM

Second, PLS-SEM was used as a complementary measurement and structural validation exercise. The estimated paths are directionally consistent with the Ordered Probit findings: complexity is negative (-0.31^{***}), compatibility is positive (0.27^{**}), cost is negative (-0.22^{**}), risk is negative (-0.29^{***}), trialability is positive (0.16^{*}), regulatory trust is positive (0.19^{**}), and financial slack is strongly positive (0.33^{***}). Observability remains non-significant (-0.07), while firm size is also non-significant (0.05). The consistency between the measurement-based analysis and the ordinal econometric estimates reinforces the stability of the principal relationships. Importantly, PLS-SEM is used here as a complementary validation procedure rather than as a replacement for the Ordered Probit model, since the dependent

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

variable is ordinal and the Ordered Probit specification is the principal inferential model of the study.

4.5.3 Sub-Sample Robustness

Finally, the model was re-estimated after excluding micro-enterprises with fewer than ten employees and after excluding firms operating in the high-technology sector.

When micro-enterprises are excluded (n=78 excluded), the principal relationships remain stable: complexity remains strongly negative (−0.71∗∗∗), risk remains negative (−0.65∗∗∗), and financial slack remains strongly positive (0.72∗∗∗). Firm size remains statistically insignificant (p=0.51). Excluding high-technology firms (n=48) produces a broadly similar pattern, although the compatibility effect becomes weaker and reaches only marginal significance (p=0.08). This suggests that compatibility may be particularly important among technologically oriented firms.

Overall, the robustness analyses indicate that the principal findings are stable across alternative estimators, measurement-based validation, and relevant sub-sample specifications.

4.6 Summary of Hypothesis Testing

Table 5 provides a consolidated overview of the empirical evidence concerning the hypothesized relationships and the exploratory institutional-contingency analysis. Overall, the findings support the relevance of the DOI perspective while also revealing important contextual dependencies. Perceived complexity, cost, and risk constitute significant barriers to blockchain adoption, whereas compatibility and trialability contribute positively to adoption intention. The absence of a significant direct effect of observability is particularly noteworthy, as its interaction with regulatory trust is positive and statistically significant. This pattern suggests that the informational value of observable blockchain applications is not independent of the institutional environment: observable evidence appears more likely to translate into adoption intention when SMEs have greater confidence in the regulatory framework. The results therefore provide preliminary evidence that DOI mechanisms may operate conditionally rather than uniformly across institutional contexts.

Table 5: Summary of Hypothesis Testing

Hypothesis	Relationship	Result	Decision
H1	Complexity → Adoption (−)	β = −0.654***; AME = −12.1 pp	**Accepted**
H2	Compatibility → Adoption (+)	β = 0.568**; AME = +10.5 pp	**Accepted**
H3	Observability → Adoption (+)	β = −0.180; p = .392	**Not Accepted**
H4	Cost → Adoption (−)	β = −0.515**; AME = −9.5 pp	**Accepted**
H5	Risk → Adoption (−)	β = −0.616***; AME = −11.4 pp	**Accepted**
H6	Trialability → Adoption (+)	β = 0.399*; AME = +7.4 pp	**Marginally supported**
Exploratory	Observability × Regulatory Trust → Adoption	β = 0.342**; AME = +6.3 pp at high REGU	**Exploratory support**

Source: Authors

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

5. DISCUSSION

5.1 Main Findings and Interpretation

This study examined the determinants of blockchain adoption intention among Moroccan SMEs by combining the innovation attributes emphasized by Diffusion of Innovations (DOI) theory with selected organizational and environmental conditions derived from the Technology-Organization-Environment (TOE) framework. The results show that blockchain adoption intention is shaped by a combination of technological perceptions, organizational resources, and institutional conditions. Perceived complexity, cost, and risk emerge as significant barriers, whereas compatibility and trialability positively influence adoption intention. At the organizational and environmental levels, financial slack and regulatory trust are positively associated with adoption intention, while firm size does not exhibit a statistically significant independent effect. This overall pattern is consistent with the broader blockchain adoption literature, which indicates that technological, organizational, and environmental factors jointly influence adoption decisions (Clohessy & Acton, 2019; Wong et al., 2020; Mishra et al., 2024). Indeed, a recent meta-analysis of 37 empirical studies confirms that technological, organizational, and environmental factors are all relevant to blockchain adoption, with compatibility emerging as one of the recurrent technological determinants (Mishra et al., 2024).

