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BLOCKCHAIN AS A TECHNOLOGICAL IMAGINARY: MEDIA FRAMING AND THE VIEWS OF BLOCKCHAIN PROFESSIONALS IN THE ARAB WORLD

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BLOCKCHAIN AS A TECHNOLOGICAL IMAGINARY: MEDIA FRAMING AND THE VIEWS OF BLOCKCHAIN PROFESSIONALS IN THE ARAB WORLD

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Under the Supervision of Dr. Badreya Al-Jenaibi

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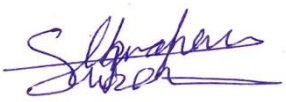
Declaration of Original Work

I, Ibrahim Majid Ahmed Subeh, the undersigned, a graduate student at the United Arab Emirates University (UAEU), and the author of this dissertation entitled "*Blockchain as a Technological Imaginary: Media Framing and the Views of Blockchain Professionals in the Arab World*", hereby, solemnly declare that this dissertation is my own original research work that has been done and prepared by me under the supervision of Professor Badreya Al-Jenaibi, in the College of Humanities and Social Sciences at UAEU. This work has not previously been presented or published or formed the basis for the award of any academic degree, diploma or a similar title at this or any other university. Any materials borrowed from other sources (whether published or unpublished) and relied upon or included in my dissertation have been properly cited and acknowledged in accordance with appropriate academic conventions. I further declare that there is no potential conflict of interest with respect to the research, data collection, authorship, presentation and/or publication of this dissertation.

Student's Signature:  Date: 16/5/2020

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Abstract

Blockchain is a new way to organize, process and share data; it is a distributed ledger that facilitates the secure and private exchange of digital assets and content types without the need for intermediaries, thus revolutionizing all sectors involving the use of databases. This first systematic study of blockchain as a technological imaginary empirically assesses the media framing of this emerging technology in the Arab world and juxtaposes it to the perceptions of blockchain professionals in the region. The researcher uses a mixed methods approach consisting of quantitative and qualitative techniques; a quantitative content analysis of the online versions of fifty-two mainstream online Arab newspapers from Saudi Arabia, Egypt, Lebanon, Morocco and UAE from 2017 to 2019 is conducted; five hundred news articles published over a period of three years are collected, read and coded according to four frame dimensions identified in earlier studies; presentation, subtopics, cognitive attributes and affective attributes. Semi-structured interviews with thirty blockchain professionals followed by a thematic analysis are used to add depth to the data. This dissertation offers insights into the degree to which Arab media institutions understand blockchain as a concept and insights on the region's readiness for adaptation; it concludes that the coverage of blockchain in online Arab press is predominantly positive. Nevertheless, there are some differences in the media coverage between the studied countries which are reflected in the amount of coverage, subtopics, applications and tone. There is a significant association between specific applications and the tone. There is also a significant association between certain subtopics and the tone. Blockchain Professional perspectives vary on the characteristics and role of the media in covering the topic. Coverage of blockchain in the Arab region is perceived as a reflection of the interest and technological understanding of Arab governments with the UAE being the most developed in this regard. Experts outline a unique set of inherent qualities that makes blockchain impactful on many fields, including media and mass communications without ignoring perceived risks. The dissertation reveals an absence in discussing technology ethics both at the level of blockchain professionals and the media. Finally, the dissertation highlights several areas of similarity and difference between the views of experts and the media and presents a list of recommendations.

Keywords: Blockchain, heterotopia, media framing, arab world, technological imaginary, disintermediation, decentralization, technological determinism, technology ethics, inherent qualities of technology, disruptive technologies, artificial intelligence, mixed method

Title and Abstract (in Arabic)

سلاسل الكتل كمخيال تقني:
التأطير الإعلامي لسلاسل الكتل وتصورات المختصين العاملين في العالم العربي

الملخص

تقنية سلاسل الكتل المعروفة بالبلوكتشين هي طريقة جديدة لتنظيم ومعالجة وتبادل البيانات: تعرف أيضاً بدفتر الأستاذ الموزع الذي يسهل التبادل الآمن والخاص للأصول الرقمية والمحتويات المتنوعة دون الحاجة إلى وسطاء وبالتالي فهي تمثل ثورة تقنية ذات أثر جذري على جميع القطاعات التي تعتمد على استخدام قواعد البيانات. ونظراً لكونها تقنية حديثة نسبيا، معظم الناس يكونون تصوراتهم عنها من خلال وسائل الإعلام فقط. تقوم هذه الدراسة المنهجية الأولى من نوعها للبلوكتشين كمخيال تقني بتحليل التأطير الإعلامي لهذه التكنولوجيا الناشئة في الصحافة العربية بالإضافة إلى استشفاف اراء العاملين في المجال. تستخدم الدراسة بيانات من خمس دول وهي مصر والمغرب والمملكة العربية السعودية ولبنان والإمارات العربية المتحدة. تعتمد هذه الدراسة على منهجية بحث مختلطة تتألف من جانب كمي يتمثل في تحليل المحتوى وجانب نوعي يتمثل في المقابلات. يحلل الباحث محتوى النسخ المتاحة على الإنترنت لستة وخمسين من الصحف العربية السائدة في الفترة ما بين 2017 إلى 2019؛ تتكون عينة الدراسة من خمسمئة مقالة إخبارية منشورة خلال فترة ثلاث سنوات، تمت قراءتها وترميزها وفقًا لأربعة أبعاد نظرية محددة في دراسات سابقة؛ وهي العرض، الموضوعات الفرعية، السمات المعرفية والسمات العاطفية. تتكون العينة المختارة للمقابلات من ثلاثين من المتخصصين في البلوكشين وذلك بهدف إضافة عمق للتحليل. تهدف الدراسة إلى إجراء تقييم منهجي للتصورات العامة لهذه التكنولوجيا الناشئة في الإعلام العربي لتكون هذه الدراسة مرجعاً للجهات المهتمة في الاستثمار في هذه التقنية والاستفادة منها في الوقت الذي تستمر تقنيات الثورة الصناعية الرابعة وعلى رأسها تقنية البلوكتشين في اكتساب أهمية إقليمية وعالمية متزايدة. تقدم الدراسة نظرة شاملة على مدى فهم المؤسسات الإعلامية لمفهوم البلوكشين في العالم العربي وتستشف بذلك مدى الاستعداد لتقبلها. تخلص الدراسة إلى أن التغطية في الصحافة العربية إيجابية في الغالب مع وجود بعض الاختلافات بين البلدان التي شملتها الدراسة والتي تنعكس في مقدار التغطية والموضوعات الفرعية والتطبيقات ومدى إيجابية التغطية. وبالإضافة الى ذلك، هناك ارتباط كبير

بين نوع التطبيق ومدى إيجابية التغطية. وهناك أيضًا ارتباط كبير بين بعض الموضوعات الفرعية ومدى إيجابية التغطية. تختلف وجهات نظر المختصين حول خصائص ودور التغطية الاعلامية للبلوكشين ويُنظر لها على أنها انعكاس لمقدار لاهتمام والفهم الحكومي للتكنولوجيا الحديثة والذي يجعل التغطية الاعلامية الإماراتية الأكثر تطوراً في هذا القطاع. يكشف المختصين عن مجموعة من الصفات المتأصلة التي تجعل تكنولوجيا البلوكشين مؤثرة في العديد من المجالات بما في ذلك مجال الإعلام والاتصال الجماهيري بدون تجاهل الإشارة الي المخاطر المتخيلة المرتبطة بهذه التقنية. تكشف الدراسة عن غياب لمفهوم اخلاقيات التقنية عن المحتوى العربي المختص بالبلوكشين وعن وتصورات العاملين في المجال. تشير الدراسة الى أن التغطية الإعلامية بشكل عام لا ترقى إلى مستوى تطلعات العاملين في مجال البلوكشين وتقدم الدراسة عدد من التوصيات.

مفاهيم البحث الرئيسية: سلاسل الكتل، المخيال التقني، المنهجيات المختلطة، التأطير الإعلامي، العالم العربي، اللاوسائطية، اللامركزية، الحتمية التقنية، أخلاقيات التكنولوجيا، الخصائص المتأصلة في التقنيات، التقنيات المزعزعة، الذكاء الاصطناعي.

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Dedication

To Satoshi Nakamoto, for they in secret searched out and stole the source of fire from Zeus; the sacred fire that taught men the use of all the arts and gave them ways to make amazing things (Johnston, 2017).

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List of Abbreviations

AI	Artificial Intelligence
ANOVA	Value Added Tax
DAO	Decentralized Autonomous Organizations
DEFI	Decentralized Finance
df	Degree of Freedom
GCC	Gulf Cooperation Council
IoT	Internet of Things
M	Mean
P	Probability Value
SD	Standard deviation
SPSS	Statistical Package for the Social Sciences
VAT	Analysis of Variance

Chapter 1: Introduction

Blockchain is a new way to organize, process and share data; it is a distributed ledger that facilitates the secure and private exchange of digital assets and content types without the need for intermediaries (De Filippi, 2016). The increasing importance of blockchain applications over the past few years was accompanied by a limited but substantial mainstream media coverage in the Arab world. It was not, however, until the recent spike in the price of Bitcoin in 2017 that mainstream Arab media started to pay a much greater attention to the topic. Interest in blockchain was not limited to media but several Arab governments have shown a great interest as well. In July 2017, the government of Dubai has announced its goal to become the world's first blockchain-powered government by 2020 (Nordrum, 2017). In December 2017, the central banks of the United Arab Emirates and Saudi Arabia announced that they would launch a pilot initiative whereby the two institutions test a new cryptocurrency for cross-border payments (Lukonga, 2018).

In April 2018, the federal government of the United Arab Emirates has advertised a strategy for blockchain which aims to place the country on the forefront of global blockchain innovation (Emirates Blockchain Strategy 2021, 2018). Saudi Arabia has also shown a great interest in blockchain for its economic potential as the country explores new ways to diversify its economy (Almowaten, 2018). Due to its novelty, however, blockchain applications remain largely unknown to the general public that learns about it mainly through the media rather than first-hand experience, which highlights the importance of the educational role of the media. In order for communities and businesses

to succeed in cultivating the benefits of this emerging technology, a special attention should be dedicated to the media's impact on technological adaptation. Furthermore, the media should offer a rich and diverse representation that is attentive to the risks and opportunities in blockchain applications including lesser known applications such as e-governance, publishing, communications, digital art and other uses beyond finance.

The research aims to understand how blockchain is perceived, discussed and represented in the Arab world as gauged from the study of media framing and the study of the opinions of blockchain experts and professionals in the region; the research aims are achieved through three objectives as explained in Table 1.

Table 1: Research Objectives

Objective 1	To empirically analyze the media representation of blockchain technology
Objective 2	To understand how professionals and experts in the Arab world perceive the technology and its implications
Objective 3	To find points of similarities and differences in the perception between the media and professionals in the blockchain domain

Three research questions are developed to accomplish the research objectives. The first question corresponds to the four dimensions of framing as identified by Ghanem (1997); presentation, subtopics, cognitive attributes and affective attributes. The four dimensions of media framing produce eight aspects which are addressed by the researcher

through nine sub-questions; these aspects are discussed in the literature review. The second research question qualitatively investigates the opinions and attitudes of blockchain professionals and experts by extracting common ideas through thematic analysis. The third question synthesizes the qualitative and quantitative findings. The research questions are listed in Tables 2 and 3.

Table 2: Research Questions

RQ1	How does the Arab media frame blockchain technology?
RQ2	How do blockchain experts in the Arab world perceive the technology?
RQ3	Is the framing of blockchain compatible with expert's perceptions?

Table 3: Research Sub Questions

RQ1.1	Which blockchain applications enjoy more media coverage?
RQ1.2	Does the media in different countries focus on different applications?
RQ1.3	Does the Arab press emphasize certain subtopics in covering blockchain?
RQ1.4	Does the Arab press frame blockchain in a positive and benefitting way?
RQ1.5	Does the tone of the coverage vary across the five countries?
RQ1.6	Does the application type affect the tone of the coverage of blockchain?
RQ1.7	Do subtopics affect the tone of the coverage of blockchain?
RQ1.8	What are the main perceived opportunities?
RQ1.9	What are the main perceived risks?

In order to answer the above questions, the researcher combines quantitative and qualitative methods. This mixed methods approach follows the convergence design and utilizes two strategies that correspond with three research techniques: first, a non-experimental strategy implemented in the techniques of quantitative content analysis, qualitative interviews and the thematic analysis of the interviews, and, second, a concurrent strategy implemented in the synthesization of qualitative and quantitative studies; five hundred online newspaper articles published in newspapers from five Arab countries over a period of three years are collected, read and coded according to four frame dimensions—presentation, subtopics, cognitive attributes and affective attributes. Statistical analysis is used to identify common patterns in the data. Thirty blockchain professionals are interviewed and their responses are coded and thematically analyzed. Quantitative and qualitative data from the media and experts form the basis for understanding the degree to which the media reflects the understanding of blockchain professionals.

1.1 Statement of the Problem

There still remains a deficit of research into the topic of blockchain and the media—not only in the Arab world, but internationally. By choosing this topic, this dissertation aims to establish a starting point for other researchers from the disciplines of humanities and social sciences.

Mass media plays an integral role in shaping people's understanding and acceptance of new ideas (Weitzman & Bailey, 2019). In many countries, news operates as a main source of risk communication to the public (Boholm, 1998). Despite high

governmental interest in blockchain, media attitudes and perceptions of risks and opportunities are yet to be systematically examined and documented. The problem this study addresses is precisely shortage of empirical data on the coverage and understanding of this emerging technology in the Arab world. This research assesses the attitudes of the Arab press towards blockchain technology in light of the opinions of professionals with expertise in the domain of blockchain in order to identify which Arab countries are more friendly towards blockchain innovation and how the media can improve and enrich its coverage and understanding of the topic.

The term 'technological imaginary' is coined by sociologist of technology Patrice Flichy, to describe the initial ideas, dreams and utopias that inform future developments of technological inventions (Galili, 2015). The term is useful to describe the type of data collected in this study. A Technological imaginary "consists of the myths, attitudes and values that a culture attaches to new technologies, sometimes in terms of their perceived abilities to fix what's wrong with society, and sometimes in terms of their perceived destruction of social cohesion" (Lister et al., 2003 as cited in Fry, 2011, p. 14). This study reveals that blockchain is imagined as a panacea. This positive outlook suggests greater future adoption and use of the technology in the Arab world. As Flichy (2008) argues, the perceptions and ideas of journalists and novelists should be considered as an integral part of the development of technology because the technical object is not only functional but also symbolic as it conveys meaning. The symbolism and history of blockchain are rooted in anarchist and fringe philosophical traditions. Paradoxically, its adoption in the Arab world is led by states and corporations seeking to appropriate its inherent qualities. The study highlights the paradox of how the Arab media reconciles the history and symbolism

of blockchain with the imperatives of the Arab media systems and provides insight into the role of governments in shaping media technological discourse.

The significance of this study is that it is the first systematic study of Arab media coverage of blockchain; it empirically assesses the media framing of this emerging technology in the Arab world and juxtaposes it to the perceptions of blockchain professionals in the region. The study is composed of two parts: a quantitative media study and a qualitative interview study, neither of which has ever been conducted before in the field of media and mass communications research. The study is useful for blockchain investors, innovators and regulators who seek to both understand and evaluate the Arab world as an environment for technological innovation by providing comparative empirical data from across the Arab world. The study is useful in evaluating the openness to blockchain technology adaptation in the Arab world and in predicting its future. Finally, the study produces important information on the implications of blockchain technology on media and mass communications.

1.2 Outline of the Study

The research is organized into seven chapters: in the first chapter, the introduction, the researcher provides an overview of the study, a statement of the research problem and the significance of the study. In the second chapter, the review of the literature, the researcher presents background information on the status of research on blockchain in a media context, a general background on blockchain technology and its various applications. In the third chapter, the theoretical framework, the research discusses the framing concept which is operationalized here by identifying specific frame dimensions.

In the fourth chapter, the methodology, the researcher explains the rationale behind choosing the research methods and the choice of samples. In the fifth chapter, data analysis and results, the researcher descriptively lists the results of the content analysis and the thematic analysis of interviews. In the sixth chapter, the discussion, the researcher discusses the results in light of the theoretical framework and previous studies. In the seventh and final chapter, the researcher concludes the study and suggests directions for further research.

Chapter 2: Literature Review

In this chapter, the researcher examines the state of academic research on blockchain. The chapter is divided into six sections: the first section defines blockchain technology; the second section explores its history; the third section discusses the significance of blockchain technology; the fourth section maps currently known non-financial blockchain applications in order to provide a basis for the content analysis of the Arab press; the fifth section provides background information on the adaptation and spread of blockchain in the Arab world. Finally, the sixth section discusses the previous research on blockchain focusing specifically on media studies in Arab context.

2.1 What is Blockchain?

Blockchains are immutable ledgers implemented in a distributed fashion to enable communities of users to transact free from the oversight of central authorities (Yaga et al., 2019). Instead of contemporary and mainstream methods of storing data on a centrally controlled server or data storage facility, according to De Filippi (2016), in blockchain applications, data are either stored directly on users' devices or divided into small fragments across a large network of users. In both cases, data is only ever accessed by relevant parties; "While the information is theoretically visible to anyone, the use of end-to-end encryption allows users to communicate privately with one another, without having to entrust anyone with the task of managing and transferring personal information" (p. 10). Much of the appeal of blockchain technology lies in its inherent qualities which provide security, data integrity and potential anonymity without third party oversight. In

short, blockchain is a new way to organize, process and share data in a way that makes it resistant to change or censorship.

2.2 History of Blockchain Technology

The history of blockchain is intrinsically tied to the history of fringe aspirations for digital money; anarchists, libertarians, hackers, criminals, entrepreneurs and various unrelated groups have long sought for digital money for different reasons (Simser, 2015). One of the earliest documented attempts to engage with this idea dates back to the 1980s, when Chaum (1983) published his paper, *Blind Signatures for Untraceable payments.* In the 1990s, however, David Chaum developed Digicash, a company specialized in electronic payments (Brodesser, 1999). Several attempts followed in the 1990s, ranging from web-based money such as PayPal and various other forms such as hashcash which uses proof of work (Back, 2002), a technology also used by Bitcoin, the most famous blockchain based currency (Nakamoto, 2008).

While pre-blockchain digital money offered some practical benefits, it was still centralized, and thus prone to hacking, manipulation and confiscation. What prevented the decentralization and disintermediation of digital money before the blockchain based currencies was a classical computer science challenge known as the *double spending problem* (Chohan, 2017), which delayed its development for decades; a third party was necessary to prevent the double spending of digital money. Blockchain was the first successful solution to this problem and, as a result, not only disintermediated encrypted digital money (cryptocurrency) became possible, but also a number of other applications unrelated to finance.

The concept of blockchain was first described in a whitepaper published in 2008 by an unknown author by the pseudonym Satoshi Nakamoto where they illustrated the idea and its first practical application, the cryptocurrency Bitcoin (Nair & Sutter, 2018). It is worth noting that while the idea of a public ledger today is mostly associated with blockchain, it is not entirely novel. Rather, it existed in ancient societies such as the Yap people of Micronesia who maintained immutable publicly accessible ledger in the form of stone blocks that resemble, in their functionality, the functions of the Bitcoin blockchain; the stone blocks are displayed in different places around the island while the ownership of each block is memorized by the entire society who collectively validates transactions in decentralized and disintermediated manner (Chen, 2018).

The second major milestone in the history of blockchain technology was the development of Ethereum which took the concept to a new level. The idea started with a paper by a then 19-year-old computer programmer named Vitalik Buterin; in his paper, he identified four major limitations in the scripting language of the bitcoin blockchain and proposed a new paradigm that can be used to create complex self-executing contracts (Buterin, 2014). The use of the new scripting language in Ethereum allowed for wide range of decentralized applications to emerge: “In September 2018, the market valuation of the well observable virtual assets (“tokens”) on the Ethereum platform amounts to US$ 35 billion, not counting the US$ 17. 6 billion of Ether, the platform’s hardwired cryptocurrency” (Fröwis et al., 2019, p. 1).

2.3 Significance of Blockchain

For the first time in history, trust no longer requires a third party. Unrelated individuals are able to perform a spectrum of collaborative operations on a global scale without institutional oversight. This is groundbreaking and radically consequential; taking money as an example, “from the beginning until the end of 2017, the total cryptocurrency market value increased from just US$ 18 billion to more than US$ 600 billion” (Bouri et al., 2019, p. 1), The decentralization and distribution of resources that would have been otherwise handled by banks are expected to impact the monetary system (Narayan et al., 2019). Blockchain is facilitating financial inclusion by connecting unbanked populations to global supply chains (Schuetz & Venkatesh, 2019). Deutsche Bank predicts that by mid-2020, around 10% of the world’s gross domestic product will have been regulated by blockchain solutions (Stawicki et al., 2019). Coeckelbergh and Reijers (2016) argue that blockchain-enabled currencies are dynamically re-configuring social relations baring not only economic consequences but ethical implications as well. While cryptocurrency is a very important novel class of assets, it is essential to understand that it is merely one application of a ubiquity of applications. As Akgiray (2019) argues, the potential for non-financial blockchain application is enormous.

2.4 Blockchain Applications Beyond Finance

Blockchain is commonly referred to as a solution in search of a problem (Fridgen et al., 2018). This section highlights some of the practical applications of blockchain in the realms of e-governance, supply chain, communication and publishing, law and art:

Examples for e-governance applications include digital signature management (Pal, 2019), property registration (Akgiray, 2019), as well as identity authentication and record keeping (Ebrahimi, 2018). Ayed (2017) and Osgood (2016) maintain that blockchain can ensure voting transparency. As Corredor Camargo et al. (2019) explain, applying blockchain to electoral systems, ensures confidentiality and integrity of results through its decentralized nature. Lesavre et al. (2019) suggest that blockchain technology has the potential to provide built-in control and consent mechanisms for data ownership and governance, thus allowing people more control over their records. Devecchi (2019) argues that blockchain can secure the right to education for children by creating an undeletable record of learning achievements which adds a layer of security for populations in precarious circumstances.

