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## BLOCKCHAIN IN THE MIDDLE EAST: CHALLENGES AND OPPORTUNITIES

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# BLOCKCHAIN IN THE MIDDLE EAST: CHALLENGES AND OPPORTUNITIES

*Research full-length paper*

*Track 04*

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## Abstract

*The Blockchain technology has attracted a huge attention from both industry and academia. Despite the fact that there are great potentials of the blockchain, it is facing a number of technical challenges and social challenges. There is a substantial body of literature on the technical challenges and a limited number of researches that addressed the social challenges and opportunities of blockchain. Drawing on a multiple case study of twenty-one firms from six different Middle Eastern countries we synthesize the blockchain technology and IT in the Middle East literature to understand the challenges and opportunities of that technology in the Middle East. Our study identifies a classification of challenges and opportunities: Fine-tune challenges, estrangement challenges, sprint opportunities and act on opportunities and four associated factors: regulation, education, collaboration and culture. In doing this, our research extends and complements existing blockchain research and contributes to the IT literature in the Middle East.*

*Keywords:* Digital Ecosystems, Blockchain, Information Technology, Challenges, Middle East

## 1 Introduction

The last few years, the Blockchain technology has attracted a huge attention from both industry and academia. This technology was initially proposed in 2008 and its first implementation was in the form of a cryptocurrency referred to as Bitcoin (Nakamoto, 2008). Although, cryptocurrencies are the most prominent applications of the blockchain (Beck et al., 2016), the Blockchain technology is increasingly applied into diverse applications and industries far beyond cryptocurrencies (Zheng et al., 2016) such as banking (Tapscott and Tapscott, 2016), insurance (Lorenz et al., 2018; Underwood, 2016), health care (Ekblaw et al., 2016; Swan, 2015), public services (Akins et al., 2013), security services (Noyes, 2016), and education (Sharples and Domingue, 2016), to name a few.

Despite the fact that there are great potentials of the blockchain technology in constructing the future of Internet systems and smart transactions/contracts, the technology is facing a number of technical challenges (Zheng et al., 2016) as well as social challenges (Beck et al., 2018). There is a substantial body of literature on the technical challenges of blockchain at different levels: block-chain challenges for enterprises (Ben Hamida et al., 2017), blockchain and its integration with IoT challenges (Reyna et al., 2018), blockchain challenges for business process management (Mendling et al., 2017), blockchain challenges in logistics and supply chain (Hackius and Petersen, 2017), blockchain challenges for educational systems (Chen et al., 2018).

At the same time, there is a limited number of researches that addressed the social challenges and opportunities of blockchain. For example, how population in the developing world can benefit from blockchain technologies (Kshetri and Voas, 2018), how blockchain emerge as a tool to break the poverty in the Global South (Kshetri, 2017), or how cities around the globe reported blockchain initiatives in countries such as Sweden, Denmark, Malta, United Started, United Kingdom, China and Australia (Jun, 2018, Ojo and Adebayo, 2017).

There is an increasingly growing literature that is tackling the adoption, implementation and development of technology in the Middle East (Jafar, 2004; Ballet et al., 2016), studying the instigating of e-government systems within this region (AlAwadhi and Morris, 2012; Amagoh, 2016; Awan, 2007; Pons, 2004), the adoption and implementation of e-banking (AbuShanab and Pearson, 2007; Hammoud et al. 2018; Khalfan and Alshawaf, 2004), focusing on computing and Information Technology transfer in the Middle East (Goodman and Green, 1998; Hill et al., 1998; Straub et al., 2001), as well as the information systems effectiveness in Middle Eastern countries (Al-Khalidi and Wallace, 1999; Atiyyah, 1989; Khalil and Elkordy, 1999; Seliem et al., 2003). However, little has been done to understand the role of the Blockchain technology in that region (Kshetri, 2017). Therefore, the focus in this paper is on the challenges and opportunities of the Blockchain technology in the Middle East. In order to address this, we embarked a multiple case study of twenty-one Middle Eastern firms from five industries (banking, insurance, government, real-estate and education).

