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BLOCKCHAIN ADOPTION IN GREECE: WHICH ARE THE RESOURCES NEEDED? WHICH IS THE ROLE OF DYNAMIC CAPABILITIES?

Research full-length paper

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Abstract

Indubitably, blockchain comprises one of the most significant innovations emerged at the outset of this century. Although it promises valuable advantages (e.g., decentralization, trust, transparency, immutability, decreased cost) in a great array of domains, the Greek organizations have not tried to harness its virtues yet due to the lack of indispensable resources. Based on the Resource Based View and the Dynamic Capabilities Theory, this study discusses the existing body of literature on the topic of blockchain adoption and conducts semi-structured interviews with Greek blockchain experts in order to detect the resources that the blockchain adopters and the blockchain providers need. Furthermore, it identifies the dynamic capabilities required for the development of the necessary resources leading to the competitive advantage in the forthcoming blockchain-based era. The results of this research will contribute to the diffusion of blockchain in the Greek market.

Keywords: blockchain adoption, Resource Based View, Dynamic Capabilities, Greece, semi-structured interviews

1 Introduction

Living in the era of Industry 4.0., there are many cutting-edge technologies that have prevailed in the daily life of humans. Unquestionably, one of the most revolutionary is blockchain provoking radical changes to the way through which markets operate. According to Glasser (2017), blockchain is defined as **“a decentralized transactional database technology that facilitates validated, transparent-resistant transactions that are consistent across a huge number of network participants called nodes”** (Beck et. al., 2018, p. 1021). In line with Niranjnamurthy et. al. (2019), blockchain brings a host of impressive advantages, such as decentralization, efficiency, auditability, traceability, transparency and security. Apart from these valuable benefits, its most important advantage is that it constitutes a versatile technology in the sense that there are use cases in all the fields of the economy (Swan, 2015); (Casino et. al., 2019). Provided its high potential, there are spectacular indications portending its rapid diffusion in the near future. For instance, according to the report of Blockdata (2022), 81 out of the 100 top public companies have already either tried or implemented blockchain solutions.

Despite its significant benefits, a lot of managers still resist to adopt this technology by taking into consideration diverse barriers (e.g., shortage of knowledge, regulatory issues, high energy consumption, immaturity of technology) (Sadhya and Sadhya, 2018). In Greece, the hesitation of organizations to adopt blockchain is very intense. Based on the report of E.U. Blockchain Observatory and Forum (2020), both blockchain-related legislative framework and blockchain ecosystem are immature in Greece compared to the other nations of European Union. Few publications studying the intention of the Greek organizations to utilize blockchain applications verify this extremely low degree of blockchain adoption. The existing literature ascribes this phenomenon to multiple causes, such as the wrong culture, the lack of regulations, the shortage of leadership and the fatigue from the adoption of previous technologies (Papathanasiou et. al., 2020); (Ntanos et. al., 2020); (Kapnissis et. al., 2022); (Xathopoulou, 2022).

Given that blockchain will rapidly diffuse in the global economy (10% of the global GDP will have been recorded in blockchain by 2027) (Cisco, 2018), the Greek companies must be equipped with the suitable resources for quickly adopting this technology. Otherwise, they will not exploit its remarkable benefits and they will lag behind their foreign competitors. Trying to respond to this major problem, the current research attempts to identify the resources and the dynamic capabilities that must be developed from the angles of the Resource Based View (hereafter RBV) and the Dynamic Capabilities Theory (hereafter DC). In doing so, this study carries out semi-structured interviews with Greek blockchain experts. The findings shed light on the external barriers to blockchain adoption in Greece, the appropriate resources and the essential dynamic capabilities for successfully implementing blockchain solutions. Beyond the Greek companies, the study's results may be utilized by organizations trading in countries in which the blockchain ecosystem is still underdeveloped.

In what follows, the text is organized into five sections (Section 2 - Section 6). In Section 2, the literature investigating the adoption of blockchain is briefly described. In Section 3, the theoretical principles of RBV and DC are explicated. The Section 4 narrates the process of interviews with Greek blockchain experts. The Section 5 analyzes the main findings. Finally, the Section 6 discusses on the results and highlights the main contributions of this research paper.

2 The literature examining the adoption of blockchain

Considering the scientific topic of blockchain adoption, there are two broad groups of publications. The first includes the research papers in which a wide variety of traditional IT adoption theories is used as an interpretive lens, such as the TAM (Sciarelli et. al., 2021), the UTAUT model (Khazaei,

2020), the UTAUT2 model (Handoko and Lantu, 2021), the DOI theory (Dobrovnik et. al., 2018), the TOE framework (Agrawal et. al., 2022) and the Status Quo Bias theory (Chatfield and Reddick, 2019). Talking about the central features of this category of publications, the supply chain is the field gathering the biggest number of research papers, while the majority of them are relied up on the TAM, the TOE framework and the UTAUT model (Almekhlafi and Al-Shaibany 2021); (AlShamsi et. al. 2022); (Taherdoost, 2022). Furthermore, among the top drivers of blockchain adoption are found to be the trust, the perceived cost, the social influence and the facilitating conditions (AlShamsi et. al. 2022).

