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**Study and Model Value–Driven Blockchain Smart Contracts for
Cooperative Enterprise Information Systems**

Présentée par

Kamal BOUHASSOUNE

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A la Faculté des Sciences et Techniques de Settat devant le jury composé de :

Pr. Abderrahim MARZOUK	PES	FST - Settat	Président
Pr. Nabil BENAMAR	PES	EST - Meknès	Rapporteur
Pr. Mohammed MOURCHID	PES	Faculté des Sciences - Kénitra	Rapporteur
Pr. Nabil LAACHFOUBI	PES	FST - Settat	Rapporteur
Pr. Amine BENMAKHLOUF	MCH	FST - Settat	Examineur
Pr. Said EL KAFHALI	MCH	FST - Settat	Examineur
Pr. Sam GOUNДАР	MC	RMIT University, School of Computing, Hanoi, Vietnam	Co-Directeur de thèse
Pr. Abdelkrim HAQIQ	PES	FST - Settat	Directeur de thèse

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Abstract

Over a decade ago, an electronic peer-to-peer exchange system introduced a new form of trust through computational means. An anonymous known as Satoshi Nakamoto initiated a peer-to-peer network that drew participants to embrace a revolutionary cryptocurrency known as Bitcoin.

The underlying technology, Blockchain, is a decentralized trust infrastructure that operates on a peer-to-peer network. Nodes within the underlying network create, exchange, and secure intangible assets, bitcoins. Bitcoin is an electronic cash system that facilitates decentralized transfers of value and ownership without relying on a trusted intermediary such as a bank.

Despite the considerable appeal of cryptocurrencies, the adoption of blockchains remains limited, and enterprises are not exempt from this narrow acceptance. In this context, a novel and value-based approach to blockchain technology adoption in the enterprise is a relevant area of research and study.

The thesis develops a novel approach to blockchain technology adoption in enterprises. It introduces a new classification of value propositions and an understanding of value capture mechanisms. It examines the potential of open innovation capabilities and blockchain-augmented enterprise information systems. The thesis considers a range of applications, including decentralized finance, smart healthcare, and more. It suggests that these developments may pave the way for a new generation of value-oriented enterprise blockchains.

Keywords. Blockchain technology, Smart contracts, Enterprise information systems, Game theory, Cooperative behavior, Classification, Shapley value, SWOT analysis, Value creation, Value capture.

Résumé

Il y a plus d'une décennie, un système d'échange électronique pair-à-pair a introduit une nouvelle forme de confiance par des moyens informatiques. Un individu anonyme, connu sous le pseudonyme de Satoshi Nakamoto, a initié un réseau pair-à-pair qui a favorisé l'adoption d'une cryptomonnaie révolutionnaire connue sous le nom de Bitcoin.

La technologie sous-jacente, la Blockchain, représente une infrastructure de confiance décentralisée fonctionnant sur un réseau pair-à-pair. Les nœuds de ce réseau génèrent, échangent et sécurisent des actifs intangibles, les bitcoins. Le Bitcoin fonctionne comme un système de monnaie électronique, facilitant les transferts décentralisés de valeur et de propriété sans dépendre d'un intermédiaire de confiance tel qu'une banque.

Malgré l'attrait considérable entourant les cryptomonnaies, l'adoption du paradigme de la blockchain reste limitée, et les entreprises ne sont pas exclues de cette réserve. Dans le contexte susmentionné, l'introduction d'une approche nouvelle de l'adoption de la technologie blockchain au sein des entreprises, basée sur la valeur, représente un domaine d'étude et de recherche pertinents.

La thèse développe une nouvelle forme d'adoption de la technologie blockchain dans les entreprises au travers d'une nouvelle classification des propositions de valeur, la compréhension des mécanismes de capture de la valeur, l'innovation ouverte et les systèmes d'information de l'entreprise augmentés par la blockchain. Les applications dans les domaines tels que la finance décentralisée, les soins de santé intelligents, et plus encore, ouvriraient la voie à une nouvelle génération de blockchains orientée par la valeur pour les entreprises.