This paper is organized as following: an overview of related literature and conceptual discussion on the digital platforms and ecosystems, the Blockchain technology, and the Information technology (IT) in the Middle East. This is followed by a description of the research method, case selection, data collection and analysis. Later, the findings are presented in the form of a situation-focused model with associated challenges and opportunities. Finally, we present the analysis and discussion of challenges and opportunities of the Blockchain technology in the Middle East as well as outlines key conclusions.

## 2 Digital Platforms and Ecosystems

The concept of digital platforms has been discussed thoroughly in multiple research settings (Baldwin and Woodard, 2009). These platforms are concomitant with software development (Constantinides et al., 2018; Franke and von Hippel, 2003; Gawer and Cusumano, 2008; Morris and Ferguson, 1993; West, 2003) and defines as “*the extensible codebase of a software-based system that provides core*

*functionality shared by the modules that interoperate with it and the interfaces through which they interoperate*" (Tiwana et al., 2010, p.676).

The developments in digital platforms is based on complementary assets (cf. Teece, 1986) that facilitates the use of technologies by individuals and/or firms (Baldwin and Woodard, 2009; Franke and von Hippel, 2003; Ghazawneh and Henfridsson, 2013; West, 2003) to design and build digital services in the form of digital services or referred to applications "apps" (Evans et al., 2006; Messerschmitt and Szyperski, 2003; Gawer, 2009; Ghazawneh, 2016). There are various settings that digital platforms can be found in, such as, personal computing (Bresnahan and Greenstein, 1999), web systems (Evans et al., 2006), smartphones (Tiwana et al., 2010; Yoo et al., 2010), video gaming (Iansiti and Zhu, 2007; Romberg, 2007), automotive technologies (Henfridsson and Lindgren, 2010), music industry (Tilson et al., 2013), and health care (Agarwal et al., 2010), to name a few. The development of digital services is recognized as a mean to build innovative digital ecosystems (Boudreau, 2012; Hanseth and Lyytinen, 2010) while addressing the needs of heterogeneous platform users. In so doing, the focus of platform owners will be shifted from development to distributing, marketing, brokering and operating of digital services (Meyer and Seliger, 1998; West and Mace, 2010).

### 3 Blockchain Technology

The blockchain is a chain of blocks that contains data of transactions within a particular period of time (Beck et al., 2018; Nakamoto, 2008). This technology has the capacity to provide all network participants with a single truth by providing disclosure of all transactions and therefore reduce transaction uncertainty, insecurity and ambiguity (Beck et al., 2016; Catalini and Gans, 2018; Nærland et al., 2017). Technically, it is based on a decentralized database of transactions that are distributed consistently across decentralized nodes (Glaser, 2017). The blockchain is a cryptography-based data structure that ensures database consistency by using a consensus mechanism and works against retrospective manipulations whenever transactions are validated (Beck et al., 2018; Underwood, 2016).

There are two types of blockchain: public blockchain and private blockchain (Buterin, 2015; Peters and Panayi, 2016; Zheng et al., 2016). Public blockchain allows the nodes to read data within the blockchain and proposes new transactions, where in private blockchain preregistered nodes by central authority are only allowed to read data within blockchain and submits new transactions (Beck et al., 2018). Access to transaction validation in blockchain is either permissioned or permissionless. In permissionless blockchain all nodes can read, submit and validate transactions, while in permissioned blockchain only authorized nodes can read, submit and validate transactions (Peters and Panayi, 2016), see blockchain typology in table 1 below (Beck et al., 2018):

Access to Transactions	Access to Transaction Validation	
	Permissioned	Permissionless
Public	All nodes can read and submit transactions. Only authorized nodes can validate transactions.	All nodes can read, submit, and validate transactions.
Private	Only authorized nodes can read, submit, and validate transactions.	Not applicable

Table 1. Blockchain Typology (Beck et al., 2018)

The first initiated blockchain enabled only the transfer of cryptocurrency Bitcoin in the form of digital tokens and was not used for any other types of purposes (Nakamoto, 2008). This was followed by the launch of Ethereum that enables blockchains to develop and program various kinds of transactions through executable pieces of software or so called "smart contracts" (Buterin, 2014). The blockchain technology therefore can be integrated into various areas and industries such as digital currency,

banking (Tapscott and Tapscott, 2016), insurance (Lorenz et al., 2018; Underwood, 2016), health care (Ekblaw et al., 2016; Swan, 2015), to name a few.