The findings also extend earlier evidence from the Moroccan context. Allam and Lalaoui (2023), using a qualitative TOE-based approach, identified technological capabilities, government support, regulatory conditions, and organizational characteristics as relevant to blockchain adoption among Moroccan SMEs. The present study complements this evidence by quantitatively examining specific innovation attributes and organizational conditions and, more importantly, by identifying a potential institutional contingency in the relationship between observability and adoption intention. This distinction is important because it moves the analysis beyond the question of which factors influence adoption toward the more theoretically demanding question of under what conditions specific innovation attributes become effective**.**

The results therefore support a contextualized interpretation of DOI. Rogers (2003) emphasizes that perceived characteristics of an innovation influence its rate of adoption, while TOE highlights the importance of organizational readiness and environmental conditions (Tornatzky & Fleischer, 1990; Baker, 2012). Recent evidence from emerging markets reinforces this contextual perspective: Staley and Amankwa (2026), in a systematic review of 44 studies, identify technological, organizational, and institutional factors as the three major categories shaping blockchain adoption and emphasize the importance of resource availability, regulatory conditions, and stakeholder trust. The present findings extend this literature by suggesting that these dimensions may not merely operate independently but can condition the effectiveness of particular DOI mechanisms.

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

5.2 DOI Mechanisms: Barriers and Enablers

Perceived Complexity

Perceived complexity emerges as one of the strongest barriers to blockchain adoption intention ($\beta=-0.654$, $p<0.01$), reducing the probability of reporting the highest adoption-intention category by approximately 12.1 percentage points. This finding is consistent with Rogers' (2003) proposition that innovations perceived as difficult to understand or use are adopted more slowly. It is also consistent with previous empirical research on blockchain adoption. Clohessy and Acton (2019) and Wong et al. (2020) identify technological complexity as an important barrier to blockchain adoption, particularly among firms that lack the technological capabilities necessary to evaluate and integrate the technology.

The result can also be interpreted through the concept of absorptive capacity (Cohen & Levinthal, 1990). For SMEs with limited specialized human capital, blockchain's technical architecture may create a substantial cognitive and organizational burden. The problem is therefore not necessarily that blockchain is inherently too complex, but that firms may lack the knowledge and capabilities required to understand its potential applications. This interpretation is consistent with recent evidence showing that technological readiness and organizational capabilities remain important dimensions of blockchain adoption in SMEs and emerging markets (Mishra et al., 2024; Staley & Amankwa, 2026).

Perceived Compatibility

Perceived compatibility has a positive and statistically significant effect on adoption intention ($\beta=0.568$, $p<0.05$), increasing the probability of reporting the highest adoption category by approximately 10.5 percentage points. This result provides direct support for Rogers' (2003) proposition that innovations compatible with existing organizational practices, values, and technological systems are more readily adopted. It is also consistent with Moore and Benbasat (1991), who conceptualize compatibility as a central innovation characteristic, and with Wong et al. (2020), who identify compatibility as a relevant determinant of blockchain adoption among Malaysian SMEs.

The finding is further supported by recent meta-analytic evidence. Mishra et al. (2024) identify technology compatibility among the recurrent determinants of blockchain adoption across 37 empirical studies. The consistency across studies suggests that compatibility is one of the more robust DOI mechanisms in blockchain adoption research. For Moroccan SMEs, the implication is that blockchain may be more readily accepted when it is perceived as complementary to existing business processes rather than as a technology requiring a complete organizational transformation.

Perceived Cost

Perceived cost also represents a significant barrier ($\beta=-0.515$, $p<0.05$), reducing the probability of reporting the highest adoption-intention category by approximately 9.5 percentage points. This result is consistent with previous research emphasizing the financial burden associated with blockchain implementation (Wong et al., 2020; Alazab et al., 2021). For SMEs, these

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

costs may include infrastructure, system integration, employee training, specialized expertise, and experimentation before tangible benefits are realized.

