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REVIEW OF BLOCKCHAIN LITERATURE – ITS APPLICATION AND ACCEPTANCE

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ABSTRACT

Aim/Purpose	To understand the current state of the body of literature in blockchain technology and propose dimensions for acceptance.
Background	Blockchain technology has large promise to replace centralized and even distributed database systems. Its premise focuses on issues such as transparency, immutability, and privacy of transactions. Created for bitcoin, researchers and practitioners have begun to see its potential in different areas and industries. Its acceptance is still debatable as there are a number of issues still to be resolved.
Methodology	We conducted a literature review to assess the size and scope of the body of research in the are of blockchain applications and carried a conceptual analysis for blockchain acceptance.
Contribution	We provide an assessment of the body of literature in the are of blockchain and cluster the number of articles according to application groupings. We show that research in blockchain cannot be considered that it even started due to its diverse, scattered and weak related studies. At the same time, blockchain is still faced with a lot of resistance yet no one is studying its acceptance. We therefore propose dimension for its acceptance, as adapted from the very rich area of ecommerce research.
Findings	Body of research is at its infancy. Research is scattered and weak. Most research is related to bitcoin and cryptocurrency. There is a great need to study the application of blockchain outside its current focus on cryptocurrency. Areas of study of

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	blockchain applications include internet of things, energy and finance – other areas are identified. Dimensions for blockchain acceptance are proposed and include: reputation, risk, usefulness, and intentions.
Recommendations for Practitioners	Blockchain has great potential to be applied in areas such as medicine, aviation and disaster relief. In terms of blockchain characteristics, practitioners have a lot of room to innovate in various approaches such as the blockchain hashing algorithm, smart contracts and peer validation. These do not need to be fixed but can vary based on the business characteristics.
Recommendations for Researchers	Research in the application of blockchain can be considered as not even started. The application of blockchain is an open playground which today few have stepped in to enjoy. Research opportunities include but are not limited to energy consumption of blockchain transactions, dimensions to blockchain adoption and acceptance, adaptability of blockchain to various industries, and innovation in blockchain characteristics such as new approaches to peer validation of transactions.
Keywords	blockchain, application, information systems, cryptocurrency

INTRODUCTION

Blockchain was created as a way to kickstart the paradigm of cryptocurrency and enable it as a trustless mechanism – Giving birth to Bitcoin. Ever since, blockchain as a mechanism found itself reappropriated from its original purpose where various industries and stakeholders' saw attractive alternatives to its use to solve persistent business problems. At the same time, blockchain found itself in the hands of many who are seeking paradigm changes in the world of business and an opportunity to disrupt mature industries. This paper reviews and looks into blockchain technology literature, discussing its increase in popularity through its use in the cryptocurrency market. We try to evaluate where blockchain technology state is today, and within the body of research identify the the areas of its study and application. Blockchain features such as privacy, security, and anonymity, are identified and discussed, and a review of where it has been applied and studied today such as Internet of Things, Energy, and Finance, elaborated. Finally, factors for consumer acceptance are proposed. We advocate in this study the need for more scientific research in the application of Blockchain and future opportunities.

The past decade has seen a tremendous growth in the world of digital commerce (Anderson, 1972). The multitude number of devices capable of harnessing the advantages of the internet has led to a global proliferation of intelligent devices, with services that opened the door for changes in the traditional structures of doing businesses and commerce. The introduction of cryptocurrencies and other forms of decentralized transactions between users, are promising to increase speed of and generally streamline transaction processing (Zheng, Xie, Dai, Chen, &Wang, 2017). A natural evolution in the realm of digital transactions is the introduction of the internet of things. Under the new promised paradigm, users would be able to not only transact and fulfill exchanges, but to disintermediate themselves from the process by enabling the devices to transact on their behalf. Through the internet of things, a multitude of smart devices containing sensors and other data collection components would be able to transfer useful and real time information seamlessly throughout the network, allowing for more intuitive and intelligent decisions from their users.