## 4 Information Technology (IT) and the Middle East

The Middle East is a region that includes the following countries: Bahrain, Cyprus, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Palestine, Qatar, Saudi Arabia, Syria, Turkey, United Arab Emirates and Yemen. The Middle East region has its own unique socio-economic characteristics when it comes to IT development and adoption. These characteristics either facilitate and inhibit the adoption and development of IT or hinder it (Jafar, 2004). This is due the fact that this region includes both poor and undeveloped economies with large populations such as Egypt, as well as rich and meagrely populated countries such as UAE, Kuwait, Qatar, Saudi Arabia and the rest of the Gulf countries. In addition, the Middle East is characterized by a homogeneous religion, language and social values.

The Middle East is also characterized by having an unstable environment and being turbulent (Aghimien, 2016; Maji and Goswami, 2016; Niazi and Hassan, 2016). For example, there are few countries in the Middle East that attracts organizations to invest in business in general and in technology in particular, Jordan being one of the safest countries and most attracted to such investments (Moideenkutty et al., 2016; Sharma et al., 2017).

The exceptional regional context of the Middle East provides by itself a research-based challenges for researchers in general and for Information Systems researchers in particular to investigate the challenges and opportunities with the role of IT in this region which is going through a continuous socio-economic transformation (Jafar, 2004). The amount of literature studying the challenges and opportunities of technology adoption, implementation and development in the Middle East is rapidly growing. For example, studying the instigating e-government systems within the Arab world (AlAwadhi and Morris, 2012; Pons, 2004), in Dubai (Awan, 2007) and in Jordan (Amagoh, 2016). Other studies focused on the adoption and implementation of e-banking in Oman (Khalfan and Alshawaf, 2004), Lebanon (Hammoud et al. 2018) and Jordan (AbuShanab and Pearson, 2007).

Moreover, studies are focusing on several other topics such as computing in the Middle East (Goodman and Green, 1998), Arab culture and Information Technology transfer (Hill et al., 1998; Straub et al., 2001), as well as the information systems effectiveness in countries such as Egypt (Khalil and Elkordy, 1999; Seliem et al., 2003), and in Saudi Arabia (Al-Khaldi and Wallace, 1999; Atiyyah, 1989). While other studies explored the applicability of technology acceptance in the Arab world in general (Al-Gahtani, 2001) and in Kuwait in particular (Almutairi, 2007). Few studies focused on health information technology in the Middle East (Bennett et al., 2015) and internet fraud in Saudi Arabia (Algarni, 2013).

## 5 Research Method

### 5.1 Research Method and Case Selection

Our research is based on multiple case studies (Yin, 2009), of twenty-one firms from six different Middle Eastern countries (UAE: United Arab Emirates, KSA: Kingdom of Saudi Arabia, Qatar, Kuwait, Jordan and Egypt). The use of multiple case study methodology is highly desirable for descriptive research studies (Benbasat et al. 1987). In addition, it's a well suiting tool to extend theoretical perspectives and cross-case analysis (Eisenhardt, 1989). It also enables to more generalizable research results (Benbasat et al. 1987) and the obtained evidences from such cases are considered more compelling and robust (Yin, 2009).

The twenty-one studied cases belong to five different industries: banking, insurance, government, real estate and education. These industries are considered among the top 10 industries that blockchain

technology is likely to disrupt (Marr, 2018). The selection of all cases is based on the following criteria: (1) a national Middle Eastern firm, (2) huge investment in technology, and (3) is considering, testing or using a blockchain technology. Table 2 below, illustrates the cases that are named after Greek alphabet for anonymity purposes.

## 5.2 Data Collection and Analysis

The main source of data for this research study is collected through interviews. A total of 48 interviews are conducted either face-to-face or via phone. All the interviews are semi-structured and last between 60-80 minutes each. All interviews are recorded, transcribed and later verified with the interviewee. The secondary data source for this study was collected through reports from the studied firms or during workshops concern blockchain that the author(s) have attended.