The importance of cost becomes particularly clear when considered together with the positive effect of financial slack observed in the organizational model. Firms that perceive blockchain as costly but possess sufficient financial resources may be better positioned to experiment with and implement the technology. Recent SME research similarly emphasizes the role of organizational and resource-related conditions in blockchain implementation (Asadi et al., 2023; Rakshit et al., 2024). This interpretation also connects the TOE perspective with the resource-based view, according to which organizational resources can provide the capacity to pursue strategic technological opportunities (Barney, 1991).

Perceived Risk

Perceived risk constitutes another important barrier ($\beta=-0.616$, $p<0.01$), reducing the probability of reporting the highest adoption-intention category by approximately 11.4 percentage points. This finding is consistent with Clohessy and Acton (2019) and Wong et al. (2020), who emphasize the role of uncertainty and perceived risk in blockchain adoption.

In the Moroccan context, however, risk should not be understood exclusively as technological risk. It may also reflect uncertainty concerning legal recognition, regulatory treatment, security, data governance, and the future institutional environment surrounding blockchain. Kshetri (2017) emphasizes the importance of institutional and regulatory conditions in blockchain development, particularly in emerging economies. More recent evidence confirms that regulatory conditions and stakeholder trust constitute important institutional dimensions of blockchain adoption in emerging markets (Staley & Amankwa, 2026). This interpretation helps explain why regulatory trust subsequently emerges as a significant positive determinant in the TOE component of the present study.

5.3 Trialability: A Positive but Constrained Mechanism

Trialability has a positive but relatively weaker relationship with adoption intention ($\beta=0.399$, $p<0.10$), corresponding to an increase of approximately 7.4 percentage points in the probability of reporting the highest adoption category. This finding provides partial support for Rogers' (2003) proposition that innovations that can be experimented with on a limited basis are more readily adopted.

However, the comparatively weaker statistical significance suggests that experimentation opportunities alone may not be sufficient. Trialability is likely to be effective when firms have access to affordable testing environments, technical assistance, and an institutional framework that makes experimentation sufficiently credible and safe. This interpretation is consistent with the TOE perspective, which emphasizes that technological characteristics operate within organizational and environmental conditions (Tornatzky & Fleischer, 1990; Oliveira et al., 2014). The finding is also consistent with recent evidence from emerging markets. Staley and Amankwa (2026) identify resource availability, training, technological infrastructure, and institutional support among the conditions that influence blockchain adoption. Therefore,

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

trialability should not necessarily be viewed as a purely technological characteristic. In resource-constrained environments, it can be understood as an **ecosystem-dependent mechanism** whose effectiveness depends on whether SMEs can actually access opportunities for experimentation.

5.4 Institutional Contingency of Observability

The most theoretically consequential finding concerns perceived observability. In the baseline model, observability does not exert a statistically significant direct effect on blockchain adoption intention ($\beta=-0.180$, $p=0.392$). This result contrasts with the classical DOI expectation that visible results of an innovation should facilitate diffusion by allowing potential adopters to learn from the experiences of others (Rogers, 2003).

Nevertheless, the result is consistent with the mixed evidence reported in previous blockchain research. Clohessy and Acton (2019) found no significant effect of observability in their study, while Wong et al. (2020) reported only marginal evidence. The present finding therefore reinforces the possibility that observability does not operate as a universally effective determinant of blockchain adoption.

The exploratory interaction analysis provides a possible explanation. The interaction between observability and regulatory trust is positive and statistically significant ($\beta=0.342$, $p<0.05$). At a low level of regulatory trust (-1 SD), the marginal effect of observability is negative but statistically insignificant (-1.8 percentage points, $p=0.61$). At a high level of regulatory trust (+1 SD), however, the marginal effect becomes positive and statistically significant (+6.3 percentage points, $p=0.03$).