Other areas the benefit from information technology advances are healthcare, energy, finance, and government, among others. Devices containing sensors able to record and process data ranging from step tracking to sleep to heart rates allows healthcare to provide better the quality of life for future generations (Mettler, 2016). The energy sector, introducing green technology to the private household and individuals open the door for them to become energy producers and consumers at the same time. We are at the interface of a new paradigm where individual households would have the ability

to generate electricity in excess and resell power back into the grid and subsidize energy needs creating energy micro grids, allowing for direct government subsidies in the repurchase and exchange of energy between citizens (Lundqvist, de Blanche, & Andersson, 2017; Sikorski, Haughton, & Kraft, 2017). The world of financial services, already improved payment processing stands to gain from cryptocurrencies and smart devices able to execute transactions efficiently, with greater liquidity security between financial institutions (MacDonald, Allen, & Potts, 2016). Last but not least, government services will be enhanced by providing a greater level of decentralization by streamlining communication with citizens while digital voting systems will gain trust through greater layer of security and accountability while reducing the risk of fraud and tampering (Ølnes & Jansen, 2017).

However, these technological enhancements come with their own set of concerns and issues, particularly pertaining to privacy, security and data centralization. With the increased proliferation of information, privacy risks becoming a thing of the past, personal data can be tagged to individuals and the need to share information can be offset by the loos of control over one's information and associated risks (Lindman, Tuunainen, & Rossi, 2017):

- Smart devices can spy on you and monitor your activities while at the same time share more of your data than you may feel comfortable about and even aware of.
- Your neighbors can spy on your energy consumption and production.
- Every transaction and purchase details can be made public to various institutions.
- A centralized medical record system can impede medical data privacy and doctor patient confidentiality.
- The spread of information over multiple locations will increase the risk and probability of data theft, which is a rather common occurrence today, and a nuisance.
- Smart device networks can be hacked to obtain sensitive information, while financial accounts lead to credit card and financial fraud.
- Centralizing information by third party entities also provide inherent risks to data. This has led to new business models; users and their data make a sufficient justification of the companies' intentions as ongoing concern for abuse as they leverage customer information to understand behavior such as user tolerances and price sensitivities.

Introduced in 2008 as the underpinning technology for Bitcoin, blockchain allowed for the validation and synchronization of content among users directly without the intervention of intermediaries and trusted third parties (Nakamoto, 2017). The introduction of asymmetric encryption allows for the existence of both private and public keys whereby the user interacts with the community using the public key while the private key remains unknown to other users (Weber, Xu, Riveret, Governatori, Ponomarev, & Mendling, 2016). As a result, users can transact through internet of things devices free of the concern of losing privacy while maintaining the anonymity of the data. As a result, financial transactions would be conducted directly between individuals thereby democratizing the financial system rendering it similar to the cash and free exchange market. Moreover, hospitals and insurance providers will also lose monopoly over patient's medical records and information. Finally, government programs and services such as digital ID and voting systems can exist without concerns of a third-party company holding individual identity records and the removing the risk of voting manipulation and fraud.

While research on blockchain technology has increased significantly in the past two years, much is left to be said concerning the acceptance of blockchain and its place within the existing literature of technology acceptance. Blockchain technology's features and promised advancements will not translate to applicability if the technology itself is not accepted by its users. User acceptance or lack thereof is a constant impediment to the adoption and proliferation of new information systems.

Blockchain systems aim to decentralize information and transactions by shifting the focus and power to the users themselves, thereby posing the issue that the system by design cannot subsist solely on the adoption of trusted third parties and organization but on the very end users it aims to serve.

While the technology acceptance model was initially designed to measure the usage of information technology at work, it has since been adapted and heavily used in various areas of ecommerce and remote transaction assessments in order to determine user's intention to use and recommend the technology. The technology acceptance model enables researchers to discern between the various internal and external motivations can lead to modifications in beliefs, behaviors as well as attitudes. By leveraging these aspects to account for a user's attitude towards a system in particular rather than a random object, the technology acceptance model (TAM) has proven to be of consistent value in determining the outlook and adoption of various technologies, its implementation within the context of blockchain is therefore a natural progression of the subject's study (Pavlou, 2003). The limited research on the topic of blockchain acceptance leaves much to be discovered due to the relative novelty of blockchain technology, and the lack of exploratory studies pertaining to blockchain user behavior.