As for supply chain, Saberi et al. (2019) argues that blockchain can simplify many of the challenges resulting from globalization by adding transparency, traceability, and security to global trade. This can fundamentally mitigate the problem of gun violence by systematically identifying manufacturers and suppliers of arms used in mass shootings for example. Blockchain can give consumers the ability to make informed choices about supply and value chains. As Schwartz and Merhout (2019) explain, blockchain is particularly useful in the tracking of diamonds which is suffering from the growing threat of increasingly realistic looking synthetic diamonds. Furthermore, applying blockchain to the diamond industry could clean the sector from common exploitative practices (Walker & Kemp, 2019).

In regard to communication and publishing, however, platforms such as Steemit implement blockchain to innovate new business models that do not rely on advertisement

and the selling of users' data (Li & Palanisamy, 2019). Various blockchain-based online services are developing including notarization for Social Media (Song et al., 2019). Blockchain was the catalyst for the quest for a new internet; startups such as Blockstack are attempting to develop a blockchain-based web browser for decentralized applications (Ali et al., 2016). Filecoin, which raised US$ 257 million in its *initial coin offering* in 2017, is building decentralized data storage where the data is distributed around a large network around the world as opposed to centralized servers of Google and Amazon which are susceptible to censorship and control (Lyandres, 2019). In addition to decentralized internet browsing and data storage services, various startups are seeking to integrate blockchain with mesh networks to facilitate decentralized internet connectivity (Selimi et al., 2018). Once matured, these innovations combined will prompt a paradigm shift in control over the Internet from corporations and governments to individuals, thus rendering the current international rhetoric on internet governance obsolete, because the current frameworks of regulation and control are based on a centralized architecture that the above innovations are set to disrupt. Moreover, it will drastically reduce the costs of connectivity as internet service providers and the contemporary infrastructure will no longer be needed; "these networks are infrastructure-less in the sense [that the], operation of client-mesh is not managed and monitored by a service provider" (Ramachandran et al., 2005, p. 1). Researchers are exploring integrating blockchain and torrents which are decentralized file sharing platforms that are often used to share pirated content. Swan (2015) argues that blockchain may add transparency to torrenting activities by keeping an immutable record of data exchange. Pant and Kumar (2018) explain that blockchain can create new ways of monetizing torrents.

Blockchain has various legal applications; among the most important are the self-enforced digital contracts otherwise known as smart contracts (Anderson et al., 2019). Research on smart contracts is ubiquitous. Wang et al. (2019), for instance, focus on the use cases and argue that smart contracts are beneficial in the fields of financial services, management, healthcare, internet of things and more. Levy (2017), on the other hand, focuses on the social and relational contexts of contracting and argues that, while they are very useful, they do not keep into consideration the social contexts within which contracts operate, and the complex ways in which people use them, and he urges for further research. Furthermore, smart contracts are not the only legal application for blockchain. Moore (2019) argues that applying blockchain to court systems will change the role of the public in overseeing justice and lead to the emergence of a new level of transparency.

In the art domain, blockchain is being used in various ways; Crypto collectables for example, are a new form of digital art that is based on the concept of digital scarcity. Studies point out various ways in which the digital scarcity enabled by blockchain can impact the creative industry; Finucane (2018) defines crypto art as works of art taking place on the blockchain. In addition to its intrinsic artistic functionality, crypto art, as she maintains, is revealing the reluctance of the art world to discuss the art market transparently. She predicts that through melding currency with art creation, blockchain may very well have implications on art creation and distribution (Finucane, 2018). Chevet (2018) confirms Finucane's predictions in his resource-based analysis of creative industries (Chevet, 2018). A notable example of crypto collectables is ForeverRose, a piece of crypto art that was sold to a group of buyers with the price of US$ 1 million (Cramer, 2019). Crypto collectibles are not limited to art collecting; it has evolved to

combine elements of card collecting with gaming as in the case of CryptoKitties, where the sale price of the first kitty was over US$ 100 thousand (Cheng, 2017). CryptoPunks is another example of crypto collectables reaching a large transaction volume (Libman et al., 2019). The market of crypto collectables is estimated by Forbes to be worth over US$ 200 billion (Fenech, 2018). It is worth noting that blockchain applications in the arts are not limited to crypto collectables; applications developed for one purpose might bear consequences on many other fields. For example, supply chain applications are useful in accounting for art provenance as explained by Alshamrani et al. (2019).

The developments above collectively will not only undermine the need for banks and internet service providers but will certainly also undermine the need for mobile connection and energy grids as they too can be monetized on a peer-to-peer basis; Grid plus (Kimura, 2018), and the Brooklyn Microgrid (Mengelkamp et al., 2018) are two companies that are providing decentralize electric grids, where houses powered by solar energy can automatically buy or sell excess utility from each other independently from power supplying companies. Less developed but discussed is the use of mesh network to enable decentralized mobile phone networks which could replace the current cellular business model which relies on service provider (Zuckerman, 2010). Blockchain technology can be combined with mesh networks to provide security and transparency (Zyskind & Nathan, 2015) as well as cheaper and thus wider connectivity in underdeveloped parts of the world (Navarro et al., 2018).

2.5 Blockchain Adoption in the Arab World

Blockchain adaptation in the Arab world is led by the Gulf Cooperation Council (GCC) region where most of the blockchain developments and innovations in the Arab world is taking place; according to Ainsworth and Alwohaibi (2017), the GCC Value Added Tax (VAT) is potentially the first blockchain-based, multi-jurisdictional VAT system in the world. The authors argue that the GCC VAT system avoids some of the vulnerabilities in the European Union VAT system such as the *missing trader intra community* fraud schemes. As Nordrum (2017) explains, the Government of Dubai is adopting blockchain in all its operations in order to increase efficiency and speed. Walch (2016) adds, Dubai sees in the adoption of blockchain a way to achieving its goal of becoming paperless in 2020. The city is also currently at an advanced stage in blockchain activities. Manushaqa et al. (2019) argue that Dubai is among the top ten cities in the world in blockchain activities. They explain that by adopting blockchain technology, the city will annually eliminate 398 million printed documents, 77 million working hours, 1.6 billion kilometers spent on driving and save 11 billion on processing fees.

In their study of the impacts of blockchains on banks in the GCC region; Othman et al. (2019) argue that the development of cryptocurrency markets has significant unidirectional causal effects on bank deposit variabilities in UAE, Qatar, Kuwait and Bahrain, and they suggest that banks in these countries should adopt blockchain in order to lower their costs and keep up new developments. Banks in the GCC region are, indeed, taking many steps in adopting blockchain. For instance, the Central Bank of Saudi Arabia has signed an agreement with the blockchain payment company, Ripple Technologies, to speed up and secure the bank's operations (Şanlisoy & Çiloglu, 2019). While financial

applications are the most prominent in the adaptation of blockchain technology in the region, in line with its blockchain strategy, the United Arab Emirates is innovating new ways to apply blockchain to its healthcare system. According to Attaran and Gunasekaran (2019), the United Arab Emirates is the first country in the world to use blockchain for organ donation. Although blockchain innovation in the Arab world is concentrated in the GCC region due to governmental encouragement of the sector, there are some isolated blockchain initiatives outside of the GCC region; Egypt, for example, has opened its first blockchain-focused incubator in 2018 which aims to encourage blockchain startups in the country (Jackson, 2018).

A handful of studies have examined blockchain adoption factors in Arab context but outside the scope of media and mass communications. Alabbasi and Sandhu (2019), for example, examine blockchain-driven innovation in the GCC region, arguing that blockchain technology is adopted by the governments of the Arabian Gulf as a solution to diversify their economies away from oil. Khan et al. (2019), however, examine blockchain as a supportive E-Governance infrastructure at the Department of Economics in Dubai, arguing that the use of blockchain benefits the government in simplifying, speeding and securing its operations. As the literature suggests, blockchain adoption in the Arab world is led by GCC governments in efforts to consolidate their governance and economic planning.

2.6 Status of Research

The recent cryptocurrency hype resulted in a ubiquity of academic studies on blockchain, albeit from the disciplines of finance and information technology. Systematic

reviews of blockchain literature indicate that the majority of research focuses solely on its financial applications. According to Yli-Huumo et al. (2016), the analysis of 41 primary papers published on scientific databases shows that the focus in over 80% of the papers is on the Bitcoin system and less than 20% deals with other blockchain applications. This is confirmed by a number of other systematic reviews which focus on specialized areas within finance and or technology, such as the study by Conoscenti et al. (2016), and the study by Seebacher and Schüritz (2017), which systematically review 31 peer-reviewed blockchain articles dealing with the technical and financial aspects of the technology.

Moreover, as a result of the growing governmental and public interest in blockchain technology, even within the context of economics and finance, topics are becoming interdisciplinary; research on blockchain is intersecting with sociology, law, political science and other disciplines as more aspects of blockchain technology are starting to be researched and discussed. For example, Parino et al. (2018) focus on the socio-economic variables behind the adoption of the bitcoin blockchain arguing that the rate of adoption significantly correlates with the population, the GDP per capita, the freedom of trade and the Internet penetration. Walch (2016), however, examines the blockchain lexicon and argues for clear legal terminology to further advance legal discourse on the topic. Atzori (2015), on the other hand, explores blockchain in the context of political science and explores its deep potential implications on forms of governance in the modern state.

Nevertheless, Frizzo-Barker et al. (2019), argue that “blockchain remains an early-stage domain of research in terms of theoretical grounding, methodological diversity, and empirically grounded work” (p. 1). Xu et al. (2019) conclude that, although many

researchers have realized the importance of blockchain, the research of blockchain is still in its infancy.

Media Research

Despite increased interest in blockchain in general, and the diversity of explored themes, even within the context of economy and finance, media research on blockchain remains scarce. Lagendijk et al. (2019) study the framing of blockchain in the Dutch media and argue that the analysis of newspaper items shows an important divide between stakeholders and policy workers. Lynn et al. (2018) study the impact of media discourses on the widespread adoption of blockchain. Cho and Jeong (2019), on the other hand, discuss practical media applications of blockchain technology arguing that blockchain is useful for securing content and for protecting copy rights.

Other studies focus on the media framing of specific blockchain applications. Ogochukwu and Jarrar (2018), for example, conduct a content analysis of the online media coverage of Bitcoin in Nigeria. Tjärnfors and Wikman (2018), on the other hand, examine the effects of media coverage on the value of Bitcoin in 2017. Mai et al. (2018), however, investigate the effects of social media content on the value of Bitcoin while Albrecht et al. (2019) map the social media rhetoric on initial coin offerings and argue that the positive sentiments on twitter contribute to higher capitalizations on cryptocurrencies.

Despite the fact that the number of articles on blockchain remains very low in general, it is still increasing every year (Dabbagh et al., 2019). Miau and Yang (2018) conduct a bibliometric analysis of Scopus database and explain that the focus of literature was on Bitcoin and cryptocurrencies from 2008 to 2013. From 2014 to 2015, research on

Bitcoin increased rapidly. After 2016, however, the literature started focusing on the techniques of blockchain and smart contract. This is in line with the recent systematic review by Xu et al. (2019), which confirms that the number of articles is drastically increasing and that the majority of the literature is still focusing on the core technology and the Bitcoin system. The number of yearly publications is outlined in Table 4. It must be noted that the study was published in the middle of 2019 and, thus, the table shows a lower number of articles in 2019 than previous years.

Table 4: Number of Blockchain Academic Papers

	WOS-All	WOS-Articles	WOS-Business & Economics
Before 2015	0	0	0
2015	4	1	0
2016	40	28	5
2017	200	158	45
2018	553	453	61
#2019	138	116	8
Total	925	756	119

Source: Xu et al. (2019)

Most recently, in 2020, a systematic review of blockchain related studies identified the areas of interest as computer science, economics, entrepreneurship, law and governance (Kher et al., 2020).

In the context of the Arab World

The researcher was unable to find a single study on blockchain and the media in the Arab world. However, there are few studies addressing the use of blockchain technology in the Arab world. El-Din (2019), for example, discusses blockchain potential for healthcare in Egypt. She maintains that the lack of a mechanism of coordinating the imports and exports of medicines in Egypt is leading to a big number of preventable deaths, especially among children due to infant milk deficiency. Thus, she argues that blockchain could solve this problem and outlines, in her study, a proposition for a national pharmaceutical database built on blockchain to solve this issue.

Bishr (2019) explores the Dubai government's goal to make Dubai a city powered by blockchain. She discusses in detail the government's strategy for implementing blockchain, maintaining that the adoption of blockchain on a citywide scale will provide an enabling environment for businesses and startups. Research on blockchain and its applications in the United Arab Emirates is not limited to the governmental scale; researchers at the United Arab Emirates University study different development platforms and argue for the feasibility of a large-scale deployment of blockchain at their university (Ismail et al., 2019).

While the number of studies focusing on the Arab world is limited, there are a number of studies focusing on blockchain in context of Islamic and Arabic culture. For example, Abu-Bakar (2018) discusses the *shariah* compliancy of Bitcoin, cryptocurrencies and blockchain. Rejeb (2018), however, discusses the supply chain of *halal* meat and argues that blockchain could address the consumers' concerns resulting from the lack of a systematic way to ensure that products sold as halal are actually halal

by adding transparency to the supply chain on a global scale. Alam et al. (2019), on the other hand, investigate digitalization and disruptions in the financial sector. They maintain that disruptive technologies, such as blockchain, are transforming the financial sector including Islamic finance.

To summarize, this chapter provided a definition of blockchain technology and a discussion of its history and significance. The chapter traced currently known blockchain applications as described in the literature and provided background information on the adaptation and spread of blockchain in the Arab world. Finally, it discussed the previous studies on blockchain focusing on studies by media and mass communications scholars. The chapter concludes that the amount of research on blockchain in the context of media and mass communications is scarce. Moreover, no previous studies were found about blockchain and the media in the Arab world.

Chapter 3: Theoretical Framework

This chapter discusses the concept of media framing covering its inception, definitions, rationale, critiques and implementation.

3.1 Media Framing

According to Borah (2011), the history of framing dates back to the 1970s with the research of Goffman who was one of the first scholars to discuss the general concept. Citing him, she explains that "frames help people organize what they see in everyday life. Goffman calls frames the schemata of interpretation, a framework that helps in making an otherwise meaningless succession of events into something meaningful" (p. 248). While research on framing is far from scarce, scholars offer a variety of definitions of the concept. As Scheufele (1999) explains, "research on framing is characterized by theoretical and empirical vagueness. This is due, in part, to the shortage of a commonly shared theoretical model underlying framing research" (p. 103). Different definitions of framing highlight different aspects of the framing process. According to Entman (1993), "to frame is to select some aspects of a perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation" (p. 52). His definition focuses on the active process of selection and creating salience by choice. Gitlin (1980) defines framing as "persistent patterns of cognition, interpretation, and presentation of selection, emphasis and exclusion by which symbol handlers routinely organize discourse" (p. 7). His definition emphasizes the unavoidable meaning creation resulting from the systematic organization of information by journalists. Fiss and Hirsch (2005),

on the other hand, argue that framing is "the processes by which actors produce frames of meaning to mobilize support for their respective positions" (p. 30), and thus they take a political reading of the concept. The major premise of framing, as Chong and Druckman (2007) explain, is that "an issue can be viewed from a variety of perspectives and be construed as having implications for multiple values or considerations" (p. 104). As they note, the studying of framing is useful in identifying trends, perceptions and comparing variation across media outlets.

While the concept of framing is a useful framework to analyze discourse, the concept is not free of criticisms; "scholars have argued that most of the research on media framing is still fairly descriptive and relatively theoretical" (Ewoldsen, 2003, p. 340). This is a common criticism of the framing concept. In his theoretical and methodological critique of framing, Scheufele (2004) argues that framing research insufficiently focuses on psychological constructs and theories, and thus, he maintains, most framing studies overlook other types of framing-effects and waste several empirical questions and methodical chances. That said, the concept of framing is chosen in this study for its ability to provide an empirical description of the media discourse on the topic. The concept of framing is "capable of bridging several research areas such as the production, content, and effects of news" (Matthes, 2009, p. 351). As a related concept, framing resembles agenda setting in various ways; "Framing analysis shares with agenda-setting research a focus on the relationship between public policy issues in the news and the public perceptions of these issues" (Semetko & Valkenburg, 2000, p. 92). Framing surpasses agenda-setting by moving from what people think or talk about to "examining how they think and talk about

issues" (Pan & Kosicki, 1993, p. 70), and that is the rationale behind using the concept of framing in this study.

3.2 Theory Implementation: Approaches to Framing

There is a considerable number of studies conducted on the media framing of technology as well as a variety of approaches to the implementation of framing as a concept. One way is to classify approaches to framing according to its disciplinary origins; as Tewksbury and Scheufele (2009) explain, "approaches to framing can be distinguished along at least two distinct dimensions: disciplinary origins –psychological vs. sociological approaches– and explanatory models –applicability models vs. other effects models–" (p. 17). Other studies classify the approaches according to the frame type; media frames vs. audience frames, and the way frames are operationalized; independent variable or dependent variable (Scheufele, 1999). The diversity in the theorization of the concept is reflected in the many ways in which the concept is operationalized; examples include the approaches of Strekalova (2015), Reese (2001) and Ghanem (1997). While diverse approaches stem from the same conceptual framework, each approach focuses on different frame dimensions, and thus, the multiplicity of approaches offers a good level of versatility.

The approach of Strekalova (2015) is characterized by differentiating between topics, frames and themes. As outlined in her study of the news coverage of medical nanotechnology in the US, her framing dimensions include topics and time frames, risk and benefit frames, thematic and episodic issue coverage framing and, finally, societal and personal impact. Her approach is useful in the study of the framing of technology as seen

in her own study and in the study by Chuan et al. (2019), which examines the media framing of artificial intelligence (AI) in American newspapers. The approach of Reese (2001), on the other hand, focuses on the way media frames are used by the public to interpret social reality. Its emphasis on power, however, makes it more useful in studies focusing on the framing of political and social issues.

The researcher chooses the approach of Ghanem (1997), among the various approaches to operationalizing the framing concept, as it focuses on the same framing dimensions identified in the research questions. Furthermore, previous literature demonstrates its usefulness in studying the media framing of technology as seen in the work of Rössler (2001) which studies the framing of the Internet by traditional media coverage in Germany using her approach.

3.3 Ghanem's Approach

In her discussion of the concept, Ghanem (1997) identifies four ways in which an issue is framed in the media: presentation, subtopics, cognitive attributes and affective attributes. On each dimension, she maintains the following:

Presentation

The way in which topics are presented, including the prominence and the size of an article, or the rhetoric of its visual and discursive elements, can influence opinions on the topic, including perceptions of its importance; Ballard (2019) maintains, "we know through decades of psychological research that information has a fluid meaning depending

on the context and presentation". Chapman et al., (2015) argue that the perception of risk varies significantly depending on the presentation format. They explain:

> For "quantitative data," risks were consistently perceived as higher, when presented as frequencies (e.g., 1 in 50) compared with equivalent percentages (e.g., 2%). Framing "qualitative data" in terms of chance of "death" rather than "survival" led to a statistically significant increase in perceived risks. Framing "quantitative" data in this way did not significantly affect risk perception (p. 231).

Because the analyzed articles are retrieved from databases and there is no way to assess the placement of the individual article within the interface of the newspaper, and because the responses of readers are not accounted for in the content analysis technique, the assessment of the presentation dimension is, thus, limited to the amount of coverage rather than the placement of the articles. The amount of coverage is quantified using the number of articles. In analyzing presentation, this study examines the following aspects:

- 1st aspect: variance in presentation across blockchain applications
- 2nd aspect: variance in presentation across blockchain subtopics

Subtopics

Ghanem (1997) explains that topics have the effect of creating issue salience in news reporting. This dimension divides each topic in the articles into two categories: general-issue salience and sub-issue salience. Subtopics, she maintains, refer to the issues covered in the article besides the main topic. In this study, subtopics may include any issue

from the environment, to the legal system or unemployment. It is the context in which various blockchain applications are discussed.