Apart from the utilization of classic IT adoption theories, within the literature body of blockchain adoption, there is a second category of publications containing a noteworthy number of research papers which examine various critical strategic questions from the managers' side. In fact, these papers focus on specific topics that the managers should become aware of as the blockchain will gradually diffuse in the market. For example, the selection among the available strategies to compete in the forthcoming blockchain-based era (Carson et. al., 2018), the process through which the organizations can identify and develop blockchain solutions (Fridgen et. al., 2018), the definition of the specifications of the blockchain solutions (e.g., read rights, write rights, consensus mechanism) (Turk and Klinc, 2017); (Mulligan et. al., 2018); (Wüst and Gervais, 2018), the choice between creating a new blockchain network and joining an existing one (Rauchs et. al., 2019), the evaluation of blockchain consortiums (Schwarzer et. al., 2022), the comparison among the existing blockchain frameworks (Polge et. al., 2020) and the establishment of partnerships with blockchain-as-a-service providers (Kernahan et. al., 2021) are some of the research questions belonging to this second category of publications.

Without doubting about the great significance of the results derived from these two categories of publications, it must be underlined that both suffer from important weaknesses. When it comes to the first, most of the research papers that are based on traditional IT adoption theories approach the embeddedness of a new technology as a one-time decision to make (Arifin, 2017). Nevertheless, the adoption of blockchain constitutes a long journey and it entails a lot of difficulties that organizations must combat by developing the essential resources. According to Rauchs et. al. (2019), the average duration of blockchain projects exceeds the two years. Concerning the second category of publications, the focal pain point is their centralization in a particular subject. The implementation of blockchain requires multiple issues to be taken into consideration in order to become successful. For instance, even though it is of utmost importance the managers to obtain an adequate level of knowledge of several technical topics around blockchain technology (e.g., consensus algorithms, blockchain frameworks), their organizations will fail to respond to the challenge of blockchain adoption if they do not devise an appropriate strategy and they do not apply a suitable business model. As such, a holistic approach is indispensable for exploring thoroughly the whole process of blockchain adoption.

In attempt to adopt blockchain and overcome all the possible obstacles, the organizations must acquire or build some indispensable resources. Put differently, the advent of blockchain necessitates the modification of the organizations' resource base (Treiblmaier, 2018); (Kummer et. al., 2020). Trying to shed light on this topic, the current study hinges upon the RBV and tries to detect the essential resources for adopting blockchain. Given that the rate at which a nascent technology evolves and diffuses nowadays is much higher than it was in the past, the alteration in the set of resources has become more urgent and frequent. Discussing on the blockchain technology, its evolution includes four stages (Blockchain 1.0. – Blockchain 4.0.) (Angelis and Da Silva, 2019) in less than fifteen years. Provided the spectacular speed at which this technology becomes advanced, the organizations must be able to renew their resources very often. In this vein, the approach of DC is deemed as an ideal theoretical tool for the analysis of blockchain adoption. The following section presents the tenets of RBV and DC. In addition, it describes the literature exploring blockchain from these two perspectives.

3 The theories of Resource Based View and Dynamic Capabilities

3.1 Resource Based View

Opposed to the Structure-Conduct-Performance paradigm that supports that the competitive advantage springs from the market conditions dictating the organizations what strategies to devise, Wernerfelt (1984) introduced an alternative explanation of why some firms outperform others by placing great weight on the possession of strategic resources. Through the parallelism between products' market and factors' market (e.g., the resource-product matrix), this renowned piece of work brought RBV to life. In line with Barney (1991), a resource must satisfy the four properties of VRIN framework in order to generate sustained competitive advantage: a.) valuable, b.) rare, c.) imperfectly imitable, d.) non-substitutable. After few years, Barney (1995) modified the VRIN framework by including in the analysis the variable of organization's capability to harness the resource. Therefore, the VRIN framework was transformed into VRIO framework (valuable, rare, imperfectly imitable, organization). By resting on either the VRIN or the VRIO framework, a lot of authors discuss whether IT-related resources can bring competitive advantage, like (Mata et. al., 1995); (Bharadwaj, 2000); (Caldeira and Ward, 2003); (Wade and Hulland, 2004); (Sayeed and Onetti, 2018). A common point highlighted in all these papers is that the implementation of a new technology does not guarantee the accomplishment of enduring competitive advantage if some necessary complementary resources do not exist, like the organizational knowledge, the support of top management, the culture of collaboration (Lado and Zhang, 1998), the alliances and the existence of an owner-manager who acts as a product champion (Elliot and Boshoff, 2009). Even if RBV is considered as a useful theory to detect the resources required for successfully adopting a new technology, there are two significant shortcomings in this approach. First, it does not recognize that the importance of resources changes through the passage of time (Teece et. al., 1997). Second, it does not provide managers with any guideline on how they can build the strategic resources and create value (Priem and Butler, 2001). In an endeavor to address these weaknesses, the theory of DC was developed.

