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Enterprise Systems and Blockchain Technology: The Dormant Potentials

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Abstract

This paper surveys the current status of blockchain technologies integration and its potentials with enterprise systems' (ES). The blockchain technology has received substantial attention since the recent cryptocurrency-boom. The corporate world seeks to stay on the blockchain-train by exploring how they can benefit from the evolving technology and platforms. Hence, this research explores the capabilities and potentials of blockchain technology illustrated in the extant literature and investigates how it can reinforce, and be integrated with enterprise systems through semi-structured interviews with subject matter experts. The literature and collected data were classified into four components of blockchain technologies; identity, assets, logistics, and transactions. Our main findings suggest that there is scarce literature on blockchain integration with ES. Nevertheless, there is a huge potential for this integration, specifically on the transactions, identity, and logistics dimensions. In addition, our interview results suggest that blockchains can reinforce ES by accomplishing a single source of truth, and a common environment for shared information amongst a larger scope of actors and organizations.

Keywords: Enterprise systems; ERP; CRM; SCM; Blockchain

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1. Introduction

The rapid evolution of blockchain technology makes researchers deem the technology will be as revolutionary and important as the Internet [1-3]. Today, blockchain is most often associated with cryptocurrency, however the technology behind the cryptocurrencies has caught the attention of researchers who believe it has broader potential in other areas of use [4]. A particular area of use that has received much attention is the opportunities that may emerge when using blockchain to address challenges or open new opportunities with regards to enterprise systems. The main objective of enterprise systems is to integrate organizational processes and functions within a single system that is exclusive to the enterprise [5]. The enterprise system is considered a center point of the enterprise business processes, where information is stored and can be shared across departments. Blockchain and enterprise systems share the common characteristic of both being "libraries" of stored data, however the accessibility to this data varies between the two [3].

Even though blockchain enthusiasm has reached the highest level in Gartner´s hype cycle [6], existing academic literature regarding blockchain in relation to enterprise systems is limited [7]. This paper presents an overview of the current academic research within the topic of blockchain applications for enterprise systems, to identify the capabilities of blockchain technology and how it can reinforce enterprise systems. The analysis of literature can contribute to achieving a greater understanding of how blockchain technology can be applied and support specific business processes within an enterprise system. A total of 19 articles were identified, and due to the scarce literature, interviews with five subject matter experts were conducted to gain a broader insight into the research topic from the different stakeholders. The data gathered was organized in relation to the four major blockchain technologies that are assumed to have enterprise potential; identity, assets, logistics, and transactions [8]. To justify the potential reinforcement which enterprise systems can expect from the blockchain technology, an understanding of both is then crucial. An enterprise system is often viewed as an essential support system that contains an organization's data, thus can enable sturdy decision-making in various business processes [9]. The content of an enterprise system is likely to vary across organizations, however, general modules that are often included in enterprise systems are; manufacturing, accounting and finance, human resources management (HRM), sales, marketing, supply-chain management (SCM), and customer relationship management (CRM) [10]. The gathering of these modules under one enterprise system is considered to be the past decade's most vital development in information technology [5].

Enterprise systems are centralized, which means that information is accessible through a centralized register. In essence, this characteristic is the one that will be challenged by blockchain technology which is decentralized by nature. Blockchain has various definitions, however, a general and much-adopted definition is presented by [3], which suggests that blockchain is a decentralized and distributed technology that allows for immutable and irreversible information and near-real-time transactions, which are shared amongst public or private participating parties. The block and the chain components are interconnected, and each block contains a cryptographic hash that is both unique to that block and chains it to the immediate preceding block of information [11]. This block consists of the hash ID and time stamping associated with each block, which are the functions that form the blockchain. A common misperception tends to occur when considering the cryptographic elements and processes of blockchain when evaluating the technology in relation to enterprise systems. From an enterprise perspective, a blockchain inspired digital ledger is sometimes considered to be a more correct term.

