Final Project: Literature Review
Blockchain Technology

Topic

The topics covered in this project are going to be around

- conducting a literature review of a technology of choice, which is going to be **Blockchain Technology**.
- Discussion around the significance of Blockchain technology and its impacts
- Literature review summarizing information provided in each article.
- Overall summary on learnings from the review of the technology in the articles
- Discuss Conceptual scheme for research project using **Technology Acceptance Model** (TAM) theoretical framework and type of research projects of interest

The review of the topic is done using 12 academic articles of the technology from a sociological perspective. This literature review covers the impact of blockchain technology on how it is shaping the intent and behavior of the society, future of the organizations promoting business and trade using this technology and also the individuals making profitable investments in this technology.

Key considerations for literature review being

- Provide a practical justification for the points being made to present the facts of blockchain technology elaborating those points in published work.
- Critical evaluation and inference towards the points and hypothesis for the technology
- Evaluate contrasting information in the published details for blockchain and its usage

The topic further summarizes the information on these various aspects from each article to define the direction of adoption of the technology and absorbing its consequences bringing around a change. Also an overall summary provides an overview of blockchain technology and learnings from review of the articles.

Final topic of this project is a discussion around the theoretical framework of Technology Acceptance Model (TAM). To use the perceived usefulness (PU) and perceived ease of use (PEOU) evaluation along with external control factors influencing attitude, behavior and intent of this framework learnt through this course.

Introduction

To introduce blockchain technology, understanding the roots of this technology is important. The sections of this research paper dive into various aspects of evaluating and reviewing the future of this technology. For a structured analysis through the literature reviews there are sections split-up as shown below that review various aspects of blockchain using targeted articles in those areas.

One of the sections analyzes the possible gaps and emerging needs that inspired the creation of the foundation of this technology. There is a section that reviews the social aspect of the technology in changing the processes of the society using digital transactions in the information age and artificial intelligence. Another section reviews the organizational changes driven by blockchain with its causes and effects that have allowed this technology to gradually become an inseparable part of digital commerce and other financial functions for these organizations.

These sections also go into understanding how this technology has changed an individual and their attachment to the society in commercial and financial terms. (Rocker, 2010) Additionally there is a section dedicated to reviewing technology acceptance model (TAM) analysis of blockchain and what external variables drive the Perceived Usefulness (PU) and Perceived Ease Of Use (PEOU) influencing attitude towards the technology, with the changes in the intention leading to its actual usage.

Finally the learnings from targeted literature reviews are summarized towards the end of the document analyzing where blockchain is headed and how it has changed the social, organization and individual aspects with the future changes it will bring. Also the paper closes with the discussion around how the theoretical framework of Technology Acceptance Model (TAM) helps to layout and review the conceptual scheme for a research project, and how it would be helpful to review in this type of research project associated with analyzing the past, present and future of a technology influencing a change on various levels of the individuals, organizations and overall society.

Methodology of the literature review and article searches

The literature review was conducted using academic articles published in academic journals that were freely available for downloading or online reading.The review was split-up to address various areas planned for this review using 12 articles.as listed below.

Article Types

- Academic articles
  - Published in publicly available journals
    - Freely available for online review or download