#	Case	Industry	Country	# of interview	Secondary Data sources
1.	Alpha	Banking	UAE	2	Reports
2.	Beta			2	Workshop
3.	Gamma			3	Reports
4.	Delta		KSA	3	Reports
5.	Epsilon		Jordan	3	Reports
6.	Zeta		Kuwait	2	Reports
7.	Eta	Insurance	UAE	2	Reports
8.	Theta		KSA	3	Reports
9.	Iota		Egypt	3	Workshop
10.	Kappa		Jordan	2	Reports
11.	Lambda		Qatar	2	Workshop
12.	Mu	Government / Public	UAE	2	Reports
13.	Nu		Oman	3	Reports
14.	Xi		Kuwait	3	Workshop
15.	Omicron		Qatar	2	Reports
16.	Pi	Real Estate	UAE	2	Workshop
17.	Rho			3	Reports
18.	Sigma		KSA	2	Reports
19.	Tau	Education	UAE	2	Reports
20.	Upsilon		KSA	2	Reports
21.	Phi		Qatar	2	Reports

Table 2. Cases and Data Collection

We have used an inductive data analysis approach for this research study (Strauss and Corbin, 1990). This ensures that the preconceptions of the researchers are not forced on the collected data and a high

degree of scientific integrity is maintained (Eisenhardt 1989). After that, the relations between codes and descriptions of the current challenges and opportunities for blockchain technology are established. This was followed by unfolding the cases events in a chronological way (Langley 1999), while at the same time understanding how each of the studied case dealt with the changeless and opportunities (Kirsch 1996). During the last stage, focused on analyzing how the challenges and opportunities are understood and tackled from an organizational perspective.

Theoretical Concepts	Interview Quotes	Analytical Description
Fine-Tune Challenges	<i>"Three years ago, it was hard here. We have been trying to approach authorities to explain what the blockchain technology can do but it was kinda useless. But, now the situation is totally different, the government is starting several blockchain initiatives."</i>	The review represents a “regulator response” to new technology that is organizational focused and how regulators response to this.

Table 3. Examples from the Data Analysis

Miles et al. (1994) key steps were used to be able to generate meanings from the data analysis conducted on this research. First, finding key patterns and developing the study themes, seeing plausibility and grouping/clustering. The circular structure of understanding from Cole & Avison (2007) was applied for each of these steps which helped the analytical interpretation and the processed of meaning generation. This included understanding, explaining and interpreting the collected data and its context.

## 6 Results

The main outcome of this research paper is in the form of a classification of challenges and opportunities of Blockchain in the Middle East region, see Table 4 below.

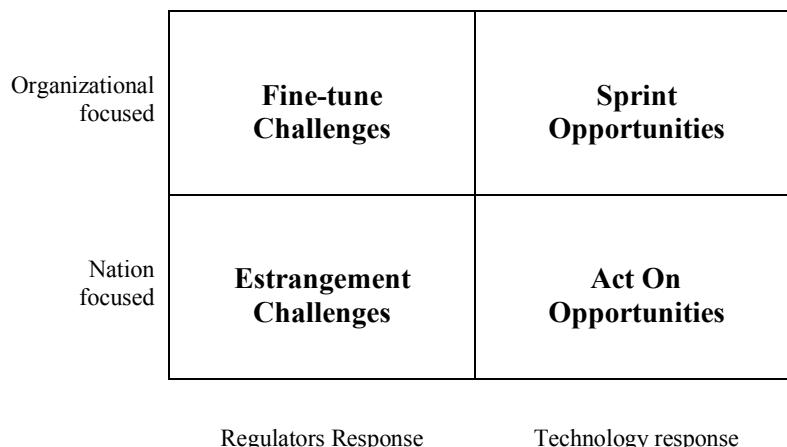


Table 4. Classification of Blockchain Challenges and Opportunities in the Middle East

### 6.1 Fine-Tune Challenges

The first quadrant of the classification is “Fine-tune” challenges. Our data analysis revealed that regulators in the Middle East can take actions towards blockchain initiatives when their authorities are threatened by the new technology. For example, the Central Bank of Jordan in 2016 issued a

resolution that prohibits its employees and the banks in Jordan to deal with blockchain. A CIO of a Jordanian bank illustrated:

*I think our government and the central bank mixed between Bitcoin and Blockchain. This is really frustrating, they are afraid that things can go out of their control.*

An Egyptian Blockchain developer added:

*It's insane, why do we mix religion with technology. Our grand Imam endorsed a ban on Blockchain since its associated with cryptocurrency, so they even know what this technology is.*

The reactions of regulators in the Middle East varies from being very supportive such as the UAE and in particular the government of Dubai to active resistance such as in Jordan, or even partial use of the blockchain technology when it's not associated with trading or cryptocurrency such as in Egypt and other Middle Eastern countries.