Based on the discussion above, this paper seeks to answer the research question of *"how can blockchain applications and technologies be integrated and reinforce enterprise systems?"*

The remainder of the paper is structured as follows: Section 2 presents the research method and gives an overview of the reviewed research articles and the conducted interviews. Section 3 presents the findings classified within the adopted four components framework, and section 4 provides a discussion of the findings and presents the limitations of this research. Finally, a conclusion is provided in section 5.

2. Research Method

As mentioned above, this research aims at exploring how the capabilities of blockchain technology can reinforce enterprise systems. For this purpose, this research employed an exploratory qualitative research methodology [12], with a combination of a literature review and supplementary interviews with experts in the field. The literature review

aided the authors in identifying the topics that have been previously studied and investigated, thus illustrated the research path of the topic [13]. In other words, the existing body of knowledge created an amalgam of information that highlighted the trending perspectives and topic areas in extant literature. In addition to gaining an understanding of published research within the chosen topic, observations of gaps and limited research areas were also identified. The limited amount of existing academic research created a motivation for the authors to validate identified theories and issues through primary research. Thus, to get a more in-depth knowledge regarding the identified issues in literature, the study conducted five semi-structured interviews [14], where participants were selected based on their knowledge regarding both enterprise systems and blockchain domains.

2.1. Data collection

The study conducted a combination of a literature review and interviews with experts in the field. The interviews were conducted during the second half of the year 2019 by the second author. The development of the blockchain technology can be considered recent and rapid, thereby peer-reviewed research between the period from January 2016 to April 2020 was covered in our review and was considered appropriate. Below, we provide more details about the review process and the interviews conducted.

For the literature review, the following actions were made to accomplish a systematic literature review process: 1) a search in the Edinburgh Napier University (ENU) database, Google Scholar, and Edinburgh University Portal (EUP) was conducted. 2) The review period was set between 2016-2020 (April). 3) The initial keywords that were used for limiting irrelevant research were: Enterprise systems, Enterprise Resource Planning, CRM, Customer Relationship Management Systems, SCM, Supply Chain Management Systems, and Blockchain. In this, 26 papers were identified as potentially relevant for the review process. 4) All abstracts and conclusions of the identified 26 papers were read by the authors to confirm their relevance to the research scope. 5) The literature review included only peer-reviewed articles that directly address enterprise systems and blockchain technologies. Thus, after the several screening rounds in the review process, nineteen articles were chosen and deemed relevant to this research scope. An overview of the identified articles is presented in table 2.

For the interviews, the selection of target informants was accomplished through purposeful and snowball sampling techniques [15]. A small group of experts in the field of Blockchain and ERP systems were identified through our network and referrals. Based on the literature review the authors identified four components that could aid in exploring how blockchain applications and technologies can be integrated and reinforce enterprise systems. Hence, the four components, identity, assets, logistics, and transactions [8]were used as a base framework for the interviews and to analyze the capabilities of blockchain and how the technology can reinforce enterprise systems. Thus, the interview questions were organized with respect to the main four components of blockchain technology, and we developed other questions to understand the participants' insights of possible integration. The essential factor in the data collection, both primary and secondary, was to gather data and literature that combines the blockchain and enterprise systems interplay.

The following processes were made to conduct the interviews: 1) a broad understanding of the topic of blockchain technology applications in enterprise systems was established based on our review. 2) Research questions were formulated based on constructs or issues found in existing academic literature. 3) Actions to engage participants were made through e-mailing and calling enterprises that were deemed to have expertise in the topic under research. 4) Contact with eleven potential participants was eventually established, and five participants were willing to participate in this study. All the interviews were digitally recorded with the informants' consent. Table 2 below provides an overview of participants and interview details.

Table 1: Overview of informants and interviews

Industry	Position	Form of Interview	Length of Interview	Reference
IT	Head of Solutions	Telephone	40 minutes	(A)

IT	Head of Blockchain Solutions	Face-to-Face	60 minutes	(B)
Manufacturing	Head of Compliance	Telephone	44 minutes	(C)
IT Consultant	Systems Developer	Telephone	31 minutes	(D)
Business Consultant	Innovation Studio Leader	Telephone	35 minutes	(E)

2.2 Data analysis

In the literature review, the articles were organized by all authors via color coding and tagging techniques [16], whereby the articles were classified according to the topic and/or theme and compared to what was applicable to each category of the blockchain components mentioned earlier. The articles were subsequently analyzed by authors independently.