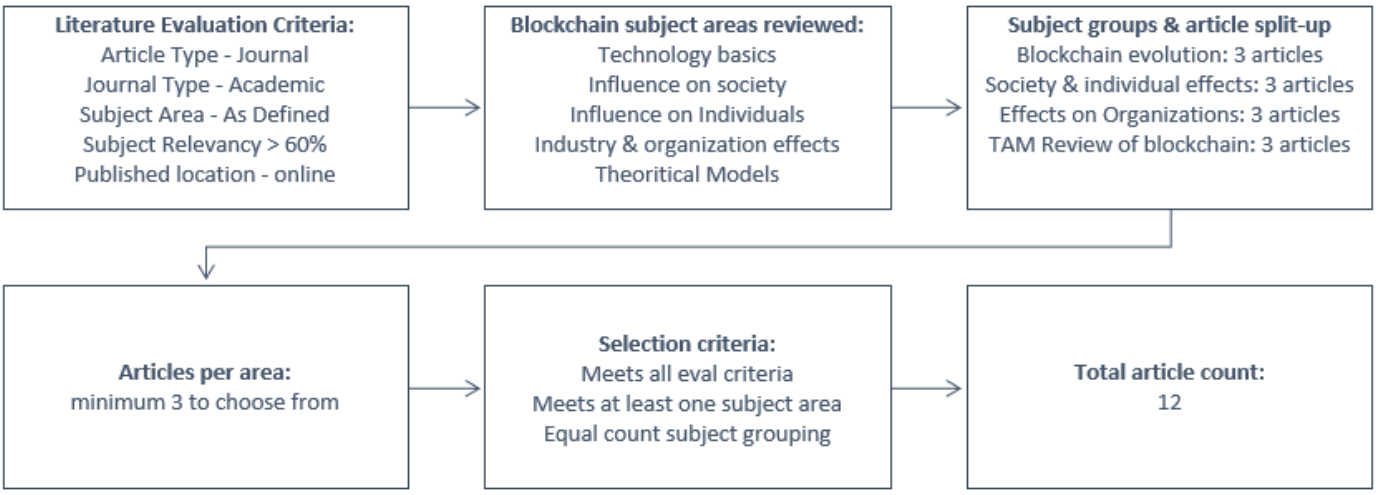
Article grouping and section split-up

- What is blockchain, the emerging needs and its evolution? 3 articles
- How blockchain affects society and the individuals? 3 articles
- Cause and effects of blockchain on organizations - 3 articles
- Technology acceptance model review of blockchain - 3 articles

Literature Review

As discussed earlier in the methodology section of the introduction, the literature review process for blockchain technology follows an evaluation criteria to select articles that meet the requirements and also are relevant to the area being reviewed. The process flow diagram below shows a brief outline of the steps involved in evaluating relevant articles.

Figure 1: Article selection methodology:



What is Blockchain, emerging needs and evolution?

The section of the literature review deals with understanding the basic foundation of blockchain technology, its emerging needs and evolution. The current state of this technology has successfully been satisfied to stabilize around the key requirements laid out for the platform. It is now continuing to grow in both the social and organizational context which is discussed in later sections of this project.

Article title: How To Time-Stamp a Digital Document.
Author & date: Haber, S., & Stronetta, S. (01/01/1991)
Journal: Journal of Cryptology
URL: https://link.springer.com/content/pdf/10.1007/BF00196791.pdf

Conceptually blockchain is a distributed ledger technology that keeps track of transactions with the assurance of their validity and trust, with additional build up of these transactions in large chains of blocks, which are transparent, trustworthy, traceable and irreversible throughout the chain of blocks. The need for this system was identified back in 1991 with a document tracking system using timestamps to assure authenticity of the documents. Since then there have been multiple attempts being made to create a decentralized trust systems using transaction tracking systems but they all failed due to issues related to gaps that allowed the trust of the system to be compromised.

Conceptually the need for an unique identifier to record a transaction was established. Although the system was not completely secure it did serve the purpose in most cases to track specific creation or

modification date stamps. The one way hash function to record this data was going to go a long way in creating the digital cryptocurrency ecosystem.

Article title: Bitcoin: A Peer-to-Peer Electronic Cash System
Author & date: Satoshi Nakamoto (10/31/2018)
Journal: MicroStrategy Intelligence Everywhere
URL: https://www.microstrategy.com/en/bitcoin/documents/bitcoin-a-peer-to-peer-electronic-cash-system

Until in 2008 Satoshi Nakamoto published his paper about peer to peer electronic cash systems that did not need any central authority and was completely decentralized with trustworthy transactions that could be tracked using secure hash values for all transactions in the chain of blocks. This was assured by proof-of-work that presented a unique identifier that generated a hash with multiple zeros in the beginning of the hashed binary.