3.2 Dynamic Capabilities Theory

In line with Helfat et. al. (2007, p. 4), the dynamic capabilities are defined as **“the capacity of an organization to purposefully create, extend, or modify its resource base”**. This theory was firstly introduced by Teece et. al. (1997) who claim that the competitive advantage is relied on specific processes (coordination, learning, reconfiguration) which are determined by the existing asset positions (e.g., financial, reputational, structural) and the organization's path dependency (facts in the past that influence its future to some extent). Eisenhardt and Martin (2000) elucidate that the appropriateness of dynamic capabilities' characteristics is dependent on the conditions of the environment under which the company operates. As they indicate, when high uncertainty exists, the dynamic capabilities must be simple, experimental and knowledge creating. As Arifin (2017) astutely observes, many studies have proposed diverse sets of dynamic capabilities, such as Teece (2007) (sensing, seizing, transforming), Wang and Ahmed (2007) (adaptive, absorptive, innovative), Ambrosini et. al. (2009) (incremental, renewing, regenerative) and Pavlou and El Sawy (2011) (sensing, learning, integrating, coordinating).

Focusing on the intersection between the research body of dynamic capabilities and the literature of Information Systems, Steininger et. al. (2022) conduct a critical review and deduce that IT plays four different roles: a.) enabler (the IT creates dynamic capabilities and increases the firm's performance), b.) embedded in Dynamic Capabilities (the IT is included in the definition of the dynamic capabilities examined), c.) context (the context of the research is related to IS) and d.) outcome (the dynamic ca-

pabilities influence the adoption of a new technology or the process of digital transformation). Provided that the current research paper elaborates on the adoption of a new technology (i.e., blockchain), the following paragraph describes the findings of two research papers belonging to the last category.

In a cross-sectional context, Daniel and Wilson (2003) analyze the concept of e-business transformation by utilizing the theory of DC. By conducting 13 semi-structured interviews, the authors detect eight dynamic capabilities and segment them into two groups: a.) innovative (e.g., the rapid formulation of strategy, the modification of business model under uncertain circumstances) and b.) integrative (e.g., the integration of new IT systems with existing ones, the alignment between IT strategy with corporate strategy). Trying to analyze the process of SMEs' digital transformation, Ellström et. al. (2022) identify six dynamic capabilities divided into three core categories: a.) sensing (conduct market research beyond the limits of the firm's industry, evaluate continuously the suitability of the current information systems), b.) seizing (equilibrate commitment and agility, decide which activities will be executed internally) and c.) reconfiguration (divide the whole process into small projects and set priorities, combine the IT systems in order to support the work of all departments).

3.3 Blockchain technology through the lens of Resource Based View and Dynamic Capabilities Theory

The literature body that explicates blockchain through the lens of RBV and DC is still extremely narrow. Among these few papers, the core research questions analyzed are the following three: a.) is blockchain a strategic resource? b.) which are the resources and the dynamic capabilities required for successfully adopting blockchain technology? c.) how does blockchain increase the organization's performance? The ensuing three paragraphs present few publications throwing light on these topics.

Trying to evaluate whether blockchain is a strategic resource or not, Bjørnstad et. al. (2017) carry out a mutli-case study analysis and explore the activity of four blockchain startups: IOTA, Bernstein, Evry and Blockstack. In line with their inferences, the implementation of blockchain per se cannot generate sustained competitive advantage. To this end, both internal (employees' know-how, founders' prior experience) and external (community building, strategic partnerships) complementary resources are indispensable. Following the V.R.I.O. framework, Jain (2020) advocates that blockchain cannot lead to sustained competitive advantage as a standalone resource, since it does not satisfy the conditions of rarity and imperfect imitability as it is an open-source protocol. Nevertheless, the author posits that blockchain can yield a sustained competitive advantage if and only if it works in tandem with complementary resources, such as the visionary leadership, the experience, the cryptocurrency token (fundraising through tokens) and the open source (in the sense that the users are ensured for the quality of the code used).

Intending to assess the importance of factors determining the adoption of blockchain technology, Li et. al. (2022) apply the FAHP methodology and process the data of 70 completed questionnaires answered by managers and directors working at shipping companies in Singapore. Their results corroborate the explanatory power of RBV, as two factors included in the organizational context (internal leadership, human resources capability) are proved to be very significant. Wamba and Queiroz (2022) study the adoption of blockchain in the supply chain field in India and USA by employing a research model containing three stages: a.) intention to adopt, b.) adoption, c.) routinization. The results show that the sole factor playing role in all these stages is the dynamic capability of absorptive capacity. Finally, Dwivedi et. al. (2023) perform a survey answered by 306 retailers from India and reveal that the managerial capability (manager's ability to plan and accomplish the introduction of a new technology) and the innovation capability (firm's positive attitude towards new technology and products) decrease the resistance to adopt blockchain.

