

# DECODING THE BLOCKCHAIN PRODUCTIVITY PARADOX IN SMES: A QUALITATIVE INVESTIGATION OF COGNITIVE BARRIERS AND INSTITUTIONAL PRESSURES

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**Abstract:** While blockchain technology (BCT) has emerged as a disruptive force capable of redefining trust and transparency in global supply chains, its adoption among Small and Medium-Sized Enterprises (SMEs) remains low, resulting in a digital productivity paradox. Existing literature predominantly attributes this technological lag to financial constraints and complex technical requirements. This study challenges the traditional cost-centric paradigm by exploring the underlying cognitive, organizational, and institutional factors driving SME decision-making. Utilizing a qualitative, exploratory research design, 22 semi-structured in-depth interviews were conducted with strategic decision-makers across five SME sectors in Hungary. The theoretical framework synthesized the Technology Acceptance Model (TAM), the Unified Theory of Acceptance and Use of Technology (UTAUT), and Institutional Theory. An innovative "negative proof" thought experiment, assuming 100% external funding was applied to rigorously isolate cognitive barriers from financial constraints. The findings reveal that the primary barrier to adoption is a fundamental cognitive gap: the lack of technological awareness, profound fears regarding transparency (e.g., GDPR conflicts, trade secrets), and exceptionally low perceived business usefulness. Furthermore, SME innovation strategies regarding decentralized networks are structurally reactive. Adoption intentions are almost exclusively driven by coercive institutional isomorphism, specifically, the mandates of dominant multinational partners and regulatory compliance, rather than internal innovativeness. These insights emphasize that BCT must be treated as a socio-technical system, necessitating proactive mentoring from large corporate integrators and targeted regulatory frameworks to bridge the technological divide.

**Keywords:** Blockchain Adoption, Small and Medium-sized Enterprises (SMEs), Technology Acceptance Model (TAM), Institutional Theory, Cognitive Barriers, Productivity Paradox.  
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## INTRODUCTION

The global economy of the twenty-first century is undergoing a profound digital transformation driven by the exponential spread of Fourth Industrial Revolution technologies (Schwab, 2017). Within this paradigm shift, blockchain technology (BCT) has emerged from the shadow of cryptocurrencies to become a potential key driver of corporate competitiveness, fundamentally rewriting the concept of trust in the global economy (TAPSCOTT & TAPSCOTT, 2016). According to traditional institutional economics, economic exchange processes involve significant transaction costs stemming from a lack of trust, information asymmetry, and the need to enforce contracts through costly intermediaries (North, 1990). Blockchain promises to minimize these agent costs and frictions by providing a decentralized, immutable, and transparent distributed ledger (CASEY & VIGNA, 2018).

Despite these theoretical advantages, the corporate adop-

tion of blockchain is increasingly characterized by a "productivity paradox" (NAGY ET AL., 2025). Enterprises invest substantial resources into blockchain developments, yet the expected financial returns and efficiency gains often materialize with significant delay, or fail to manifest entirely, placing many blockchain solutions in the "trough of disillusionment" (GARTNER, 2023). The paradox between the theoretical promise and practical business reality highlights a critical gap, where the initial implementation costs often overshadow short-term profitability (SWAN, 2015; CASATI ET AL., 2024).

The mentioned productivity paradox and the resulting technological gap become particularly evident within the Small and Medium-Sized Enterprise (SME) sector. While multinational corporations possess the resources and R&D capacities to experiment with BCT, the SME sector faces a severe technological lag that poses a critical risk to their integration into global value chains (JACKSON & ALLEN,

2024; CHOTIA ET AL., 2025). Although the existing scientific discourse has extensively applied frameworks such as the Technology-Organization-Environment (TOE) and the Technology Acceptance Model (TAM) to evaluate adoption barriers, research focusing specifically on the Central and Eastern European (CEE) region, and particularly on the cognitive and institutional constraints of Hungarian SMEs, remains scarce (WONG ET AL., 2020). Prevailing studies frequently cite high costs as the primary obstacle for SMEs; however, psychological approaches suggest that decision-maker attitudes, such as the lack of technological awareness and low perceived usefulness, may play an equally decisive role (DAVIS, 1989; PARASURAMAN, 2000).