This study selects six subtopics for the content analysis: the economy, the environment, morality, technology, security and the law. The first subtopic, economy, is selected based on the large number of systematic reviews on blockchain research suggesting that the focus of most blockchain research is on fintech (Yli-Huumo et al., 2016; Conoscenti et al., 2016; Seebacher & Schüritz, 2017). The second subtopic, the environment, is selected to be tested due to the regional adoption of the Arab strategy on health and environment (World Health Organization, 2018). The third subtopic, morality, is selected because of the ubiquity of religious rhetoric on the morality of using cryptocurrencies (Abubakar et al., 2018; Adam, 2017). The fourth subtopic, technology, is selected because "the majority of the literature mentions the core technology of blockchain and its most widely known application—bitcoin" (Xu et al., 2019). The fifth subtopic, security, is selected because "blockchain has (slowly) become one of the most frequently discussed methods for securing data storage and transfer" (Paul et al., 2019). The sixth and final subtopic, law, was selected based on the resolution of the Arab leagues' Jerusalem summit, which identified cybercrime as a top priority (2018). This dimension corresponds to the following aspect:

- 3rd aspect: the relationship between subtopics and the tone

Cognitive Attributes

Cognitive attributes relate to a fact-based understanding of a topic. Garay (2019) maintains that breaking down attributes is useful in understanding image formation and

he classifies it into two categories, soft and hard cognitive attributes. Ghanem (1997), on the other hand, classifies cognitive attributes into three categories: first, problem and solutions, second, ecology; the level of collectiveness, which she divides into five levels (individual, microsystem, mesosystem, ecosystem and macrosystem), and finally, third, the thematic framing which identifies specific issues or themes within each of the four subtopics identified. The focus in this study will be on the first of the three categories which is identified hereby as risks and opportunities. The pilot study, which examined 300 newspaper articles from four Arab countries, identifies a number of risks and opportunities: the perceived risks i.e. money loss, money laundering, terrorism, drug use and other categories of crime, and the perceived opportunities i.e. saving money, accountability, efficiency and speed. This dimension corresponds to the following aspects:

- 4th aspect: positive cognitive attributes
- 5th aspect: negative cognitive attributes

Affective Attributes

Affective attributes are closely related to cognitive attributes, whereas cognitive attributes describe the knowledge of a subject and its properties such as the advantages and disadvantages that are associated with blockchain technology. For example, affective attributes describe how the framer feels about what is known on the subject. This dimension focuses on the emotional responses to the cognitive attributes. Emotional responses are measured quantitatively by assessing the tone of the coverage through content analysis and qualitatively through the interviews which aim to aid with the interpretation of the qualitative data. In their discussion of attribute agenda setting,

Ghanem et al. (2009) explain that “the impact of a negative or positive tone on the people's assessment of the state of economy has been recently documented. Both experimental and nonexperimental studies affirm the role of affective attributes in shaping the attitudes and opinions of people” (p. 521). This is confirmed by Kim and Perdue (2013), who maintain that in the context of marketing, consumers choose products not only based on cognitive attributes, such as price and quality, but also on feelings. In this study, affective attributes are measured in terms of the tone in which the article discusses the topic. In other words, it refers to how positive or negative the article is in general. This dimension corresponds to the following aspects:

- 6th aspect: the tone of coverage
- 7th aspect: the variance in the tone across the Arab world
- 8th aspect: the relationship between the application type and the tone

To summarize, in the sections constituting this chapter, the researcher discussed the concept of media framing covering its history, various definitions, rationale, critiques and implementation. The framing concept is operationalized here by identifying specific frame dimensions which are presentation, subtopics, cognitive attributes and affective attributes. While each dimension is operationalized differently in the literature, in this study, in the analysis of presentation, the researcher focuses on the variance in the amount of coverage across blockchain applications and across subtopics. Based on the literature and the pilot study, the researcher produces six subtopics for the analysis which are economy, environment, morality, technology, security and law. Cognitive attributes are operationalized by measuring risks and opportunities. Finally, affective attributes are operationalized by measuring the tone of the article.

Chapter 4: Methodology

This chapter presents the rationale for using both quantitative and qualitative methods, strategies and techniques. It highlights the research aims and demonstrates how to methodologically achieve them. It discusses the research design, the research questions and the validity of the questionnaires. The chapter thoroughly discusses the techniques of content analysis, interviews and thematic analysis by examining their definitions and purposes and methods of data collection and analysis.

The study aims to empirically gain an understanding of the public discourse on blockchain as reflected in the media and the perceptions of specialists in the Arab world as the subject gains an increasing regional and global importance.

A pragmatist research philosophy is adopted with a mixed methods approach. A quantitative content analysis of the online versions of fifty-two mainstream Arab newspapers from 2017 to 2019 is conducted; this time frame is determined based on the limited number of articles available before 2017. Relevant news articles published over a period of three years are collected, read and coded according to four frame dimensions identified in earlier studies: presentation, subtopics, cognitive attributes and affective attributes. As for the qualitative study, in-depth interviews with blockchain professionals are conducted. Statistical Package for the Social Sciences (SPSS), is used to analyze the data from the content analysis while thematic analysis is used to analyze the interviews. The data from the content analysis and interviews are compared to assess the degree to which the Arab media coverage reflects the attitudes and perceptions of blockchain professionals in the Arab world.

The research questions are devised into sub-questions designed to measure various aspects of the four framing dimensions as well as to compare the media coverage to perceptions and expectation of blockchain experts; the first aspect is the variance in the presentation across blockchain applications. The second aspect is variance in presentation across subtopics. The third aspect is the relationship between the subtopics and the tone. The fourth aspect is the framing of positive cognitive attributes. The fifth aspect is the framing of negative cognitive attributes. The sixth aspect is the tone of coverage. The seventh aspect is the variance in the tone across the Arab world. Finally, the eighth aspect is the relationship between the application type and the tone.

4.1 Research Methods Overview

In order to justify the chosen research method, the researcher discusses quantitative, qualitative and mixed research methodologies highlighting the qualities and relevance of each choice:

According to Stojanov (2014), researchers define quantitative research as "explaining phenomena by collecting numerical data that are analyzed using mathematically based methods" (p. 365). McCusker and Gunaydin (2015) argue that the aim of quantitative research is to classify, count, and explain observations through statistical models. He also adds that "quantitative data is more efficient, able to test hypotheses, but may miss contextual detail" (p. 2). It is for that reason that the researcher decided not to rely solely on quantitative data. Quantitative research can be experimental or non-experimental (Creswell, 2009). The researcher uses a non-experimental strategy in this study.

Qualitative research, on the other hand, has a wide range of definitions. According to Van Maanen (1979), scholars define qualitative research as "an umbrella term covering an array of interpretive techniques which seek to describe, decode, translate, and otherwise come to terms with the meaning, not the frequency, of certain more or less naturally occurring phenomena in the social world" (p. 520). Rahman (2017), however, argues that qualitative research refers to processes of inquiry that yield conclusions through non-statistical measures. He resumes that qualitative research could account for living experiences, behaviors, feelings as well as culture phenomena which cannot be studied using numerical and statistical means. The strength of this method, Rahman maintains, lies in its ability to describe how subjects make sense of the world. It is fitting to include qualitative methods in this research because the aim of the study is to understand how the Arab media and blockchain professionals make sense of the technology.

Scholars have various definitions of mixed methods research. As Guest (2013) points out, "mixed methods scholars do not even agree on the definition of mixed methods research… A recent count identified at least 15 published mixed methods typologies… each with its own definitions and terms" (pp. 142-143). Nevertheless, he explains that some scholars see this diversity as a point of strength for this research method by making it versatile and thus more suitable for this study. Maxwell and Loomis (2003) explain that "the actual diversity in mixed methods is far greater than any typology can adequately encompass'' (p. 244). Mixed methodologies are useful for producing data that combine breadth of statistical analysis and depth of interviews. As Muijs (2011) explains, mixed methods research is "a flexible approach where the research design is determined by what we want to find out rather than by any predetermined epistemological position. In mixed

methods research, qualitative or quantitative components can predominate, or both can have equal status" (p. 8). In light of McCusker and Gunaydin (2015), "it is not possible to place research methods in a hierarchy of excellence, as different research methods are appropriate for addressing different research questions" (p. 5).

4.2 Mixed Methods Research Design and Techniques

There is a wide variety of approaches to using mixed methods. Creswell (2009) groups the six categories identified in his prior research into three main categories: sequential, transformative and concurrent strategies which are the focus of this section:

> Concurrent mixed methods procedures are those in which the researcher converges or merges quantitative and qualitative data in order to provide a comprehensive analysis of the research problem. In this design, the investigator collects both forms of data at the same time and then integrates. The information in the interpretation of the overall results. Also, in this design, the researcher may embed one smaller form of data within another larger data collection in order to analyze different types of questions (the qualitative addresses the process while the quantitative, the outcomes) (Creswell, 2014, p. 14).

Terrell (2012) elaborates that there are various types of concurrent strategies: "Mixed-methods can provide an investigator with many design choices which involve a range of sequential and concurrent strategies" (p. 255). Such choices, he adds, include concurrent nested strategy, concurrent transformative strategy and concurrent triangulation strategy, which is the strategy of choice in this study. He argues that

concurrent triangulation has many advantages; it is familiar to many researchers and has a shorter data collection time when compared to sequential methods. It also offsets the weaknesses inherent to one design by using two. Nevertheless, Terrell acknowledges many weaknesses to this design choice as well. For instance, it requires a great deal of expertise and effort to study the phenomenon under consideration using two different methods. It may be difficult to compare two types of data as well as resolve potential discrepancies. The illustration (Figure 1), explains concurrent triangulation procedures in a simple form.

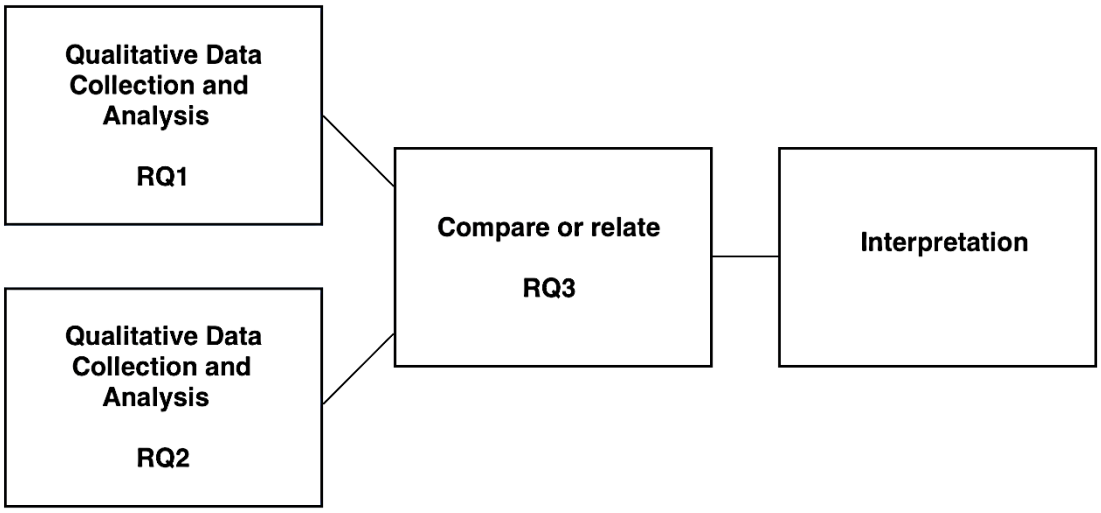

Figure 1: Illustration of Concurrent Triangulation (Terrell, 2012)

4.3 Content Analysis

Content analysis is one of several techniques of textual analysis. One of the first general accounts of this type of inquiry was initiated by Bernard Berelson in 1952 (Jensen,

2013). According to Berelson (1952), it is a technique for the quantitative, systematic, and objective description of the content of communication. Additionally:

> The process of reviewing any type of media to evaluate what it says and how it says it. While it is often thought of in the context of literary content analysis, examining written works to understand the author's meaning, the term has broader implications. It can be applied to the analysis of such diverse sources as books, newspapers, television programs, movies, survey results, social media posts, and advertising (Ungvarsky, 2019, p. 1).

Content analysis can be conducted as a quantitative or a qualitative technique (Cho & Lee, 2014; Zhang & Wildemuth, 2009). In this study, content analysis is used as a quantitative technique and it is chosen by the researcher for its versatility and usefulness in the analysis of media content; it is useful for making replicable and valid inferences from texts or other meaningful mater to the contexts of their use (Krippendorff, 2004). As a quantitative technique, content analysis encompasses the advantages and disadvantages of the quantitative methods; it requires less time for data analysis as it can be done with statistical software such as SPSS as in this study. As a quantitative technique, however, it is bound by the limitations of the positive research paradigm which, according to Rahman (2017), leaves out the common meanings of social phenomena and fails to ascertain deeper underlying meanings and explanations.

Pilot Study

The research starts with a pilot study whereby seventy-five articles are sampled from Saudi Arabia, UAE, Egypt and Lebanon between January 2017 and December 2018.

Twelve variations of the Arabic translation of the keyword blockchain are used to identify the articles. A full sample was collected from all mainstream Egyptian and Lebanese newspapers. While it was possible to find seventy-five articles from mainstream Egyptian online newspapers, the researcher was only able to find seventy-one articles from Lebanese newspapers published from within Lebanon. Thus, the researcher resorted to including four articles from Lebanese online newspaper that is unlicensed or published from abroad. The total number of newspapers used to produce the full sample for Lebanon is nine. The total number used to produce the full sample for Egypt is six. As for UAE and Saudi Arabia, however, plenty of articles were found, especially in the UAE, as the main newspapers included hundreds of articles. Three newspapers were selected from the UAE in order to represent different Emirates. Twenty-five randomly selected article were chosen from each newspaper. Four newspapers were selected in order to produce a random sample that reflects different regions in Saudi Arabia. The total number of newspapers used is twenty-one. The pilot study concluded that the coverage of blockchain in online Arab press is predominantly positive. Nevertheless, there are some differences in the media coverage between the four studied countries which are reflected in the amount of coverage, subtopics, applications and tone. There is a significant association between some applications and the tone. There is also a significant association between some subtopics and the tone. The timeframe of the study is limited by the low number of articles on the subject, particularly before 2017, and thus, the analysis in the pilot study was limited to two years only. Further limitations resulted from the restricted focus on blockchain coverage in online versions of mainstream newspapers; the study does not include hard copies of the newspapers or information disseminated on blogs, social media

or new media platforms which may mildly impact the results. Moreover, while the focus on online versions of mainstream Arab newspapers is a practical way to achieve the research objectives, the exclusion of other media types such as radio and television may limit the diversity in the sample as representation might vary across platforms. Furthermore, the sample data are extracted from four Arab countries only which exclude major Arab countries such as Algeria, Iraq and Sudan which limits the ability to generalize the results to the entire Arab world. Based on the findings of the pilot study, the researcher made several modifications; the number of articles analyzed increased from 300 to 500 derived from five countries as opposed to four. Furthermore, while the initial coding form treated e-governance and supply chain as one category due to overlap in some industries such as official ports, in this study the researcher treated each as its own category. Finally, the researcher included qualitative interviews in order to interpret and enrich the data.

Quantitative Data Collection

A coding scheme is developed to identify various variables through twenty-nine questions. The variables include the country, the newspaper, the year of publication and the application type such as cryptocurrencies, e-governance, management, supply chain, banking and fintech. Moreover, the variables include subtopics such as economy, technology, security, environment, morality and law. They include the tone of coverage, which is measured by the degree of positivity. They include the perceived opportunities such as saving money, accountability, efficiency and speed, and finally, variables include the perceived risks such as money loss, money laundering, terrorism, drug use and other categories of crime.

Eight questions are designed to identify the blockchain application. Eight questions are designed to identify the subtopics. Six questions are designed to identify the opportunities. Six questions are designed to identify the risks, and finally, one question is designed to identify the tone of the coverage. The unit of analysis is the individual article. Articles are retrieved from online databases using keyword searches of multiple variation of the word blockchain. Five hundred articles from fifty-two mainstream newspapers are randomly selected to provide an equal number of articles from each country.

Inter-coder Reliability

An inter-coder reliability test was conducted on a sample of 30 articles which is equivalent to ten percent of the sample for the pilot study. Two individuals conducted the coding; the researcher and an aide who was trained to understand the concepts and answer the questions listed in the coding scheme. Inter-coder reliability was calculated according to the formula below:

$$\text{Reliability} = \frac{2M}{N_1 + N_2}$$

where M is the number of coding decisions on which two coders agree, and N_1 and N_2 are the total number of coding decisions by the first and second coder. This formula does not take into account the occurrence of agreement strictly by chance as a function of the number of categories. Inter-coder reliability is equivalent to 87%.

Sample

According to Altman (1980), the approach to calculating the size of a sample is contingent on the complexity of the study. In other words, he explains that a sample that is too large is unnecessarily costly and time consuming while a sample that is too small may thus be scientifically useless. He also adds that "there are many approaches to determining the sample size; many who give little thought to sample size, choosing the most convenient number (20, 50, 100, etc.) or time period (one month, one year, etc.)" (p. 1336). The researcher uses the sample size for prevalence studies as explained by Conroy (2015): "The sample size needed for a prevalence study depends on how precisely you want to measure the prevalence" (p. 3). Table 5 illustrates the sample size required for the desired level of accuracy.

Table 5: Sample Size for Prevalence Studies

Acceptable margin of error	Size of population					
	Large	5000	2500	1000	500	250
±20%	24	24	24	23	23	22
±15%	43	42	42	41	39	35
±10%	96	94	93	88	81	65
±7.5%	171	165	160	146	127	92
±5%	384	357	333	278	217	132
±3%	1067	880	748	516	341	169

Source: Conroy (2015)

At the time of data collection, newspaper articles from the countries included in this study barely exceeded 100 news articles on blockchain, with the exception of Saudi Arabia and the UAE who had a higher number of articles. Using the same keywords search technique, the number of articles produced in Arab countries that were investigated but not included in this study such as Algeria, Iraq and Sudan is insignificant. Therefore, the researcher can conclude with a high degree of certainty that the total number of articles from which the sample is drawn is less than 1000.

Based on the above details and in light of Conroy's table, in order to generalize the results with a ±3% margin of error, the researcher determined that five hundred is the required size of the sample. And in line with the objective of the quantitative study which is to conduct a comprehensive and systematic study of the news framing of blockchain applications in Arab press, the researcher decided to use a stratified random sample from five different Arab countries; the sample must meet two conditions: first, it should reflect geographic diversity and second, an equal number of articles from the same time period should be selected (Elfil & Negida, 2017).

Investigated Countries and Newspapers

The above conditions, however, restricted the amount of countries that can be studied as it was not possible to collect enough articles from Algeria, Iraq or Sudan using the same data collection method; a keyword search for articles between 2017 and 2018 in thirty-one online Sudanese newspapers resulted in only thirty-four articles. Far less results were found in Iraqi newspapers and none were found in Algerian newspapers. On the contrary, one hundred articles or more were readily available in Egyptian, Moroccan,

Saudi Arabian, Lebanese and Emirati newspapers and, consequently, these five countries constitute the sample of the study. The researcher's inability to retrieve articles from Algerian, Iraqi or Sudanese newspapers does not necessarily confirm that they do not exist, the inability to retrieve articles using the same data collection method could be due to archiving limitations or other technical reasons.

In light of the stratified random sampling method, the studied countries reflect a geographical diversity and are able to produce an equal number of samples. Egypt and Morocco were selected as they are among the most highly populated Arab countries and also because they are located in the African region, which provides more diversity and representativeness to the sample. Saudi Arabia, on the other hand, was selected because it is a member of the G-20 and the biggest Arab economy. It included the UAE, for its leading role in blockchain technology. Finally, it included Lebanon as a country with a relatively more open media system and because it's located in the Levant which gives more diversity and representativeness to the sample.

Newspapers from various Arab countries vary in the amount of coverage of blockchain. In order to collect a similar number of articles from each of the five countries of the study, the researcher had to use a total of fifty-two online newspapers. While Emirati online newspaper archives contained hundreds of articles, each Moroccan newspaper for example contained only a handful of articles. As a result, the researcher conducted quantitative content analysis of three online newspapers from UAE, five online newspapers from Egypt, six online newspapers from Saudi Arabia, nine online newspapers from Lebanon, and finally twenty-nine online newspapers from Morocco.

From the United Arab Emirates, the researcher selected the following newspapers: first, *Albayan*, a newspaper established in 1980 by the government of Dubai and managed by the Dubai media department until 2003 when it became part of Dubai media incorporated (Albayan, 2019). It was included as a voice representing the Emirate of Dubai as one of the most active emirates in this domain. Second, *Alittihad*, which is a newspaper established in 1969 and is one of the oldest newspapers in the country, was selected. It is also one of the biggest newspapers with over one hundred reporters nationally and internationally (Alittihad, 2019). *Alittihad* is chosen as a national voice that represents all Emirates. Third, *Alkhaleej*, which is a newspaper established in 1970 as a private newspaper, was selected. The newspaper is concerned with national topics and is headquartered in the Emirate of Sharjah. (Alkhaleej, 2019). *Alkhaleej* is selected as a voice that represents the Emirates of Sharjah.

From Saudi Arabia, the researcher selected the following newspapers: first, *Okaz*, a newspaper established in 1960 as an individually owned newspaper until a new media law prohibited individuals from owning newspapers. *Okaz* grew rapidly with established offices in London Cairo, Beirut (Okaz, 2014). It is selected as a voice that represents the western region of Saudi Arabia. Second, *Alwatan*, which is a newspaper established in 1998 in Abha Saudi Arabia, was selected. It was the first Saudi Arabian newspaper to be established as a result of a study conducted by 40 researchers (Alwatan, 2019). *Alwatan* was chosen as a voice that represents the southern region of Saudi Arabia. Third, *Alriyadh*, which is a newspaper established in 1965 in the City of Riyadh, was selected. It was the first daily newspaper to be printed in Riyadh in the Arabic language. It has three times the number of employees as any other Saudi Arabian newspaper (Alriyadh, 2019). *Alriyadh*

was chosen as one of the most important and widely distributed Saudi Arabian newspapers. Fourth, *Alyaum,* which is a private newspaper established in Dammam in 1965, was selected. It was printed on a weekly basis until 1978 when it became a daily newspaper (Alyaum, 2019). *Alyaum* was selected as a voice representing the eastern region of Saudi Arabia. Finally, *Makkah,* which is a newspaper established in 1957 as an individually owned newspaper until the law prohibited individuals from owning newspapers and it became institutionally owned, was selected. The newspaper was supported by the personal funds of king Abdullah after facing a financial crisis (Makkah, 2019). *Makkah* was chosen for its importance as one of the oldest newspapers in the kingdom.

As for Egypt, it is a full sample of every mainstream Egyptian newspaper that discusses blockchain. This list has five newspapers, including *Akhbarelyom*, *Youm7*, *Almasryalyoum*, *Alwafd*, and, finally, *Aldostor*.