Figure 2: Distributed Ledger Technology

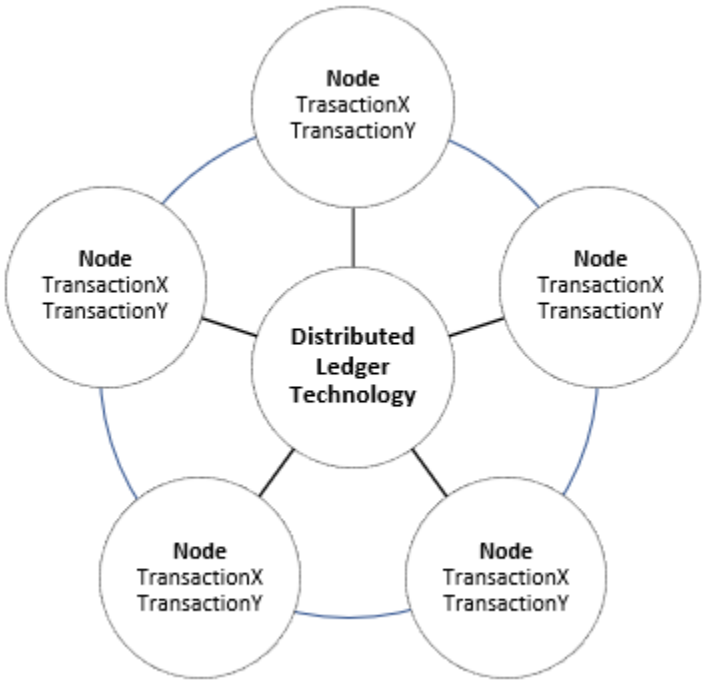
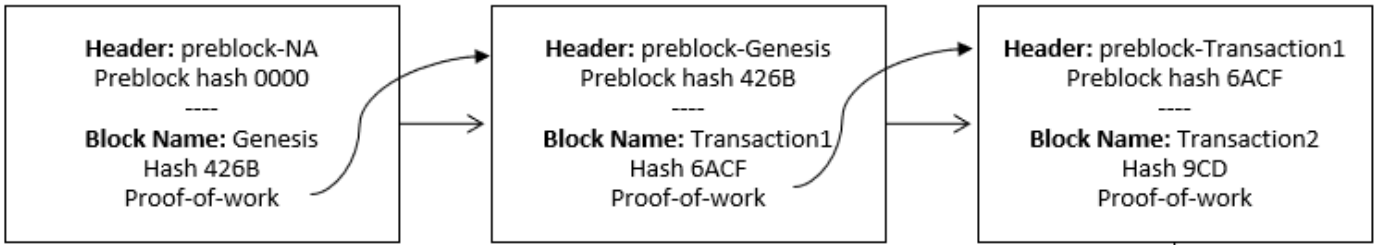


Figure 3: Blockchain Hash Validation



Article title: Blockchain: Emerging Applications and Use Cases
Author & date: Danda Rawat, Vijay Chaudhary, Ronald Doku (06/2018)
Journal: Data Science and Cybersecurity Center (DSC2) Department of Electrical Engineering and Computer Science
URL: https://arxiv.org/pdf/1904.12247.pdf

The Bitcoin effectively used the blockchain technology to demonstrate the key requirements of a decentralized ledger system that met the following criteria -

- It did not need a financial institution or any centralized authority to track transactions
- The financial transaction could be valued without using physical money making is universally accepted anywhere in the world beyond geographical boundaries
- The blockchain was encrypted using private and public key cryptography making it secure and traceable
- It was programmable to make the system efficient to use encryption and generate unique blocks that could be added to existing chain.
- All the participant had the same copy of the blockchain and were able to accept more blocks with longer reliable blockchains
- The transactions were immutable or irreversible to tracking of the entire chain with all the blocks right to the first genesis block with all the tracking hashes validating in the entire chain.
- All the transactions were time stamped and contained unique proof-of-work to avoid tampering of the blocks in the chain.