Therefore, the primary objective of this qualitative study is to investigate the underlying realities of blockchain adoption within the domestic SME ecosystem. Based on the identified research gaps and the integration of the Technology Acceptance Model with Institutional Theory, this study formulates and tests the following two primary hypotheses:

- Hypothesis 1 (H1): The primary barrier to blockchain adoption within the SME sector is not technological complexity or financial constraints, but rather a fundamental cognitive gap, characterized by the lack of technological awareness and a low level of perceived business usefulness.

- Hypothesis 2 (H2): The intention of SMEs to adopt blockchain technology is driven predominantly by external institutional pressures (coercive mandates from dominant partners or regulatory bodies) rather than internal organizational innovativeness or proactive strategy.

## LITERATURE REVIEW

### The Foundational Nature of Blockchain and the Productivity Paradox

The literature increasingly emphasizes that blockchain is not merely a disruptive, plug-and-play cost-reduction tool but a "foundational technology" whose economic benefits are realized indirectly through the establishment of data integrity and organizational trust (IANSITI & LAKHANI, 2017). Similar to the evolution of the TCP/IP protocol, the true value of BCT requires an ecosystem-level transformation over a longer time horizon (CASATI ET AL., 2024). This foundational nature explains the "Blockchain Productivity Paradox" observed in the early adoption phases: high initial implementation costs, complex maintenance, substantial energy requirements, and the need for specialized human capital often overshadow short-term profitability (KOUHIZADEH ET AL., 2021; NAGY, 2025; GÜRPINAR ET AL., 2025).

Furthermore, the paradox is deepened by the theoretical concept of "trustless trust." BCT supposedly eliminates traditional intermediaries by transferring trust to cryptographic codes and consensus mechanisms (BISWAS & GUPTA, 2019; PATHAK ET AL., 2025). However, as Meyers & Keymolen (2023) note through the concept of "functional fiction," trust does not disappear; it merely shifts from human intermediaries to technological experts and software, creating new forms of information asymmetry and vulnerability for non-technical users. Additionally, the "Garbage In, Garbage Out" (GIGO)

phenomenon and the "Oracle problem" demonstrate that blockchain only guarantees the integrity of data once it is on the ledger; it cannot verify the truthfulness of physical inputs, necessitating the integration of IoT sensors and maintaining a certain degree of institutional trust (CALDARELLI, 2020; HASSAN ET AL., 2024). Consequently, the cost-efficiency gains only emerge when the technology successfully mitigates ex-post opportunism and agency costs within a mature and reliable network (JEANNERET ET AL., 2024).

### Individual and Organizational Technology Acceptance Models (TAM, UTAUT, TRI)

Understanding SME adoption requires analyzing individual cognitive attitudes and organizational readiness. The Technology Acceptance Model (TAM) identifies Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) as the primary determinants of behavioral intention (DAVIS, 1989; ALTAMIMI ET AL., 2024). In the context of blockchain, PU is highly dependent on clear advantages such as transparency and transaction speed (HAMADEH ET AL., 2025). However, the inherent complexity of BCT, such as managing private keys and understanding cryptographic hashes often negatively impacts PEOU, creating a significant cognitive barrier (OBIDALLAH ET AL., 2024). If the system requires excessive cognitive effort, users tend to rely on familiar, centralized solutions like SQL databases (MALIK ET AL., 2021; DEGHANI ET AL., 2022).

The Unified Theory of Acceptance and Use of Technology (UTAUT) incorporates Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions (VENKATESH ET AL., 2003; AL-SULAMI ET AL., 2024). For BCT, Social Influence - the pressure from network partners or competitors - is a profound driver, reflecting the network-dependent nature of the technology (CHEN ET AL., 2023; CRICELLI ET AL., 2025). Conversely, the lack of Facilitating Conditions, such as adequate IT infrastructure and technical support, severely hinders adoption, particularly in emerging economies (AL-SULAMI ET AL., 2024). Additionally, the Technology Readiness Index (TRI) highlights that personality traits like optimism and innovativeness act as drivers, while technological insecurity serves as a strong deterrent (PARASURAMAN, 2000; ULLAH ET AL., 2021).