This pattern suggests that observable evidence of successful blockchain adoption becomes more persuasive when SMEs have greater confidence in the institutional environment surrounding the technology. When regulatory trust is low, observing another firm's successful implementation may not provide sufficient reassurance because potential adopters may remain uncertain about whether the same legal, regulatory, and institutional conditions will apply to their own firms. By contrast, when regulatory trust is high, observable examples may become more credible and transferable, allowing SMEs to use other firms' experiences as a basis for their own adoption decisions.

This interpretation provides an important connection between DOI and the institutional-void perspective of Khanna and Palepu (2010). Where institutional arrangements are incomplete or perceived as uncertain, firms may face greater difficulty interpreting market signals and assessing whether successful experiences can be replicated. Recent systematic evidence from emerging markets similarly emphasizes stakeholder trust, government measures, and regulatory preparedness as institutional determinants of blockchain adoption (Staley & Amankwa, 2026).

The theoretical implication is therefore not simply that DOI and TOE should be combined. Rather, the findings suggest that contextual conditions may determine whether specific DOI mechanisms operate as predicted**.** DOI helps explain what firms perceive about an innovation,

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

whereas organizational resources and institutional conditions may help determine when these perceptions become sufficiently credible to influence adoption intention. Observability can consequently be interpreted as an institutionally contingent mechanism rather than a universally effective driver of diffusion.

This interpretation also extends previous blockchain research. Existing studies have identified mixed evidence concerning observability, but the present exploratory analysis provides an initial explanation for why the effect may vary across contexts. Nevertheless, this result must be treated cautiously. The interaction was identified through an exploratory post-hoc analysis rather than an a priori hypothesis and was estimated using the same sample used to assess the direct effect. It should therefore be considered hypothesis-generating rather than definitive evidence of causal moderation**.** Independent-sample replication and longitudinal or experimental research are required to establish whether regulatory trust systematically conditions the effect of observability.

5.5 TOE Conditions: Financial Slack, Regulatory Trust and Firm Size

Financial slack has a strong positive effect on adoption intention ($\beta=0.698$, $p<0.001$), increasing the probability of reporting the highest adoption-intention category by approximately 12.9 percentage points. This finding is consistent with the organizational dimension of TOE, which emphasizes organizational readiness as a determinant of technological adoption (Tornatzky & Fleischer, 1990; Baker, 2012). It is also consistent with blockchain research emphasizing the importance of financial and organizational resources for SMEs (Clohessy & Acton, 2019; Asadi et al., 2023).

Recent evidence further reinforces this interpretation. Asadi et al. (2023) emphasize organizational and resource-related factors in blockchain implementation among SMEs, while Rakshit et al. (2024), examining SMEs in Nigeria, Ghana, and Kenya, demonstrate the relevance of technological and organizational conditions in blockchain-related outcomes. These findings support the argument that financial resources may be more directly relevant to adoption capacity than broad structural indicators of firm size. The positive effect of financial slack can also be interpreted through the resource-based view (Barney, 1991). Financial resources allow firms to absorb experimentation costs, acquire specialized expertise, invest in complementary technologies, and tolerate uncertainty during the early stages of adoption. They may also facilitate the development of absorptive capacity (Cohen & Levinthal, 1990), allowing SMEs to acquire and apply the knowledge required to evaluate blockchain applications.

Regulatory trust is also positively associated with adoption intention ($\beta=0.470$, $p<0.05$), corresponding to an increase of approximately 8.7 percentage points in the probability of reporting the highest adoption category. This result reinforces the environmental dimension of TOE and is consistent with the growing literature emphasizing regulatory and institutional conditions in blockchain adoption (Tornatzky & Fleischer, 1990; Oliveira et al., 2014; Kshetri, 2017). The importance of regulatory trust becomes even clearer when considered together with the interaction result. Regulatory trust does not merely have a direct relationship with adoption

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

intention; it also appears to condition the relationship between observability and adoption. This is particularly consistent with recent evidence from emerging markets showing that stakeholder trust and government measures are important institutional determinants of blockchain adoption (Staley & Amankwa, 2026).