Regarding Morocco, it is a full sample of every Moroccan newspaper that discusses blockchain. This list has twenty-nine newspapers, including *Akhbarona, Alyaoum24, Noonpresse, Lakome, Hespress, Bayanealyaoume, Eighth, Alittihad, Chaabpress, Telexpresse, Ahdathpress, Goud, Assabah, Andaluspress, Aljassour, Rissalatalomma, tanja2, Alraiy, Agorapresse, Cawalisse, Bouzypress, Agadir24, Alalam Chtoukapress, Alayam2, Doniapress, Arrifinu, Alhurra,* and *Febrayer.*

As for Lebanon, it is a full sample of every mainstream Lebanese newspaper that discusses blockchain. The list has nine newspapers, including *Annahar, Elnashra, Aliwaa, Alankabout, Arabweek, Almustaqbal, Addiyar, Al-binaa*, and finally, *Alsadaranews.*

Quantitative Data Analysis

Data analysis is conducted using the statistical analysis software SPSS. The researcher conducts descriptive statistics that include frequencies and cross tabulations. The researcher conducts test for comparing means such as independent sample t-test and one-way analysis of variance (ANOVA).

4.4 Interviews

Interviews differ in the medium of delivery and/or in the format of the interview. Each medium and format has its unique advantages and disadvantages. The medium chosen by the researcher is Google Forms facilitated by an email message exchange and the format is semi-structured interviews.

As defined by Zhang and Wildemuth (2009), “interviews are a widely used tool to access people's experiences and their inner perceptions, attitudes and feelings of reality” (p. 1). Whiting (2008) explains that, on the basis of the degree of structuring, interviews can be divided into three categories: structured, in-depth and semi-structured interviews which, as he maintains, involves the use of predesigned open-ended questions that allow for a degree of variation between the fully structured and the in-depth interviews. The researcher uses semi-structured interviews in this study.

Interviews provide context and depth through the interpretive accounts of specialists. Johnson and Onwuegbuzie (2004) argue that the versatility of interviews allows it to accommodate mixed methods approaches, which is, as pointed out by Barriball and While (1994), “well suited to the exploration of attitudes, values, beliefs and motives” (p. 329). Since the participants are distributed across the Arab world, the researcher chose

to conduct the interviews by email and Google Forms. According to Opdenakker (2006), there are situations where email interviews are the most preferred:

> Using e-mail interviews for collecting information is preferred, when social cues of the interviewee are not important information sources for the interviewer (of course dependent on the research problem); the interviewer has a small budget and less time for travelling; […]; standardization of the interview situation is not important; […]; both the interviewer and the interviewee are both competent enough in typewriting and using (and have access to) computers (p. 11).

All of the above conditions are applicable in this study. While the qualitative interview technique has many advantages, it is not free of limitations and disadvantages; Hunt & McHale (2007) identify several disadvantages such as missing nonverbal cues and impersonality which relate to the previous point. Another disadvantage of email interviews he points out is the withdrawal from the interview without notice: "the interviewer who fails to receive a response from a participant has to make a decision regarding whether to request the information again or whether the person has withdrawn from the interview" (p. 1417). Other researchers identify a set of disadvantages embedded in the qualitative methodology. According to Rahman (2017), some argue that qualitative research approaches may leave out contextual sensitivities. Furthermore, qualitative results may be seen as incredible by policy makers, and, finally, the analysis may take a long time to complete.

The researcher selected the semi-structured format because it is useful "for the exploration of the perceptions and opinions of respondents regarding complex and

sometimes sensitive issues and enable probing for more information and clarification of answers" (Barriball & While, 1994, p. 330).

Ethical Considerations in Interviews

The questionnaires were approved by the Research Ethics Review Board at UAE University. They were carefully designed to eliminate interviewer biases and the data produced from the interviews were aggregated so that no interviewee could be linked to a particular answer. A stratified sampling method was used to eliminate any sort of sampling bias.

Designing and Procedures

The researcher conducts semi-structured interviews with thirty blockchain experts and professionals from a stratified sample representing the five studied countries. In the following sections, the researcher discusses the participants, the method of data collection, the interviewing process and the analysis of the results.

Interview Participants

Thirty blockchain professionals are sourced through LinkedIn to form the population of the study. The parameter of selection is the relevant professional or educational experience as listed on the participants' publicly available credentials on their LinkedIn profiles. The sample is stratified into groups of six participants based on the country of blockchain experience regardless of their nationality, age or gender.

Qualitative Data Collection: Interviewing Process

Between August 16, 2019, and September 17, 2019, the research contacted a total of two hundred and twenty blockchain professionals and invited them to participate in the study. This number includes all LinkedIn users who have a public profile, relevant blockchain credentials and who are residing in one of the studied countries. The overall response rate was 18.15 percent; 40 interviews. Only the first 6 completed interviews from each country were included in the study and, thus, a total of 10 online interviews were excluded from the study as they were completed after the target number had been covered. The data was collected using Google Forms then exported into Excel sheets stratified according to the countries, credentials and the interview questions.

The online interviews consisted of three components. First, the researcher introduced the study and the research objectives. Second, a set of questions exploring various aspects of blockchain and the media, from the perceptions of coverage to the understanding of the technology and its implications, was presented. Finally, the researcher asked the interviewees if they would like to add any comments or suggestions. The interviewees credentials are listed in Tables 6, 7, 8, 9 and 10.

Table 6: Interviewees Working in Saudi Arabia

Credentials		Gender	Education	Age
1	Director & technology expert	Male	Higher education	55+
2	Executive consultant	Male	Higher education	26-35
3	Principal blockchain architect	Male	Higher education	36-45
4	Blockchain developer	Male	Higher education	19-25
5	Software and AI team lead engineer	Male	Higher education	46-55
6	Blockchain consultant	Male	Higher education	26-35

Table 7: Interviewees Working in the United Arab Emirates

Credentials		Gender	Education	Age
1	CEO and co-founder of several blockchain and IT companies	Female	Higher education	26-35
2	Senior manager at a blockchain company	Male	Higher education	36-45
3	Certified blockchain solution architect	Male	Higher education	36-45
4	Blockchain investor	Male	Higher education	26-35
5	Chief information officer	Male	Higher education	46-55
6	Blockchain strategist & speaker	Male	Higher education	26-35

Table 8: Interviewees Working in Lebanon

Credentials		Gender	Education	Age
1	PhD on blockchain & blockchain cybersecurity engineer	Male	Higher education	26-35
2	PhD on blockchain & energy consultant	Male	Higher education	36-45
3	Co-founder of a blockchain company & certified blockchain Architect	Male	Higher education	36-45
4	analyst | blockchain-machine learning	Male	Higher education	36-45
5	Computer scientist	Female	Higher education	26-35
6	Early bitcoin developer	Male	Higher education	36-45

Table 9: Interviewees Working in Morocco

Credentials		Gender	Education	Age
1	CEO and founder	Male	Higher education	36-45
2	PhD on blockchain	Female	Higher education	26-35
3	CTO and co-founder | blockchain expert and author of "blockchain by example"	Male	Higher education	36-45
4	Blockchain consultant	Male	Higher education	26-35
5	Blockchain developer	Male	Higher education	26-35
6	Blockchain developer	Male	Higher education	26-35

Table 10: Interviewees Working in Egypt

Credentials		Gender	Education	Age
1	Senior consultant and blockchain developer	Male	Higher education	36-45
2	Blockchain and data science leader	Male	Higher education	46-55
3	Blockchain developer	Female	Higher education	19-25
4	Blockchain / micro services lead practitioner	Male	Higher education	36-45
5	Managing digital strategy consultant - blockchain	Male	Higher education	26-35
6	Blockchain developer	Male	Higher education	26-35

4.5 Thematic Analysis: Qualitative Data Analysis

Thematic analysis is used to interpret and analyze the data retrieved from interviews. Boyatzis (1998) defines thematic analysis as "a method for identifying, analyzing, and reporting patterns (themes) within data" (Salleh et al., 2017, p. 1315). Maguire and Delahunt (2017) elaborate that the goal of a thematic analysis is "to identify themes, i.e. patterns in the data that are important or interesting, and use these themes to address the research or say something about an issue. This is much more than simply summarizing the data; a good thematic analysis interprets and makes sense of it" (p. 3353).

As Cruzes and Dybå (2011) explain, thematic analysis "minimally organizes and describes your data set in rich detail. However, it also often goes further than this, and

interprets various aspects of the research topic" (p. 434). One of the benefits of thematic analysis, Braun and Clarke (2006) argue, is its flexibility; "through its theoretical freedom, thematic analysis provides a flexible and useful research tool, which can potentially provide a rich and detailed, yet complex account of data" (p. 5). Despite its advantages, they argue that thematic analysis has limited interpretative power beyond mere description, and, unlike narrative or other biographical approaches, it is not possible to maintain a sense of continuity and contradiction through any individual account. Like the previously discussed techniques, as a qualitative technique, thematic analysis is bound to the advantages and disadvantages of qualitative research methods.

Applicability of Braun & Clarke Approach

There is a huge number of approaches to thematic analysis. Approaches differ in terms of procedures as well as underlying philosophy. The researcher chooses the approach of Braun and Clarke (2006) because it offers a systematic way to produce themes qualitatively. This thematic analysis procedure is illustrated in Figure 2.

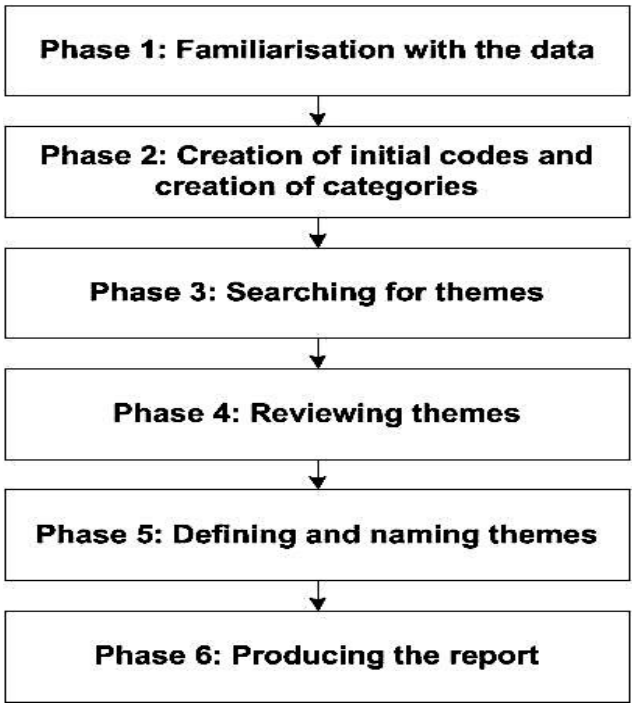

Figure 2: Thematic Analysis Phases (Herring, 2015)

As per the procedures outlined in Figure 2, the researcher read the interviews with the blockchain experts to develop an understanding of the data. Indicial codes are created, and the data were divided into categories. The researcher looked for themes in the data which were reviewed, defined and named. Finally, the results were reported.

Data Integration

As outlined above, there are various designs for mixed methods studies and the researcher uses the convergence design as described by Creswell (2009). First, the research completed each study separately. Qualitative and quantitative data were descriptively reported and analyzed. Finally, the results were examined together in light of the research questions with the goal of identifying areas of agreement and disagreement between the qualitative and quantitative data.

To summarize, in the sections forming this chapter, the researcher defined and rationalized the methodology illustrating its mixed methods approach, the techniques of content analysis, interviews and thematic analysis, the underlining non-experimental and concurrent strategies, as well as its convergent design. The chapter discussed the research aims, the research questions and the validity of the questionnaires. The chapter presented the pilot study and illustrated the changes implemented as a result. It discussed the samples and the rationalization for the use of the stratified random sampling technique.

Chapter 5: Data Analysis and Results

In light of the convergent research design, the qualitative and the quantitative methodology were conducted separately. The first section of this chapter reports frequencies, cross tabulations and tests for mean comparisons, such as independent-sample t-test and one-way ANOVA to descriptively list the results from the quantitative content analysis. The second section reports the results of the thematic analysis of the interviews. In the third section, the researcher compares both qualitative and quantitative studies side by side.

5.1 Quantitative Results

RQ1.1 Blockchain Applications Most Frequently Covered in Arab Press

Applications are ranked according to the frequency as outlined in Figure 3.

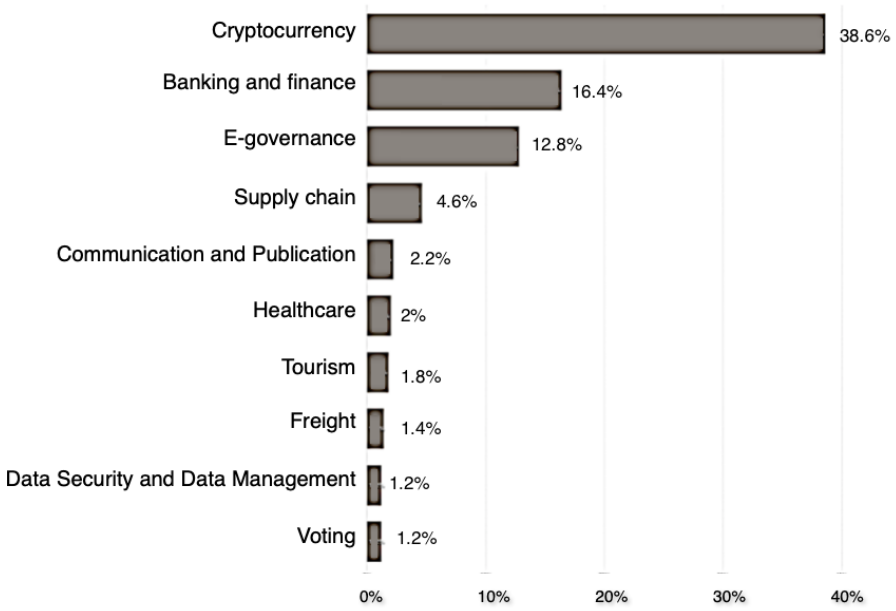

Figure 3: Application Frequency in online Arab Press

Crypto currency is, by far, the most frequently discussed application followed by banking and finance, e-governance, supply chain, communication and publication, healthcare, tourism, freight, data security and management, and, finally, voting.

RQ1.2: How does the coverage of blockchain applications in Arab countries differ?

A chi-square test was conducted to answer this question, and results were grouped into four main categories according to previous application frequency analysis. The first category is cryptocurrencies, the second is banking and finance, the third is e-governance, and, finally, the fourth is supply chain. The details are outlined in Figure 4 and Table 11.

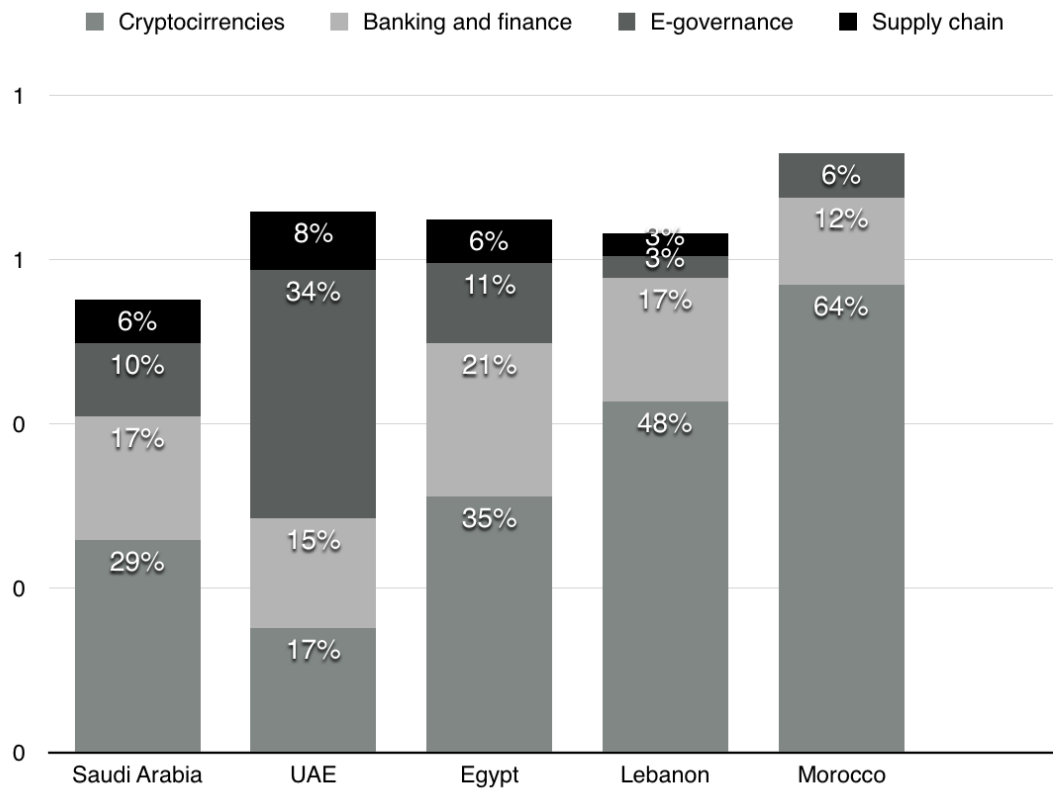

Figure 4: Graphical Representation of the Application Frequency in Each Country

Table 11: Application Frequency in Each Country

Description	Saudi Arabia	UAE	Egypt	Lebanon	Morocco	Significance
Cryptocurrencies	29%	17%	35%	48%	64%	0.000
Banking and Finance	17%	15%	21%	17%	12%	0.533
E-Governance	10%	34%	11%	3%	6%	0.000
Supply chain	6%	8%	6%	3%	0%	0.011

In terms of the coverage of cryptocurrency, the results show that supply chain is discussed in 17 articles out of the 100 articles that form the full sample from the UAE (17%), compared to 48 articles (48%) in the sample from Lebanon, 35 articles (35%) in the sample from Egypt, 29 articles (29%) in the sample from Saudi Arabia and 64 articles (64%) in the sample from Morocco. The difference is statistically significant as $p = 0.0000$ which is < 0.001 and, thus, it can be said that the five countries differ significantly in their coverage of cryptocurrencies.

As for banking and finance, however, the results show that banking and finance applications are discussed in 15 articles out of the 100 articles that form the full sample from the UAE (15%), compared to 17% of the sample from Lebanon, 21% of the sample from Egypt, 17% of the sample from Saudi Arabia and 12% of the sample from Morocco. The difference is not statistically significant as $p = 0.533$ which is > 0.001 and, thus, the study finds that Arab countries do not significantly differ in their coverage of banking and finance applications.

In terms of e-governance, the results show that supply chain is discussed in 34 articles out of the 100 articles that form the full sample from the UAE (34%), compared

to 3 articles (3%) in the sample from Lebanon, 11 articles (11%) in the sample from Egypt, 10 articles (10%) in the sample from Saudi Arabia and 6 articles (6%) in the sample from Morocco. The difference is statistically significant as $p = 0.000$ which is < 0.001 and, thus, it can be said that the five countries differ significantly in their coverage of e-governance applications.

As for supply chain, the results show that supply chain is discussed in 8 articles out of the 100 articles that form the full sample from the UAE (8%), compared to 3 articles (3%) in the sample from Lebanon, 6 articles (6%) in the sample from Egypt, 6 articles (6%) in the sample from Saudi Arabia and none (0%) in the sample from Morocco. The difference is not statistically significant as $p = 0.011$ which is > 0.001, and, thus, it can be said that the five countries do not differ significantly in their coverage of supply-chain applications.

RQ1.3: What subtopics are associated with blockchain applications?

The results were retrieved using descriptive analysis as outlined in Figure 5.

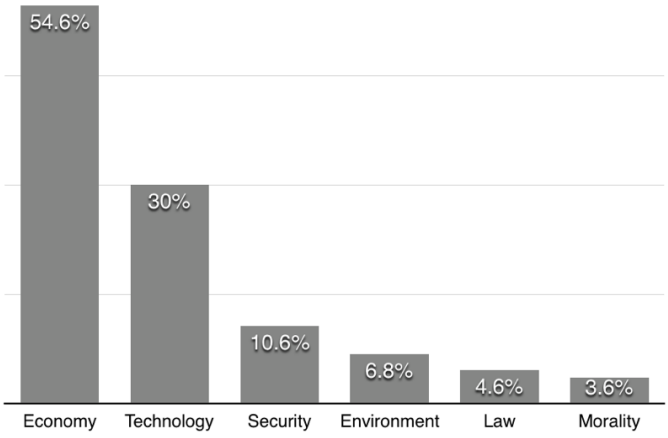

Figure 5: Subtopic Frequency in Online Arab Press

The economy is the most frequent subtopic, followed by technology, security, law and morality.

RQ1.4: What are the differences in the coverage of subtopics in Arab countries?

A chi-square test was conducted to answer this question and the results were grouped into six main categories according to the previous subtopic frequency analysis. The first category is economy, the second is technology, the third is security, the fourth is environment, the fifth is law, and, finally, the sixth is morality, which refers to social and moral contexts. The results are outlined in Figure 6 and Table 12.