### Institutional Theory, TOE Framework, and SME Innovation Dynamics

The adoption of complex networked technologies in SMEs is best contextualized by integrating the Technology-Organization-Environment (TOE) framework (TORNATZKY & FLEISCHER, 1990) with Institutional Theory (DIMAGGIO & POWELL, 1983). The TOE framework underscores that technological complexity, top management support, and environmental pressures collectively dictate adoption readiness (OLIVEIRA ET AL., 2014). However, SMEs often lack the strategic resources, such as specialized human capital and capital reserves, required to proactively exploit BCT as a strategic asset (BHARDWAJ ET AL., 2021). Consequently, SME innovation behavior is predominantly reactive and driven by institutional isomorphism (DIMAGGIO & POWELL, 1983).

Coercive pressures from dominant multinational partners (e.g., mandates for supply chain tracking) or regulatory bodies (e.g., ESG reporting, Digital Product Passports) often force SMEs to adopt technologies merely to maintain market access and ensure survival (ORJI ET AL., 2020; LUSTENBERGER ET AL., 2021). Mimetic pressures also play a role, as companies copy successful competitors to reduce uncertainty under conditions of technological immaturity. Ultimately, the literature suggests that for SMEs, particularly in developing and CEE regions, blockchain adoption is less about proactive strategic innovation based on internal innovativeness and more about compliance within the prevailing supply chain ecosystem (OLIVEIRA ET AL., 2014).

## MATERIALS AND METHODS

### Research Design and Theoretical Framework

This study employed an exploratory qualitative research design based on semi-structured in-depth interviews with strategic corporate decision-makers in the domestic SME sector. This design was considered appropriate because the aim of the research was not to statistically test technology acceptance models, but to uncover the underlying motivations, cognitive barriers, organizational constraints, and institutional pressures shaping blockchain technology adoption decisions among SMEs. The theoretical framework synthesized established models of technology acceptance and organizational innovation, while maintaining clear conceptual boundaries between individual-level, organizational-level, and environmental-level explanatory dimensions. DAVIS'S (1989) Technology Acceptance Model (TAM) was used to interpret cognitive evaluations related to Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). VENKATESH ET AL.'S (2003) Unified Theory of Acceptance and Use of Technology (UTAUT) informed the analysis of Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions. PARASURAMAN'S (2000) Technology Readiness Index (TRI) was incorporated to capture awareness, innovativeness, insecurity, and technology-related hesitation at the decision-maker level.

At the organizational and environmental levels, Institutional Theory and the Technology-Organization-Environment (TOE) framework were applied to examine external adoption pressures and contextual constraints. DIMAGGIO AND POWELL'S (1983) Institutional Theory was used to interpret coercive, mimetic, and normative pressures, particularly those originating from dominant supply chain partners, regulatory requirements, and industry-level expectations. The TOE framework, originally developed by TORNATZKY AND FLEISCHER (1990) and later applied in technology adoption research by OLIVEIRA ET AL. (2014), provided a complementary lens for examining technological, organizational, and environmental conditions influencing blockchain adoption readiness.

The semi-structured interview guide was developed deductively from the conceptual dimensions of TAM, UTAUT, TRI, TOE, and Institutional Theory. These frameworks were not used as validated quantitative measurement scales; rather, they served as theory-informed analytical lenses for structuring the interview protocol and guiding the subsequent deductive cod-

ing process. Accordingly, the study does not claim to validate or statistically test TAM, UTAUT, TRI, TOE, or Institutional Theory. Instead, these models were used to organize the qualitative inquiry and to support the interpretation of recurring patterns in the interview data. To enhance comparability across interviews, selected anchor statements were included at the end of the interview protocol and rated by participants on a 1–7 scale. These ratings were used only as qualitative elicitation devices and descriptive indicators to stimulate deeper narrative responses and to support cross-case comparison. They were not treated as psychometrically validated constructs, nor were they used as a basis for statistical inference.

The complete semi-structured interview guide is presented in Appendix 1.

### Sampling Procedure and Participant Profile

Data collection employed a purposive, stratified sampling method to ensure contextual depth and industry-specific validity. The inclusion criteria strictly required interviewees to hold strategic decision-making or senior operational leadership positions within domestic SMEs, possessing direct oversight of technological investments, IT infrastructure, or organizational innovation processes. In total, 22 semi-structured in-depth interviews (N=22) were conducted. The sample deliberately diversified across five key industries critical to the Hungarian economy: Information Technology (IT) and Software Development, Retail and Logistics, Manufacturing, Agriculture, and Financial Technology (FinTech). Geographically, the participants represented five distinct Hungarian regions (Pest, Hajdú-Bihar, Csongrád-Csanád, Szabolcs-Szatmár-Bereg, and Baranya counties) to prevent localized bias. The composition of the qualitative sample is detailed in Table 1.