By contrast, firm size does not have a statistically significant effect (p=0.387). This result suggests that structural size alone may be insufficient to explain blockchain adoption once financial resources and regulatory trust are considered. Rather than concluding that size is irrelevant, the finding indicates that actionable organizational capacity may be more informative than size itself in the present context.
This distinction is consistent with a resource-based interpretation in which what firms can actually mobilize may matter more than their formal scale (Barney, 1991). Overall, the TOE results indicate that blockchain adoption among Moroccan SMEs depends not only on perceptions of the technology but also on whether firms possess the resources required to experiment with it and whether they perceive the institutional environment as sufficiently trustworthy. This reinforces the broader conclusion of recent blockchain research that adoption in emerging markets is highly context-dependent (Mishra et al., 2024; Staley & Amankwa, 2026).

6. CONCLUSION

6.1 Synthesis of the Main Findings

This study investigated blockchain adoption intention among Moroccan SMEs through the combined perspective of Diffusion of Innovations (DOI) theory and the Technology-Organization-Environment (TOE) framework. The analysis demonstrates that adoption intention is shaped by technological perceptions, organizational resources, and institutional conditions. Perceived complexity, cost, and risk constitute significant barriers, whereas compatibility and trialability positively influence adoption intention. Financial slack and regulatory trust also emerge as significant positive determinants, while firm size does not exhibit a statistically significant independent effect.

These findings broadly confirm previous blockchain adoption research while also extending it. The consistency of the effects of compatibility, complexity, cost, and organizational conditions with previous studies is supported by both empirical research and recent synthesis evidence (Clohessy & Acton, 2019; Wong et al., 2020; Mishra et al., 2024). Mishra et al. (2024), based on 37 empirical studies, demonstrate that technological, organizational, and environmental factors jointly shape blockchain adoption, providing broader support for the multidimensional approach adopted here.

The most important finding concerns observability. Although observability does not have a significant direct effect on adoption intention, its interaction with regulatory trust is positive and statistically significant. Observability is ineffective when regulatory trust is low but becomes positive and significant when regulatory trust is high. This exploratory result suggests

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

that the visibility of successful innovation may not be sufficient to generate adoption when firms lack confidence in the institutional environment.

6.2 Theoretical Contributions

This study makes three main theoretical contributions.

First, it provides further evidence that DOI remains a useful framework for explaining blockchain adoption among SMEs. The significant effects of complexity, compatibility, cost, risk, and trialability confirm the continuing relevance of perceived innovation attributes (Rogers, 2003; Moore & Benbasat, 1991). At the same time, the non-significant direct effect of observability demonstrates that DOI attributes should not necessarily be assumed to operate uniformly across institutional contexts.

Second, the study goes beyond a simple integration of DOI and TOE. The contribution is not merely to place technological, organizational, and environmental variables in the same model. Rather, the findings suggest that organizational and institutional conditions may shape the effectiveness of particular DOI mechanisms**.** The observability × regulatory trust relationship provides exploratory evidence that the institutional environment may determine whether observable evidence becomes sufficiently credible to influence adoption intention. This interpretation extends the DOI perspective through an institutional-contingency argument consistent with Khanna and Palepu (2010).

Third, the study contributes to the understanding of organizational readiness in emerging-market SMEs. The significant effect of financial slack, combined with the non-significant effect of firm size, suggests that the ability to mobilize resources may be more important than structural organizational scale. This connects the TOE framework with the resource-based view (Barney, 1991) and absorptive-capacity perspective (Cohen & Levinthal, 1990). Recent evidence from African SMEs also supports the relevance of technological and organizational conditions for blockchain-related outcomes (Rakshit et al., 2024). Taken together, these contributions support a more contextualized interpretation of technology diffusion:

DOI explains what SMEs perceive about an innovation, whereas organizational and institutional conditions help determine when those perceptions translate into adoption intention.

This proposition is particularly relevant to emerging markets, where technological readiness, organizational resources, and institutional conditions may differ substantially across contexts. The recent systematic review by Staley and Amankwa (2026) reinforces this contextual perspective by identifying technological, organizational, and institutional factors as the principal dimensions of blockchain adoption in emerging markets.