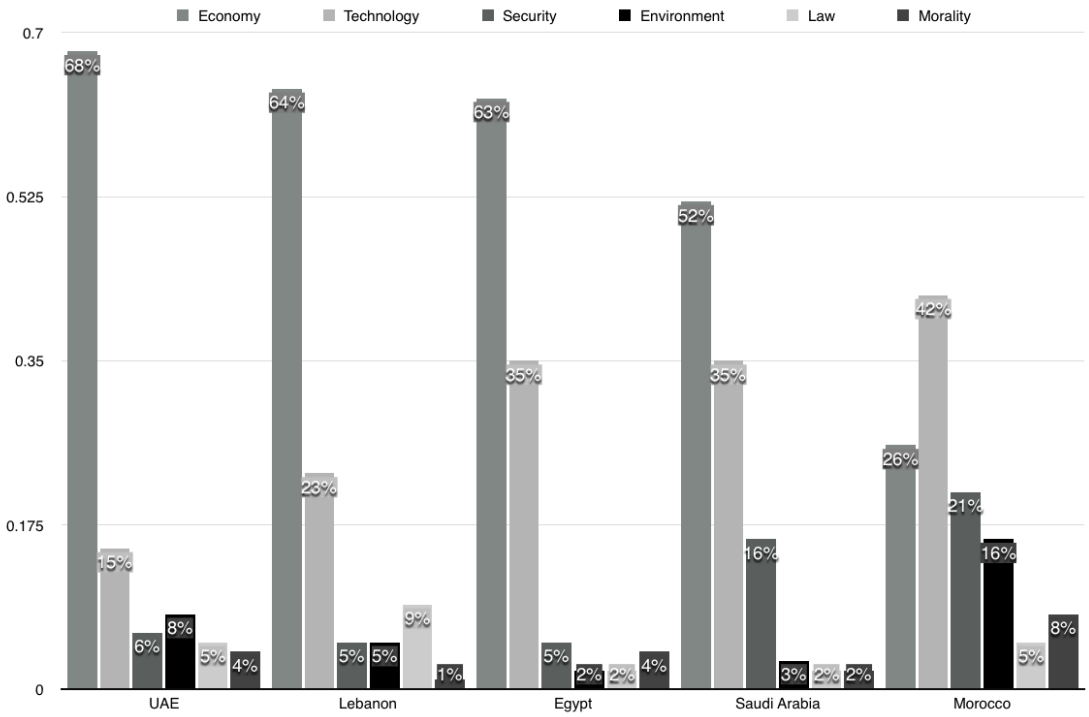

Figure 6: Graphical Representation of the Subtopics Frequency in Each Country

Table 12: Subtopic Frequency in Each Country

Description	UAE	Lebanon	Egypt	Saudi Arabia	Morocco	Significance
Economy	68%	64%	63%	52%	26%	0.0000
Technology	15%	23%	35%	35%	42%	0.0000
Security	6%	5%	5%	16%	21%	0.0000
Environment	8%	5%	2%	3%	16%	0.0000
Law	5%	9%	2%	2%	5%	0.001
Morality	4%	1%	4%	2%	8%	0.205

In terms of economy, the results show that within the UAE sample, 68 articles (68%) discuss blockchain in the context of economy, compared to 64 (64%) in Lebanon, 63 (63%) in Egypt, 52 (52%) in Saudi Arabia, and 26 (26%) in Morocco. The difference is statistically significant as $p = 0.000$ which is < 0.001 and, thus, it can be said that the five countries differ significantly in their coverage of economy as a subtopic.

In terms of technology, the results show that within the UAE sample, 15 articles (15%) discuss blockchain in the context of technology, compared to 23 (23%) in the sample from Lebanon, 35 (35%) in the sample from Egypt, 35 (35%) in the sample from Saudi Arabia, and 42 (42%) in the sample from Morocco. The difference is statistically significant as $p = 0.000$, which is < 0.001 and, thus, it can be said that the five countries differ significantly in their coverage of technology as a subtopic.

As for security, however, the results show that within the UAE sample, 6 articles (6%) discuss blockchain in the context of security, compared to 5 (5%) in the sample from Lebanon, 5 (5%) in the sample from Egypt, 16 (16%) in the sample from Saudi Arabia, and 21 (21%) in the sample from Morocco. The difference is statistically significant as $p = 0.000$, which is < 0.001 and, thus, it can be said that the five countries differ significantly in their coverage of security as a subtopic.

With regard to the environment, the results show that within the UAE sample, 8 articles (8%) discuss blockchain in the context of the environment, compared to 5 (5%) in the sample from Lebanon, 2 (2%) in the sample from Egypt, 3 (3%) in the sample from Saudi Arabia, and 16 (16%) in the sample from Morocco. The difference is statistically significant as $p = 0.000$, which is < 0.001 and, thus, it can be said that the five countries differ significantly in their coverage of the environment as a subtopic.

As for law, the results show that within the UAE sample, 5 articles (5%) discuss blockchain in the context of law, compared to 9 (9%) in the sample from Lebanon, 2 (2%) in the sample from Egypt, 2 (2%) in the sample from Saudi Arabia, and 5 (5%) in the sample from Morocco. The difference is not statistically significant as $p = 0.115$, which is > 0.001 and, thus, it can be said that the five countries do not differ significantly in their coverage of law as a subtopic.

In terms of social and moral issues, the results show that within the UAE sample, 4 articles (4%) discuss blockchain in the context of social and moral issues, compared to 1 (1%) in the sample from Lebanon, 4 (4%) in the sample from Egypt, 2 (2%) in the sample from Saudi Arabia, and 8 (8%) in the sample from Morocco. The difference is not statistically significant as $p = 0.205$ which is > 0.001 and, thus, it can be said that the five

countries do not differ significantly in their coverage of social and moral issues as subtopics.

RQ1.5: How do different blockchain applications affect the tone of coverage?

Regarding the influence of the application discussed on the tone of the media coverage, a t- test was performed to test for differences in the tone in relation to the most frequently covered applications. Statistically significant differences were found in the tone when the applications discussed were cryptocurrencies, e-governance, or supply chain applications. The results are outlined in Table 13 and Figure 7.

Table 13: Tone in Relation to Applications

Variables	Yes Mean	No MEAN	YES SD	No SD	t - value	df	Significance
Cryptocurrencies	3.290	4.450	1.286	0.825	12.170	489.000	$p < 0.05$
Banking and Finance	4.130	3.980	1.003	1.201	-1.242	132.097	ns
E-Governance	4.770	3.890	0.496	1.200	-5.759	489.000	$p < 0.05$
Supply chain	4.780	3.970	0.422	1.183	-3.290	489.000	$p < 0.05$
Responses were coded by 5-point Likert-type scale: 1 = Negative to 5 = positive							

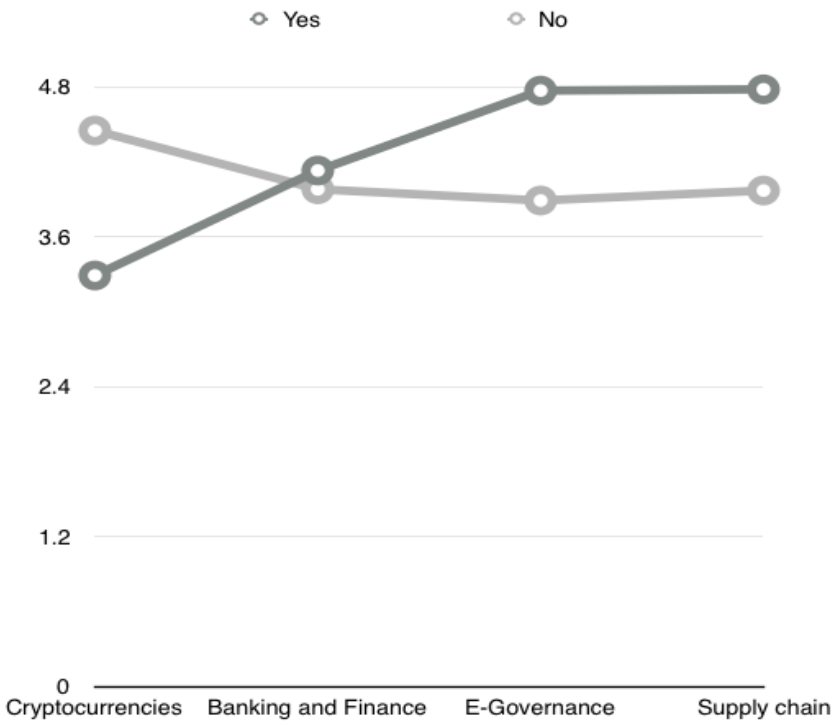

Figure 7: The Tone in Relation to the Applications

For cryptocurrencies, the means (M) and standard deviations (SD) for articles that are covering cryptocurrency and those that are not are M = 3.29 (SD = 1.286), and 4.45 (SD = 0.825), respectively. The t-value = 12.17, the degree of freedom (df) = 489.000, and the probability value (p) < 0.05, which indicates that articles discussing cryptocurrencies are less positive than articles discussing other applications.

For e-governance, the means for articles that are covering e-governance applications and those that are not are M = 4.770 (SD = 0.496), and 3.890 (SD = 1.200), respectively. The t-value = -5.759, df = 132.097, p < 0.05, which indicates that the articles discussing e-governance are more positive than those discussing other applications.

For supply chain, the means for articles that are covering supply chain and those that are not are M = 4.780 (SD = 0.422), and 3.970 (SD = 1.183), respectively. The t-

value = 3.290, df = 489.000, $p < 0.05$, which indicates that the tone is more positive when the application discussed is supply chain than articles that are not discussing it.

For business and finance, the means for articles that are covering business and financial applications and those that are not are M = 4.130 (SD = 1.003), and 3.980 (SD = 1.201), respectively. The t-value = -1.242, df = 132.097, $p > 0.05$, which indicates that there is no significant difference in the tone between articles covering banking and financial applications and those that are not.

RQ1.6: How do subtopics affect the tone of the coverage of blockchain?

Regarding the influence of the subtopic discussed on the tone of the media coverage, a t- test was performed to test for differences in the tone in relation to the most frequently discussed subtopics. Statistically significant differences were found in the tone when the subtopics discussed were economics, technology, security, environment, law and morality. The results are outlined in Table 14 and Figure 8.

Table 14: Tone in Relations to Subtopics

Description	Yes Mean	No MEAN	YES SD	No SD	t-value	DF	Significance
Economy	4.070	3.920	1.230	1.091	-1.466	489.000	$p < 0.05$
Technology	4.250	3.900	0.890	1.259	-3.090	489.000	$p < 0.05$
Security	3.300	4.090	1.422	1.109	4.706	488.000	$p < 0.05$
Environment	3.850	4.020	1.372	1.156	0.790	489.000	$p < 0.05$
Law	3.350	4.040	1.695	1.132	2.771	489.000	$p < 0.05$
Morality	3.260	4.030	1.558	1.145	2.833	489.000	$p < 0.05$
Responses were coded by 5-point Likert-type scale: 1 = Negative to 5 = positive							

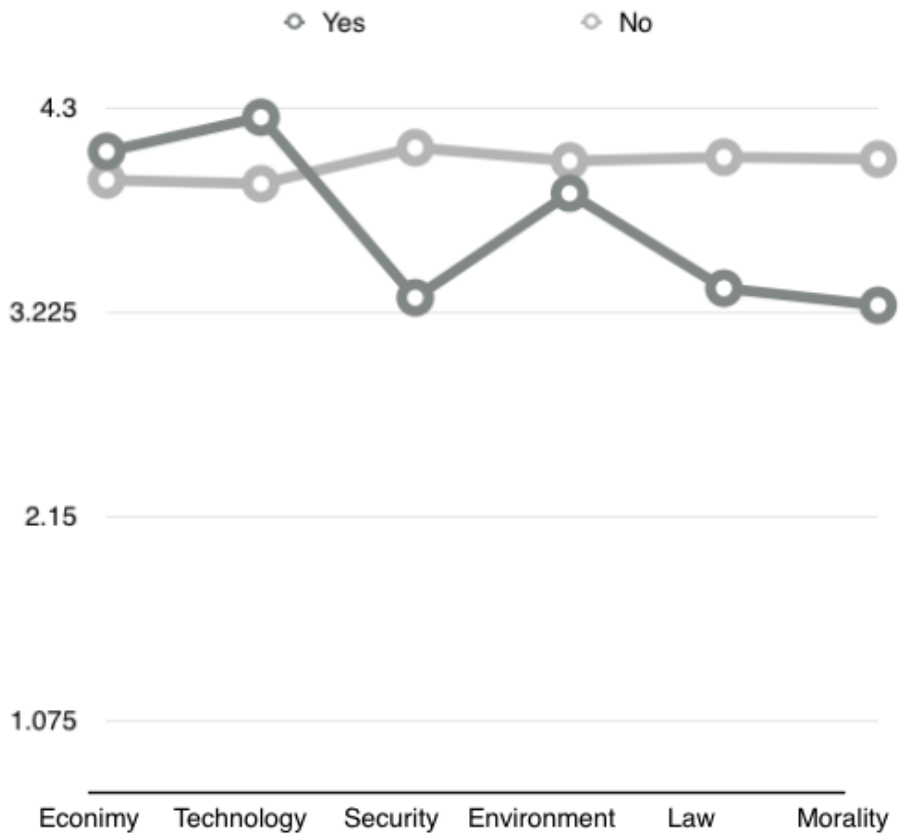

Figure 8: Tone in Relation to Subtopics

In regard to economy, the means for the articles discussing it and those that are not are M = 4.070 (SD = 1.230), and 3.920 (SD =1.091), respectively. The t-value = -1.466, df= 489, p= 0.029, which indicates that the articles discussing economy are more positive than those that do not.

As for technology, the means for articles discussing technology and those that are not are M = 4.250 (SD = 0.890) and 3.900 (SD = 1.259), respectively. The t-value = -3.090, df = 489, p = 0.000, which indicates that the articles which discuss technology are more positive than those that do not.

Regarding security, the means for articles that are discussing security and those that are not are M = 3.300 (SD = 1.422), and 4.090 (SD = 1.109), respectively. The t-value = 4.706, df = 488, p = 0.001, which indicates that the articles which discuss security are less positive than those that do not.

In regard to environment, the means for the articles discussing the environment and those that are not are M = 3.850 (SD = 1.372), and 4.020 (SD = 1.156), respectively. The t-value = 0.790, df = 489, p = 0.042, which indicates that the articles which discuss the environment are less positive than those that do not.

As for law, the means for articles that are discussing legal subtopics and those that are not are M = 3.350 (SD = 1.695), and 4.040 (SD = 1.132), respectively. The t-value = 2.771, df = 489, p = 0.000, which indicates that the tone of the articles discussing law is less positive.

Finally, in regard to morality, the means for the articles that are discussing social and moral issues and those that are not are M = 3.260 (SD = 1.558), and 4.030 (SD = 1.145), respectively. The t-value = 2.833, df = 489, p = 0.007, which indicates that the articles discussing moral and social issues are less positive.

Q1.7: Is there any difference in the tone of the coverage between Arab countries?

One-way ANOVA test is conducted to determine the difference in tone between the five Arab countries. The results are outlined in Table 15 and Figure 9.

Table 15: Tone in Relation to Countries

	SS	df	Mean Square	F	Sig.
Between Groups	87.475	4	21.869	18.183	$p < 0.05$
Within Groups	584.517	486	1.203		
Total	671.992	490			

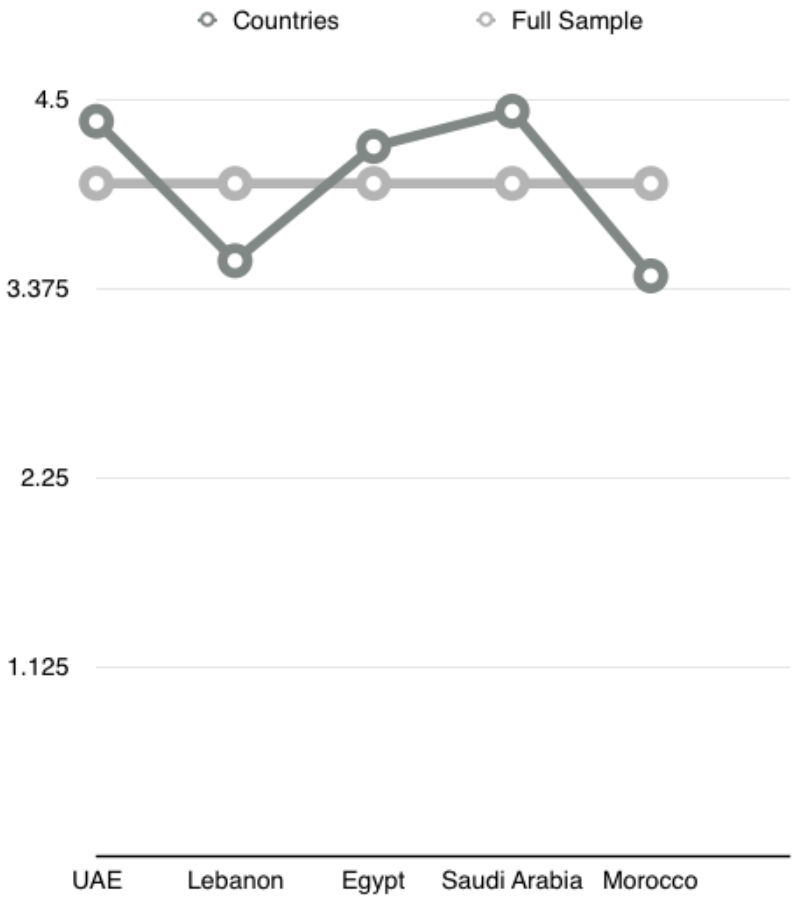

Figure 9: Tone in Relation to Countries

The results show that there is a significant difference in the tone between the different countries; F = 18.183, p = 0.000. The tone is significantly less positive than the

rest of the sample in Lebanon and Morocco (M = 3.54), (M = 3.45), respectively. UAE (M = 4.37), Egypt (M = 4.22), Saudi Arabia (M = 4.43), the tone for the full sample is (M = 4), which is positive.

RQ1.8: What are the main perceived opportunities?

Perceived blockchain opportunities are visualized in Figure 10.

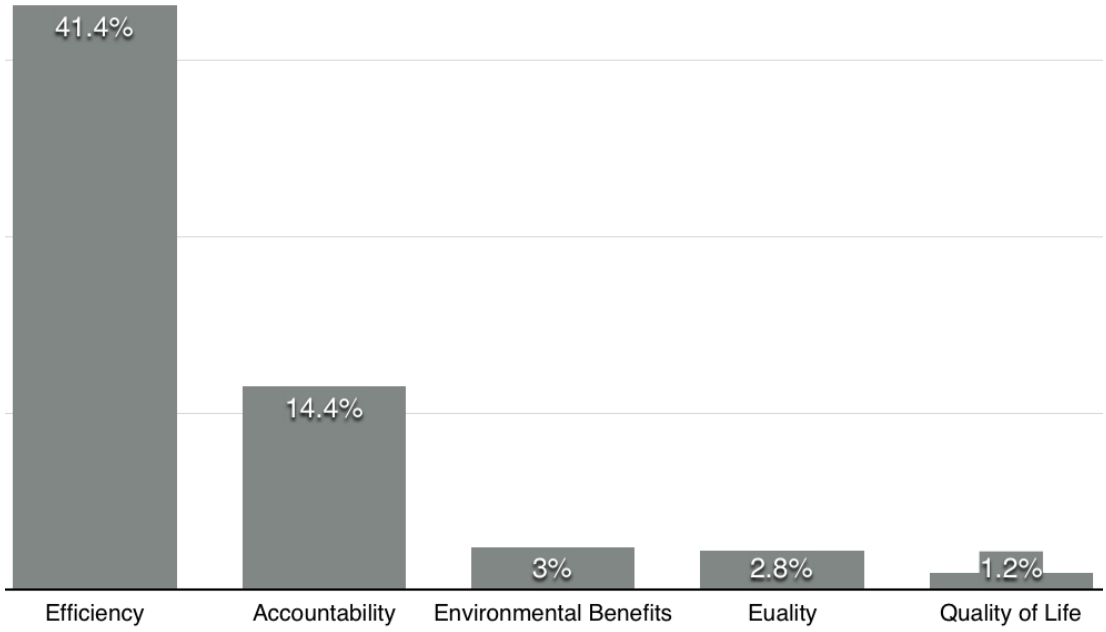

Figure 10: Perceived Opportunities

Efficiency is framed as the main opportunity in the analyzed sample. It is followed by accountability, environmental benefits, security, equality, and finally, quality of life.

RQ1.9: What are the main perceived risks?

Perceived blockchain risks are visualized in Figure 11.

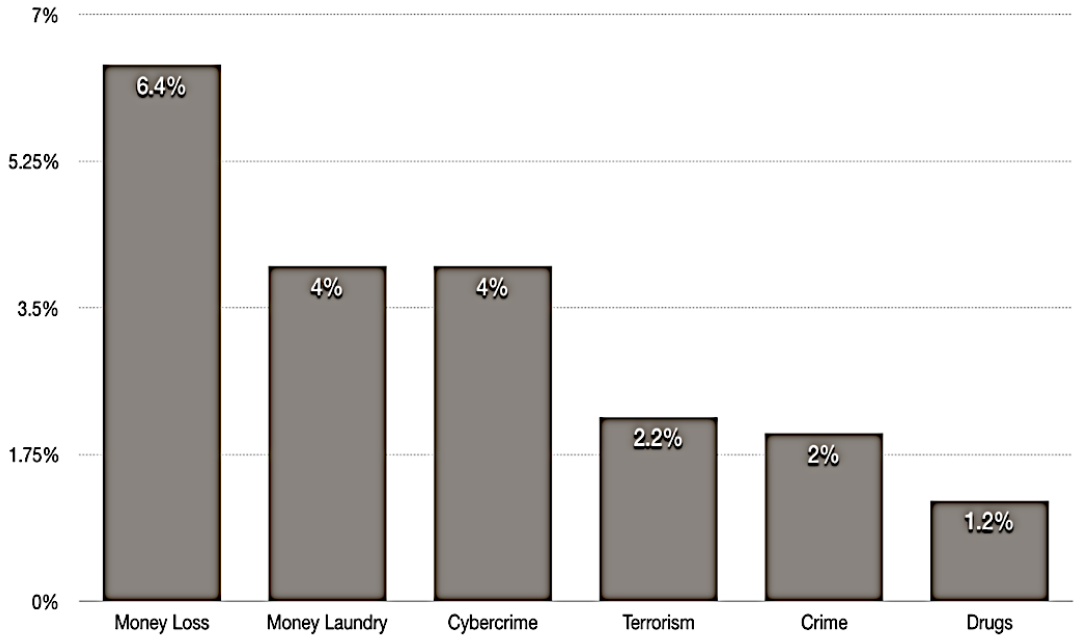

Figure 11: Perceived Risks

Money loss is framed as the main risk in the analyzed sample. It is followed by money laundering, cybercrime, terrorism, crime and, finally, drugs.