### Data Collection Instrument and The "Negative Proof" Method

The primary data collection instrument was designed semi-structured interview guide built around the conceptual dimensions of the TAM, TOE, and UTAUT models. A unique methodological feature of the interviews was the integration of structured anchor questions. These anchors required participants to qualitatively self-assess the intensity of their subjective attitudes on a 7-point scale (1 = completely uncharacteristic, 7 = completely characteristic). This scale was not utilized as a validated quantitative measurement instrument, but rather as a heuristic tool to provoke deeper narrative qualitative responses and structure the interview process. To rigorously test Hypothesis 1 (H1), which posits that the primary barrier is the lack of technological awareness and perceived usefulness rather than pure financial constraints, a specific thought experiment, termed the "negative proof" method, was applied based on the "free paradox" models (LIN ET AL., 2007). This scenario asked decision-makers if they would adopt blockchain technology immediately if a grant provided 100% funding for the software, hardware, and expert integration. This methodological tool effectively isolated hidden operational fears, cognitive resistance, and regulatory (e.g., GDPR) barriers from the explicit investment costs. However, it is important to acknowledge the methodological limitations of this approach. The 'negative proof' is a hypo-

thetical thought experiment designed primarily as an elicitation technique. While it successfully uncovers hidden organization-

al fears, self-reported hypothetical behavior may differ from actual strategic business decisions.

**Table 1. Composition of the qualitative interview sample**

Interview Code	Industry / Activity	County	Respondent's Position	Company Size (Employees)
INT-01	IT - Software Development	Pest	Managing Director	35
INT-02	Agriculture - Arable Farming	Hajdú-Bihar	Head of Family Farm	12
INT-03	Manufacturing - Metal Structures	Szabolcs-Szatmár-Bereg	Production Director	45
INT-04	Retail - Food	Csongrád-Csanád	Managing Owner	28
INT-05	IT - Cybersecurity	Baranya	Technical Manager	18
INT-06	Fintech & Consulting	Pest	Head of Development	42
INT-07	Retail - Building Materials	Szabolcs-Szatmár-Bereg	Logistics Manager	22
INT-08	Manufacturing - Plastic Injection Molding	Pest	Production Administrator	55
INT-09	IT - Software Testing	Baranya	Engineer	25
INT-10	Agriculture - Crop Production	Hajdú-Bihar	Shift Supervisor / Chief Mechanic	32
INT-11	IT - Database Administration	Csongrád-Csanád	Systems Engineer	26
INT-12	Agriculture - Fruits	Szabolcs-Szatmár-Bereg	Farm Manager	8
INT-13	Retail - E-commerce Logistics	Pest	Logistics Team Leader	38
INT-14	Manufacturing - Furniture	Csongrád-Csanád	Plant Manager	24
INT-15	Retail - Building Engineering	Hajdú-Bihar	Senior Warehouseman	15
INT-16	IT - Web Development	Szabolcs-Szatmár-Bereg	Lead Developer	5
INT-17	Manufacturing - Plastic Recycling	Hajdú-Bihar	Engineer	48
INT-18	IT - Compliance / Data Protection	Baranya	Legal Advisor	12
INT-19	Retail - Machine Parts	Csongrád-Csanád	Warehouse Manager	18
INT-20	IT - Network Monitoring	Pest	Junior Analyst	22
INT-21	Manufacturing - Textile	Baranya	Shift Supervisor	52
INT-22	IT - Business Intelligence	Hajdú-Bihar	Analyst	14

Source: Own elaboration based on qualitative data collection.

### Data Analysis Strategy and Limitations

The recorded and transcribed interviews were analyzed using qualitative content analysis (Mayring, 2014). A deductive category formation approach was utilized to evaluate the hypotheses regarding cognitive barriers and external institutional pressures. The coding process incorporated qualitative frequency analysis, which aggregated the occurrences of specific cognitive (e.g., lack of ROI, complexity) and operational barriers (e.g., GDPR fears) within the text corpus to enhance the robustness and transparency of the findings. Patterns of adoption barriers and motivators were also examined across different industry cross-sections to identify sector-specific nuances. While this research design is highly suitable for uncovering deep structural

and cognitive barriers, the study has certain limitations. The exploratory qualitative approach and the sample size (N=22) imply that the statistical frequencies are not representative of the entire domestic SME sector; the objective was contextual depth rather than statistical generalization. Furthermore, to minimize the risk of social desirability bias regarding technological innovation, the anchor questions and the negative proof method were employed, though such bias cannot be entirely eliminated. Lastly, given the rapid evolution of BCT and dynamic regulatory environments (e.g., MiCA regulations), the findings reflect the cognitive and institutional state at a specific cross-sectional point in time.