When it comes to the effect of blockchain on the firm's performance, the work of Martinez et. al. (2019) focuses on the order management process and explicates how the combination of three resources (blockchain, knowledge, IT infrastructure) creates two new resources (detection of opportunities, modification of rules) which in turn are transformed into dynamic capabilities enabling the company to obtain and retain competitive advantage. The authors run three simulations (without blockchain, one year after the implementation of blockchain, five years after the implementation of blockchain) and find that the application of blockchain can reduce the number of operations needed for processing an order, refine the visibility of the process and eliminate the duplications. Sharma et. al. (2023) consider the adoption of blockchain as a dynamic capability, analyze 4994 firm-year observations and find that it increases the organizations' expected future performance (Tobin's Q). In addition, the authors prove that the intangible capital and the environmental dynamism positively mediate the relationship between blockchain adoption and the expected future performance.

4 Semi-structured interviews with Greek blockchain experts

After presenting the literature body that pertains to the adoption of blockchain and the theories of RBV and DC, the analysis proceeds to the description of the whole process of interviews with Greek blockchain experts. It is clarified that the six steps suggested by Rabionet (2011) were followed:

Step	Short description
1. Selecting the kind of interview	The semi-structured style was the kind of interview selected. Even though the research questions were clear, the researchers intended to have an open discussion with the interviewees enabling them to offer insights that may have not been highlighted within the literature.
2. Establishing the ethical guidelines	At the outset of every single interview, the interviewee was notified that the conversation would be recorded. Moreover, the researchers ensured the participants that their anonymity would be fully respected in the process of findings' description.
3. Crafting the interview protocol	At the beginning of the interview protocol, the researchers made some introductory questions in order to understand the details of the case study examined and the participant's blockchain-related activity. In turn, the sequence of the interview questions reflects a possible path of blockchain adoption. More specifically, the questions refer to the three broad stages of adoption: a.) pre-adoption (e.g., which is the business value of adopting blockchain?), b.) adoption process (e.g., obstacles, resources needed, ways to transform the internal environment), c.) post-adoption (e.g., how will the competitive advantage be acquired in the upcoming blockchain era?)
4. Conducting and recording the interview	The twelve interviews were conducted through the Microsoft Teams platform facilitating the researchers to record the discussions. The average duration of interviews is 74 minutes.
5. Analyzing and summarizing the interview	After completing the process of transcription, the processing of interview data was executed by following the six steps proposed by Braun and Clarke (2006): a.) familiarization with the data, b.) generation of initial codes, c.) search for themes, d.) review of themes, e.) definition of themes, f.) production of the results' report. In particular, the method selected is the deductive thematic analysis, which comprises a theory driven approach ("top down"). Regarding the exploration of every single research question, the coding frame was grounded in a specific theoretical framework existing in the bibliography. Considering the first research question investigating the external conditions in the Greek market preventing the adoption of blockchain, the analysis of interview data was conducted through the lens of the four factors of PEST analysis (Aguilar, 1967): political, economic, social, technological. When it comes to the second research question pertaining to the detection of the resources needed from blockchain adopters and providers, the processing of data was carried out by utilizing

	the classification of resources proposed by Bharadwaj (2000), who claims that the organizations need tangible, human and intangible resources in order to be capable of reaping the fruits of new technologies and increasing their performance. Finally, regarding the last research question related to the identification of the essential dynamic capabilities, the researchers analyzed the data by taking into consideration the nineteen dynamic capabilities pinpointed by Leemann and Kanbach (2022), who run a systematic literature review on the topic of dynamic capabilities.
6. Reporting the findings	Within the next section the key findings are described.

Table 1. *The process of conducting interviews with Greek blockchain experts*

Before starting the process of performing semi-structured interviews, the researchers had portrayed the blockchain ecosystem in Greece by dividing the market participants into three categories: a.) providers (e.g., companies that construct blockchain solutions, firms that enable people to buy cryptocurrencies and issue NFTs), b.) adopters (companies that although their core activity is not associated with blockchain, they have used this technology with a view to ameliorating some of their processes), c.) promoters (organizations or individuals contributing to the diffusion of blockchain in the Greek territory, such as columnists, training providers and authors of related books). Even though invitations were sent to all the categories of market participants, the vast majority of interviewees belong to the first. In particular, regarding the second category (i.e., adopters), only one organization replied to the invitation email. This fact may be attributed to the low maturity of blockchain solutions in the companies that are included in this category. The following table contains some useful information about the twelve participants:

Participant	Position in the market	Year of establishment/ Year that the blockchain-related activity started	Context	Which is the main value of blockchain? Why did the participant get involved in blockchain technology?
A	Provider	2021	Journalism	Offering a platform that secures the validity of news and the immutability of data.
B	Provider	2020	Blockchain research team	Undertaking blockchain research projects. The deliverables are prototypes.
C	Provider	2022	Supply chain	Providing a platform that enables the traceability of all the events in the supply chain.
D	Provider	2020	Supplier of blockchain products	Constructing various blockchain products (e.g., crypto wallets, NFT marketplaces).
E	Provider	2021	Offering blockchain solutions	Developing blockchain solutions that pertain to various domains.