5.2 Qualitative Results

The following section descriptively outlines the results of the interviews by providing direct quotes without any analysis or interpretation by the researcher. As reported in the methodology, the interviewees were found by contacting all LinkedIn users who have blockchain credentials and reside in Saudi Arabia, the United Arab Emirates,

Egypt, Lebanon or Morocco. Out of the 220 professionals invited to participate, only thirty interviewees completed the online interviews on time. The interviews were organized into 6 groups of 6 members, according to the country of blockchain experience. Participants were randomly selected based on publicly available information about their blockchain experience, and the reported results reflect the interviewees' perceptions of blockchain technology and the media coverage of the topic.

RQ2: How do blockchain experts in the Arab world perceive blockchain technology?

The interviewees discussed the distinctions between blockchain and other technologies. They also discussed the Arab media coverage of the topic. They explained their perceptions on the reasons for the variation in the tone, the interest and the amount of coverage between various Arab countries. Furthermore, they shared their opinions on the blockchain applications that they see as more worthy of media coverage as well as the contexts that are more relevant to discussing blockchain technology. Interviewees talked about perceived risks and opportunities, the problems for which blockchain can be a solution. Finally, they were asked to imagine block chain’s implications on mass communications. Answers were coded to produce a set of emerging themes as outlined in the Table 16.

Table 16: Emerging Themes from the Interviews

Themes	Quotes
1- Blockchain is unique due to a set of inherent qualities that makes it impactful.	"The blockchain is a fresh form of digital technology that generally prevails independently of government or private institutions; there is absolutely no central server, no administrator, no national boundary, no owner, and it is at the forefront of conversations about the future of democracy, money, legislation, personal information, health, security, insurance, and more" (Interviewee #20).
2- Blockchain will have implications on media and mass communications.	"When it comes to news integrity and video or audio files protection, blockchain can help to preserve content as it came from the source" (Interviewee #11).
3- Arab media coverage of blockchain reflects governmental interest and understanding.	"Depends on what purpose the government wants to use the tech for, if it is blockchain as a service where services are provided by government it will be seen as more positive" (Interviewee#3).
4- Professional perspectives vary on the characteristics and role of the media in covering the topic.	"People would never accept any new concept without understanding how they can benefit from it, and here comes the role of the media" (Interviewee #14).
5- Blockchain offers many benefits and can solve many problems.	"It provides a crucial link in the value chain of digitization, addressing credibility issues" (Interviewee #5).
6- The adaptation of blockchain is not free of associated risks.	"The fact that it is totally encrypted makes it a potentially dangerous technology if used by the wrong leagues" (Interviewee #14).

- Blockchain is unique due to a set of inherent qualities that makes it impactful

Blockchain is unique due to a set of inherent qualities that sets it apart from other innovations. It is a foundational technology that can be applied to any field

including media and mass communications. Such qualities include nonrepudiation, immutability, encryption, disintermediation, anti-regulation, decentralization, distribution, scarcity, automation, accessibility and transparency. References to the qualities of decentralization, distribution and antiregulation are quantified in Table 17.

Table 17: Decentralization, Distribution and Antiregulatory Qualities

Out of 30	Percentage (%)
19	63.33

Blockchain is an inherently anarchist technology that we are only beginning to understand. According to Interviewee #19 (2019), blockchain generally prevails independently of government authorities or private institutions. He adds that it has no central server, no administrator, no national boundary, no owner, and it is at the forefront of conversations about the future of democracy, money, legislation, personal information, health, security, insurance, and more. Although blockchain technology was first seen as a financial technology, he argues that it could be applied to many other fields in such a way that it will have profound influence on the ways in which people and markets work and interact in the foreseeable future. Furthermore, he emphasizes that blockchain is likely to have profound implications on the nature of capitalism. Interviewee #15 (2019) maintains that blockchain's main power lies in its decentralized nature. As a consequence of its decentralized architecture, blockchain is anti-regulatory; Interviewee #22 (2019) adds that blockchain is still evolving as a

technology and it is challenging the status quo when it comes to government regulations. References to the digital scarcity are quantified in Table 18.

Table 18: Digital Scarcity

Out of 30	Percentage (%)
6	20

Digital scarcity is one of the main qualities associated with blockchain technology. According to Interviewee #19 (2019), blockchain represents a fundamental change in the way in which humans can exchange value by enabling the digital transfer of assets in an independent manner. Interviewee #18 (2019) adds that it enables the tokenization of real-life assets. References to the disintermediation are quantified in Table 19.

Table 19: Disintermediation

Out of 30	Percentage (%)
14	46.66

Blockchain eliminates the need for trusted mediators; as Interviewee #11 (2019) explains, the most important quality provided by blockchain is that it puts trust where there is no trust between parties. It eliminates intermediates but at the same time guarantees confidence between all involved elements within the system. At the same time, it provides transparency and data protection in a very creative way

compared to other technologies. Interviewee #30 (2019) adds that blockchain could resolve all problems that originate from lack of trust between the players by replacing the middleman. References to the versatility are quantified in Table 20.

Table 20: Versatility

Out of 30	Percentage (%)
10	33.33

Blockchain is a solution for a considerable number of problems; as Interviewee #1 (2019) states, blockchain technology can be applied to almost everything. It can be said that blockchain is able to solve all problems. Interviewee #7 (2019) states, “As far as I know, almost every domain has a good use for the technology; governments, healthcare, education, you name it”. References to Nonrepudiation are quantified in Table 21.

Table 21: Nonrepudiation

Out of 30	Percentage (%)
7	23.33

Events documented on a blockchain cannot be falsified; as Interviewee #5 (2019) explains, “Blockchains are about applying the singularity principle to data sanctity. In contrary to the old world defined by Albert Camus of several "truths", a public and even private blockchain offers only one version of the truth”. In technical

terms he explains that each new block uses a hash; a one-way code, from the block preceding it. To undo something on a blockchain requires the corruption of all blocks after the edit, thereby creating an apparent hard fork. In essence, Interviewee #5 maintains that this logic tells people that if you attempt to do something like this, then you have publicly attempted to distort the truth. Interviewee #7 (2019) adds that blockchain technology, as commonly defined, is a streamlining technology for information which enables flow of information in a non-repudiated trusted manner. It is a distributed system with emphasis on non-repudiation where each user is bound to a digital signature. References to immutability are quantified in Table 22.

Table 22: Immutability

Out of 30	Percentage (%)
14	46.66

A recurrent theme is immutability. Data on the blockchain cannot be modified; as Interviewee #9 (2019) states, “On the blockchain, data never changes”. Interviewee #15 (2019) also adds that blockchain is an immutable ledger that is saved with multiple parties. It is a database but in a distributed form. References to accessibility are quantified in Table 23.

Table 23: Accessibility

Out of 30	Percentage (%)
6	20

Unlike standard database structures, blockchains are always accessible; Interviewee #24 (2019) explains that a blockchain has no single point of failure and, thus, it cannot be switched off. Interviewee #7 (2019) adds that resources ‘nodes’ are accessible at all times; they are fault-tolerant and are able to recover from node failure. References to consensus are quantified in Table 24.

Table 24: Consensus

Out of 30	Percentage (%)
9	30

Blockchain is an inherently egalitarian system; as Interviewee #13 (2019) states, “Network nodes—participants—have equal capabilities”. Interviewee #24 (2019) explains that blockchain creates a paradigm shift in "Trust". Instead of trusting a single database held by an IT team, the trust shifts to a decentralized ledger and distributed consensus. In simple terms, a single database admin cannot be bribed to act in a nefarious way, because any change would make his node out of sync with other nodes. In the future, he argues that “this egalitarian technology will lead to the development of decentralized autonomous organizations which work on smart contracts with greater transparency in decision making, law, policies and audits”. References to encryption are quantified in Table 25.

Table 25: Encryption

Out of 30	Percentage (%)
7	23.33

Blockchain processes are strongly encrypted; as Interviewee #16 (2019) explains, data on the blockchain are stored using cryptographic coding. Interviewee #14 (2019) adds that "encryption of blockchain provides a high level of security and privacy as no entity can learn what goes on it, neither cybercriminals nor governments". Due to encryption, he argues, while all transactions are public, "it is technically impossible for anyone including governments to know the identity of law violators on the system which may facilitate unauthorized monitory transactions for example". References to interoperability are quantified in Table 26.

Table 26: Interoperability

Out of 30	Percentage (%)
10	33.33

Blockchain is interoperable with other disruptive technologies such as AI and the Internet of things (IoT). Interviewees have many conceptions about the interoperability of blockchain. Interviewee #1 (2019), for example, argues that blockchain and AI can be integrated or used alone depending on the project, thus achieving different results. Interviewee #3 (2019), however, argues that blockchain verifies data while AI makes sense of big data. Interviewee #4 (2019), on the other

hand, asserts that the power will be in combining those two technologies into one solution. Interview #6 (2019) suggest that blockchain can be a platform for AI applications. Interviewee #8 (2019) adds that blockchain and AI are complementing each other. Interviewee #10 (2019), however, argues that "AI tends to replace human intervention while blockchain relies on people to run it. But, in some applications, such as industry and automotive they can complement each other". Interviewee #20 (2019) concludes that blockchain is a decentralized technology that supports peer-to-peer transactions without major need of an intermediary while AI is a real centralized technology which examines behavior based on huge data analysis very quickly. Blockchain would make sure that the data accessed by AI are authentic and traceable, both could complement each other though their model is different between decentralize and centralized. References to transparency are quantified in Table 27.

Table 27: Transparency

Out of 30	Percentage (%)
14	46.66

Blockchain applications are profoundly transparent yet private. As Interviewee #3 (2019) explains, blockchain provides transparency and accountability without having to disclose all your data. Interviewee #8 (2019) adds that blockchain enables a totally new decentralized business model through trusted-transparent business network. References to automation are quantified in Table 28.

Table 28: Automation

Out of 30	Percentage (%)
8	26.66

One of the unique qualities of blockchain lies in its ability to automate its processes; as Interviewee #12 (2019) explains, blockchain automates workflows. Interview #15 (2019) adds that it can simplify and automate many of the current systems through smart contracts. Interviewee #24 (2019) states that through smart contracts and decentralized consensus mechanisms, the old methods of using papers, couriers, and processing manually for days or months can be eliminated.

In short, participants spoke of various inherent qualities of blockchain technology; qualities include nonrepudiation, immutability, encryption, disintermediation, anti-regulation, decentralization, distribution, scarcity, automation, accessibility and transparency.

- Blockchain Will Have Implications on Media and Mass Communications

53.33% of the interviewed blockchain experts believe that blockchain technology will impact media and mass communications. Interviewees spoke of different ways in which this can occur. For instance, they discussed that blockchain will enable the development of new business models, and that it allows for the authentication of identities and the identification of social bots and enables accurate tracing of information to its original sources and the identification of fake news. Finally, it makes it possible to guarantee that the information will not be altered. References to new business are quantified in Table 29.

Table 29: Blockchain Enabling New Business Models

Out of 30	Percentage (%)
11	36.66

Blockchain will enable a variety of new business models in the media sector and beyond. As Interviewee #9 (2019) asserts, blockchain can ensure copyright protection; smart contracts—a function of blockchain—can automatically enforce licenses and payment agreements. Interviewee #15 (2019) adds that blockchain can reduce and automate many of the current systems through smart contracts. He also explains that blockchain could potentially eliminate the need for data backup and data centers which involve huge investments. Interviewee #1 (2019), however, believed that blockchain "can solve the problem of trust establishment in the digital world". Interviewee #11 (2019) explains that in the context of media and mass communications, blockchain can reduce the cost. It is useful for archiving and money transfer as it provides transparency and ensures data integrity. Interviewee #12 (2019) argues that blockchain has many media applications including social media apps. Interviewee #22 (2019) states that smart contracts can be used for data and identity management. Interviewee #7 (2019) elaborates that the technology is promising and proves to be a key player for opening different business venues; it provides a promising mechanism for sharing information on a need to know basis. He gives the example of the social network Facebook which is attempting to launch its own cryptocurrency that might cause a notable change for normal internet users. References to authenticating identities are quantified in Table 30.

Table 30: Authenticating Identities: Fake Accounts and Social Bots

Out of 30	Percentage (%)
11	36.66

As a consequence of applying blockchain in data and identity management, "people would be less able to be fake and hide behind fake identities" (Interviewee #3, 2019). Interviewee #12 (2019) asserts that blockchain is useful for solving many current problems including identity authentication. Interviewee #19 (2019) maintains that the National Bank of Egypt and Commercial International Bank are working on one blockchain use case which is related to digital identity. References to tracing news sources and identifying fake news are quantified in Table 31.

Table 31: Tracing News Sources and Identifying Fake News

Out of 30	Percentage (%)
7	23.33

Blockchain is a good solution for tracing news sources and identifying fake news; as Interviewee #20 (2019) explains, "In today's social media era, one gets confused by conflicting news reports. Knowing which outlet is authentic is a real challenge". Applying blockchain principles of consensus, he argues, might help verifying authenticity of information. Interviewee #22 (2019) confirms that "blockchain is useful for the validation and authentication of data transactions". Interviewee #26 (2019) affirms that "fake news won't exist if blockchain is used to validate news sources". While the majority of interviewees agree that blockchain can

potentially solve various media and mass communication problems, some argue that, at the current state of technological development, blockchain might not be the most practical solution; Interviewee #15 (2019) argues that the theoretical benefits of blockchain are constrained and dependent on the state of development of other technologies currently in use such as hard disks for example, which may render blockchain a cost prohibitive solution for current problems. References to information preservation are quantified in Table 32.

Table 32: Preserving Information from Alteration

Out of 30	Percentage (%)
7	23.33

Information on blockchains is immutable; as Interviewee #11 (2019) explains, "When it comes to news integrity and video or audio files protection, blockchain could preserve content as it came from its source". He argues that applying blockchain to an environment provides security, transparency and integrity. Interviewee #5 (2019) adds that "Immutability means that there is no undo button; if you publish bad information, you will have to issue a regret statement or a correction, admitting that you made a mistake". Interviewee #24 (2019) explains that today, a media agency could retract or delete an article and claim that they never published it. If the hash of the article is stored on a blockchain, they will not be able to deny the fact that a certain article was published at a certain time, because it is stored in an immutable ledger. He also explains that corrections can be made, but these

amendments will always be visible. This, he argues, will increase accountability in the media sector.

To summarize, the most commonly referenced ways in which blockchain could impact media and mass communications are the development of new business models, the authentication of identities and the identification of social bots, the accurate tracing of information sources, detecting fake news and, finally, the preservation of information from alteration.

- Arab Media Coverage of Blockchain Reflects Governmental Interest and Understanding

Causes of variation in media coverage are perceived to result from the variation in economic priorities, political priorities and the variation in the degree of governmental understanding of the technology in different Arab countries. References to economic and political priorities are quantified in Table 33.

Table 33: Economic and Political Priorities

Out of 30	Percentage (%)
14	46.66

Interviewees suggest that media coverage directly reflect governmental economic and political priorities; Interviewee #11 (2019) argues that there is a direct link between the media coverage and the politics and economics of the country, and he argues that this applies to the coverage of blockchain technology as well. Interviewee #20 (2019) explains that if a government is pursuing blockchain for its entities, then

the media would focus on smart contracts and decentralized applications but if it was used to facilitate the objectives of central banks, then cryptocurrencies would be the most covered. Interviewee #3 (2019) suggests that media coverage of blockchain depends on the purpose for which the government wants to use the technology; if it is blockchain as a service where services are provided by the government, then it will be covered more positively. References to the understanding of technology are quantified in Table 34.

Table 34: The Understanding of the Technology

Out of 30	Percentage (%)
14	46.66

Interviewees point out that Arab governments vary in their understanding of the technology and its implications, which, in turn, reflects on the media. As Interviewee #21 (2019) explains, the variation in media coverage in different Arab countries depends on the level of the government's understanding of the potential impact of such technology on society. Interviewee #5 (2019) suggests that most governments do not yet fully grasp the comprehensive benefits of blockchain technology, and since there are many alternative solutions that are cheaper, blockchain is not on top of the media agenda of many Arab countries. Another limitation is the issue of conflating blockchain with cryptocurrency. This problem is not limited to the media; as Interviewee #20 (2019) explains, "Some countries associate blockchain with cryptocurrencies only, and do not look at the potential of blockchain away from crypto". This conflation between blockchain and

cryptocurrencies contributes to the rejection of the technology in some countries. “Countries differ because of the perceived threat on their sovereignty” (Interviewee #16, 2019). On the lack of understanding of the technology, Interviewee #24 (2019) argues that, as a new technology, blockchain suffers from the lack of awareness. He lists the misconceptions that blockchain refers to bitcoin, mining, or that it consumes a lot of energy, and thus it is unsustainable, or used in the dark web. He argues that even experts are sometimes unaware of many of these issues. Hence, it is important that useful use-cases are presented to governments and businesses to help them understand the true utility of blockchain technology. References to coverage evaluation are quantified in Table 35.

Table 35: UAE Media Offers the Best Coverage of Blockchain in the Arab World

Out of 30	Percentage (%)
7	23.33

The United Arab Emirates offers the best coverage of blockchain technology in the Arab world. As Interviewee #24 (2019) explain that the coverage of blockchain is good in the United Arab Emirates. He also adds that the UAE has a blockchain vision for 2021; it hosts Future Blockchain Summit and has numerous meetups, startups and events focusing on blockchain. He also states that the media played a role in the marketing and introduction of these initiatives. Interviewee #20 (2019) adds that the media coverage of blockchain technology in the UAE is much better than in other countries in the region as the UAE government adopts impactful and practical plans.

Interviewees offer different conceptions about the causes of variation in the Arab media coverage of blockchain technology. 46.66% of the interviewees believe that the reason is the variation in governmental political and economic priorities. 46.66% believe that the variation is due to differences in the level of governmental understanding of the technology in different Arab countries, whereas 23.33% believe that the UAE offers the best coverage of the topic.

- Professional Perspectives Vary on the Characteristics and Role of the Media

The interviewed experts presented various conceptualizations of the characteristics and role of the media. Views vary greatly between countries. The most positive outlook is in the UAE. The participants speak about the degree to which media succeed in meeting their expectations and the areas where the media falls short of presenting the topic in a useful way. The interviewees suggest relevant contexts for the discussion of blockchain technology and recommend the applications that they believe are worthy of higher media attention. References to expectations are quantified in Table 36.

Table 36: The Media is Not Up to the Expectations of Arab Blockchain Experts

Out of 30	Percentage (%)
19	63.33

The media is not up to the expectations of Arab blockchain experts. As Interviewee #9 (2019) explains, it is still not up to the expectations, as we need more media coverage to educate the society and the new generation about how important

this technology is to our life. Interviewee #24 (2019) suggests that the media should start spreading awareness to the public on the best cyber security practices through simple quizzes and animations. Interviewee #12 (2019) adds that the media should talk about blockchain applications which are interesting to private users. He gives the examples of e-commerce, gaming, entertainment, and social media apps that are built on top of blockchain. This is needed, he argues, to create awareness in the masses, pave the way for mass adoption and finally trigger the government to make key decisions in the digital space. Secondly, he argues that success stories of sand boxing schemes of global jurisdictions also need to be showcased by the media to guide those countries lagging behind. References to conflation are quantified in Table 37.

Table 37: The Media Conflates Blockchain with Bitcoin

Out of 30	Percentage (%)
4	13.33

Among the themes that immerged while discussing the characteristics of Arab media coverage is the conflation of blockchain and cryptocurrencies. 13.33% of interviewees mention this as a problem in the Arab media coverage. For instance, Interviewee #20 (2019) argues that, in some countries, blockchain is seen as cryptocurrencies only and no thought is given to its potential beyond Cryptocurrencies. Interviewee #22 (2019) confirms that “some Arab media lack the knowledge and understanding of the difference between blockchain and cryptocurrencies which are two different things”. Interviewee #15 (2019) affirms that

to many in the media, blockchain is bitcoin. References to application coverage preferences are quantified in Table 38.

Table 38: Applications Worthy of Media Coverage

Application	Out of 30	Percentage (%)
Fintech	17	56.66
Supply chain	8	26.66
E-governance	7	23.33

The opinions of the interviewees vary on the applications worthy of media coverage. Many interviewees present a wide list of applications. For instance, Interviewee #28 (2019) suggests supply chain, healthcare, music, government public value, birth, wedding, and death certificates, as well as personal identification, and voting. The majority of interviewees, 56.66% of them, assert that financial technology or fintech is where the media focus should be. Interviewee #15 (2019), for example, argues that blockchain best works with financial transactions and, thus, the media should primarily focus on it. The second most recurrent application is supply chain, with 26.66% of interviewees recommending it and, finally, e-governance applications are recommended by 23.33%. References to the relevant context are quantified in Table 39.