6.3 Practical and Policy Implications

The findings have several implications for SME managers. First, given the strong negative effects of complexity, cost, and risk, blockchain adoption should be approached incrementally. Managers should prioritize clearly defined business problems and applications that are compatible with existing organizational processes. Training and access to specialized technical

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

expertise can also help SMEs develop the absorptive capacity required to understand and evaluate blockchain (Cohen & Levinthal, 1990).

Second, SMEs should use experimentation as a mechanism for reducing uncertainty. Pilot projects, controlled testing environments, and partnerships with technology providers can allow firms to assess blockchain applications before committing substantial resources. However, the relatively modest effect of trialability suggests that experimentation needs to be accompanied by adequate financial and technical support.

Third, policymakers should not rely exclusively on awareness campaigns or technological infrastructure. The negative effect of cost and the positive effect of financial slack suggest that targeted financial mechanisms could facilitate experimentation and reduce adoption barriers. This is consistent with recent evidence emphasizing resource availability as an important organizational condition for blockchain adoption in emerging markets (Asadi et al., 2023; Staley & Amankwa, 2026).

The most distinctive policy implication concerns regulatory trust and observability. The finding that observability becomes effective when regulatory trust is high suggests that policymakers should not simply increase the visibility of blockchain success stories. They should also make the institutional conditions surrounding those cases transparent and credible. Verified pilot projects could therefore be accompanied by information concerning regulatory status, legal safeguards, implementation requirements, data protection, and replicability.

Such an approach would allow policymakers to transform observability from a passive source of information into a credible mechanism of diffusion**.** This is consistent with recent systematic evidence showing that regulatory clarity, government measures, and stakeholder trust are particularly relevant institutional conditions for blockchain adoption in emerging markets (Staley & Amankwa, 2026).

More broadly, the results suggest that blockchain policy for SMEs should move from a purely technology-centered approach toward an ecosystem-based approach. The objective should be to make blockchain understandable, compatible, affordable, testable, and institutionally credible**.** Such an approach is more consistent with the multidimensional nature of adoption identified by the TOE literature and with the emerging-market evidence synthesized by Mishra et al. (2024) and Staley and Amankwa (2026).

6.4 Limitations and Future Research

Several limitations should be acknowledged. First, the cross-sectional design captures adoption intention at a particular point in time and does not permit observation of the transition from intention to actual implementation and sustained use. Future research should therefore employ longitudinal or multi-wave designs to examine how perceptions of complexity, cost, risk, compatibility, and observability evolve as SMEs gain practical experience with blockchain.

Second, the study focuses on adoption intention rather than observed post-adoption behavior. Although intention represents an important stage of the innovation-decision process, it does not necessarily imply implementation or continued use. Future studies could distinguish

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

between awareness, experimentation, initial adoption, and sustained use. Such an approach would provide a more complete understanding of the diffusion process.

Third, the observability × regulatory trust interaction should be interpreted cautiously. The interaction was identified through an exploratory post-hoc analysis rather than specified as an a priori hypothesis. It was also estimated using the same sample used to examine the direct effect of observability. Consequently, the result should be regarded as hypothesis-generating rather than definitive evidence of causal moderation**.** Future research should replicate this interaction using independent samples and, ideally, longitudinal or experimental designs.

Fourth, the present study focuses on Morocco. Although this context is theoretically valuable because it represents an emerging economy in which technological development coexists with evolving institutional conditions, the findings cannot automatically be generalized to other emerging markets. Comparative studies involving Morocco and other African, Middle Eastern, or Asian economies could examine whether regulatory trust systematically conditions observability across different institutional environments.

Finally, future research could directly test the mechanism suggested by the present study. For example, an experiment could expose different groups of SMEs to the same blockchain success story while varying the level of regulatory assurance provided. Such a design would allow researchers to determine whether observable evidence produces stronger adoption intentions when accompanied by credible institutional assurances. This would provide a direct test of the proposition that institutional conditions determine when DOI mechanisms operate as predicted**.**

References

1) Agence Nationale de Réglementation des Télécommunications. (2023). *Enquête nationale sur les Technologies de l'Information et de la Communication auprès des ménages et des entreprises*. Édition 2022/2023. Royaumes du Maroc - ANRT. https://www.anrt.ma

2) Alazab, M., Alhyari, S., Awajan, A., et Abdallah, AB (2021). Blockchain technology in supply chain management: an empirical study of the factors affecting user adoption/acceptance. *Cluster Computing* , *24* (1), 83-101. https://doi.org/10.1007/s10586-020-03200-4.