F	Provider	2022	NFTs	Offering an astounding variety of NFT services (e.g., minting NFTs, promotion, training).
G	Provider	2021	Networking	Building a big network of blockchain professionals and earning referral fees. Moreover, the company develops internally some blockchain solutions
H	Provider	2018	Ticketing solution	Issuing tickets as NFTs to eliminate the transactions in the black market.
I	Provider	2019	Offering blockchain solutions	Participating in projects that develop blockchain solutions.
J	Promoter	2020	Educational institution	Planning a curriculum for blockchain experts.
K	Promoter	2017	Columnist, trainer, author	Informing people about a topic (cryptocurrencies) that had not been covered by mass media in Greece.
L	Adopter	2021	Public services	Utility token for serving social needs. Transparency in transactions is ensured thanks to the blockchain.

Table 2. The profile of interviewees

The results derived from the twelve semi-structured interviews are presented in the next section by being categorized into three groups: a.) the barriers to blockchain adoption in Greece, b.) the resources required for blockchain adoption in Greece, c.) the dynamic capabilities required for blockchain adoption in Greece.

5 The results of the semi-structured interviews

5.1 Which are the barriers to blockchain adoption in Grece?

In this subsection, the word “barriers” refers to the conditions of external environment that act as a brake on the Greek organizations’ decision to adopt blockchain. It is elucidated that these conditions are not associated with the internal part of organizations (e.g., resources, processes, structure). By analyzing the interview data, the barriers detected are categorized into the four factors of PEST analysis (Aguilar, 1967): (political, economic, social, technological).

Regarding the political factors, a lot of interviewees accentuated the lack of relevant legislative framework in Greece. This fact is mainly attributed to two reasons. Firstly, **the regulators cannot understand the unique virtues of blockchain**. As a consequence, it is extremely difficult for them to enact laws that impel the blockchain activity in Greece. For example, the participant “G” wondered: “if a large part of the Greek politicians cannot understand how basic technologies (e.g., smartphones) function, how can they understand the value that blockchain brings?”. Secondly, some interviewees sounded the warning that **the authorities may desire to exploit the features of blockchain in order to exert control over the society**. The interviewee “A” expressed his fear by saying: “when I discuss

with people about the network that I desire to build up on the blockchain, very often they ask me if I have thought about the possibility of a central authority to try to control the network”.

Considering the economic factors, the current market conditions do not encourage the organizations to adopt blockchain. The most significant obstacle is **the shortage of blockchain experts in the Greek market**. Even if there are remarkable Greek blockchain developers, these people work in foreign countries due to the low maturity of blockchain ecosystem in Greece (brain drain). In addition, **there are not training programs suitable for educating employees to the blockchain technology**. The participant “D” underscored that “there are not blockchain training programs that cover the needs of the existing workforce.... the duration of various seminars is short and hence nobody can become a blockchain developer by taking part in them”. Furthermore, **some blockchain solutions that had developed within the Greek territory were inadequate** and reduced the perceived usefulness of blockchain by Greek organizations. Trying to curb this problem, the participant “G” stressed that “it would be valuable to build an innovation hub and translate some successful blockchain case studies in the Greek language”.

Concerning the social factors, many respondents mentioned that **Greek people are more interested in the short-term profit rather than the long-term benefits**. Therefore, they are willing to buy cryptocurrencies and NFTs for speculative purposes. In contrast, they do not intend to spend time on learning about the principles and the utility of blockchain technology. Furthermore, **some Greek organizations may use corruptive practices** and as such they may avoid partaking in a blockchain network. For example, the interviewee “C” posed a question about “how can an organization launch a defective batch in the market if all the events are recorded in the blockchain and hence become shared to all the parties involved?”.

When it comes to the technological factors, a lot of respondents punctuated that **the maturity of blockchain technology is still at a very low level**. For instance, the interviewee “E” clarified that “until now there are not protocols that fully meet the requirements of organizations...at this moment blockchain is like Amazon in 2000”. In line with the participants’ insights, the major weakness of blockchain is its low scalability in comparison to the traditional centralized systems. Finally, a last factor that must be taken into consideration is the digital transformation in the Greek society. As the most of participants claimed, even though there have been some noteworthy initiatives recently, **Greece is still behind of other developed countries in terms of digital transformation**. The value of blockchain gets higher if it works in tandem with other nascent technologies (e.g., IoT, AI). To this end, the existence of sufficient IT infrastructure is essential.