Table 39: Relevant Context

Context	Out of 30	Percentage (%)
Economy	11	53.33
Technology	15	50
Security	10	33.33
Law	8	26.66
Environment	4	13.33
Mortality	3	10
Politics	1	3.33

Interviewees vary widely in their opinion of the contexts in which blockchain should be discussed and presented to the public in the media. The top three most suggested contexts are *economics* with 53.33%, *technology* with 50%, followed by *security* with 33.33%. Interviewee #4 (2019), for example, argues that the context of economy ought to be highlighted by the media due to its relevance to crypto currency. Interviewee #7 (2019), however, suggests that consensus is the relevant context for the presentation of this technology. Other less-common contexts are suggested as well. Interviewee #3 (2019) argues that blockchain is a way to enable data management and should be discussed in this context only. Despite its importance, however, only one interviewee suggests *morality* as a context for discussing blockchain; Interviewee #5 (2019) explains that it will no longer be technically feasible for someone to call a friend in a traffic department, for example, and ask them to remove a traffic violation ticket; immutability means that decisions on blockchains cannot be reversed.

To summarize, professional perspectives vary on the characteristics and role of the media. 63.33% of the participants maintain that the media is not up to their expectations. 13.33% identify the conflation of blockchain and crypto currency is among the limitations of the Arab media. Fintech, supply chain and e-governance are perceived by interviewees as the worthiest of media coverage. The contexts of economy, technology and security are perceived as the most relevant context for presenting blockchain to the public.

- Blockchain Offers Many Benefits and Can Solve Many Problems

Blockchain's inherent qualities are associated with a number of unique benefits. With encryption comes user privacy and security, with transparency comes accountability, and with automation, distribution and decentralization comes efficiency. Interviewees identify various benefits. References to efficiency are quantified in Table 40.

Table 40: Efficiency

Out of 30	Percentage (%)
19	63.33

Efficiency comes in the form of saving time and saving valuable resources. Interviewee #22 (2019) maintains that smart contracts improve the efficiency of supply chain management as well as data and identity management. Another interviewee explains:

> Efficiency of decision making can be improved. Each entity will be part of the blockchain consensus and will have access to their particular data. It can be cryptographically guaranteed that the data has not been tampered with. This allows easier audit, faster business processes and overall efficiency (Interviewee #24, 2019).

References to security and privacy are quantified in Table 41.

Table 41: Security and Privacy

Out of 30	Percentage (%)
13	43.33

Encryption provides a higher level of privacy and data security. Interviewee #9 (2019) explains that it is a beneficial technology as it will make transactions more secure and requires much less time and effort than the currently used solutions. Another interviewee explains that "the larger the network of the blockchain, the more secured it gets" (Interviewee #14, 2019). References to traceability are quantified in Table 42.

Table 42: Traceability

Out of 30	Percentage (%)
21	70

Operations on blockchains can be traced to their sources, which makes blockchain a great solution for supply chain applications whether it is intended for physical or digital goods and assets. This level of transparency, if enabled, provides a higher level of

accountability. Interviewee #5 (2019) states that blockchain can bring credibility and accountability to digitization. It provides a crucial link in the value chain of digitization, addressing credibility issues. Interviewee #25 (2019) explains that the traceability of the chain through blockchain is useful for the tracking of goods.

In brief, blockchain technology has a wide range of benefits. Interviewed blockchain experts identify many of such benefits but they vary in their conceptions of the benefits of the technology. The most commonly perceived opportunities are efficiency, security and traceability.

- The Adaptation of Blockchain Is Not Free of Associated Risks

  While interviewees unanimously agree on the usefulness of blockchain as a solution for various problems, they point out various issues that they perceive as risks. References to the lack of governments' oversight are quantified in Table 43.

Table 43: Lack of Governments' Oversight

Out of 30	Percentage (%)
11	36.66

A commonly perceived risk of blockchain is the lack of governments' oversight; an interviewee argues that while it is not dangerous in and of itself, the high degree of encryption and distribution makes it potentially dangerous if used with the wrong intention as it can be used to facilitate illegal activities privately and securely:

> The most famous blockchain application is Bitcoin. In itself, Bitcoin is not dangerous, but the way it is being used on dark web for criminal transactions and for money laundering is extremely dangerous. It is being used by criminals to escape the politically controlled SWIFT banking system (Interviewee #15, 2019).

Interviewee #8 (2019) adds that applications that operate outside of government oversight such as cryptocurrencies can be dangerous. References to energy use are quantified in Table 44.

Table 44: High Energy Usage

Out of 30	Percentage (%)
6	20

Another theme is the electricity waist of blockchain. Interviewee #30 (2019) explains that some applications consume high levels of electricity. Other interviewee adds that "last year it was claimed that the computing power required to keep the bitcoin network running consumes as much energy as the amount used by 159 of the world's nations" (Interviewee #24, 2019). References to the loss of private keys are quantified in Table 45.

Table 45: Loss of Private Key or Balance

Out of 30	Percentage (%)
7	23.33

If a user loses his private key, they lose everything associated with it with no way to recover it. Interviewee #9 (2019) points out that "if the user lost his private key this means he lost his money in his blockchain crypto currency wallet". Interviewee #27 (2019) explains that if the devices are changed without saving the recovery phrases, the balance is lost forever. Thus, he affirms, users need to be very accurate with addresses because one mistake could cost so much. Interviewee #23 (2019) explains that if funds are transferred to the wrong address, the amount is permanently lost.

Like any technology, blockchain has some associated risks. Experts identify a wide range of risks. In terms of common perceptions, the top three risks as perceived by interviewees are: first, the lack of government oversight with 36.66% of interviewees; second, the loss of private key or balance with 23.33% of interviewees, and, finally, the waist of energy with 20% of interviewees.

RQ3: Is the media framing of blockchain compatible with experts' perceptions?

The researcher reads the results of the quantitative content analysis of media content and the qualitative interviews side by side, and then, descriptively outlines the points of similarities and differences between the perceptions of Arab blockchain professionals and the Arab media. Similarities and differences are outlined in the Tables 46 and 47.

Table 46: Similarities

Similarities
Blockchain is perceived to be very beneficial
High emphasis on financial applications
Identical prioritization of contexts; economy technology and security
More positive tone towards e-governance applications
Similar perceptions of opportunities and risks
Highly positive tone
Absence of ethical contexts

Table 47: Differences

Differences
Experts identify much more applications than the media
Experts identify more inherent qualities
Experts believe the media should cover more than cryptocurrencies

This chapter concludes that both the quantitative and qualitative studies show that blockchain is perceived positively. There are some differences in the media coverage between the five studied countries which are reflected in the amount of coverage, subtopics, applications and tone. There is a significant association between certain application and the tone. There is also a significant association between certain subtopics and the tone. As for the qualitative study, the interviews show that blockchain is perceived positively. Blockchain experts offer a richer and more comprehensive understanding of blockchain than the media coverage; they identify various inherent quality of blockchain technology. They talk about more blockchain applications, more qualities and more implications of the technology. They see the Arab media coverage of blockchain as a

reflection of the governmental interest in the technology with many pointing out the UAE as the leader in this regard. They differ on their perception of risks and opportunities, and the role of media in covering the technology as well as the applications that are more worthy of media attention.

Chapter 6: Discussion

6.1 Overview

This chapter discusses the results in light of the theoretical framework of the study. It highlights the following points: the aims and objectives of the research, the research questions, an overview of the relevant literature, the methodology, a side-by-side discussion of the quantitative and qualitative findings, the significance and limitations, recommendations for future research and, finally, the theoretical implications of the study

This study seeks to achieve one fundamental quest, which is to descriptively explain the Arab public discourse on blockchain technology as an initial step towards understanding and shaping the future of blockchain innovation. This is achieved through three means: first, by conducting content analysis of the Arab press in light of the four framing dimensions (presentation, subtopics, cognitive attributes and affective attributes); second, by interviewing professionals with expertise in the blockchain domain and, finally, by comparing the results side by side to understand the points of similarities and differences. As listed in Table 48, the data for the study are collected and analyzed using mixed methods involving semi-structured interviews, quantitative content analysis using SPSS software and the thematic analysis of the interviews.

Table 48: Data Collection and Analysis of the Study

Data type	Data collection Method	Data Analysis technique
Quantitative data	Content analysis of 500 Arab news articles retrieved from mainstream Arab newspapers between 2017 and 2019	SPSS is used to produce descriptive statistics including frequencies and cross tabulations. Comparing means including independent-sample t-test and one-way ANOVA.
Qualitative data	Semi-structured interviews with 30 Arab Blockchain professionals	Thematic analysis

Research objectives are divided into three main questions and nine sub-questions as mentioned earlier.

6.2 Characteristics and Role of Media Coverage

Highlights of the Results:

- The study finds that *cryptocurrencies* is the highest covered blockchain application (38.6%). This is followed by banking and finance (16.4%), e-governance (12.8%), supply chain (4.6%), and, finally, communication and publishing platforms (2.2%). Other less frequently mentioned applications include healthcare, tourism, voting, and data management.
- Regarding the differences in the coverage of blockchain applications among the five Arab countries, the study finds that the coverage of blockchain applications

in the UAE is different than all the studied countries in that it focuses primarily on e-governance applications while the rest of the Arab countries focus primarily on cryptocurrencies.

- As for the subtopics associated with the coverage of blockchain, the study finds that the majority of the articles discuss economy (54.6%). The second most discussed topic is technology (30%), and the third most discussed topic is security (10.6%).
- Regarding the differences in the coverage of subtopics among the five Arab countries, the research finds significant differences between Arab countries in the discussion of economy, technology, security, and environment but no significant differences in the coverage of law, and social and moral issues; over half of the sample from Saudi Arabia (52%), the UAE (64%), Lebanon (64%), and Egypt (63%) discuss the economy. On the other hand, only (26%) of the sample from Moroccan newspapers discuss economy. Moroccan newspapers are substantially higher in discussing blockchain in the context of environment (19%), technology (42%) and security (21%), compared with Egypt (2%, 35%, 21%), Saudi Arabia (3%, 35%, 16%), Lebanon (5%, 23%, 5%), and the UAE (8%, 15%, 6%).
- In regard to the relationship between the application covered and the tone of the coverage; the researcher finds a significant correlation between the tone and the coverage of cryptocurrencies, e-governance, and supply chain. While the coverage of blockchain is overall positive, the articles display less positive tone towards cryptocurrencies and a more positive tone towards governance, and supply chain. No significant difference in regard to banking and financial applications.

- As for the way subtopics affect the tone of the coverage of blockchain, the research finds association between the subtopic and the tone when it comes to the coverage of economy, technology, security, environment, law and morality. Economy and technology are more positive than the rest of the subtopics.
- In regard to the differences in the tone of the coverage between the four Arab countries, the research finds that the overall tone of coverage is positive in all the studied countries with Morocco and Lebanon being the least positive, and Saudi Arabia and the UAE being the most positive.
- Arab media coverage of blockchain reflects governmental interest and understanding.
- Professional perspectives vary on the characteristics and role of the media in framing the topic; the majority of interviewees report that the Arab media framing of the topic is not up to their expectations.

Applications

The heightened focus of the press on financial application such as cryptocurrencies is consistent with the literature, which also gives more attention to the financial applications of the technology; multiple systematic reviews of blockchain research indicate that the majority of research focuses solely on its financial applications (Yli-Huumo et al., 2016; Conoscenti et al., 2016; Seebacher & Schüritz, 2017).

Unlike all studied countries focusing on cryptocurrencies, the UAE focuses on e-governance. This can be explained by considering that the UAE is the only Arab country that has a strategy for blockchain and a declared aim to become an international leader in

utilizing this technology for governance. The qualitative study confirms that the UAE media is the most actively engaged with blockchain technology in the Arab world.

Subtopics

The ranking of economy, technology and security as the most relevant subtopics is identical in the quantitative and qualitative studies. Furthermore, the suggestion of economy as the most relevant context is consistent with academic research on blockchain as discussed above. The emphasis on technological topics is only natural due to the novel and technologically unintuitive nature of blockchain which requires simplification to unspecialized audiences. Finally, the heightened interest in security can be understood in light of increasing Arab governmental interest in cyber security (Fikry, 2014), internet governance (Cerf et al., 2014) and recent resolutions of the Arab League which discuss these topics (Arab League's Jerusalem Summit Resolution, 2018).

Tone

A possible explanation to the less positive tone when it comes to cryptocurrency relates to the quality of decentralization, and the potentially disruptive impact of cryptocurrencies on current financial systems. This is consistent with the findings of the qualitative study. As for the positive tone in the coverage of e-governance and supply chain, it can be attributed to its supplementary role in fulfilling the government development goals. This is consistent with the findings of the qualitative study which suggest that applications that are perceived as beneficial by the government are likely to receive better coverage in the media.

In terms of subtopics, a possible explanation to the less positive outlook in articles discussing security and environment is the bad reputation of Bitcoin which impacts perceptions of blockchain technology in general as suggested by (Lynn et al., 2018). This is consistent with the findings of the qualitative study which suggest that part of the negative outlook is resulting from the perception that Bitcoin consumes excessive energy or that it could facilitate unlawful activities.

The variation in tone between countries may be attributed to many factors. One way to look at it is by looking at the different applications covered in each country and by understanding the association between these particular applications and the tone. For example, since the coverage of cryptocurrencies applications in Morocco and Lebanon is higher than it is in Saudi Arabia and the UAE, and since cryptocurrencies are associated with less positive tone as demonstrated by the quantitative and qualitative studies, it is natural that blockchain would be framed less positively in Morocco and Lebanon. Furthermore, Saudi Arabia and the UAE are developing governmental blockchain initiatives which contribute to the positivity of the media coverage tone in these countries.

Media as a Reflection of Governmental Interest and Understanding

The qualitative study suggests that the variation in media coverage of blockchain technology is due to the variation in governmental interest and understanding. Arab media is commonly perceived as a reflection of governmental interest and understanding (Rugh, 2007; Subeh, 2017). The UAE media publishes a larger number of blockchain news content than any other Arab country and it publishes the highest percentage of blockchain

e-governance articles as confirmed by the quantitative study. This can be understood in light of its announced goals as explained by Alketbi et al. (2018):

> The Blockchain technology is a good example of an emerging technology that is attracting government attention. Many government entities such as the United Kingdom, Estonia, Honduras, Denmark, Australia, Singapore and others have taken steps to unleash the potential of Blockchain technology. Dubai Government is aiming to become paperless by adopting the Blockchain technology for all transactions by 2021 (p. 1)

Role of the Media

Interviewees maintain that the media coverage is not up to their expectations, which is consistent with the literature suggesting that individual satisfaction with Arabic-speaking TV channels is generally low (ALsamydai et al., 2013). The qualitative study highlights various applications worthy of media coverage as well as various context for discussion and relevant context for discussing the technology and points out to the importance of distinguishing blockchain from its most famous application, Bitcoin. 13.33% of the interviewees identify conflation as a problem, which is a common theme in the literature (Carson et al., 2018; O'Dair, 2019). This conflation is potentially damaging to startups and to the acceptance of blockchain technology in general:

> Bitcoin's legitimacy has been questioned by regulators (Blundell-Wignall, 2014; European Central Bank, 2012; Interpol, 2017). It is not the only application of blockchain, but it is arguably the most famous. This generates confusion among the general public (Culpan, 2017; Lucas, 2017), and, in light of the bad reputation that Bitcoin has developed over time, potential damage for blockchain technology. Indeed, failure to achieve legitimation can reduce adoption and result in the failure of new digital innovations (Flynn & Du, 2012). Blockchain is still at an early stage of development with IT, financial services and consulting firms leading the innovation process (Miles, 2017), and the media extensively covering major events in the ecosystem (Hsieh et al., 2017; Umeh, 2016). Thus, these actors may play a critical role in building legitimacy around blockchain technology, particularly the early stages of development (Lynn et al., 2018, p. 2).

In order for blockchain innovation to reach its full potential, it is important for developers and users to understand it as a foundational infrastructure of decentralization. While fintech is a natural context to discuss this technology, as shown in the quantitative and qualitative studies, other contexts such as law, ethics and the environment can facilitate a deeper understanding and motivate a more meaningful discourse.

The Absence of an Ethical Dimension

Only 3.3% of the interviewed experts and 3.4% of the media sample discuss moral and ethical implications of blockchain technology. Moreover, media discussions of moral topics in the analyzed articles can be described as incidental and superficial; as in debating whether using cryptocurrencies is religiously permissible or not in lieu of questioning its implications on financial inclusion or the right to privacy. This lack of interest in the

ethical implication both in the Arab media and the interviewed sample is worthy of contemplation. To understand the relevance of the ethical dimension in discussing blockchain technology and technology in general, it is useful to juxtapose blockchain to its sociological antithesis; AI.

Despite its numerous benefits, many scientists are wary of AI. Stephen Hawking, for example, argues that the development of full AI could spell the end of the human race. He reasons that "humans, who are limited by slow biological evolution, couldn't compete and would be superseded" (Cellan-Jones, 2014. p. 4). The fear of AI taking over is common in science fiction and among scientists alike. Elon Musk argues that "we need to be very careful with artificial intelligence because it is more dangerous than nuclear bombs" (Gherheș, 2018, p. 7).

The researcher, however, argues that the real danger of AI is not in a scenario where machines would take over; rather the real danger comes directly from its centralized architecture that allocates the power to shape its decision-making capacity in the hands of few actors. According to Feller et al. (2016), AI is being used today in courts across the United States to help make bail decisions by assigning social scores to defendants in order to determine how likely they are to commit a crime. The researchers cite studies debating whether or not this widely used software has built-in biases against people of African descent which remains a possibility. Such possibility is addressed in articles 59 and 71 of the European General Data Protection Regulation (General Data Protection Regulation, 2018). The issue, however, is yet to be grasped in the Arab public discourse.

AI-generated scores are a form of social control that could fundamentally impact the quality of life of individuals and groups based on the imperatives of a single actor. AI

configuration bias is an ethical challenge with tangible consequences. Imagine, for instance, a hypothetical scenario where someone like Sam Harris would have the power to define the ethical logic of an AI system for bail decisions, how would a biased configuration impact the human rights and quality of life of individuals of Arab or Muslim heritage?

Today, AI algorithms are used by banks to determine applicant access to loans and by universities to make admissions and hiring decisions (Saxena et al., 2020). The Chinese government is testing a pilot program for the large-scale use of AI-generated social scores that utilize face recognition technology and mass surveillance (Botsman, 2017). The beauty of blockchain as a technology is in not allowing for the consolidation of power in the hands of a single actor; because of its decentralized architecture, all decisions on the system require consensus. From this perspective, blockchain is the antithesis of AI and the ethical examination of one soliciting the other.

The US media has historically played an important role in shaping investment decisions in the US (Durand & Vergne, 2015). Most recently, Microsoft has launched an investigation led by ex-US Attorney General Eric Holder to determine whether or not it should continue its relationship with AnyVision (Solon, 2019), the latest Israeli technology company to make headlines on accusations of human rights violations after the NSO Group which was sued by WhatsApp (Entous, 2019). AnyVision's promotional content on social media now focuses mainly on morality, claiming that ethics is central to their technology (AnyVision, 2019). This example highlights the connection between media framing of technology ethics and direct investment decisions, an important

dimension that is absent from the framing of blockchain technology in the Arab media as this study demonstrates and arguably from the Arab public discourse.

> If our moral and political language for evaluating technology includes only categories having to do with tools and uses, if it does not include attention to the meaning of the designs and arrangements of our artifacts, then we will be blinded to much that is intellectually and practically crucial (Winner, 1980, p. 125).

It is important to understand that technologies carry purposes beyond their immediate use. This can be illustrated through the inherent qualities analysis which can be used as a framework to enrich technological imaginaries and construct more ethical and inclusive technological discourses.

6.3. Inherent Qualities of Blockchain

- The qualitative study suggests that blockchain is unique due to a set of inherent qualities that makes it impactful. Such qualities include nonrepudiation, immutability, encryption, disintermediation, anti-regulation, decentralization, distribution, scarcity, automation, accessibility, and transparency.

  What do inherent qualities mean? This question solicits a deeper discussion into the philosophy of technology and supplicates predisposed positions on technological determinism. Inherent qualities are used in this research to refer to embedded characteristics that produce certain effects if the technology is used; effects that have the potential of changing or disrupting other domains. Researchers present various views on this notion:

> The computer scientist Joseph Weizenbaum notes that there can be no 'general-purpose tools' (1976, p. 37), and the philosopher Don Ihde (1979) has argued that particular tools unavoidably select, amplify and reduce aspects of experience in various ways. Abbe Mowshowitz, a computer scientist, argues that 'tools insist on being used in particular ways' (Mowshowitz, 1976, p. 8). In this technical sense, tools are not 'neutral' and their use may contribute to shaping our purposes. (Chandler, 1995, p. 9).

Ideas on technological determinism are far from conclusive; the researcher argues that technology is an important player in the dialectical forces shaping our societies today. It is, in this sense, that this study urges for a deeper examination of the implication of technology starting by identifying and discussing what the researcher refers to as the inherent qualities.

What makes blockchain revolutionary is not simply the aggregation of all these qualities in one technological solution, but rather its ability to seamlessly integrate with other disruptive technologies to introduce new concepts, challenges and opportunities. Among the most interesting technologies that can be coupled with blockchain are mesh-connectivity and AI, both carry within, a set of socially consequential implications that could be perceived as beneficial or dangerous. While the idea of objects encompassing socially consequential qualities is relatively novel in the domain of software, it is well discussed in the domains of city planning and politics as in the classic example of the New York City planner Robert Moses:

> Moses designed a parkway between New York and Jones' Beach State Park on Long Island. But Moses was also racist and wanted to keep blacks out of the park. But how should this be done? Moses' answer was to invent an architecture of discrimination in the form of low bridges. When he designed these, he made sure that they were high enough for cars, but too low for buses. Which meant that if you were rich enough to own a car, then you could use the parkway to get to Jones' Beach, but if you depended on the bus then you couldn't (Gallon & Law, 1997, 172).