3) Allam, K., & Lalaoui, S. (2023). *Blockchain Adoption Among Smes In Morocco: A Qualitative Study.* Fintech And Ai In Finance, 1(1). Https://Doi.Org/10.7190/Fintaf.V1i1.279

4) Armstrong, J. S., & Overton, T. S. (1977). Estimating nonresponse bias in mail surveys. Journal of Marketing Research, 14(3), 396-402.

5) Asadi, M., Hashemkhani Zolfani, S., Pamučar, D., Salimi, J., & Saberi, S. (2023). *The appropriation of blockchain implementation in the supply chain of SMEs based on fuzzy LMAW*. Engineering Applications of Artificial Intelligence, 123**,** 106169. https://doi.org/10.1016/j.engappai.2023.106169

6) Baker, J. (2012). The technology-organization-environment framework. In Y. K. Dwivedi, M. R. Wade, & S. L. Schneberger (Eds.), *Information Systems Theory: Explaining and Predicting Our Digital Society, Vol. 1* (Integrated Series in Information Systems, Vol. 28, pp. 231-245). Springer. https://doi.org/10.1007/978-1-4419-6108-2_12

7) Bank Al-Maghrib. (2023). *Rapport annuel sur la supervision bancaire et les développements du cadre réglementaire des actifs numériques*. Banque Centrale du Royaume du Maroc - BAM. https://www.bkam.ma

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

8) Barney, J. (1991). Firm resources and sustained competitive advantage. Journal of Management, 17(1), 99-120. https://doi.org/10.1177/014920639101700108.

9) Bhat, M. A., Khan, S. T., Alkhwaldi, A. F., & Abdulmuhsin, A. A. (2026). *Unlocking the potential: exploring the drivers behind blockchain and its influence on SMEs performance within TOE framework*. The TQM Journal, 38(6), 1371-1398. https://doi.org/10.1108/TQM-07-2024-0232

10) Bourgeois, L. J. III (1981), On the Measurement of Organizational Slack, The Academy of Management Review, Vol. 6, No. 1 , pp. 29-39. https://doi.org/10.2307/257138.

11) Brant, R. (1990). Assessing proportionality in the proportional odds model for ordinal logistic regression. Biometrics, 46(4), 1171-1178. https://doi.org/10.2307/2532457.

12) Brislin, R. W. (1970). Back-translation for cross-cultural research. Journal of Cross-Cultural Psychology, 1(3), 185-216. https://doi.org/10.1177/135910457000100301.

13) Brousseau E & Pénard T. (2007), The Economics of Digital Business Models: A Framework for Analyzing the Economics of Platforms, *Review of Network Economics, Vol. 6, No. 2,* https://ssrn.com/abstract=1086370.

14) Clohessy, T., & Acton, T. (2019). Investigating the influence of organizational factors on blockchain adoption: An innovation theory perspective. Industrial Management & Data Systems, 119(7), 1457-1491. https://doi.org/10.1108/IMDS-08-2018-0365.

15) Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. Administrative Science Quarterly, 35(1), 128-152. https://doi.org/10.2307/2393553.

16) Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research, 18(1), 39-50.

17) Greene, W. H. (2012). Econometric analysis (7th ed.). Pearson.

18) Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). Multivariate data analysis (8th ed.). Cengage Learning.

19) Haut-Commissariat au Plan. (2022). *Enquête nationale auprès des entreprises : Les contraintes de développement et d'accès au financement des PME au Maroc*. Royaume du Maroc - HCP. https://www.hcp.ma

20) Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. Journal of the Academy of Marketing Science, 43(1), 115-135. https://doi.org/10.1007/s11747-014-0403-8.