For the interviews, all interviews were digitally recorded and transcribed. The interviews were then classified independently via color coding and tagging techniques. The data was compared to what was applicable to each category of the four components. The data gathered in each interview was then classified according to the four components; identity, assets, logistics, and transactions. The color-coding and tagging techniques aided in identifying similarities and patterns across the data. This made it easier to visualize the data and speed up data extraction into matrix tables and eased further analysis. Results were consequently compared and discussed to achieve consensus on the interview text, as well as the reviewed articles' classifications. For each blockchain component, findings from both, the literature and interviews were combined and aligned with various business processes that are commonly included in enterprise systems. The combination of interviews and literature data into classifications aided the authors to see the similarities and contrasts between what has been published in academic articles and the experts' and practitioners' opinions. It is important to mention that an article or interview excerpt could fall into one or more classification themes or blockchain components.

3. Research Findings

After several rounds of screening, the authors identified 19 articles that were deemed relevant to the focus of this study. The 19 articles were composed of 15 journal papers, 1 journal editorial, and 3 conference articles (see table 2).

Table 2: Literature overview and classification

Reference	Author(s)	Type	Main Method	Blockchain Component
[7]	Woodside et al. (2017)	Journal Article	Case Study	Transactions
[17]	Maslova (2018)	Journal Article	Conceptual Paper	Identity
[18]	Appelbaum & Smith (2017)	Journal Article	Conceptual Paper	Identity - Logistics
[19]	Rechtman (2017)	Journal Article	Conceptual Paper	Identity
[20]	Wang et al. (2016)	Journal Article	Case Study	Assets
[21]	Wang et al. (2017)	Journal Article	Conceptual Paper	Identity
[22]	Wang & Kogan (2018)	Journal Article	Case Study	Assets
[23]	Tribis et al. (2018)	Journal Article	Case Study	Logistics
[24]	Dobrovnik et al. (2018)	Journal Article	Conceptual Paper	Logistics
[3]	Parikh (2018)	Journal Article	Conceptual Paper	Assets - Logistics
[25]	Gateschi et al. (2018)	Journal Article	Case Study	Logistics

[26]	Iansiti & Lakhani (2017)	Journal Article	Conceptual Paper	Transactions
[27]	Korpela et al. (2017)	Conference Paper	Case Study	Assets - Transactions
[28]	Chen (2018)	Journal Article	Conceptual Paper	Identity
[29]	Beck et al. (2017)	Journal Editorial	Editorial	Assets
[8]	Banerjee, A. (2018)	Journal Article	Conceptual Paper	Identity -Assets – Logistics -Transactions
[30]	Gomaa et al. (2019)	Journal Article	Conceptual Paper	Transactions
[31]	Gatteschi et al. (2020)	Conference Paper	Conceptual Paper	Transactions
[32]	Basl & Novakova (2019)	Conference Paper	Conceptual Paper	Transactions

To organize the literature and interviews findings, this paper presents the main results structured based on the adopted four components framework of blockchain technology in the sections below.