5.2 Which are the resources required for blockchain adoption in Greece?

This subsection describes the resources needed for the diffusion of blockchain in the Greek market from two different angles. The first is the perspective of adopters, i.e., the organizations that do not provide blockchain services, but they may implement blockchain solutions in order to refine some of their processes. As it was mentioned above, the set of interviewees contains only one possible adopter. Therefore, the researchers asked from the providers and the promoters to reply some questions by putting themselves in the adopters’ shoes. Despite the fact that this process may entail some bias as it may lack substantial pieces of information, it can be assumed that both of them have obtained sufficient degree of knowledge about the shortage of resources in this kind of organizations. The two promoters are familiar with blockchain market in Greece, whereas the nine providers have already made a lot of conversations with potential customers and hence they have pinpointed the core reasons behind the fact that the most of blockchain projects in Greece have discontinued.

Talking about the second angle, beyond the resources that adopters need for successfully proceeding with blockchain solutions, the researchers attempted to identify the critical resources from the providers’ side. Given the low maturity of blockchain ecosystem in Greece, the success of Greek blockchain

providers may play a determining role in the rate at which this technology will be adopted. The next paragraphs explicate the resources needed from the sides of adopters and providers.

From the angle of adopters, by using the classification of Bharadwaj (2000), the resources detected through interviews are categorized into three groups: a.) tangible, b.) human, c.) intangible. In respect of the first category, almost all the interviewees stated that the organizations need **high amount of financial capital** to apply blockchain-based solutions. Even though the final cost depends on the specifications of the solution and the role that the organization plays in the blockchain network, by and large, the Web 3.0. applications are much more expensive than the Web 2.0. applications. Two are the core causes of this fact: a.) big storage space is required, b.) high wage of blockchain developers due to the disequilibrium in the labor market (the labor demand exceeds the labor supply to a large extent). Furthermore, it must be highlighted that the cost may get increased if the organization desires to install new IT infrastructure (e.g., IoT devices) in order to harness the benefits of blockchain technology. Furthermore, an additional tangible resource that affects the effectiveness of blockchain adoption is the **organization's degree of digitalization**. A lot of participants pointed out that many processes of Greek traditional companies remain paper based. For example, the interviewee "B" underlined that "many companies are not ready for adopting blockchain...actually they are at the stage of digitalization...from the paper-based model to the computer-based one....in Greek organizations the degree of this problem is higher than it is in the foreign companies". Under these adverse circumstances, provided the huge amount of effort required for converting the format of data from paper into digital, the adoption of blockchain cannot be deemed as a plausible step.

Discussing on the human resources, all the interviewees underlined the high importance of people inside the organization that can understand the characteristics of blockchain. As the respondent "I" said, "it is very difficult for Greek companies to understand that there will not be central servers in which their data will be saved". Taken for granted that Greek companies cannot comprehend the features of this technology, they are vulnerable to the possibility of paying for the implementation of a blockchain solution an amount of money which is much higher than its real value. Therefore, **the existence of an IT department being capable of understanding the properties of blockchain** is indispensable if the organizations intend to integrate blockchain in their processes. The second human resource that is needed is **the provision of blockchain training**. Given that new blockchain-based professions will gradually emerge (e.g., blockchain developers, blockchain architects, blockchain managers), the organizations must find the appropriate ways to train their staff. Undoubtedly, this constitutes a complicated challenge. The interviewee "D" highlighted this challenge by saying that "there are not seniors who are blockchain specialists to train the rest staff". The third human resource detected is **the presence of a project manager who can act as a product champion**. This person must have clear vision and business plan of how blockchain technology can be utilized. As a lot of providers claimed, the majority of Greek organizations deprive of such a project manager.

Referring to the intangible resources, almost all the interviewees underscored that the culture of the most Greek organizations comprised an important barrier to adopt blockchain. More specifically, the respondents characterized the Greek organizations as resistant to change. The provider "A" described this attribute by quoting the reply that he had received from a potential adopter: "why should we depart from the way through which we have worked for so many years? This is how our customers are used to utilizing our services". As such, **the willingness to spend time and funds on learning about blockchain and trying relevant solutions** is essential. Given the low maturity of blockchain solutions, the organizations' attitude towards short-term profits must be changed. The organizations should start implementing blockchain solutions by taking into consideration that the benefits will become apparent in the long term. Finally, the organizations that aim at participating in blockchain networks must be **willing to collaborate with other market participants (even competitors)**. A noteworthy number of providers argued that many Greek organizations hesitate to adopt blockchain, because they are afraid

that some critical data will be exposed to their competitors. Certainly, the appearance of a new revolutionary technology requires significant changes in the managers' mindset.