In this article we present two important aspects of blockchain, namely that state of the current research and its acceptance as an underlining technology for its application in different business sectors and the important factor that influence that acceptance. We specify that the literature review is a synthesis of an article recently accepted (Aboujaoude and Saade, 2019) while the acceptance of blockchain is part of an ongoing research and includes initial results recently obtained. The motivation and justification for this research is that when we first looked at the body of knowledge in blockchain we found that most of the research focuses on technical aspects and on bitcoin and cryptocurrency. Realizing that blockchain has the potential to address important issues in businesses and presents interesting opportunities, we looked into the application of blockchain research. We found that this was very lacking. Moreover, we delved deeper into empirical work and research on its acceptance (considering that many sectors such as finance and banking see it as a disruptive technology) and found only two articles. This article's primary aims are:

1. Reveal the weakness in blockchain research as it is implemented in different business sectors,
2. Advocate the need for more research in the opportunities that blockchain technology provides for the various business sectors,
3. State the fact of lack of empirical research on blockchain acceptance and the need for research in this area.

LITERATURE REVIEW

As mentioned in the previous section, blockchain is the technology behind bitcoin cryptocurrency. It is a decentralized data management technology allowing for a low trust exchange system, independent from third-party, leveraging a peer network to validate transaction details. Blockchain is revolutionizing the industry by its application to sectors other that cryptocurrency. The main driver to the adoption of blockchain is related to the double spending. Double spending is when a user of a digital currency can spend several times the same amount of money before there has been a realization that the amount has already been spent / claimed. Blockchain solves this via cryptography and a shared ledger maintained by the peer to peer community, allowing for the verification of the transaction's legitimacy.

Blockchain technology today has shown promise of its applicability to various industries and business applications due to its characteristics of decentralized development and open source standards. While these characteristics define blockchain's purpose, the most important aspect is the immutability of the ledger itself. When a transaction is processed and validated by the peer nodes in the network, the information is permanently recorded in the ledger and cannot be modified or erased from the network. In cases, where some modifications and action are required, another feature can be utilized,

namely smart contracts to respond to the rigidity of the immutability of the Blockchain (Aste, Tasca, & Di Matteo, 2017).

In a study submitted recently to IEEE-Access (Aboujaoude & Saade, 2019), we scoped our literature review to focus on the business management and application aspects (instead of the technical perspective only) of blockchain implementation. In that study we elaborated on the different approaches to literatures reviews that are used in previous research, such as the systematic mapping process or another that outlines a process to apply the review to the software engineering field. While there are many similarities and overlaps between the various approaches, their evaluation and comparison are not discussed as it is outside the scope of the present research.

In our study, a systematic literature review approach based on the eight category coding steps established by Brereton, Kitchenham, Budgen, Turner, and Khalil (2007) was followed. The literature review approach is made up of three sequential stages, namely criteria and coding, aggregation and consolidation (article reduction) and synthesis. The third stage includes synthesis of the final articles set, we identify the core and most relevant articles to our research questions. We elaborate on the phases and steps taken below. We summarize some of the findings herein:

- The explosion in blockchain research started 2016, with 2017 representing the most significant year thus far in terms of research output reaching over 550 publications as compared to slightly over 100 in 2015 (search in google scholar containing the term Blockchain in the title.
- It seems that the nature of blockchain research has shifted in context within the last 2 years. While roughly 80% of all research articles prior to 2016 revolved around bitcoin, the evolution of blockchain research however, significantly surpassed those of bitcoin, in 2016 and 2017.
- Interest in cryptocurrency research has increased in 2018 and surpassed Blockchain research by about 30%, while research on Bitcoin has decreased gradually since 2015 to its original level in 2011-2012.
- Blockchain related applications have only just recently started to be explored. Many organizations ranging from aerospace to banking and the United Nations are presently considering its use in one way or another. Yet, the research to help them make sense of blockchain technology while safely utilizing and taking advantage of the opportunities it brings is limited.

Searching in google Scholar, 1512 publications (or more) containing the word blockchain(s) in the title can be found. Looking closer into the articles, we find that around 150 address the application of blockchain to various industry sectors and we found only one that only discusses adoption and satisfaction. Looking into peer refereed journals alone we identify 53 articles published in only 4 publishers. Top themes of study found within the 150 articles (in decreasing order) include: Internet of things (30 articles); energy; healthcare; resource management; government; exchange (from here on less than 10 articles); transportation; business process management; rights management; privacy; supply chain; smart cities; insurance (less than 5 from hereon); education; data transfer; social networks; fraud detection; environment; research; decision making; data accountability; and access control. By far, it seems that most researchers today associate Blockchain application to the IoT.