3.1 Identity

Digital identity is the lock that opens the door to further capabilities of blockchain technology. It is considered a building block that grants access to a larger ecosystem and a common environment. The level of awareness amongst enterprises regarding blockchain can give an impression of the likelihood of creating a digital identity to adopt blockchain technologies. Thus, a study [17] analyzed the Fortune 50 enterprises in relation to the diffusion of innovation (DOI) theory, to position the 50 enterprises in relation to their adoption phase of blockchain. The study suggests that there is a general lack of blockchain awareness among the studied enterprises, as only one organization (IBM) considered the potential of integrating the technology with ERP systems. This lack of awareness is also echoed by a scarcity in research investigating the rapid evolution of blockchain applications in relation to enterprise processes, which could be the reason for the limited understanding in the business environment [18]. Several studies (e.g. [11, 19, 33]) explored enterprise systems in relation to the decentralized aspect of blockchain technology, and the scope of enterprise digital identity in a broader blockchain ecosystem. The various blockchain's applications were compared in relation to enterprise systems to investigate how these applications would be appropriate in a business setting. The literature argues that private platforms would be appropriate for adopting blockchains, because an enterprise that seeks to use blockchain technology must persuade their collaborating actors to adopt the same software and technology, and this could be problematic [11]. Likewise, [11, 19, 33] identified various drawbacks of adopting a public blockchain, similar to the Bitcoin application, and they argue that this is considered high risk and may pose limited efficiency for business purposes. On the other hand, [19] argue that a closed blockchain application with only permitted parties granted access to it, was recognized as the most appropriate form of environment, in which it will include trusted actors only. The arguments and findings of [11, 19, 33] were validated by interviewee (A) who reflected on this in relation to building a blockchain consortium that would protect the enterprises' digital identity; *"If groups or enterprises gather around one application that is based on a blockchain consortium, then it is more likely that a limited number of processes within a specific area are optimized amongst trusted parties."*.

A blockchain consortium restricts the access to the network, hence only consists of trusted entities who share mutually agreed-upon rules within the ecosystem. Interviewees (A, B) described the public and private blockchains as more Bitcoin-related and suggested that a blockchain consortium should be the enterprise focus. Interviewee (B) suggests; *"When considering a private blockchain this limits the blockchain to internal organizational use only. I don't see the demand for integrating internal blockchains in ERP systems as trust should already exist internally. The main demand for blockchain is based on the wish to trust external parties."*.

Further studies consider the obstacles of adopting digital identity for blockchain purposes [11, 21]. A study [21], proposed a maturity model for blockchain adoption, where integration and update challenges are considered major obstacles. The need for standardization of blockchain is also recognized in literature, thus if an organization seeks to adopt a digital identity for blockchain, estimations of the organization's adoption-readiness must be incorporated in a strategic plan for integration. Interviewee (C) supports this reflection; *"The potential for what blockchain can be used for will be consistent with the demand for tracing transactions and sharing these amongst a group of actors without*

involving middleman. It is going to be hard to replace an existing working business process with new technology and gain a compelling ROI.".

3.2 Assets

The ownership, record-keeping, and tokenization of assets are capabilities of blockchain technology that are considered to have the potential for reinforcing enterprise systems. How these capabilities can increase asset management processes such as inventory, manufacturing, and distribution are discussed in the extant literature and also by our informants. Several publications that discuss enterprise and blockchain consider the valuable potential or adopting blockchain to generate irreversible, immutable, and near-real-time record-keeping [11, 22, 34]. For example, a study [22] evaluated the potential of these blockchain technologies in relation to inventory operations and suggested that the authentication of records will optimize the data quality in an enterprise system. This is expected to occur through the inability to change transaction records, thus grants every actor that operates with or within inventory with a constant record of the original transaction. This is also supported by [34], which argues that blockchain technology will generate higher data quality due to the irreversible mechanism that it offers. Another study [3] practically contributes to this domain by introducing the blockchain application *Smart Property*, which is suggested to have the ability to track assets (e.g. inventory), and distribution of an enterprise´s products. Interviewee D elaborates on how this may reinforce enterprise systems; *"People and organizations will not have the same perception of data, and this is a risk for organizations in that there will be inefficient operations of assets such as inventory. The ability to track actions in the constant blockchain is likely to be very appealing for organizations."*.