In the same vein, the resources that blockchain providers need are divided into the same three groups (i.e., tangible, human, intangible). Talking about the category of tangible resources, a lot of providers mentioned that they must develop the **adequate technological infrastructure**. For example, the provider "F" stated: "we must obtain technological tools in order to make our job easier". In doing so, **high financial capital** is required. Beyond the development and the maintenance of blockchain solutions, a big quantity of funds is needed for recruiting specialized blockchain developers. An additional tangible resource is the provision of **blockchain-as-a-service platform**. The providers do not desire to spend long time on building customized products satisfying the particular needs of every single customer. On the contrary, they consider it more convenient to build a general platform where the customers can harness the virtues of blockchain.

Considering the human resources, as it was anticipated, all the providers must hire **blockchain developers**. The advanced programming skills will enable the providers to build reliable products and services. It must be emphasized that some providers outsource additional blockchain developers. In addition, through the passage of time, the providers declared that they plan to **recruit a big variety of professionals** (e.g., economists, salespeople). Apart from their staff, the blockchain providers must cultivate **relational capabilities**. In other words, they must build strong relationships with other market participants and especially their customers. This comprises an essential element for their survival. Regardless of their size, the blockchain providers must devise the suitable strategy for approaching big customers. A piece of advice derived from the interviews is that, during the meetings with potential customers, the providers must present specific numbers proving the high level of efficiency accomplished thanks to the blockchain.

Talking about the intangible resources that blockchain providers need, **the attitude to continuously learn** is of utmost importance. The blockchain technology has rapidly evolved and hence the providers must be willing to keep abreast of the facts occurring within the blockchain space. Finally, the blockchain providers must formulate **the appropriate business model**. Since the Greek blockchain ecosystem is in the early stages of development, this choice constitutes a complicated task.

5.3 Which are the dynamic capabilities required for blockchain adoption in Greece?

Aiming at harnessing the benefits of blockchain, all the organizations must be able to modify their set of resources. Given the high rate at which this technology evolves, the next two paragraphs present the dynamic capabilities that the adopters and the providers must cultivate. As in the previous subsection (5.2), due to the shortage of adopters in the set of interviewees, the dynamic capabilities of adopters derived from the answers of providers and promoters. This process may be characterized as biased to some extent, since it may miss some critical data that could have been collected if many more adopters had participated. Nevertheless, provided that blockchain adoption in Greece is in its infancy, the providers and promoters that were interviewed can be deemed as blockchain evangelists. Given their expertise in blockchain, their experience in working on blockchain projects with foreign companies and their knowledge of the particularities of Greek market, they can offer valuable insights about how the Greek organizations can manage to modify their resource base and capture large market share by exploiting the properties of blockchain.

From the adopters' point of view, because of the complexity of blockchain technology, the managers should recruit blockchain experts and train their existing staff. Nevertheless, given the extremely high speed at which this technology develops, the organizations must develop the dynamic capability **to quickly predict their resource needs and always hire the appropriate candidates**. The participant

“J” mentioned: “it is very difficult to forecast the skills that will be required in the next years”. Furthermore, provided that the present senior managers are not familiar with blockchain technology, another dynamic capability that must be developed is **the management under uncertainty**. In other words, talking about the adoption of blockchain, neither the team’s leader nor the members have the adequate knowledge for predicting what the next steps will be. As such, the managers will be obliged to lead a team while getting trained at the same time. The participant “F” highlighted this point by saying that “the managers must be trained to cultivate soft and hard skills.... nevertheless, they must not only get trained about what blockchain and NFTs are, but they must also learn about how to lead a team doing that...they must be open-minded... they are all equal in the team...there is no one who knows everything...the technology evolves on daily basis”. Unambiguously, this new reality will diverge considerably from the current situation, where the managers are superior to their subordinates in terms of knowledge and experience. Apart from the human and management skills, the organizations must be **capable of recognizing the suitable manners through which they can capitalize on blockchain products**. The participant “E” clarified that “if there is not any real need to utilize blockchain, the companies must not apply blockchain solutions”. The respondent “B” elucidated the conditions under which blockchain is useful for the collaboration among diverse entities by explaining that “within the use case, if there is a network of actors who must collaborate, but at the same time there is conflict of interest, the blockchain is more compatible than a centralized database”. Discussing on the market of NFTs, the interviewees “F” and “H” underlined that although all the organizations can issue NFTs, the buyers will not be equally interested in them. The proper design (e.g., the number of tokens issued, the resale royalties) and the content of NFTs (e.g., pictures, videos, AR) will make the difference among the competitors. In an endeavor to implement blockchain solutions and use blockchain products, the organizations must be **willing to experiment with blockchain solutions by altering their evaluation criteria and the process of decision-making**. As it was aforementioned, the success of blockchain projects should be evaluated in the long-term. Undoubtedly, the advent of blockchain will require from the organizations **to plan a new strategy and modify their structure**. As plenty of interviewees underscored, if the top managers are satisfied with the current level of revenue stream, they will not be incentivized to alter the way through which they run their business.