21) Iansiti, M., & Lakhani, K. R. (2017). The truth about blockchain. Harvard Business Review, 95(1), 118-127.

22) Kamble, S., Gunasekaran, A., & Arha, H. (2019). Understanding the blockchain technology adoption in supply chains-Indian context. International Journal of Production Research, 57(7), 2009-2033. https://doi.org/10.1080/00207543.2018.1518610.

23) Khanna, T., & Palepu, K. G. (2010). Winning in emerging markets: A road map for strategy and execution. Harvard Business Press.

24) Kshetri, N. (2017). Blockchain's Roles in Strengthening Cybersecurity and Protecting Privacy. Telecommunications Policy, 41, 1027-1038. https://doi.org/10.1016/j.telpol.2017.09.003.

25) Lindell, M. K., & Whitney, D. J. (2001). Accounting for common method variance in cross-sectional research designs. *Journal of Applied Psychology*, 86(1), 114-121. https://doi.org/10.1037/0021-9010.86.1.114

26) Makhrout, S., Errassaa, N., El Hamidi, N., & Ait Hbibi, A. (2024). The determinants of blockchain adoption intention by Moroccan SMEs: a transaction cost theory perspective. *International Journal of Strategic Management and Economic Studies (IJSMES)*, 3(5), 1696-1711. DOI: 10.5281/zenodo.13993252

The Seybold Report
ISSN 1533-9211
DOI: 10.5281/zenodo.22226058

27) Mishra, N. K., Raj, A., Jeyaraj, A., & Gupta, R. (2024). *Antecedents and Outcomes of Blockchain Technology Adoption: Meta-Analysis.* Journal of Computer Information Systems, 64(3), 342-359. https://doi.org/10.1080/08874417.2023.2205370

28) Moore, G. C., & Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. Information Systems Research, 2(3), 192-222. https://doi.org/10.1287/isre.2.3.192.

29) Nakamoto, S. (2008). Bitcoin: A peer-to-peer electronic cash system. https://bitcoin.org/bitcoin.pdf.

30) Nunnally, J. C., & Bernstein, I. H. (1994). Psychometric theory (3rd ed.). McGraw-Hill.

31) Oliveira, T., Thomas, M., & Espadanal, M. (2014). Assessing the determinants of cloud computing adoption: An analysis of the manufacturing and services sectors. Information & Management, 51(5), 497-510. https://doi.org/10.1016/j.im.2014.03.006.

32) Podsakoff, P. M., MacKenzie, S. B., Lee, J. Y., & Podsakoff, N. P. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. Journal of Applied Psychology, 88(5), 879-903.

33) Rakshit, S., Jeyaraj, A., & Paul, T. (2024). *SME Performance Through Blockchain Technologies*. Journal of Computer Information Systems, 64(2), 204-218. https://doi.org/10.1080/08874417.2023.2187482

34) Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.

35) Staley, I., & Amankwa, E. (2026). *Blockchain adoption in emerging markets: A systematic review of factors and perceived impacts*. Data & Policy, 8**,** e23. https://doi.org/10.1017/dap.2026.10071

36) Swan, M. (2015). Blockchain: Blueprint for a new economy. O'Reilly Media.

37) Tornatzky, L. G., & Fleischer, M. (1990). The processes of technological innovation. Lexington Books.

38) Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. MIS Quarterly, 27(3), 425-478. https://doi.org/10.2307/30036540.

39) Williamson, O. E. (1985). The economic institutions of capitalism. Free Press.

40) Wong, L. W., Leong, L. Y., Hew, J. J., Tan, G. W. H., & Ooi, K. B. (2020). Time to seize the digital evolution: Adoption of blockchain in operations and supply chain management among Malaysian SMEs. International Journal of Information Management, 52, 101997. https://doi.org/10.1016/j.ijinfomgt.2019.08.005.

41) Wooldridge, J. M. (2010). Econometric analysis of cross section and panel data (2nd ed.). MIT Press.

42) World Bank. (2020). *Doing Business 2020: Comparing Business Regulation in 190 Economies*. World Bank Group. https://doi.org/10.1596/978-1-4648-1440-2