Further consideration of blockchain capabilities is undertaken in paper [20], which considers record-keeping in HR. The blockchain technology is argued to help manage internal structures within HR, as the unchangeable records can be validated by different actors in an ecosystem, such as the employee's university or the previous employer can grant authentic data records of employees. Controlling personal information in HR records, as well as administrating employee's accessibility to certain data can be possible through blockchain technology as an additional layer of security to the ES. Another view of how blockchain can reinforce ES is through the capability of tokens, which in relation to CRM is illustrated in literature [27]. The paper presents the possibility of accomplishing greater B2C relationships through encouraging loyalty tokens or encourage engagement amongst consumers by persuading them in using tokens. Interviewee E elaborates in relation to this blockchain capability; *"Tokens can be considered rights to an asset and are today frequently used in start-up blockchain applications. In the future, one can predict the use of blockchain within buyers-rights in for example music and that the organization's tokens represent the rights to listen to the music."*. There is scarce literature regarding the topic of tokenization of assets within enterprise systems in general, and ERP systems in specific. The potential of tokens is presented in [29], which suggests that tokens are usually related to proof-of-work for the ones that mine blocks of Bitcoins. Interviewee E supplements this with a statement on the potential of tokenization of assets; *"Tokens are interesting and present various areas of use. In the future, organizations may only rely on tokenization of assets, which will generate a totally new marketplace. The technology of sharing tokens amongst participants is current, however the adoption of this technology in a business setting will be interesting to see. It has great potential."*.

3.3 Logistics

A much-discussed focus area when considering integrating blockchain with enterprise systems is the logistics-related competency of the technology. The emphasis on a common decentralized environment and trackability is often associated with the logistics capabilities, thus it is most often referred to in relation to the potential for optimizing supply-chain management within an ERP system. A case study conducted by [24] explored the mapping of existing research on SCM and blockchain, thus found that the most researched topics within SCM and blockchain are focused on the physical traceability of supply-chains. An enterprise's ability to track various elements of the supply-chain, thus have control over the different actors and their production methods are likely to generate greater profitability as it is expected to decrease waste along the way. This is recognized as the most demanded application of blockchain technology within SCM. The importance of tracking is further discussed in [3] which suggests that the tracking has the potential for recognizing false or stolen merchandise, thus will limit the risks of fraud, which also can be connected

to the domain of *sustainability*. This is argued to be possible as the streams of information are recognizable to every player in the supply-chain, yet the ability to change the information is non-existing. Interviewee C agrees with the importance of traceability, thus contributes with further thoughts; *"The willingness of entering partnerships is likely to increase due to the safety protocols that blockchain inherit."*. A talk by [35] illustrates the value of a shared external platform in a case study of Walmart's adoption of blockchain in the enterprise´s supply-chain of mangoes. The optimization is believed to be inherited from every actor in the supply-chain being a part of the same platform or ecosystem, with access to the original product order, path, and information needed. This is suggested to generate more effective and transparent communication amongst multiple actors, which will optimize the efficiency of the supply-chain. This is supported by [18] who recognized the problems that can arise when different actors in the supply-chain operate in the different enterprise systems. Problems such as lack of transparency, delays, and the amount of time that is spent on validation activities are believed to be dissolved if the supply-chain could operate in a common environment through blockchain technology. A study [23] suggests that the common environment in which the literature argues for is a valuable technology due to its ability to generate "a single source of truth.". Interviewee D has adopted the statement and argues that; *"Supply-chain management is the ERP process that is likely to gain the most from a common environment as the information flow will be much more consistent, thus present a single source of truth."*. The integration of blockchain in SCM is also argued to generate cost savings, due to enhanced logistics processes. A paper [25] suggests that blockchain integration in supply-chain operations will create cost savings due to a more automated, error-free process. It is further argued that the transformation blockchain will enable SCM to disrupt production, purchasing, and consumption, thereby generate a physical flow of goods.

Other enterprise applications are also discussed in relation to enhancement from logistics. Several studies [8, 27] suggest that the blockchain application in logistics can enhance CRM as the enterprise can track customer behavior and particularly purchasing habits. This may result in enhanced analysis and reinforcement of decision-making processes. Interviewee E argues; *"There is great potential for enhanced logistics in multiple processes within an ERP process. The demand for tracing operations and sharing these either internally or external to the organization can apply to multiple ERP processes, not only supply-chain management."*.