Overall, it seems that Blockchain applications research is still very young by any standard despite the recent spike in 2017.

BLOCKCHAIN SECTORS

The internet of things was by far the most popular "application" field. We found over 25 articles that were related to Blockchain applications in the internet of things area of research. All these articles were making the case for Blockchain's ability to improve and enhance the internet of things paradigm

providing examples and making the case for it. However, they were all descriptive. In reviewing those Internet of things articles, enhanced security, maintaining anonymity, smart contract provisions, device management, and network security were the primary areas of study (Christidis & Devetsikiotis, 2016).

The energy field included around 15 articles discussing the application of blockchain. Four different clusters of studies within the area of blockchain applications to energy and energy management were identified: machine-to-machine electricity control, energy trade, security of the energy grid, and green energy.

Although many articles can be found in the finance sector related to cryptocurrency fewer than 12 articles discussed blockchain. Most articles studied the interaction between finance and blockchain applications as it relates to transaction processing, sustainable banking, enhanced financial security and privacy, and automated financial contracts.

Around 10 articles were found in the healthcare sector. A search of healthcare blockchain applied articles resulted in identifying areas of research in medical data access, sharing of medical records, and unification and standardization of medical records.

Similar to healthcare only ten articles were found on the application of blockchain to government with studies primarily discussing eGovernment, digital identity, eVoting, and regulations management.

BLOCKCHAIN ACCEPTANCE

Borrowing from consumer behavior and adoption research we identify and discuss appropriate factors for blockchain technology implementation consideration and study. Consumers do not make their decisions in a bubble, they are often confronted by choice situations that are far less than ideal with regards to risk and uncertainty (Pavlou, 2003). The introduction of trusted intermediaries in processing transactions serves to establish trust by building on the reputation of the transacting parties and leveraging the public aspect of the transaction. All else equal, consumers will tend to choose the less risky options. However, risk is not the sole motivation driving the personal decision-making process of the consumer as perceived usefulness contributes to the positive aspects of the choice and will work to offset the negative attributes of risk. The balance between the two will translate to the appropriate transaction intentions depending on the overall risk / usefulness structure as well as the personal risk aversion and usefulness functions of the consumer (Wilkie & Pessemier, 1973).

REPUTATION

Reputation is considered an affect-based trust antecedent. In previous literature (Kim, Ferrin, & Rao, 2008), reputation was used as a moderator to trust and the other constructs of the technology acceptance model. Reputation measurements include items such as knowing a specific website as well as determining its perceived reputation along with that of the vendor that operates within it and the overall familiarity with the website itself. Unfortunately, given that blockchain is an underlying technology meant to support existing systems and brands, it is difficult for blockchain to establish a reputation for the technology on its own without a brand name or independent from the cryptocurrency or site that leverages its potential (Kang et al., 2017) This is further reinforced by the overall discrepancy in awareness of cryptocurrencies vs blockchain, even though blockchain provided the underpinning to cryptocurrencies. As such, we set out to convert the items presented in previous reputation research into those that would apply to blockchain technology.

RISK

There are various types of risks associated with blockchain technology that can range from privacy, security, overall transaction risk as well as the overall risk of the system itself as a sustainable model for its users. Given that the main advantages and offerings of blockchain technology are the in-

creased security and privacy offerings that it offers its users in relation to conventional transaction mechanisms. We believed it better to focus on items involving overall transaction risk of blockchain (BRI) as well as the risk of blockchain as a business model and system of daily use (BCPRB) (Hwang et al., 2017) This is due to the premise that blockchain technology suffers from a lack of recourse in the case of fraudulent transactions or stolen account. Furthermore, the current issues plaguing blockchain relate heavily to government regulation and efficiency concerns regarding power consumption which jeopardize its standing as a long-term sustainable system. Unfortunately, the unique nature of blockchain meant that the types of risks presented to the user were unconventional and therefore were not represented in the current literature. As such new items were added to measure blockchain system risk (Kim et al., 2008).