Finally with bitcoin establishing the requirements for securely using blockchain technology, it has since become more widely trusted and accepted. It is flourishing rapidly in other fields and industries that needed transaction mapping and reliability. Some of the functions that needed this system were supply chain, healthcare records, document and risk assessment tracking in audit and financial transactions covered in later sections of this literature review.

How does blockchain affect society and the individuals?

Since the industrial age our society has become more financially aware and has been using transactions to track trades and contracts in the primary capacity to validate an agreement. The concept of ledger has been the foundation of keeping a record of transactions in the industrial era. It provided the traders necessary trust and mechanism to validate their contractual agreements for services, supply chains, goods and financial debt. There were large institutions and experts who understood this better and governed the system for long periods of time

Article title: Blockchain and the Tokenization of the Individual: Societal Implications
Author & date: Monique Morrow (10/14/2019)
Journal: Future Internet
URL: https://www.mdpi.com/1999-5903/11/10/220

(Morrow, 2019) Most of the society, individuals and traders followed the system and the standards initially but gradually as industrialized social structure grew globally diverse the system designed for a certain trade, geography, culture and agreements became unstable. There were issues with trust, fraud and financial bubbles that caused the system to collapse with meltdowns and be manipulated by the large

institutions and central authorities. This totally crushed the middle class individuals who were left no choice but to get exploited by the system. At the same time continuous efforts were being carried out to build a more trustworthy system.

The literature review of the articles provided evidence that the blockchain technology helped with implementing individual tokenization for placing the foundation of the new form of decentralized social contract.

Article title: Blockchain Basics and Hands-on Guidance - Taking the Next Step toward Implementation and Adoption
Author & date: Deniz Applebaum, Sean Stein Smith (06/19/2018)
Journal: The CPA Journal
URL: https://www.cpajournal.com/2018/06/19/blockchain-basics-and-hands-on-guidance/

(Appelbaum & Stein Smith, 2018) As the industrial age dawned the devices in the new generation were capable of creating data and communicating it to their peers. The tracking of this data became more efficient and highly reliable using blockchains where peer to peer decentralized data transfers were more trustworthy where the embedded systems and IoT devices could be trusted with sensitive data that needed transaction tracking at each stage.

The contrast of transparency of information on one end to the risks associated with a centralized model for managing fast growing industry was clearly visible. The structural function of the decentralized ledger technology for managing irrefutable transactions was taking over centralized systems and safe to conduct trustworthy business operations. Overall the individual in the society is getting more comfortable in using this technology and implementing it for tracking transactions with his data, trust being a critical sociological and psychological factor in the fast expanding information age.

Article title: Blockchain technology in supply chain operations: Applications, challenges and research opportunities
Author & date: Pankaj Dutta, Choi Tsan-Ming, Surabhi Somani, Richa Butala (09/29/2020)
Journal: Transportation research. Part E, Logistics and transportation review
URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7522652/#b0250

The literature review also throws light on hurdles and challenges that blockchain technology faces through its journey of social and individual acceptance considering all associated processes. (Dutta et al., 2020) Even though the transactions are decentralized, distributed and trustworthy, there is no way to undo a block or reverse a transaction. Example would be to process a possible refund like we can do in a credit card or cash transaction. In that case a new transaction would have to be posted on the successive blockchain with necessary correction.

It’s more of the technology operational feature that provides transparency in reference to time and progression. This also calls for a learning curve in the acceptance process against the way they have been used to doing things, which in turn could lead to confusion and opposition. Another factor to take into consideration is cost associated with blockchain technology is much higher than existing transaction tracking systems. It required a lot more computing power and peer to peer systems that are capable of running the transaction monitoring to create new blocks in the chain.

How does blockchain influence the organizational commerce landscape?

The key feature strength of Blockchain technology is set in its ability of decentralization of its operational details. Which make it secure and reliable and tamper proof against forgery or fraudulent alteration. This ability is the critical component for building trust for individual transactions or organizational processes.