3.4 Transactions

The focus on increased transaction-capability when integrating blockchain in enterprise systems is discussed in the existing literature. The transaction capability of blockchain is commonly discussed in relation to finance and accounting processes within an enterprise system. Several authors (e.g. [3, 7, 18, 30, 36]) argue that the transaction capability of blockchain technology is highly demanded due to the ability to eliminate third parties. This is also echoed in [36], which argues that this could generate cost savings and time, as the two parties in the deal will communicate directly. An organization's ability to gain greater control of accounting and financial processes is also believed to be a potential outcome of integrating blockchains with ES. Another study [3] emphasizes the decentralization effect on transactions, where actors involved in the ecosystem will verify transactions, and actions will be stored as irreversible data. This is argued to contribute to a more secure financial transaction process, in which will encourage partnerships amongst low-trusting actors. Interviewee A contributes to the understanding of capabilities of blockchain technology in relation to accounting and finance; *"If blockchain is implemented, every data would be stored there which would create a totally different corporate environment. Taking out the middleman could go further than banks, as a corporation might not even need to depend on ERP vendors. There would always be a copy of the company´s information in the blockchain."*.

Integrating blockchain technology in accounting and finance processes can enable a common environment for sharing enterprises' internal transactions and external relationships [26, 31, 32]. This is suggested to be possible in an ecosystem in which every interested party has access to another organization's database. The literature emphasizes on how enterprises continuously update their economic actions, which will be replicated and updated regularly in a common ledger. Interviewee C provides a practical example for this scenario; *"within a large corporation that emphasizes on sales, payment ability of external parties will always be a problem. Their annual reports are not current enough, and if transactions were available on the blockchain, one could do their own analysis of payment ability of the other party. I believe this is the most interesting and compelling aspect of blockchain and ERP systems."*. A study [26] presents a SWOT analysis regarding the adoption of blockchain in accounting and finance. The strengths of this

analysis are considered arguments for integration as it would potentially provide low-cost transfers, eliminate intermediaries, enable Smart Contracts, and worldwide accessibility. On the other hand, weaknesses may include reduced user privacy, no intermediaries, and that the blockchain development is still in its infancy. These arguments are recognized amongst multiple publications, including [27, 28]. [27] gathered statistics in which displayed that 1/3 of enterprises that consider blockchain technology base their motivation on payments or transactions. The statistics further showed that 10% identified Smart Contacts as valuable contributions to accounting and finance [27].

4. Discussion

While there is a great interest in the use of blockchain technology, however, we recognized the limited research that exists in relation to blockchain and enterprise systems. The speculations regarding the scope blockchain technology´s level of impact on ES are broad. This paper includes a collection of 19 articles that have been used as the basis for the topics we explored through data collection from subject matter experts. In addition, several of our expert informants requested the demand for practical actions and not simply hypothetical discussions regarding the topic. This research has identified key blockchain capabilities in which can reinforce enterprise systems, however, as there is limited evidence to show actual integration, further research is needed to define the success-factors of integration. The following capabilities of blockchain technology were defined as potential opportunities for reinforcing enterprise systems: the adoption of blockchain as a technology for enhanced or supporting enterprise system processes would require the creation of a digital identity in which would allow access to ecosystems, otherwise referred to as common environments. Blockchains decentralized characteristic is recognized as an important aspect in relation to this, as the enterprise would operate in a digital ledger where various levels of data sharing will be generated and approved by external actors to the enterprise. The level and form of data sharing are discussed in the existing literature and provide concerns on how exposed the enterprise and enterprise system processes will be to the public. Thus, a consortium of enterprises was suggested as most appropriate, which may be due to the limited actors that will be granted access to the common environment. The identity function of blockchain technology is viewed as the lock that opens the door to further technologies, which then can be assumed to impact every enterprise system process that an organization chooses to integrate blockchain within. The blockchain characteristics of irreversible records and near-real-time transactions were emphasized as beneficial when considering assets management in various enterprise system processes. Record-keeping of assets in inventory and warehousing operations is also viewed as an important feature, where irreversible logging would be beneficial for the enterprise system processes. The irreversible and near-real-time blockchain technology could also be applied to record-keeping in HR. The value of blockchain in these enterprise processes are shared amongst researchers of this topic and are viewed as highly demanded by our interviewees. On the other hand, the information gathered from the aspect of the tokenization of assets displayed limited research. The interviewees emphasized how this might disrupt the trading environment that we see today, however, the lack of research makes it hard to build up strong arguments or conclude on this matter. The mainstream literature reviewed, presented also the opportunities for enhanced logistics in SCM. This was argued to be based on the common environment, irreversible records, and near-real-time information sharing. The potential impact this function of blockchain can have on SCM is viewed as gigantic, due to the concept of a “single source of truth.”. This concept is argued to create more efficient SCM as the information is accurate, visible, and equal for every actor in the supply-chain. Further, the opportunities for combining this technology with CRM systems for tracking consumer behavior can be assumed to reduce the possibility of bullwhip effects. How blockchain technologies can prevent challenges in the supply-chain such as the bullwhip effect, is an untapped area of research, hence, is a recommended future research avenue.