USEFULNESS

Little research has been conducted on the overall used and application of blockchain technology. a review of the literature indicates a focus of blockchain on key areas of energy, internet of things, finance, government and healthcare. These areas all stand to benefit from the technology due to the inherent advantages that its structure offers. These include greater control over your own information as well as a removal of intermediaries, high speed of information transfers, low costs of data transfer, high security, international scope and improved trust among stakeholders. While previous research has been conducted on perceived usefulness in relation to technology systems, the disintermediation and global effect of blockchain does not lend itself to conventional benefit characteristics. As such, new items were added in order to measure the construct based on previous surveys regarding blockchain and cryptocurrencies (Kim et al., 2008).

INTENTIONS

Traditional research methods would incorporate an aspect of pre and post purchase or transaction of an item in order to identify the overall attitude in using the technology itself. However, due to the previously mentioned underlying nature of the technology in that it is currently inseparable from cryptocurrencies, the use and trade of which is likely subject to immense regulation and scrutiny; a measure of actual transactions and purchases is not possible, this is especially true given the decentralized and anonymous nature of cryptocurrencies and blockchain based systems. We therefor contented with the measurement of overall transactions intentions (Suh & Han, 2003).

CONCLUSIONS

Blockchain technology as a paradigm has gained today just enough momentum to make it perceived as a tool for industrial applications and a potential source of disruption for established industries. From the management of information systems perspective, this can be viewed as a replacement to distributed and centralized databases resolving issues of privacy, transparency, security and anonymity. Some of the blockchain characteristics include the immutability of a ledger, the decentralization of data, the preservation of privacy, the allowance of trustless transactions, the efficiency and sustainability of processes as well as the ability to automate multi-step processes using smart contracts and possibly other approaches appropriate to specific industries.

A literature review of blockchain research was performed. The literature review was done from the standpoint of blockchain applications and publications dealing with the integration of blockchain into specific sectors and industries. Our final output resulted in around 150 blockchain application publications extracted from an initial pool of over 1500 academic works and sifted by including only the top publishers.

Looking through the literature, blockchain applications seem to have focused primarily on the IoT, Energy, Finance, Healthcare and Government. Our study indicates that blockchain research is expanding rapidly with a distinct evolution pattern among the different layers and concepts of block-

chain implementation, with initial research focusing on blockchain's first application Bitcoin, then progressing to study the underlying technology itself in the past 3 years while gradually shifting from blockchain improvement related works into application papers.

Blockchain on the other hand poses an important and ignored (in the literature) challenge, namely the lack of consumer awareness and the identification of barriers surrounding its especially with the overall current hype built around its dependent system of cryptocurrencies. This isolates the user from directly experiencing the technology itself.

There is a great need to study satisfaction and adoption (and other derivatives in the psycho-sociao-behavioral domains) of blockchain to identify and establish dimension and factors such as those proposed herein. This is especially pertinent due to the inability to conduct studies pertaining to blockchain acceptance without the prevalence of such factors. At the same time, practitioners need to better understand and make sense on how to apply blockchain and what are the elements of its successful implementation.

In this study, we set out to provide insight on the state of body of research in the area of blockchain application and propose some potential dimensions for its acceptance of implementation. We advocate in this article the need for further studies in this area.

REFERENCES

Aboujaoude, J., & Saade, R. (2019). Business applications of blockchain technology: A systematic review. *IEEE-Access. DOI:* 10.1109/ACCESS.2019.2902501

Anderson, A. (1973). Technology and American economic growth. By N. Rosenberg. *Business History Review,* 4(03), 376-378. https://doi.org/10.2307/3113274

Aste, T., Tasca, P., & Di Matteo, T. (2017). Blockchain Technologies: The Foreseeable Impact on Society and Industry. *Computer*, *50*(9), 18-28. https://doi.org/10.1109/mc.2017.3571064

Brereton, P., Kitchenham, B. A., Budgen, D., Turner, M., & Khalil, M. (2007). Lessons from applying the systematic literature review process within the software engineering domain. *Journal of Systems and Software*, *80*(4), 571-583.