**RESULT AND DISCUSSION**

**The Primacy of Cognitive Barriers over Financial Constraints**

The prevailing discourse in technology adoption often posits that the primary obstacle for Small and Medium-Sized Enterprises is the lack of financial capital and the high costs associated with initial investments (BHARDWAJ ET AL., 2021; ORJI ET AL., 2020). However, the qualitative findings of this study fundamentally challenge this assumption. The evaluation of Hypothesis 1 reveals that the foremost barrier to blockchain adoption within the domestic SME sector is a profound cognitive gap: the absence of technological awareness and an exceptionally low level of Perceived Usefulness. Based on the TAM framework, PU is the strongest predictor of adoption. When asked to evaluate the anchor question ("The lack of understanding and concrete business usefulness of BCT is a greater barrier than the cost of implementation" on a 1-7 scale), 17 out of the 22 SME leaders gave the maximum score of 7, with an additional 5 respondents scoring it a 6. The qualitative narratives confirmed that SME decision-makers operate on a strictly pragmatic, short-term cost-benefit logic. This approach is necessitated by the fact that SMEs typically possess limited financial reserves and face intense daily liquidity pressures, compelling them to prioritize investments with immediate, tangible returns over abstract, long-term ecosystem benefits. The abstract concept of "algorithmic trust" or "ecosystem transparency" cannot be readily converted into immediate profit. As a leader in the agricultural sector stated, "My boss always asks: How many liters of diesel do we save with this? With blockchain, there is no answer to that." Similarly, an IT executive noted that traditional SQL databases are faster, cheaper, and universally understood, making the cognitive and financial overhead of blockchain unjustifiable without explicit client demand (MALIK ET AL., 2021).

**The "Negative Proof" Thought Experiment**

To rigorously isolate cognitive barriers from financial constraints, the "negative proof" thought experiment, rooted in

the "free paradox" models (LIN ET AL., 2007) was applied. Respondents were asked whether they would adopt BCT immediately if a grant covered 100% of the software, hardware, and expert integration costs. Strikingly, 21 out of 22 corporate leaders explicitly rejected the hypothetical offer or expressed severe hesitation; only one manufacturing executive proactively accepted it.

The justifications for rejecting a "free" technological upgrade revealed four critical hidden barriers:

1. Hidden Operational and Maintenance Costs: SMEs fear vendor lock-in and the ongoing "overhead" of maintaining complex networks. A web developer emphasized: "Who will pay the utility costs of the technology? I don't want the complication even for free if there is no customer demand."

2. Time as Lost Production: In physical sectors (agriculture, manufacturing, logistics), the steep learning curve equates to lost labor hours.

3. The Network Effect Dilemma: Participants recognized the cooperative nature of BCT; adopting a distributed ledger in isolation is rationally meaningless. "What if my partners don't want to use it? Such a system is only worth something if everyone is in it."

4. Legal and Privacy Risks (GDPR): The immutability of the ledger directly conflicts with the GDPR's "right to be forgotten". IT and compliance experts stated they would not deploy BCT in a live environment while this legal contradiction persists.

**Perceived Ease of Use (PEOU) and Sectoral Cognitive Dissonance**

While Perceived Ease of Use (PEOU) is a significant barrier, the qualitative data highlighted sharp sectoral disparities. In the IT sector, BCT does not cause cognitive dissonance (average PEOU barrier score: 4.25); developers often view it as a professional challenge. However, in traditional sectors like agriculture and manufacturing, abstract concepts like "hashes" and "smart contracts" generate severe resistance (average score > 6.00).