The majority of the extant literature is focused on enterprise system processes related to accounting and finance, where the elimination of middlemen was viewed as a valuable potential. This is based on the ability to gain greater control over financial actions, thus, have direct communication with external partners. Other research focused on how a common environment between interested parties would allow enhanced accounting when considering sales processes. This is viewed as highly demanded, due to the ability to view the payment ability of external parties. In addition, irreversible logs of transactions were further discussed in relation to security and enterprises’ ability to collude with low-trusted actors. In essence, the existing research provides an overview of the potential impact blockchain technology can have on enterprise systems. The technology´s characteristics of decentralized, irreversible

and immutable, and near-real-time capabilities virtually prove to apply to various enterprise system processes that include asset, logistics, and transaction activities. The topic of enterprise systems and blockchain is scarcely researched, hence examples that are given are often not based on actual integration of blockchain technology but mainly rely on theoretical, hypothetical, and conceptual discussions and scenarios. Researchers do, however, apply blockchain characteristics that are viewed in applications such as Bitcoin, thereby drawing assumptions of how this could be potentially integrated into enterprise systems. Besides our informants, multiple research articles that were reviewed in this research stress the importance of further research and practical case studies for enterprise system vendors to demonstrate the actual integration of blockchain to prove potential outcomes.

There are two major limitations in this study that could be addressed in future research. First, the lack of prior research on this topic formed the basis of the literature review and helped lay the foundation for understanding the research problem. The lack of prior research hindered the scope of the research and the understanding of the main obstacles and other possibilities or applications of blockchains in ES. For further development of blockchain technology in enterprise systems, research should be conducted especially on actual integration of blockchain technology. Second, the study focused on an exploratory qualitative research approach. Exploratory studies with interviews generate qualitative information and interpretations that may be subject to bias. While we have reached data saturation [12] during the interviews, however, our modest number of experts may not adequately represent the target population. Accordingly, it cannot be generalized to a wider population. In retrospect of conducting this study, two blockchain characteristics stand out as major factors that can reinforce enterprise systems processes; accomplishing a single source of truth, and a common environment for shared information amongst a larger scope of actors.

5. Conclusion

This research has employed an exploratory analysis of how the capabilities of blockchain technology have the potential for reinforcing enterprise systems. An area that attracts broad interest regarding how the blockchain technology can benefit the business transaction, actors and organizations involved in partnerships, and value- and supply chains. This paper conducted a thorough literature review; however, scarce levels of existing academic research were identified. Primary research in the form of interviews with five experts was thereby conducted in order to gain a greater understanding of the topic and gather insights from the professionals within both fields (ES & blockchain). The research findings were structured and classified into four components presented in existing literature, which were deemed as the potential areas and applications of blockchain integration in enterprise systems. The four components consist of identity, assets, logistics, and transactions. Hence, this research contributes to the understanding of how blockchain can be integrated with enterprise systems and presented the common misunderstandings regarding the potentials of blockchain in relation to enterprises. In addition, key capabilities of blockchain technology were discussed in relation to specific business processes, thus expose how blockchain can have multiple areas of application within an enterprise. Finally, two key benefits were recognized as strongly reinforcing capabilities: blockchains capability of providing “a single source of truth”, and the common environment that can accommodate external or internal actors.

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