Christidis, K., & Devetsikiotis, M. (2016) Blockchains and smart contracts for the internet of things. *IEEE Access*, *4*, 2292-2303. https://doi.org/10.1109/access.2016.2566339

Hwang, J., Choi, M. I., Lee, T., Jeon, S., Kim, S., Park, S., & Park, S. (2017). Energy prosumer business model using blockchain system to ensure transparency and safety. *Energy Procedia*, *141*, 194-198.

Kang, J., Yu, R., Huang, X., Maharjan, S., Zhang, Y., & Hossain, E. (2017). Enabling localized peer-to-peer electricity trading among plug-in hybrid electric vehicles using consortium blockchains. *IEEE Transactions on Industrial Informatics*, *13*(6), 3154-3164.

Kim, D., Ferrin, D., & Rao, H. (2008). A trust-based consumer decision-making model in electronic commerce: The role of trust, perceived risk, and their antecedents, *Decision Support Systems*, 44, no. 2, pp. 544-564. https://doi.org/10.1016/j.dss.2007.07.001

Lindman, J., Tuunainen, V., & Rossi, M. (2017). Opportunities and risks of blockchain technologies: A research agenda., *Proceedings of the 50th Hawaii International Conference on System Sciences (2017).* https://doi.org/10.24251/hicss.2017.185

Lundqvist, A., de Blanche, A., & Andersson, H. R. H. (2017), Thing-to-thing electricity micro payments using blockchain technology, *2017 Global Internet of Things Summit (GIoTS).* https://doi.org/10.1109/giots.2017.8016254

MacDonald, T., Allen, D., & Potts, J. (2016). Blockchains and the boundaries of self-organized economies: Predictions for the future of banking. *Banking Beyond Banks and Money*, pp. 279-296. https://doi.org/10.1007/978-3-319-42448-4_14

Mettler, M. (2016). Blockchain technology in healthcare: The revolution starts here. *2016 IEEE 18th International Conference on e-Health Networking, Applications and Services (Healthcom)*. https://doi.org/10.1109/healthcom.2016.7749510

Nakamoto, N, (2017). Centralised bitcoin: A secure and high performance electronic cash system. *SSRN Electronic Journal*, 2017. https://doi.org/10.2139/ssrn.3065723

Ølnes, S., & Jansen, A. (2017). Blockchain technology as a support infrastructure in e-government. *Lecture Notes in Computer Science*, pp. 215-227. https://doi.org/10.1007/978-3-319-64677-0_18

Pavlou, P. (2003). Consumer acceptance of electronic commerce: integrating trust and risk with the Technology Acceptance Model. *International Journal of Electronic Commerce*, *7*(3), 101-134. https://doi.org/10.1080/10864415.2003.11044275

Sikorski, J. Haughton, J., & Kraft, M. (2017). Blockchain technology in the chemical industry: Machine-to-machine electricity market, *Applied Energy*, vol. 195, pp. 234-246. https://doi.org/10.1016/j.apenergy.2017.03.039

Suh, B., & Han, I. (2003). The impact of customer trust and perception of security control on the acceptance of electronic commerce. *International Journal of Electronic Commerce*, *7*(3), 135-161. https://doi.org/10.1080/10864415.2003.11044270

Weber, I., Xu, X., Riveret, R., Governatori, G., Ponomarev, A., & Mendling, J. (2016). Untrusted business process monitoring and execution using blockchain. *Lecture Notes in Computer Science*, pp. 329-347. https://doi.org/10.1007/978-3-319-45348-4_19

Wilkie, W., & Pessemier, E. (1973). Issues in marketing's use of multi-attribute attitude models. *Journal of Marketing Research*, *10*(4), 428-441. https://doi.org/10.1177/002224377301000411

Zheng, Z., Xie, S. Dai, H., Chen, X., & Wang, H. (2017). An overview of blockchain technology: Architecture, consensus, and future trends. *2017 IEEE International Congress on Big Data (BigData Congress)*. https://doi.org/10.1109/bigdatacongress.2017.85

BIOGRAPHIES

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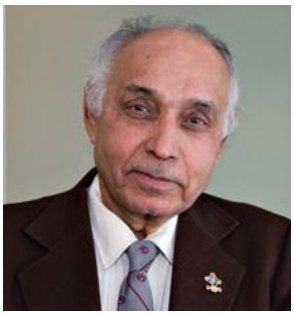

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