Article title: A systematic literature review of blockchain-based applications: Current status, classification and open issues
Author & date: Fran Casino, Thomas Dasaklis, Constantinos Patsakis (03/2019)
Journal: Telematics and Informatics
URL: https://www.sciencedirect.com/science/article/pii/S0736585318306324

(S3 Casino et al., 2019) This provides immutability for protecting integrity and anonymity which makes its ideal for non-financial domains too that involve smart contracts tracking, IoT (Internet-of-Things), scoring systems for reputation systems, threat management, compliance & security services to name a few. This is making Blockchain extremely popular and state-of-the art technology for all thriving industries and organizations. This technology is becoming a relevant and hot topic in boardroom discussions and steering committee agendas.

Table 1: Organizational or Industrial applications of Blockchain Technology

Financial	**Integrity**	**Governance**	**Internet of Things**	**Healthcare**	**Academics**	**Privacy**	**Industrialization**
Crypto currencies	Insurance	Identity management	IoT data integrity	EHR	Certifications	Data security	Energy
Underwriting	Intellectual property	Notary	IoT Device management	Controlled substance	Reputation	Anonymization	Supply chain

Based on the industrial sector and organizational need for risk management and compliance rigor blockchains have been extended and evolved to serve specific applications. So far the blockchains can be broadly classified into three types of evolutions.

Article title: Blockchain Technology Adoption Behavior and Sustainability of the Business in Tourism and Hospitality SMEs: An Empirical Study
Author & date: Guych Nuryyev, Yu-Ping Wang, Jennet Achyldurdyyeva, Jaw Yi-Shien, Lin Hsien-Tang, Wu Li-Fan (01/08/2020)
Journal: Sustainability
URL: https://www.mdpi.com/2071-1050/12/3/1256

These evolved generations of blockchains can be classified as generation 1.0 which is associated with its use for mainly tracking cryptocurrency transactions. The generation 2.0 extended the transaction tracking system to social contracts that automatically enforced the integrity checking process on any type of transaction to assure it in form of a digital baseline state for that transaction. This was further extended as

the scope evolved into applications in government, healthcare, patents, evidence for scientific discoveries, innovations and data centric embedded systems like IoT.

Article title: Understanding the Blockchain technology adoption in supply chains-Indian context
Author & date: Sachin Kamble, Angappa Gunasekaran, Arha Himanshu (04/03/2019)
Journal: International Journal of Production Research
URL: https://www-tandfonline-com.ezproxy.emich.edu/doi/full/10.1080/00207543.2018.1518610

Looking at adoption and environment covered in the article blockchain needs connected platforms that can transact data at high speeds with huge computing power. It is not a standalone technology and needs constant communication with peers to report progress and reliability for maintaining accuracy of its transactions. Especially in the organizations that use Big Data with large amounts of enriched data sources.

Also when looking at adoption of blockchain in governmental public sector organizations a regulatory framework is an essential element. The governance and rules for managing transactions is a significant factor for successful adoption of this technology. A contrast overview of adoption process between government organizations that have successfully adopted blockchain with those that are in the process of doing so will provide a lot of learnings for future governmental processes to adopt this more efficiently.

Blockchain significance on individuals and TAM?

Article title: Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology
Author & date: Fred Davis (09/1989)
Journal: MIS Quarterly
URL: http://www.jstor.org/stable/249008

This section looks at literature reviews of blockchain technology in view of the Technology Acceptance theory (TAM) for establishing the **dependent** and **independent** variables weighing in on the **perceived usefulness** (PU) and **perceived ease of use** (PEOU). This would help understand the attitudinal variations for intended use and purpose of this technology in various organizations, industries, cultures with social and individual acceptance trends looking through this conceptual framework.