This is a form of regulation, not by law but by design; the bridge as a technology is configured to achieve the imperatives of a race-class hegemon. The intentionality here has been a subject of debate, but this example is far from being the only one in city planning and software development alike. A considerable number of studies have discussed the regulatory power of design in the physical space (Petty, 2016; Foucault, 1977). The idea is also gaining recognition in the world of software development as seen in axioms like *Code is Law* (Lessig, 2000). This dissertation argues that every technology encompasses a set of inherent qualities that are socially consequential; to choose a technology is to enable particular modalities of power relations:

> Technological innovations are similar to legislative acts or political foundation that establishes a framework for public order that will endure over many generations. The issues that divide or unite people in society are settled, not only in the institutions and practices of politics proper, but also, and less obviously, in tangible arrangements of steel and concrete, wires and transistors, nuts and bolts (Winner, 1980, p. 128).

Centralized technologies such as AI consolidate the imperatives of hegemons and normalize the power relation modalities that blockchain is set to disrupt through its egalitarian decentralized architecture.

6.4 Perceptions of Opportunities and Risks

- The main perceived opportunities in the media are efficiency (41.4%) which includes saving time and lowering costs through disintermediation and decentralization. Given the results which identify economy as the most frequently covered subtopic, it follows naturally that efficiency is among the top perceived opportunities. The second top perceived opportunity is accountability (14.4%) followed by other marginally discussed opportunities such as environmental benefits (3%).
- The main perceived risks in the media, however, are found in money loss (6.4%) and various categories of crime, including money laundering (4%), cybercrime (4%), terrorism (2.2%), drug trafficking, human trafficking, and illegal tax related activities (3%).
- The qualitative study reveals that blockchain is perceived to offer many benefits and can solve many problems; the top perceived opportunities are efficiency, followed by privacy and security, and, finally, accountability.
- While interviewees in the qualitative unanimously agree on the usefulness of blockchain as a solution for various problems, it is not free of perceived risks such as the lack of government oversight, money loss and energy waist.

Opportunities

Both the qualitative and quantitative studies as well as blockchain research (Rabah, 2017) suggest that efficiency and accountability are among the top opportunities associated with blockchain. Efficiency comes in the form of saving both time and valuable resources: "Blockchain technology has the potential to radically reduce the time and costs for the transactions by eliminating the intermediaries or third-party agents" (Morabito, 2017, p. 26). In confirmation with the findings, the literature places much emphasis on accountability. Tenorio-Fornés et al. (2019), for example, discuss utilizing the heightened accountability in blockchain to create a decentralized process for scientific publication and peer review, whereby "processes like the selection of reviewers, or the contents of the reviews, are open to the public. With interactions being time-stamped and tamper-proof thanks to blockchain technology, they can be monitored, audited, and held accountable" (p. 4638). In addition to efficiency and accountability, blockchain professionals also regard the increased security and privacy as benefits. This view is also present in the literature:

> If the field of systems security and privacy-enhancing technologies has learned one lesson, it is that all databases are likely operating in an adversarial environment. Therefore, some of the "hype" around blockchains is for good reason: For the first time in decades, the venerable database itself may be replaced by blockchains (Halpin & Piekarska, 2017, p. 1).

Risks

Top three framed risks by the media are money loss, money laundering and cybercrime. A possible explanation of these fears can be attributed to the decentralized

and distributed nature of the technology which makes it ungovernable. A recurrent theme in the interviews, yet debatable in literature is the perception that the lack of government oversight will necessarily result in crime and misuse. In their discussion of blockchain, Crosby et al. (2016) affirms that as an application that is intrinsically tied to blockchain, "Bitcoin helps to enable a multibillion-dollar global market of anonymous transactions without any governmental control. Hence, it has to deal with a number of regulatory issues, involving national governments and financial institutions" (p. 8). This perception is consistent with the findings of both the qualitative and the quantitative studies. However, there is a growing evidence that the traceability and transparency currently embedded in the Bitcoin code make it more transparent than paper currencies which are also used in money laundering and crime:

> Regarding law enforcement, digital ledgers should be recognized as a new and more complicated digital venue where illegal activities may be taking place alongside honest activities. Regulatory agencies are called upon to become savvy about the risks presented by the new technology and operate within this domain. Regulators need to understand how digital ledger technologies work and can be used for operations such as money laundering, and they need to understand how illegal practices might be detected, tracked, and persecuted in these new transnational cryptographic areas. An example of this was regulators using the tracking features inherent to blockchain transactions to apprehend perpetrators in the Silk Road case (Brandom, 2015). While being cognizant of these and other challenges, overall, the economic benefits of blockchain could outweigh the potential risks (Swan, 2017 p. 11).

That is said, the underlying technologies behind Bitcoin and other cryptocurrencies are constantly evolving with some cryptocurrencies built on the principal of privacy by design which renders it more fungible and less traceable than cash.

Another recurrent concern among the interviewees is the perception of high energy usage. In speaking about the bitcoin blockchain, Fairley (2017) confirms that "it uses an absolutely stunning amount of power. The ever-expanding racks of processors used by miners already consume as much electricity as a small city. It is a problem that experts say is bad and getting worse" (p. 1). While this is a serious risk to consider, it is important to understand that this is a specific problem related to the consensus algorithm used to validate the transactions in blockchains that use *proof-of-work*. However, not all blockchains use this algorithm. As suggested by King and Nadal (2012), blockchains relying on *proof-of-stake* as a consensus algorithm consume substantially less energy than those relying on *proof-of-work*.

6.5 Practical Implications on Media and Mass Communications

- The qualitative study affirms the notion that blockchain will have implications on media and mass communications; it will lead to the development of new business models that do not rely on advertisement. Blockchain enables the accurate tracing of information to its sources and the identification of fake news. Finally, it makes it possible to preserve information from alteration.

New Business Models

Tripathi (2018) argues that there are three ways by which blockchain can disrupt current media business models and enable new ones: first, by enabling new pricing option for paid content; he argues that unlike current payment processing solution, even fractions of cents are cost-efficient using blockchain and, thus, penny price content purchases for reading a single news article or streaming a single song are feasible, which reduces the need for traditionally ad-sponsored content. Second, it will enable the purchasing of paid content regardless of national boundaries and regulations. Finally, Tripathi explains that payment will be automatically initiated according to the terms of the smart contract, thus reducing the need for intermediaries and the associated costs.

Media Transparency

A major area where blockchain will impact mass communications is through increased transparency. Social bots are used by individuals, companies and governments alike and are considered a problem for creating false impressions of popularity (Woolley, 2016). It is also exacerbating the spread of what is commonly referred to as fake news:

> The spread of fake news online is another area in which the effect of bots is believed to be relevant (Bessi et al., 2015; Lazer et al., 2018). A study based on 14 million tweets posted during and after the 2016 U.S. presidential election revealed that bots played a key role in the spread of low-credibility content (Shao et al., 2018). The study uncovered strategies by which social bots target influential accounts and amplify misinformation in the early stages of spreading and before it becomes viral.

> Even bots created with good intentions may contribute to the spread of misinformation (Yang et al., 2019, p. 5).

This, in turn, begs the question, as to whether the current media's interest in blockchain technology is a case of *technological somnambulism*. The paradoxical situation of simultaneously using social bots and investing in the technology that will eventually lead to its decay is a delicate enterprise. The researcher predicts that media interest in blockchain will decrease in the future as the understanding of its inherent qualities increase.

Censorship

Blockchain is commonly referred to as a disruptive technology. Among the areas it will disrupt is the access and control of information; one of the advantages of the decentralized structure of Blockchain is resistant to outages (Alketbi et al., 2018). This means that content on the blockchain is more resistant to censorship than content on traditional databases. How would the Internet look like if it was built on a blockchain? Will this result in a new World-Wide-Web and what are the implications of decentralized and censorship resistant internets on communication theory? "Blockchain is challenging the status quo of the central trust infrastructure currently prevalent in the Internet towards a design principle that is underscored by decentralization and transparency" (Ali et al., 2016, p. 1).

6.6 Theoretical Implications on Media and Mass Communications

Blockchain perfectly symbolizes the concept of heterotopia as discussed by Michael Foucault (Sfetcu 2019; Miscione, & Kavanagh, 2015). A heterotopia is "any real or metaphorical space that permits thought and action that noticeably departs from the conventions of a society" (Castree et al., 2013, p. 212). Blockchain systems are purposefully designed as spaces where hierarchies do not apply. It is a version of cyber space that is not only metaphorically independent, but also tangible; by functioning as a parallel decentralized ecosystem of monetary and informational exchange. Theories of media and mass communications must catch up to the practical implications discussed in this study. The structural changes blockchain will bring to media business models, mechanisms of news source tracking, and models of information access and control require new theorization; the traditional media theories that are based on centralized architecture are not relevant in this anarchist heterotopia; one example is the gate keeping theory (Shoemaker & Vos, 2009) which, in its various forms, assumes the existence of controlling hierarchies. In their analysis of western media systems, Herman and Chomsky (2002) argue that media is controlled through forces of political economy such as sponsorship and advertisement. They argue that a business model that relies on advertisement encompasses built in biases due to the systematic conflict of interest between journalistic ethics and revenue. One of the first implications of blockchain on traditional communication theories is that the new business models render advertisement-based explanatory frameworks obsolete similarly to the hypodermic needle theory which is no longer relevant. More research needs to be conducted to understand how mechanisms of censorship function in decentralized environments. Based on the law of 51% attack

(Watanabe et al., 2016), the researcher predicts that new decentralized censorship mechanisms will emerge to allow blockchain communities to filter out content that is unwelcomed by the majority of the network. This hypothesis, however, requires the validation of technology experts but it could, nevertheless, provide a reference point to understand the new paradigm in communication research that will be enabled by the recent technological developments.

6.7 Limitations

The study is limited by the low number of newspaper articles on the subject. They were almost non-existent prior to 2017, which resulted in the analysis of articles dating back three years only, even though blockchain was developed more than 10 years ago. Furthermore, limitations result from the restricted focus on blockchain coverage in online versions of mainstream newspapers; the study does not include hard copies of the newspapers or information disseminated on blogs, social media or new media platforms which may mildly impact the results. While the focus on online versions of mainstream Arab newspapers is a practical way to achieve the research objectives, the exclusion of other media types such as radio and television may limit the diversity in the sample as representation might vary across platforms. Furthermore, the quantitative data sample is extracted from five Arab countries only, which limits the ability to generalize the results to the entire Arab world; the number of articles in Iraqi, Algerian and Sudanese newspapers is too low and is insufficient to conduct a quantitative analysis and thus it was not possible to investigate the countries listed as initially intended. Moreover, the study focused on the Arab world and professionals working in the Arab world, but the available

literature was largely international with little research focusing on blockchain in the Arab world. While the selection of interviewees was based solely on credentials and country of residence, the sample was largely skewed when it comes to gender with only 13.33% females. Finally, no locals participated in the sample from the United Arab Emirates, which limits the viewpoints assessed in the sample to the views of expatriates which may or may not be different than the views of locals as in the rest of the countries that have been studied.

Chapter 7: Conclusion

7.1 Directions for Further Research

This study targeted the most basic and fundamental questions about the topic. Many aspects, however, remain to be researched; from the role of blockchain in authenticating information and identifying misinformation to studying the implications of decentralized architecture on media systems. After demonstrating that blockchain technology will have substantial implications on media and mass communications, the next step is to find out how. As an untapped domain for media research, the questions are ubiquitous: how effective is blockchain in addressing the challenges of news source tracking and identifying social bots? How would blockchain enable decentralized censorship mechanisms and how would it impact media content? How could blockchain preserve original content from alteration? How can blockchain enhance the efficiency of archiving media content? How would nano payment systems impact pirating? How would traditional media theories function under the new conditions and what new theoretical framework can be developed to explain blockchain's implications?

This study can be repeated to examine the future changes in perceptions as the technology matures. In doing so, it would also be useful to include the perceptions of media viewers. The researcher’s approach can be used to explore and discuss other technologies such as AI and the Internet of things. Finally, the researcher advocates further exploration of the inherent qualities concept as a proposed framework to discuss and juxtapose technological choices. The inherent qualities analysis can be applied to explore an array of questions related to public perceptions of technology. For example, public

perceptions of blockchain as a tool for enabling alternative economic and financial models and spaces such as Islamic decentralized-finance (DEFI) and agoristic decentralized autonomous organizations (DAO).

7.2 Concluding Remarks

The aims and objectives of the research have been achieved. This first systematic study of blockchain as a technological imaginary provided an empirical description of the status of understanding and attitudes towards blockchain technology in five Arab countries as inferred from the media and the views of professionals in the blockchain domain. The study explained perceptions of risks and opportunities, the characteristics of the media coverage and the attitudes of professionals towards the media coverage. The study also highlighted the potential practical and theoretical implications of blockchain on the media and mass communications.

The research made use of framing literature and contextualized previous blockchain studies. It also illustrated areas of agreement and disagreement between the media and the experts and made predictions on the development of the media coverage of the topic in the future. The study demonstrated that the coverage of blockchain in online Arab press is predominantly positive; there are some differences in the media coverage between the five studied countries which are reflected in the amount of coverage, subtopics, applications and tone. There is a significant association between specific applications and the tone. There is also a significant association between certain subtopics and the tone.

Professional perspectives vary on the characteristics and role of the media in covering the topic. Coverage of blockchain in the Arab world is perceived as a reflection of the interest and technological understanding of Arab governments with the UAE being the most developed in this regard. There is an absence in discussing technology ethics both at the level of blockchain professionals and the media.

The study suggests that blockchain technology encompasses a unique set of inherent qualities that makes it impactful on many fields including media and mass communication. Such inherent qualities include nonrepudiation, immutability, encryption, disintermediation, anti-regulation, decentralization, distribution, scarcity, automation, accessibility and transparency. Experts present a variety of perceived technological benefits and risks. Finally, the study documents low satisfaction among blockchain professionals about the Arab media framing of blockchain.

The study recommends a more in-depth exploration of blockchain as a technological imaginary; it is important to rethink the framing of technology and place more emphasis on ethical and social questions. It is ever more pressing now as its far-reaching implications on human rights and quality of life become apparent, and as data become the new means of production.

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APPENDICES

Appendix A: Consent Letter

Please read carefully before signing the consent form

News Framing of Emerging Technologies: Perceptions of Blockchain in Online Arab Press

You will be asked to provide or deny consent after reading this form.

You have been invited by PhD Candidate Ibrahim Subeh at the Department of Mass Communications, UAEU, to take part in his study to investigate the way blockchain is understood in the Arab world.

The study will benefit both academia and blockchain professionals by providing valuable quantitative and qualitative data on the ways in which blockchain is understood and discussed in the Arab world. News articles published over a period of three years from Saudi Arabia, Morocco, Lebanon, Egypt and UAE are analyzed and interpreted in light of the opinions of blockchain experts.

The study will be conducted online through written interview questions. Participation in this study will take 30 to 60 mins to complete—five minutes for the overview, around 30 minutes for the interview itself, and 20 minutes for the follow-up with the researcher afterwards. The interview is composed of 16 questions which can be completed online. Any private information is confidential, and all participants have the right to withdraw at any stage in the interview.

Feel free to ask any questions you may have.

Informed consent

I confirm that I have read and understood the above information and have had the opportunity to ask questions.
I understand that my participation is voluntary and that I am free to withdraw.
I understand that my data will be kept confidential and, if published, the data will not be identifiable as mine.

I agree to take part in this study:

Name: _____ Signature: _____ Date: _____

Appendix B: Coding Scheme

Coder Name: each coder is assigned a number in SPSS; Ibrahim: 1, Roaa:2.
Newspaper Name: each newspaper is assigned a number in SPSS as in the schedule below.

Article reference number, title, hyperlink and country: titles and hyperlinks and countries are listed, and each article is given a number that corresponds to the hyperlink in SPSS.

Coding Questions

Instructions for CQ1, CQ2, CQ3, CQ4, CQ5 and CQ6: The aim of these questions is to document the coverage of blockchain applications in each article.

Refer to the schedule.

Variable	Definition	Example
Cryptocurrencies	Digital money	Bitcoin, Ether and Litecoin
Communication platforms	Social networks, messaging and publishing platforms	Steemit, dust and blockstack
Crypto collectables	Digitally scarce non-fungible items	Cryptoketties, cryptopunks and the foreverrose
e-governance	Platforms to enhance government services	Theoretical
supply chain applications	Platforms that employ the concept of digital scarcity to tracking the sources and ownership of goods or data and or to preserve paperless documentation of organizational documents	IBM blockchain and Everledger
Fintech and Banking	Financial applications	Stock markets
Other applications	None of the above	None of the above

CQ1: Does the article discuss Cryptocurrencies?
0. No
1. Yes

CQ2: Does the article discuss Communication platforms?
0. No
1. Yes

CQ3: Does the article discuss Crypto-collectibles?
0. No
1. Yes

CQ4: Does the article discuss supply chain applications?
0. No
1. Yes

CQ5: Does the article discuss e-governance applications?
0. No
2. Yes

CQ6: Does the article discuss Banking and fintech applications?
No
Yes

CQ7: Does the article discuss other unlisted applications?
0. No
1. Yes

CQ8: If yes, name the other applications discussed in the article.

Instructions for CQ9: The aim of these questions is to document the tone of the coverage of each blockchain application in each article. On a Likert scale, 1 represents extremely negative tone and five represents an extremely positive coverage.

CQ9: How do you describe the tone of the coverage of blockchain applications in the article?

1	2	3	4	5
Extremely negative		Natural		Extremely positive

Instructions for CQ10, CQ11, CQ12, CQ13, CQ14 CQ15, CQ16 and CQ17: The aim of these questions is to document the subtopics that are discussed under the main topic of blockchain. Identify the presence of each of the following six subtopics: economy, environment, morality and the law. In addition, identify the presence of other topics not listed here.

Variable	Definition	Example
Economy	Topics related to the business	Tracking goods
Environment	Topics discussing the environmental implications	Using papers & seals
Morality	Topics related to morality virtue and sin	Bitcoin is unethical
Technology	Topics related to technology and innovation	Innovations
Security	Topics related to safety and security	Hacking
The law	Topics related to the laws and its enforceability	Illegal activities
Others	None of the above	None of the above

CQ10: Does the article discuss the environment?
0. No
1. Yes

CQ11: Does the article discuss morality?
0. No
1. Yes

CQ12: Does the article discuss the law?
0. No
1. Yes

CQ13: Does the article discuss the economy?
0. No
1. Yes

CQ14: Does the article discuss the technology?
0. No
1. Yes

CQ15: Does the article discuss security?
3 No
4 Yes

CQ16: Does the article discuss other unlisted subtopics?

0. No
1. Yes

CQ17: If yes, name the other subtopics discussed in the article.

Instructions for CQ18, CQ19, CQ120, CQ21, CQ22 and CQ23: The aim of these questions is to document the opportunities that are discussed in each article. Identify the presence of each of the following four opportunities: economy, environment, morality and the law. In addition, identify the presence of other topics not listed here.

Variable	Example
Saving money	Low transaction fee
Saving Environment	Going paperless
Social equality	Including underdeveloped regions in global trade
accountability	Immutable record of transactions
Others	None of the above

CQ18: Does the article suggest saving money?
0. No
1. Yes

CQ19: Does the article suggest saving the environment?
0. No
1. Yes

CQ20: Does the article suggest achieving more social equality?
0. No
1. Yes

CQ21: Does the article suggest saving more accountability?
0. No
1. Yes

CQ22: Does the article discuss other unlisted opportunities?
0. No
1. Yes

CQ23: If yes, what are they?

Instructions for CQ24, CQ25, CQ26, CQ27, CQ28 and CQ29: The aim of these questions is to document the risks that are discussed in each articles. Identify the presence of each of the following four risks: economy, environment, morality and the law. In addition, identify the presence of other topics not listed here.

Variable	Example
Money laundering	Using cryptocurrencies to facilitate international money laundering
Money loss	buying highly volatile assets or using insecure platforms
terrorism	Using crypto currencies for unlawful financing
Drug use	Using cryptocurrencies to buy drugs from the silk road platform
Others	None of the above

CQ24: Does the article suggest money laundering?
0. No
1. Yes

CQ25: Does the article suggest money loss?
0. No
1. Yes

CQ26: Does the article suggest terrorism?
0. No
1. Yes

CQ27: Does the article suggest drug use?
0. No
1. Yes

CQ28: Does the article suggest other unlisted risks?
0. No
1. Yes

CQ29: If yes, what are they?

Appendix C: Interview Questions

1- What inherent qualities distinguish blockchain technology from other technologies?

2- Do you see blockchain technology as beneficial or potentially dangerous and why?

3- How would you describe your country's media coverage of blockchain technology in relation to other Arab countries and the world?

4- This study reveals that while the Arab media presents blockchain positively, the degree of positives varies between countries. In your perception, what is the reason behind this variation and what is its significance?

5- Which blockchain applications are more worthy of more media attention in your opinion?

6- This study reveals that, in different countries, the media focuses on different blockchain applications. What do you think is the reason for this variation and what is its significance?

7- Are there any blockchain applications that are beneficial and others that are potentially dangerous? Can you give examples?

8- This study reveals that the context in which blockchain is discussed influences the attitude towards blockchain. Technology articles tend to be more positive than economic or security-themed articles. What do you think is the reason for this variation and what is its significance?

9- What context is more relevant to discuss blockchain technology, economy, law, security, environment, technology, morality, politics and why? Choose and rank all that applies and if there are any other contexts that can be relevant to blockchain technology please specify?

10- What are the main advantages and opportunities of using blockchain technology?

11- What problems can blockchain solve?

12- What are the main disadvantages and risks of relying on blockchain technology?

13- Can blockchain technology impact media and mass communication? Why, and how?

14- Can we say blockchain is socially disruptive? If so, how can it impact society?

15- In which ways are the implications of blockchain technology different than the implications of artificial intelligence?

16- Would you like to add any insights, suggestions or comments?