ISSN No:-2456-2165 https://doi.org/10.38124/ijisrt/26may547

A Maturity Model for Blockchain Adoption: Towards a Structured, Progressive and Human-Centered Integration

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Publication Date: 2026/05/29

Abstract: Blockchain technology is growing really fast and is being used in more and more areas. Because of that, it's becoming essential to have clear guidelines for how to adopt it properly. But beyond all the hype, one important question remains: How can we integrate blockchain in a smart, responsible way that actually fits real organizational and human needs? This paper introduces a blockchain maturity model inspired by the Capability Maturity Model (CMM). It helps organizations understand how ready they are and how to plan their adoption strategy. We also suggest a three-step adoption approach that supports a gradual, secure, and sustainable implementation. The goal is not just to structure technology adoption, but to put people, trust, and real value back at the center of digital decisions.

How to Cite: Muka Kabeya Arsene; Oshasha Oshasha Fiston; Musas A Musas Andre; Kabeya Mukosayi Joseph; Tshielo Koka Souvient; Kobalanga Liamba Pathy Cedrick (2026) A Maturity Model for Blockchain Adoption: Towards a Structured, Progressive and Human-Centered Integration. *International Journal of Innovative Science and Research Technology*, 11(5), 2190-2192. https://doi.org/10.38124/ijisrt/26may547

I. INTRODUCTION

➢ *Technology Built on Trust*

Blockchain is essentially a peer-to-peer shared database that keeps records of transactions (or digital events) in a tamper-evident and append-only way and is validated by consensus among the participants. It makes it possible for smart contracts and smart property to function within decentralized and distributed architectures, among other things.

Fintech products are emerging in both non-financial and financial sectors. Insurance, digital assets, and online finance are just a few financial subsectors making use of blockchain. For non-financial applications, it enables use cases such as IoT, document verification, anti-counterfeiting solution, and decentralized storage solution.

Nevertheless, after everything has been said and done, one verdict that can be drawn is that no matter how great the capacity for a technology might be, it is only useful if it can satisfy the needs of individual human beings and organizations. While enthusiasm for blockchain appears to be escalating, determining the development level of blockchain systems also remains an elusive task. Such challenges often result in "crappy code" or "crappy" implementations.

As the saying goes, "you can't manage what you can't measure." Thus, to design and integrate systems using blockchain, well thought out methodology like a life cycle model is much needed to be developed to cover the technical aspect.

II. MATURITY MODELS AND CLASSIFICATION

Maturity models have been applied for years in the information systems domain, and particularly, the Capability Maturity Model (CMM), developed initially to assess software development processes, has been widely used. Later this model has been adapted for other areas, such as the People Capability Maturity Model, or the Green IT Maturity Model.

In a blockchain environment, we present a model that is rooted in a taxonomy defined by four high-level categories of the ACM Computing Classification System. Among them are: networks, information systems, computing methods, and security and privacy. This categorization allows one to perform an all-round and unified assessment of a firm's competency in the field of blockchain implementation.

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III. THE FIVE MATURITY LEVELS

The model proposed there are five maturity levels which illustrate a gradual growth that an organization experiences when adopting and implementing blockchain technology.

The "better" done at this level is roughly defined and things are generally done reactively. Blockchain is frequently implemented without knowing what is under the hood, or what value could be really derived.

At the repeatable level, organizations develop a knowledge base that can be reused across projects. But this way of thinking is still very much reactive and not fully formalized.

The defined Process levels 2 through 5 for a specific process area have defined processes that are documented, capable of being executed, and sufficiently well-defined that they are more predictable. At this blockchain is part of an evidently definable organisational vision.

Performance is measured by a relevant process at the managed level. Robust governance arrangements are developed to provide further oversight and regulation of the blockchain activities.

Then again, in the optimizing stage of maturity the enterprises take on continuous improvement methods. The sharing of knowledge, innovation and learning becomes institutionalised, which in turn strengthens long-term resilience and value.

IV. DETAILED ANALYSIS OF THE MODEL

The analysis of the model is structured around four main dimensions corresponding to the core components of blockchain systems.

From a network perspective, one of the main challenges lies in managing network load. Since each transaction must be shared and validated across multiple participants, this can lead to scalability issues and increased latency.

Regarding information systems, several challenges must be addressed. These include architectural decisions such as the choice between public and private networks, the complexity of coordinating updates across distributed nodes, the difficulty of integrating blockchain solutions with existing systems, and issues related to data storage and scalability. At the same time, blockchain offers significant business value, particularly in terms of traceability and data reliability.

In terms of computing methods, the lack of standardization and the high computational cost associated with repeated processing can negatively impact system efficiency.

Finally, in the domain of security and privacy, blockchain provides strong guarantees. However, the effectiveness of these guarantees largely depends on the quality of implementation and governance practices.

V. RECOMMENDED ADOPTION PROCESS

Given the evolving nature of blockchain technology, a gradual and structured adoption approach is recommended.

The first step consists of conducting a feasibility study aimed at evaluating whether blockchain is truly appropriate for the intended use case. This involves examining whether multiple parties are involved, whether mutual trust is required, whether intermediaries introduce significant costs, and whether there is a need to reduce operational delays. Such an analysis helps prevent unnecessary or inappropriate adoption of block chain solutions.

The second step focuses on the development phase, which requires a thorough analysis of requirements, careful architectural design, and a strong emphasis on security considerations. This phase is critical to ensuring the robustness and reliability of the system.

The third step involves progressive deployment. This consists of implementing a controlled transition strategy in which the existing system is temporarily maintained while the new blockchain-based system is gradually introduced. This approach ensures fault tolerance, minimizes risks, and allows for a smoother operational transition.

VI. A HUMAN-CENTERED VISION OF BLOCKCHAIN

Beyond its technical dimensions, blockchain addresses a fundamentally human issue: trust. In environments where systems are weak, fragmented, or unreliable, blockchain has the potential to improve transparency, secure transactions, and reduce inequalities in access to information.

However, such transformation can only be successful if it is guided by ethical considerations, a deep understanding of user needs, and a focus on generating real social value.

VII. CONCLUSION

Blockchain represents a major technological advancement with significant potential across a wide range of industries. However, its adoption should not be driven solely by trends or hype. Instead, it must be approached as a thoughtful and human-centered decision.

The maturity model presented in this paper provides organizations with a structured framework to assess their readiness, guide their adoption strategies, and increase their chances of successful implementation.

Ultimately, the objective is not merely to adopt a new technology, but to build systems that are reliable, meaningful, and beneficial to society as a whole.

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