**Table 2. Summary of anchor questions evaluating cognitive and operational barriers (mean values on a 1–7 scale)**

Industry Segment	Lack of Perceived Usefulness (PU) vs. Cost Barrier	Perceived Ease of Use (PEOU) Barrier
IT Sector (N=8)	6.37	4.25
Agriculture (N=4)	7.00	6.50
Retail / Logistics (N=5)	6.40	5.80
Manufacturing (N=4)	6.75	6.00
FinTech (N=1)	6.00	3.00
Overall Average	<b>6.50 (High barrier)</b>	<b>5.11 (Medium barrier)</b>

Note: These numerical summaries are used only as descriptive sensitizing indicators and are not intended for statistical inference. 1 = Completely disagree, 7 = Completely agree.

Source: Own elaboration.

To triangulate these findings, a qualitative frequency analysis was conducted on the occurrence of specific cognitive and operational barriers within the interview corpus (MAYRING, 2014). The lack of visible ROI was reported by 21 out of 22

respondents, making it the most ubiquitous barrier, overshadowing the high cost of implementation (mentioned by 15 out of 22).

**Table 3. Frequency analysis of primary adoption barriers (N=22)**

Coded Adoption Barrier	Frequency of Mentions	Explanation in the Context of H1
1. Lack of visible business benefit / ROI	21 / 22	Almost all respondents (except FinTech) reported the lack of immediate, monetary return as the primary barrier. This confirms that Perceived Usefulness (PU) is the most critical factor.
2. Complexity / Lack of adequate IT knowledge	16 / 22	Particularly strong cognitive barrier in manufacturing, retail, and agriculture sectors.
3. High implementation / operational cost	15 / 22	Cost is a significant barrier, but often secondary to the lack of benefit. Respondents indicated that clear benefits would justify costs.
4. Data security / GDPR and trade secret fears	14 / 22	SMEs fear transparency, competitive exposure, and regulatory conflicts (e.g., GDPR compliance).

Note: *Qualitative frequency analysis based on deductive coding.*

Source: *Own elaboration.*

### Institutional Pressures vs. Internal Innovation

Hypothesis 2 posited that SME adoption intention is driven predominantly by external environmental pressures rather than internal organizational innovativeness. The findings strongly corroborate Institutional Theory (DIMAGGIO & POWELL, 1983) and the environmental dimension of the TOE framework (TORNATZKY & FLEISCHER, 1990; OLIVEIRA ET AL., 2014).

### Coercive Isomorphism as the Primary Catalyst

The most consistent result across the interviews was the acceptance of external coercion as the sole viable trigger for adoption. Coercive institutional isomorphism, which refers to the process where organizations are compelled to adopt similar structures or technologies due to external pressures from more powerful entities and regulatory frameworks (DIMAGGIO & POWELL, 1983). When evaluating the anchor question ("We would not adopt it ourselves unless forced"), 15 respondents gave the maximum score of 7. SMEs generally occupy subordinate positions in global value chains, resulting in fundamentally reactive technological strategies.

Two main forms of coercive pressure were identified:

1. **Multinational Partner Mandates:** If top-tier companies (e.g., automotive giants, global retail chains) mandate block-chain-based tracking, SMEs will immediately integrate it to survive. A manufacturing director bluntly stated: "90% of SMEs work like this: if the big fish says we have to dance like this, we dance like this, otherwise we fall out of the basket."

2. **Regulatory Compliance:** The second strongest driver is government and EU mandates, such as the implementation of the Digital Product Passport (DPP) or ESG reporting. Respondents likened this to the mandatory introduction of online tax invoicing: "Nobody wanted it, but everybody did it because they had to."

### Mimetic Pressures and the Absence of Internal Proactivity

Internal innovation affinity (strategic proactivity) is critically low in traditional SME sectors, limited mostly to modernizing physical machinery rather than software infrastructure. Consequently, mimetic isomorphism (copying competitors to reduce uncertainty) only exists in a latent form. SMEs reported a medium level of competitive pressure (average score: 4.45); they would only emulate competitors if BCT had already proven to secure a definitive market advantage.