Article title: Variables Influencing Cryptocurrency Use: A Technology Acceptance Model in Spain
Author & date: Mario Olivia, Jorge Pelegrín-Borondo, Gustavo Matías-Clavero (03/18/2019)
Journal: Frontiers in Psychology
URL: https://www.frontiersin.org/articles/10.3389/fpsyg.2019.00475/full

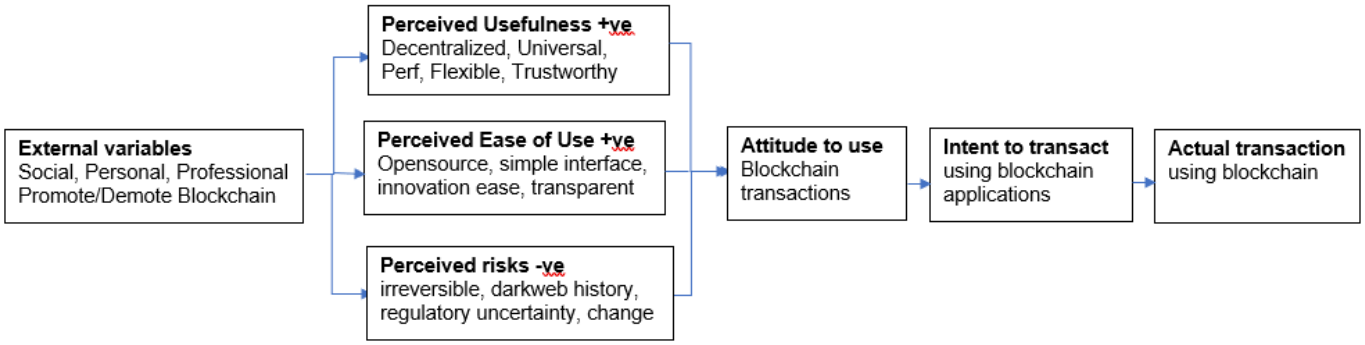
(Arias-Oliva et al., 2019) Most of the literature classifies blockchain environments into 3 different types - financial, on-financial and contractual within which the variables for perceived usefulness and ease of use are evaluated. One of key controls for this technology that affects the dependent variables and outcomes in most IT processes is availability of data and ability to store it for longterm analysis and tracking through the transactions in the blockchains.

There were negative trust concerns operating with blockchains and then used cryptocurrencies associated with darkweb due to lack of regulations around the powerful technology. But there was willingness to manage the risk and progress forward with using the technology. It was noticed that perceived usefulness was much stronger than perceived ease of use. There was not as much motivation with social attitude towards using blockchain yet.

Article title: Braving Bitcoin: A technology acceptance model (TAM) analysis
Author & date: Daniel Folkinshteyn (02/02/2017)
Journal: Journal of Information Technology Case and Application Research
URL:https://www.researchgate.net/publication/313248218_Braving_Bitcoin_A_technology_acceptance_model_TAM_analysis

The hypotheses considered positive influences and trust associated with higher performance, universal across geography, flexibility, facilitating trust.

(S4 Folkinshteyn, 2017) Figure 4: Blockchain Technology Acceptance Model



Independent variables and controls on which other factors and variables were dependent are as shown in table below.

Table 2 - Blockchain technology independent variables and external control factors

- Performance expectancy : +ve
- Effort expectancy : +ve
- Social influence : +ve
- Facilitating tech conditions : +ve
- Innovation ease : +ve
- Existing Financial literacy : +ve
- Perceived Risks : -ve

Dependent variables from literature reviews found that were influenced by various factors associated with key conceptual driver were:

- **Trust** which was dependent on the positive and negative drivers shown in the Figure4 and Table2
- **Attitude towards use of blockchain transactions**, **intent to transact** using blockchain technology
- Performing **Actual transactions using blockchain**

The surveys conducted in this research showed that on an individual level the dependent variable that clearly showed an assuring curve for intention to use blockchain applications had 68% variance with facilitating tech conditions influencing it with 14.81%. Also despite the negative perceived risks and association of blockchain driven cryptocurrency usage by darkweb commerce sites (like Silk Road, Empire Market, Tochka, Dream Alt, Nightmare, Genesis to name a few) the blockchain technology has lead to increase in **Trust** than decreasing it.