From the angle of providers, the interviewees underscored again the high importance of **quickly predicting the resource needs and always hiring the appropriate candidates**. The provider “A” underlined this necessity: “we must always hire very talented people”. In addition, the blockchain providers must always **monitor the market and understand the areas of high demand in the future**. Talking about his team’s daily life, the respondent “I” said: “we must always study”. In terms of future demand, it can be extrapolated from the interviews that the interconnectivity of blockchain with other technologies, the interoperability among blockchain networks and the quantum-proof blockchains will attract a big volume of investments in the next years. Furthermore, except for sensing the future market preferences, the providers must be capable of **always covering the real needs of their customers**. On account of the low level of customers’ comprehension around blockchain technology, the specifications asked for the blockchain solutions are frequently either unrealistic or vague. The interviewee “D” described this situation: “Most of the times the customers imagine a blockchain solution that cannot be created.... there were cases that we spent many months on deciding how the solution would look like”. Under these uncertain conditions, the provider must recognize the features that meet the customers’ preferences. Needless to say, the user-friendliness of blockchain solutions plays determining role in the customers’ satisfaction. The interviewee “I” commented on that by underlining that “the blockchain solutions must be designed in a way that the final user will not recognize the transition from the client-server model to the Web 3.0. paradigm”. Moreover, the providers must continuously try to **expand the network of their partners**. The respondent “G” described the activity of his company by mentioning: “we always seek for people and firms to start successful collaborations”. Finally, several providers estimated that their business model will change many times through the passage of time. In particular, the participant “A” said: “I am sure that we will not keep the present business mod-

el in the future”. Indubitably, **the proper adaptation of the business model** constitutes a significant dynamic capability.

6 Discussion and conclusion

The central objective of this research was to examine the adoption of blockchain in Greece. Even though this technology promises a host of benefits in all the domains of the economy, the Greek organizations have not tried to harness its valuable properties yet. Beyond the obstacles existing in the external environment, it was assumed that the Greek organizations lack the resources required for adopting blockchain. In an endeavor to respond to this challenge, this study attempted to identify the necessary resources and dynamic capabilities from the angle of both sides of the market: blockchain adopters and blockchain providers. In doing so, a series of semi-structured interviews with Greek blockchain experts were conducted.

Despite the existence of several limitations (e.g., the shortage of adopters in the set of participants, the fact that the degree of blockchain adoption in Greece is very low and hence the interviewees may not be able to predict all the resources that will be needed), this study makes some important contributions. First, it is added to the small number of publications investigating the adoption of blockchain in Greece. It must be underscored that, compared to the previous research papers, it is the only that explicates the view of both sides of the market (providers and adopters). Concerning the external conditions in the Greek market, the obstacles to blockchain adoption pertain to the four axes of PEST analysis. In particular, the inexistence of legislative framework, the shortage of blockchain developers, the speculative short-term mindset and the low degree of digitalization are found to be the focal factors impeding blockchain adoption in Greece. Therefore, the Greek authorities must urgently curb these challenges and ameliorate the circumstances under which the organizations will try to invest in blockchain.

When it comes to the resources needed from both types of organizations (providers and adopters), the findings show that the three categories of resources proposed by Bharadwaj (2000) are essential. Focusing on the Greek organizations, although some tangible resources (e.g., financial capital, technology infrastructure) are found to be indispensable, the vast majority of resources detected are associated with human skills and intangible assets, like the recruitment of blockchain experts and the eagerness to collaborate and seek for new knowledge. The high importance of intangible resources confirms the results of Kouhizadeh et. al. (2020) who find that intangible resources are more significant than tangible ones for the development of blockchain solutions.

Talking about the modification of the organizations’ resource base, some of the dynamic capabilities that are identified in the systematic literature review of Leemann and Kanbach (2022) are found to be compatible with the results of this study, such as the detection of future opportunities in the market, the expansion of the organizations’ network, the experimentation with new solutions, the alteration of the strategy, the adaptation of the business model and the change in the process of decision making. Discussing on the adoption of blockchain in Greece, the findings show that emphasis must be given to the dynamic capability of always hiring the appropriate candidates. Even though the need for recruiting blockchain specialists has been widely highlighted within the blockchain-related literature, the future research must investigate the relationship between the dynamic capability of renewing the human capital and the competitive advantage in the rapidly changing environment that the diffusion of blockchain technology will create. Finally, another dynamic capability that emanates from the results and merits further research is the management under uncertainty. The managers will have to respond to the challenge of leading a team without being superior to the rest members in terms of knowledge and experience. By taking for granted the high frequency that nascent technologies appear nowadays and the breakneck speed at which they evolve, this dynamic capability may be crucial for the accomplishment of sustained competitive advantage in the coming years.

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