**Table 4. Evaluation of Institutional Theory and TOE factors driving adoption intention (mean values on a 1–7 scale)**

Industry Segment	Coercive Pressure (Institutional)	Competitive Pressure (TOE)	Internal Innovation Affinity (TOE)
IT Sector (N=8)	6.12	4.62	5.50
Agriculture (N=4)	7.00	4.50	1.75
Retail / Logistics (N=5)	7.00	4.80	2.20
Manufacturing (N=4)	7.00	4.25	1.25
FinTech (N=1)	5.00	7.00	7.00
Overall Average	6.54 (Very High)	4.68 (Medium)	3.50 (Polarized / Low)

Note: *These numerical summaries are used only as descriptive sensitizing indicators and are not intended for statistical inference. 1 = Completely disagree, 7 = Completely agree.*

Source: *Own elaboration.*

**Table 5. Frequency analysis of decision-making motivations (N=22)**

Decision-Making Motivation	Frequency of Mentions	Explanation in the Context of H2
1. External Coercion: Mandates of multinational partners / clients	19 / 22	The most frequent catalyst for future adoption. Supports coercive isomorphism.
2. External Coercion: Legal / Regulatory requirements (e.g., EU, Tax Authorities)	17 / 22	Regulatory pressure is the second strongest driver of adoption.
3. Competitive Pressure (Mimetic isomorphism)	10 / 22	Firms follow competitors only after proven market advantage.
4. Internal Innovation Affinity (Strategic proactivity)	3 / 22	Only FinTech and a few IT firms indicated proactive adoption without external pressure.

Note: Qualitative frequency analysis based on deductive coding.

Source: Own elaboration.

**Evaluating Adoption through the UTAUT Framework**

Synthesizing the qualitative data through the Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003) provides a structured understanding of the SME context:

- Performance Expectancy (PE): Critically low. Most respondents do not perceive BCT as outperforming traditional cloud ERPs or SQL databases in terms of daily operational speed. A logistics supervisor feared that waiting for "block confirmations" would slow down warehouse picking.

- Effort Expectancy (EE): Exceptionally high. In physical production sectors, the expected effort to train an aging or non-digitally native workforce (e.g., textile workers, farm laborers) to interact with decentralized interfaces is viewed as an insurmountable barrier.

- Social Influence (SI): This dimension perfectly overlaps with coercive institutional pressure. SI is exerted exclusively top-down by multinational clients or regulatory bodies. Horizontal SI from IT consultants or chambers of commerce is met with skepticism, often viewed as vendor-driven upselling.

- Facilitating Conditions (FC): The SME sector suffers from a lack of FC. Many traditional companies lack dedicated in-house IT personnel, relying on outsourced, ad-hoc system administrators. Furthermore, basic infrastructure is often missing. As one agricultural leader noted, "First, let's have proper cell reception on all our lands, and then we can talk about blockchain."

**Sectoral Nuances and the "Transparency Paradox"**

The analysis revealed a profound "transparency paradox" within the agricultural and manufacturing sectors. While BCT's core value proposition is data integrity and traceability, SMEs view this transparency as a strategic threat rather than an asset. Farmers and manufacturers fear that opening the supply chain ledger will expose highly guarded trade secrets, such as yields, procurement costs, and proprietary formulas to competitors or tax authorities. In the Hungarian SME culture, business is still heavily reliant on informal, trust-based relationships, making the algorithmic exposure of data a severe deterrent. This creates a paradoxical situation where the very feature that makes blockchain valuable at the ecosystem level (total transparency) becomes its greatest cognitive barrier at the micro-organizational level, as SMEs perceive information asymmetry as a protective mechanism for their market position. Conversely, in the FinTech sector, internal business processes directly benefit from

BCT (e.g., cross-border payments, KYC logging). For these entities, the barrier is not a lack of PU, but rather navigating the nascent and overly strict regulatory environments (e.g., MiCA regulations).

**CONCLUSION**

In summary, the empirical evidence supports both research hypotheses. Hypothesis 1 (H1) is supported, as the negative proof thought experiment and the structured anchor questions indicated that the fundamental cognitive gap, specifically the severe lack of perceived business usefulness and technological awareness, acts as a far more formidable barrier to SME adoption than pure financial constraints. Furthermore, Hypothesis 2 (H2) is supported by the qualitative data, which revealed a structural absence of internal organizational innovativeness regarding decentralized networks. The adoption intentions of SMEs are almost exclusively reactive and dictated by coercive institutional isomorphism, primarily originating from the mandates of dominant supply chain integrators and strict regulatory compliance requirements. While this study offers deep contextual insights, its limitations lie in its exploratory qualitative design and specific geographical focus on Hungary. The sample size precludes broad statistical generalization. Future research should employ longitudinal quantitative designs to track how SME cognitive attitudes and institutional pressures evolve.