Learning Summary from literature review

In summary of the literature review of blockchain technology there are key factors that were significantly represented in every literature specifically addressing the future of this technology and various applications that it can be used for. The fact that this technology has existed since the 1980 elaborates an important aspect that trust of a transaction has played in the information era. With the abundance of data and recording a particular transaction with its authenticity is very critical to invoke trust and maintain it throughout the process of transaction. Another important aspect of blockchain is its decentralized operation making it fraud proof from conflict of interest of centralized governing authorities. Lastly its open source nature allowing it to be readily accessible to anyone across geographical boundaries.

The important landmark for this technology came through when Satoshi Nakamoto used it for launching the cryptocurrency bitcoin that used the blockchain in its most optimal application. It marked the strong beginning for leveraging its key benefits of a distributed ledger system with decentralized blocks representing every transaction. With the example use of blockchain in Bitcoin created a footprint for using it for other applications that involved transactions using smart contracts, supply chain material management, underwriting risks, insurance validation, education reputation accreditation and IOT transaction secure verification.

There are certain risks that cannot be overlooked associated with cost of the computing environment needed for blockchains, its learning curve associated with irreversible transactions adapting to new ways of managing industrial and business processes.Also cryptocurrencies being used for anonymity and illicit trade in the darkweb needs lot of information to attest to the users identity creating a fear of loss of privacy that needs to be addressed.

Overall blockchain applications are being widely deployed to adapt existing processes to them more effectively. They are definitely more scalable and have an ever increasing number of applications that can help leverage its acceptance in social structure more efficiently. Its already at our door step and helping to make our daily processes more reliable and trustworthy faster than we think.

Discussion: Framework for Conceptual Scheme - TAM

Article title: Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology
Author & date: Fred Davis (09/1989)
Journal: MIS Quarterly
URL: http://www.jstor.org/stable/249008

One of the frameworks presented in this course that I strongly perceive would be useful as the conceptual scheme for a research project is Technology Acceptance Model (TAM) framework.TAM framework Davis (1985) analyzes various critical aspects of technology acceptance in relation to possible factors that control the acceptance of technology using dependent and independent variables. This approach to analyze acceptance is helpful through multiple methods with adoption of technology using scientifically predictive means based on hypotheses, as well as statistically mathematical in reviewing survey responses for basing the findings for probable outcomes.

Article title: Why Traditional Technology Acceptance Models Won't Work With Future Information Technologies Conference Paper
Author & date: Carsten Rocker (05/2010)
Journal: Fraunhofer Institute of Optronics, System Technologies and Image Exploitation IOSB
URL:https://www.researchgate.net/publication/265375732_Why_Traditional_Technology_Acceptance_Models_Won%27t_Work_With_Future_Information_Technologies

Another important ability of TAM is to examine social and individual influence of attitude, intent and actual use of technology in reference to variables associated with the environment in which the technology is used. The review of these variables based on perceptions of an end-user roles like developer or consumer for using blockchain, organizations using blockchain for business processes like supplychain or smartcontract bring immense value when it comes to evaluation of technology. This also helps provide an efficiency and efficacy mapping to identify gaps associated with usefulness delivering value and ease of use to promote usability for the technology.

What type of research project would you engage in?
Especially when looking at this project and evaluating blockchain technology using TAM helped provide not only the perceived usefulness and perceived ease of use, but also helped analyze perceived risk factors affecting the trust. Which further influenced the attitude and intent of adoption and acceptance of blockchain technology at individual and organizational levels.

Considering these factors, a research project associated with **risk analysis and developing mitigation measures for smoother and trusted adoption of blockchain technology** makes most sense to me. Using the TAM would provide the analytical data for hypotheses evaluating PU and PEOU for controls and variables on predetermined scales. These could be assessing influencing controls and variables from - Financial literacy from **poor** to **excellent** or Privacy controls from **unreliable** to **trustworthy** or cryptocurrency investment from **doubtful** to **confident** as some examples, especially when analyzing the discomfort with complex technologies.Also the research could specifically help identify and implement usability through innovation, helping in reducing effort to learn the intricate linkages between financial concepts in digital terms.