Mots-clés. Blockchain, Contrats intelligents, Systèmes d'Information d'entreprise, Théorie des jeux, Valeur de Shapley, Comportement coopératif, Classification, Analyse SWOT, Création de valeur, Capture de valeur.

موجز الأطروحة

قبل أكثر من عقد من الزمن، أدخل التبادل الإلكتروني، من نظير إلى نظير، نوعا جديدا من الثقة بواسطة أدوات حسابية. بحيث قام شخص مجهول، مستعيرا إسم ساطوشي ناكامو، باستعمال شبكة من نظير إلى نظير، جلبت لها مشاركين تبناوا عملة مشفرة ثورية تسمى البيتكوين.

التكنولوجيا المُستند عليها والمسماة بالبلوكشين، تمثل نظاما من لامركزية الثقة، تشتغل على شبكة من نظير إلى نظير، تقوم على وحدات تعمل على خلق تبادل وتأمين الأصول غير المادية مثل البيتكوين. كما أن البيتكوين نفسه كنظام للعملة، يساعد على التحويلات غير المركزية للقيمة والملكية الرقمية، من دون اعتماد على وسيط موثوق مثل البنك.

ورغم الجاذبية التي تحظى بها العملة المشفرة، فإن اعتماد أسلوب البلوكشين يبقى محدودا، ولم تسلم المقاولات من هذا التَّحَفُّظ أيضا. وبناء على ذلك فإن الحاجة إلى منظومة جديدة لتقنية البلوكشين لدى المقاولات القائمة على مقاربة القيمة، تظل مجالا جديرا بالبحث والدراسة.

لذلك جاءت هذه الأطروحة لتقديم تصنيف جديد للقيم المقترحة من البلوكشين، منها الإلمام بآليات التقاط القيمة، وسُبل الابتكارات الواعدة التي تقدمها البلوكشين، مضافة إلى تطبيقات البلوكشين في مجالات متعددة، مثل التمويل اللامركزي وفي وسائل العلاج الذكية... إلى غير ذلك من مجالات القيم التي ستُفتَح أمام المقاولات، لتكون حافزا لها لاعتماد البلوكشين.

الكلمات المفتاحية: تكنولوجيا البلوكشين، العقود الذكية، نظم معلومات المقاولات، نظرية الألعاب، قيمة شابلي، السلوك التعاوني، تصنيف، تحليل سووط، إختلاق القيمة، إلتقاط القيمة.

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List of Abbreviations

<i>Abbreviation</i>	<i>Meaning</i>
AI	Artificial Intelligence
BI	Business Intelligence
CGT	Cooperative Game Theory
CRM	Customer Relationship Management
DAG	Directed Acyclic Graph
DApps	Decentralized Applications
DeFi	Decentralized Finance
DLT	Distributed Ledger Technology
DPoS	Delegated Proof-of-Stake
EDCC	Ethereum Distributed Computing Contracts
EDI	Electronic Data Interchange
EHR	Electronic Health Record
EIS	Enterprise Information System
ERC	Ethereum Request for Comments
ERP	Enterprise Resource Planning
EVM	Ethereum Virtual Machine
FinTech	Financial Technology
HIE	Health Information Exchange
ICO	Initial Coin Offering
IoMT	Internet of Medical Things
IPFS	Interplanetary File System
IT	Information Technology
MES	Manufacturing Execution Systems
MFG	Mean Field Game
MIS	Management Information System
MRP	Material Requirements Planning

NCG	Non-Cooperative Game
NFT	Non-Fungible Token
N2T	Network Transaction Token
OI	Open innovation
PHR	Personal Health Record
PLM	Product Lifecycle Management
PoS	Proof of Stake
PoW	Proof of Work
RoSCA	Rotating Savings and Credit Associations
SC	Smart Contract
SCM	Supply Chain management
SWOT	Strengths, Weaknesses Opportunities, and Threats
TMS	Transport Management Systems
TU	Transferable Utility
UML	Unified Modeling Language
VAN	Value Added Network
VAT	Value Added Tax
WMS	Warehouse Management Systems