Our data findings revealed that organizational-focused has been found which cope with a particular degree of fine-tune to approaching authorities in these countries by private firms. For example, in KSA, one of our informants stated that:

*Three years ago, it was hard here. We have been trying to approach authorities to explain what the blockchain technology can do but it was kinda useless. But, now the situation is totally different, the government is starting several blockchain initiatives.*

## 6.2 Estrangement Challenges

The second quadrant in the classification is “*Estrangement*” Challenges. It has been found that when response of regulators in the Middle East cope with nation-focused strategy different types of challenges are developed which is referred to as “estrangement”. An Egyptian case informant explaining the launch of their insurance blockchain startup added:

*It's hard for us, the insurance industry here in Egypt as in other countries has its regulations, and the government has its own strategy that to some extent I can say not coping the international standardization of technology and innovation. Thus, it will be very hard to tackle both the nation and the regulations and make magic..... Even if we are talented technology and development wise when the surrounding environment doesn't help nothing works.*

This also connected to educational institutions in Middle Eastern countries and their lack of experience in the blockchain education and curricula. One of our case informants in Oman stated:

*I think the main challenge for us is also the lack of experience in blockchain development. Our universities have traditional computer science and IT education and no one single course in blockchain. They need to develop, plan and approve this, then comes the ministry of education and others. Meanwhile, who will move to Oman to join a blockchain project or startup, that's the question.....we need local talents and this seems not the case for at least now.*

This was also illustrated by a case informant from Jordan:

*If we have one single announcement about a blockchain developer job, I doubt we will receive 2-3 applicants at most applying for this job. I don't know who*

*to blame, the universities, the ministry or the whole IT ecosystem that is still not ready for blockchain revolution.*

### 6.3 Sprint Opportunities

The third quadrant in the classification is “*Sprint*” Opportunities. This type of opportunity classification is based on the fact that in particular countries in Middle East such as KSA and Qatar, there is a huge number of organizations that has a huge focus on blockchain. This cope very well with the technology response available which result in opportunities for blockchain projects and initiatives in these countries. Our data revealed that in particular cultures, such as in KSA and Qatar, governments tend to turn to the private sector when it comes to major technology initiatives which enables the “sprint” opportunities. This was explained by a case informant from KSA’s banking sector:

*You might know that Islamic Banking is a major issue for us. Blockchain is a great solution for this, our government knows and they gave the private sector the encouragement to work on solutions powered by the blockchain. I think it's the Islamic Corporation for the Development of the Private Sector that is driving these initiatives now.*

Our data analysis shows that the studied cases in Qatar are also seeing this type pf opportunities. The current sanctions in Qatar that started in 2017 by Saudi Arabia, United Arab Emirates, Bahrain and Egypt forced the country to turn into private organizations and new technology that can help during their crisis. For example, our data shows that the Qatar's supply chain industries is among the top industries that can benefit from blockchain technology. An informant from one of our studied cases in Qatar, clarified:

*I think its about innovation and opportunities under certain circumstances. This country is small and at this stage we have this closure from surrounding countries, I hope it will be solved soon.....but as a company and a country you need to keep operating and you can't discontinue yourself from others even if they don't like you. That's why Qatar asked for the help from major firms in Blockchain and vastly supported the GCC cross-border payments that will revolutionize the local financial sector and protect it from such sanctions and grow our Fintech ecosystem as well.*