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## APPENDICIES

### Appendix 1. Semi-Structured Interview

#### INTRODUCTION

"Please introduce your company in a few sentences, what industry do you operate in, what is the size of the company, and what is your exact role in making decisions about technological investments?" (TRI - Awareness / Baseline measurement): "If you had to briefly explain to a lay industry partner what blockchain technology is in your understanding, specifically beyond cryptocurrencies, with a business focus, how would you phrase it?"

#### BLOCK I:

Awareness vs. Complexity and Costs (TAM - Perceived Usefulness / H1): "Based on your current knowledge, do you see any specific, everyday processes or business problems in your own company that blockchain technology could solve more efficiently? If so, what would they be?"

(TAM - Perceived Usefulness / H1): "Do you currently see enough added value in blockchain that would make it worthwhile to replace or supplement your well-established, existing IT systems and processes?"

(TRI - Insecurity & Awareness / H1): "When you hear about a relatively new, widely discussed technology like this, what risks or uncertainties do you see in it? Is there perhaps distrust from management because the operation of the technology is difficult to understand?"

(TAM - Perceived Ease of Use & UTAUT - Effort Expectancy / H1): "How complicated do you think it would be for your own employees and your IT team to understand, learn, and use blockchain-based systems on a daily basis?"

(UTAUT - Price Value / H1): "When judging such a technology, how much weight does the implementation cost carry? Is it the absolute amount of the investment that is alarming for SMEs, or rather that the return on investment (ROI) is unpredictable?"

(Synthesis of TAM, UTAUT, TRI / H1 - The "Negative Proof"): "Let's do a thought experiment! Suppose that tomorrow you win a non-refundable grant that covers 100% of the system, and a professional team of experts performs the entire technical integration for free. So, there is no cost and no technical burden. In this case, would you immediately adopt the technology, or is there something else, for example, the lack of real business benefit, that would still make you hesitate?"

#### BLOCK II:

External Pressure vs. Internal Innovation Willingness (TRI - Innovativeness / H2): "Generally speaking, where would you place your company on the technology adoption curve? Do you like to be first and experiment, or do you prefer to wait until the big players pay the learning costs, and only adopt proven

technologies?"

(TOE - Organization & Context / H2): "Has there ever been an instance in your company's life where you implemented a completely new, unproven digital technology entirely out of internal determination, simply to gain a strategic advantage?"

(Institutional Theory - Mimetic pressure & TOE - Competitive Environment / H2): "How closely do you monitor the technological steps of your direct competitors? Would you embark on a blockchain project simply because you see your competitors doing it and fear falling behind?"

(Institutional Theory - Coercive pressure & UTAUT - Social Influence / H2): "How would your company react if your most important client, for example, a multinational partner, or your dominant supplier network suddenly made the use of a blockchain-based tracking system mandatory starting tomorrow?"

(Institutional Theory - Normative pressure / H2): "How much influence do industry standards, recommendations from professional chambers, or the opinions of external IT consultants have on your decisions when implementing new technology?"

(TOE vs. Institutional Theory / H2): "Overall, looking at the spread of blockchain in the domestic SME sector: What do you think will bring the breakthrough? An internal maturation process where company leaders recognize the usefulness of the technology, or rather an external 'coercion' where the supply chain dictates the conditions, or perhaps a better financial support environment?"

#### *CLOSING BLOCK:*

"At the end of our conversation, I will read five short statements. Please tell me to what extent you agree with them on a scale of 1 to 7 (1: totally disagree, 7: completely agree)."

1. (TAM - PU vs. Cost / H1): "The lack of understanding and concrete business usefulness of blockchain technology is currently a greater barrier for us than the financial cost of implementation." [ \_\_\_ ]

2. (TAM - PEOU / H1): "The excessive complexity of the technology is the main reason SMEs shy away from blockchain." [ \_\_\_ ]

3. (Institutional Theory - Coercive / H2): "In our industry, SMEs will not use blockchain on their own, only if large partners or regulations force them to." [ \_\_\_ ]

4. (TOE - Competitive / H2): "We would only move towards blockchain if the competition is already proven to be successfully using it, putting us at a competitive disadvantage." [ \_\_\_ ]

5. (TRI - Innovativeness / H2): "Our company proactively and independently seeks out such pioneering solutions, regardless of external pressures." [ \_\_\_ ] "

Do you have any other comments or observations?"