### 6.4 Act-On Opportunities

The fourth quadrant in the classification is “*Act On*” Opportunities. It has been found that in particular countries in the Middle East, such as UAE, when the blockchain technology is a nation focused cope with the technology response there is a vast majority of opportunities for firms and startups working on blockchain projects and initiatives. It shows that the culture in UAE supported such initiatives and created a collaboration ecosystem with several active actors such as the government, public and private institutions as well as educational institutions and entrepreneurs. A case informant from UAE explained:

*In 2019, it was reported that the UAE will be a leading destination for blockchain-based business ..... we are now in Dubai, look, we are ready to become the world first blockchain-powered government, even the police department want to use blockchain for their work.*

Another informant from a banking-case in UAE, added:

*You know about this ICO and Blockchain issue. It needs regulations and standards to be nationally accepted and this is what the UAE is doing. These*

*regulations will be introduced based on reports from The Securities and Commodities Authority of UAE (SCA), mid 2019 which is great for all in banking sector in particular and in blockchain in general when we have the market to develop a platform and ecosystem for ICOs.*

In addition, the educational system in particular countries such as UAE, seem to reflect the nation focus on supporting technology initiatives. This was reflected by an education case informant who explained:

*International universities with campuses in UAE and national ones started teaching blockchain. Not only this, but also some universities are adopting blockchain technologies and even The British University in Dubai had awarded the first Digital Blockchain Degree to its students since 2017.*

## 7 Discussion and Conclusions

The challenges and opportunities of blockchain in Middle East are classified into four main types as illustrated previously: Fine-Tune Challenges, Estrangement Challenges, Sprint Opportunities and Act On Opportunities. There are four main factors that are associated with each of the challenges and opportunities which are: regulation, education, collaboration and culture. Each of those factors either affect the “challenge” or “opportunity” in a positive, negative or neutral way, see Table 5 below.

#	Classification	Factors	Positive	Negative	Neutral
1.	Fine-Tune Challenges	Regulation		X	
		Education		X	
		Collaboration			X
		Culture		X	
2.	Estrangement Challenges	Regulation		X	
		Education		X	
		Collaboration			X
		Culture			X
3.	Sprint Opportunities	Regulation	X		
		Education			X
		Collaboration	X		
		Culture			X
4.	Act On Opportunities	Regulation	X		
		Education	X		
		Collaboration	X		
		Culture	X		

Table 1. Blockchain Challenges and Opportunities: Classifications and Factors

The first factor is “Regulations” which has been negatively creating challenges for blockchain technology in certain countries such as Egypt, KSA and Jordan. While at the same time, it has been positively creating opportunities when governments, regulators and local authorities adapt to new global environment and established national initiatives to support economy and national innovation.

The “Education” is a vital factor in determining the degree of challenges and opportunities for blockchain within Middle East. This factor negatively affected the challenges in “Fine-Tune” and “Estrangement”, due to the lack of educational strategy for particular countries in the blockchain and positively turned to opportunity when the educational system supported the technology education.

The “Collaboration” factor is neutral when it comes to blockchain challenges and positive when its associated with opportunities. This is aligned with the regulators that try to develop and implement national strategies by motivating collaboration with several actors, such as cases in Qatar and the current sanctions in Qatar where collaboration with international actors is significantly needed.

The fourth factor is “Culture” which has been negatively creating challenges for blockchain technology in certain countries KSA for some time. While at the same time, it has been positively creating opportunities when it has been supported by regulators that hugely supported innovation and modernity such as in UAE and in particular Dubai.

In this paper, the literature on blockchain technology (Beck et al., 2018; Nakamoto, 2008), digital ecosystems (Tiwana et al., 2010), and Information Technology (Jafar, 2004) were synthesized study the challenges and opportunities on blockchain in the Middle East. Based on a qualitative study of twenty-one firms from six different Middle Eastern countries (UAE: United Arab Emirates, KSA: Kingdom of Saudi Arabia, Qatar, Kuwait, Jordan and Egypt), a classification of challenges and opportunities of Blockchain in the Middle East region was developed. The classification of challenges and opportunities illustrates; fine-tune challenges, estrangement challenges, sprint opportunities and act on opportunities and four associated factors: regulation, education, collaboration and culture. We believe that further research is needed to explore and examinee the classification across other Middle Eastern Countries as well as other countries across the globe.

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